Voluntary Carbon Standard
Project Description Template

19 November 2007

Date of VCS PD: 28 February 2011
PD Version 5

Table of Contents

1 Description of Project:

1.1 Project title

Sırma 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"

The project is not a grouped project.

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

Sırma run-of-river hydro project is a small-scale VCS project.

With an installed capacity of **5.88 MW**, an expected annual electricity production to be sold of up to **23,230 MWh**[1] and an estimated baseline emissions factor of **0.5502 tCO_2e/MWh**, the following reduction amounts are expected.

*Table 1-1: Emission reduction volume during first crediting period**

Length of crediting period	10 years
Year	Estimate of annual emission reductions in tons of CO_2e
2009 (07 June – 31 Dec.)	7,455
2010	12,780
2011	12,780
2012	12,780
2013	12,780
2014	12,780
2015	12,780
2016	12,780
2017	12,780
2018	12,780
2019 (1 Jan.– 06 May)	5,325
Total estimated reductions [tCO_2e]	**127,800**
Annual average of estimated emission reductions [tCO_2e]	**12,780**

(*) Eventual inconsistencies linked to rounding errors.

[1] Sırma HPP Licence, available to DOE.

A renewable crediting period of 10 years shall apply. In general the lifetime of the project is linked to the remaining licence duration, which is 36 yr for this project.

1.4 A brief description of the project:

Sırma hydro project is a 5.88 MW (three 1.96 MW units) small-scale run-of-river hydro power plant. It started commercial electricity production in 7 June 2009. 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. The overall emission reductions shall amount to 12,780 tCO_2e per year on average.

The hydro project shall be registered as a voluntary emission reduction project under the Voluntary Carbon Standard. The expected co-financing from carbon market proceeds has enabled the projects implementation.

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 in Aegean Region, Aydın City, Bozdoğan district, close to Sırma village. The site is accessible via the pre-existing Kemer dam road. The geographical coordinates of the hydro power plant are:

Project Facilities	**Latitude**	**Longitude**
Powerhouse	37° 36′ 26.280′′ N	28° 28′ 26.340′′ E
Head pond	37° 36′ 24.960′′ N	28° 28′ 26.460′′ E

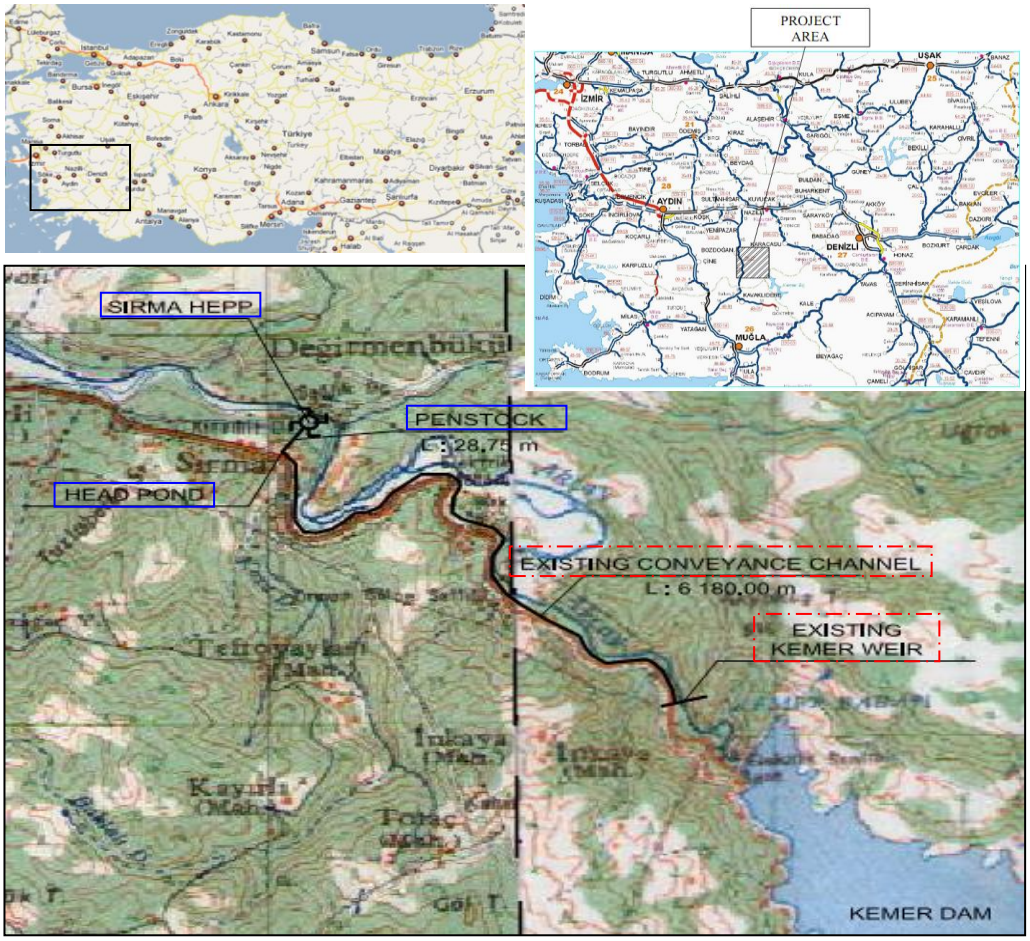

Figure 1: Location of the project

1.6 Duration of the project activity/crediting period:

The project started with the initial commercial operation of the turbines after testing phase on 07 June 2009.

A two-times renewable crediting period of 10 years shall apply. First verifiable emission reductions were achieved on 07 June 2009. Thus the first crediting period shall begin on that date and last until 31 May 2019.

1.7 Conditions prior to project initiation:

Sırma HPP project site is located at Akçay River in Aegean Region (see Figure 1 above), downstream of the existing Kemer weir. Water is taken from the existing irrigation canal that leads down from Kemer weir.
Kemer dam and weir generates electricity from the Akcay River and feeds it to the national electricity grid. It belongs to DSI. In Figure 1 the existing installations (conveyance channel, Kemer weir) are marked red while project installations are highlighted in blue colour. The technical overview of Figure 2 of section 1.9 again gives a simplified illustration of new and existing installations.

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

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

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

The 5.88 MW Sırma run-of-river HPP produces electricity for transmission into the national grid. For this purpose it uses kinetic energy of the water in the pre-existing power channel on the left bank of Akçay River, downstream of Kemer Weir. The water is directed towards a head pond from where it is being send through a penstock to tree turbines powering three generators for electricity generation. Figure 2 gives an overview.

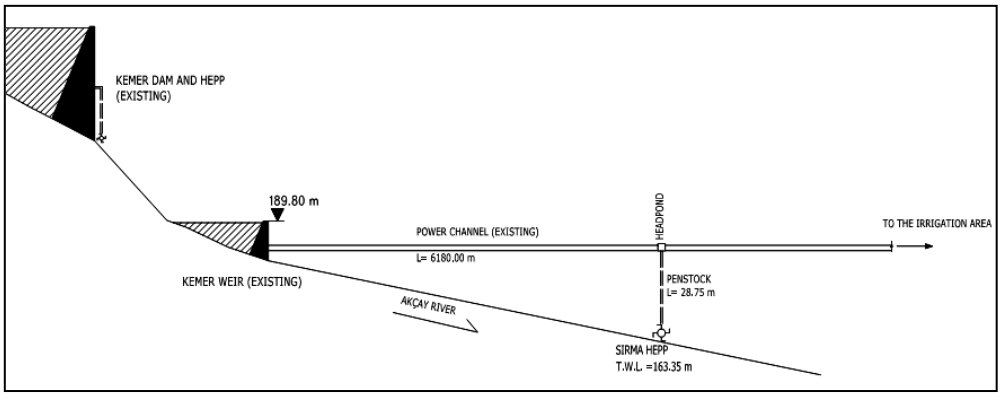

Figure 2: Technical overview of Sırma HPP

Sırma HPP thus involves the constructions of installations on the left bank area of Akçay River (head pond, penstock, power plant and grid connection line.

The Turbine type will be vertical-axis Kaplan type with fixed blades. (for a picture of the turbine, see Figure 4). Generated electricity will be fed into national grid via a connection to Karacasu distribution center via 20 km long 36 kV single line from the switchyard close-by to the power plant. The net annual electricity production of the project activity is expected to be 23.230 GWh. Detailed technical characteristics of Sırma HPP are given in table 1-2 and figure 3 (Single Line Diagram) below.

Table 1-2: Technical Characteristics of Sırma HPP

Project Main Characteristics	Type: Run-of-river HPP Gross Head: 21.3 m Design Discharge: 33.00 m^3/s Total Installed Power: 5.88 MW_e Net Power Generation: 23.230 GWh/year
Weir, Water Intake Structure	Type: Concrete Elevation at crest: 189.8 m Height from river bed: 12.8 m

Channel	Type: rectangular, concrete Gradient: 0.003 Bottom Width: 5.0 m Length (to head pond): 6,180 m
Headpond	Width: 10.0 m Length: 23.5 m Height: 9.5-20 m
Penstock	Diameter: 3.2 m, Length: 28.75 m, Steel Thickness:10 mm (St52)
Turbine	Type: Vertical Axis Kaplan, with fixed blades Installed Power: 3 x 1.960 MW_e (2178 kVA, power factor: 0.9) Manufacturer: Zhejiang Orient Engineering Co. Ltd.
Generator	Number of Generators: 3 Type: Vertical Axis, 3-phase, synchronised Nominal Voltage: 6.3 kV (+- 5%) Frequency: 50 hz Synchronic Rotation Frequency: 600 rpm Zhejiang Orient
Transmission Line	Type: 3x477 MCM, single line Line Voltage: 36 kV Connection Point: Karacasu Distribution Center Length: 20 km

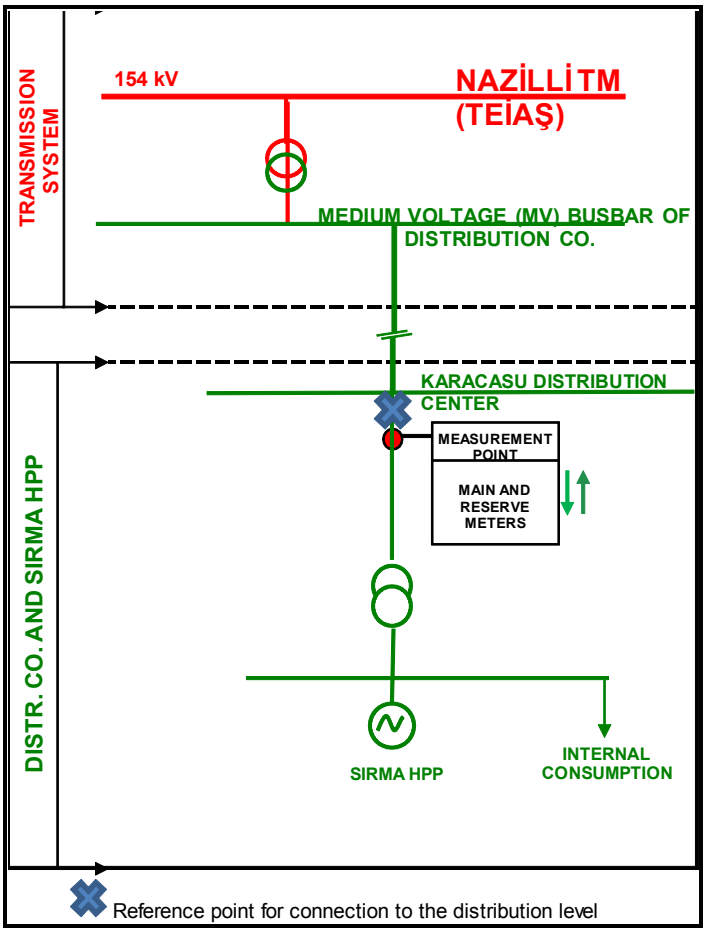

Figure 3: Single Line Diagram of Sırma HPP

Figure 4: Photo of Kaplan 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:
(1) Electricity Market Law[2] (Nr. 4628 / 03.03.2001)
(2) Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy[3] (Nr. 5346 / 10.05.2005)
(3) Environment Law[4] (Nr. 2872 / 16.12.2003) – on results of the Environmental Impact Assessment please see also section 5.
(4) Forest Law (Nr. 6181)[5]
(5) Energy Efficiency Law (Nr. 5927 / 02.05.2007)[6]

The renewable Energy generation license for Sırma 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 Sırma 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 may 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 Sırma hydro project is the creation of carbon friendly energy generation capacity via realization of a hydro-

[2] See: http://www.epdk.gov.tr/mevzuat/kanun/elektrik/elektrik piyasalari kanunu.pdf (Enactment Date:2001)

[3] See: http://www.epdk.gov.tr/mevzuat/diger/yenilenebilir/yenilenebilir.doc (Enactment Date: 2005)

[4] See: http://www2.cevreorman.gov.tr/yasa/k/2872.doc (Enactment Date: 1983)

[5] See: http://www2.ogm.gov.tr/bilgi edinme/mevzuat/Genel/genel kanun/6831 orkanun.doc (Enactment Date: 1956)

[6] See: http://www.eie.gov.tr/duyurular/EV/mevzuat/EV-mevzuat/Kanun/EnVerKanunu Temmuz2008.pdf (Enactment Date: 2007)

project. The baseline to the project is defined by energy generation and respective emission intensities of the already existing Turkish grid. There is no way in which the construction of the HPP may have led to higher emission levels (of that baseline) which are to be reduced by the project.

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).

Sırma hydro project has not created any form of other credits.

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

Sırma hydro project 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). For contact please refer to the below directions:

Table 2: Project Contact Data

Organization:	**Beyobası Enerji Üretimi A.Ş.**
Street/P.O.Box:	Koza Sok.
Building:	No:22 GOP
City:	Ankara
State/Region:	Ankara
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).

Organization:	FutureCamp Türkiye
Street/P.O.Box:	Çetin Emeç Bulvarı,
Building:	No. 19/18
City:	Ankara
State/Region:	Ankara
Postcode/ZIP:	06460
Country:	Turkey
Direct FAX:	0090 312 480 88 10
Direct tel:	0090 312 481 21 42

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):

Any commercially sensitive information that has been excluded from the public version of the VCS PD that will be displayed on the VCS Project Database shall be listed by the project proponent.

/DFA/ - Contracts of Beyobası Enerji Üretimi A.Ş., used for investment analysis

2 VCS Methodology:

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

Version 16 of CDM approved baseline and monitoring methodology AMS-I.D. – "Grid-connected renewable electricity generation" is applied. For baseline calculations AMS-I.D. refers to the "Tool to calculate the emission factor for an electricity system", Version 2. Additionality (see 2.5) is demonstrated via application of the "Tool for the demonstration and assessment of additionality", Version 05.2. Aforementioned methodologies are applied to project activity on 14 July 2010.

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

The choice of methodology AMS-I.D. is justified as the proposed project activity meets the relevant applicability criteria:

- The project is a Greenfield renewable energy power plant;
- The project is a small scale activity with a capacity less than 15 MWe;
- The project does not results in construction of a new reservoir. .

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

Greenhouse gases included in the project boundary and used in calculations of emission reductions are given in table 3 below.

Table 3: 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	*Main emission source*: Fossil fuels fired for electricity generation cause CO_2 emissions. It is included in baseline calculation.
		CH_4	No	*Minor emission sources*: Even though there may be some CH_4 and N_2O emissions during electricity generation, these emissions are negligible and not included in baseline calculation to be conservative.
		N_2O	No	
Project Activity	Emissions from construction and operation of the plant	CO_2	No	*Minor emission sources´(AMS-I.D., p.7, refers to latest ACM0002, here v.11)*: The project activity will not create a new reservoir. Therefore there will not be any project emission.
		CH_4	No	
		N_2O	No	

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

The baseline scenario is identified as defined in AMS-I.D. via calculation of the combined margin calculation.

In detail the following stipulations according to baseline determination as per AMS-I.D. apply (respective AMS-I.D. sections are indicated):

- Sırma hydro plant is a greenfield hydro project (thus no retrofit/capacity addition project or gas project; for baseline determination methodology sections 10-12 are applicable while 13-18 are non-applicable).
- As the project activity is a new grid-connected renewable power plant the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources (I.D., section 10).
- The baseline emissions are equivalent to the product of electrical energy baseline – expressed in MWh of electricity produced by the renewable generating unit – multiplied by the grid emission factor (see section 11).
- The emission factor is calculated in transparent and conservative manner as per option a (see section 12). For this the "Tool to calculate the emission factor for an electricity system" is applied. The calculations may be found in section 4.2 of this PD.

In the following for description and development of the baseline, (i.e. the Turkish grid emission factor), 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 4: 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.TEİAŞ.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf (page 4, Table 1)

[8] See, http://www.TEİAŞ.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf (page 12-13, Table 4 for High and Table 5 for Low Scenarios)

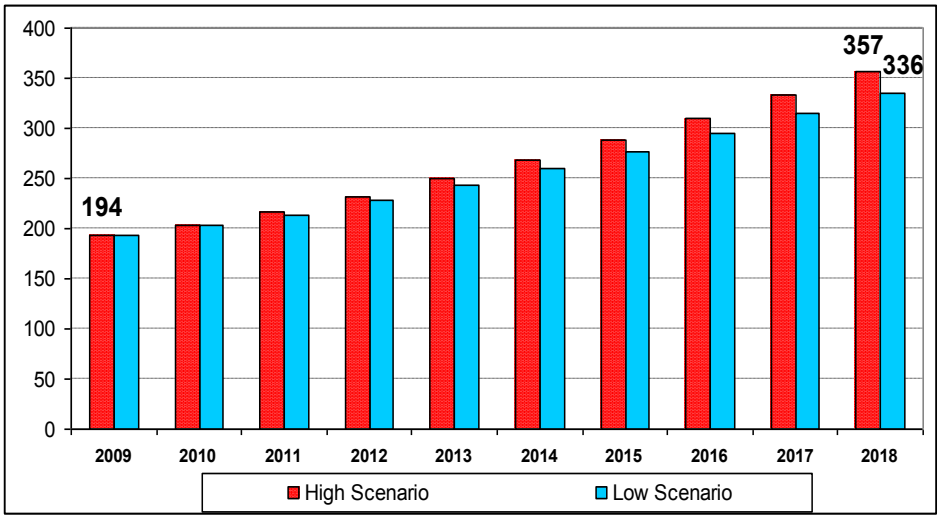

Figure 5: Low/High Demand Projection Scenarios - graphs (TWh)

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 5 below).

Table 5: Projection of Total Generation Capacity by Fuel Types[9]

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	*10.3%*
NATURAL GAS	110.3	111.9	114.6	125.9	139.0	137.9	138.6	139.2	138.4	134.5	*42.7%*
GEOTHERMAL	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 (75.5% in 2018: Thermal excluding geothermal). Natural gas will continue to dominate the market while total imported fuel (natural gas + imported coal) will still be at 53.0%. 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 6 below. The share of fossil fuels in

[9] See, http://www.TEİAŞ.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf (page 32, Table 22)

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

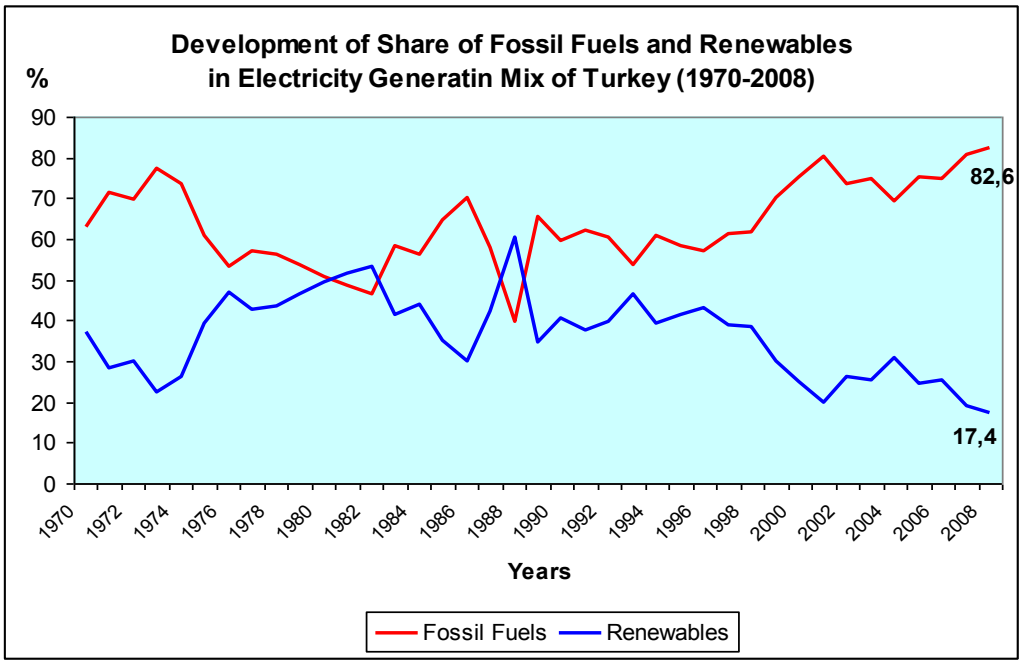

Figure 6: Fossil Fuels and Renewables in Turkish Electricity Mix (1970-2008)[10]

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-fuelled 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 75.5% 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.

[10] See TEİAŞ, http://www.TEİAŞ.gov.tr/istatistik2008/33.xls (Renewable generation is composing of 'renewable and waste', 'hydro' and 'geothermal and wind' data, i.e.: total of data in I93, L93 and M93 cells)

[11] See, http://www.TEİAŞ.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 alternatives to the project activity consistent with current laws and regulations

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. Define alternatives to the project activity

(a) The proposed project activity undertaken without being registered as a VER project activity;

(b) Other energy project(s) that could also deliver electricity with comparable quality, properties;

(c) Continuation of the current situation, i.e. Sırma hydro project is not built

The decision in favour or against of a project investment depends on the expected revenues and risks, like for every other private investment. Investment decisions other than Sırma HPP 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 it may be assumed that Beyobası Enerji Üretimi A.Ş. would have undertaken the project activity without carbon income.

Scenario (b) though has to be excluded in this step as it is not realistic. Beyobası Enerji Üretimi A.Ş. (owner and operator of Sırma hydro project) is free to chose the project type that fits his portfolio. The company is also not forced by law to invest in any type of capacity. At the time when the investment decision was made, Beyobası Enerji Üretimi A.Ş. as a whole had only licenses for hydro power generation.[12] Thus without a alternative license an investment in a different type of energy generation capacity (e.g. coal or wind) was not possible. Thus there is no basis to assume that Beyobası Enerji Üretimi A.Ş. would have invested in another type of project or project at all as replacement to Sırma hydro project investment. Thus the only two realistic scenarios are (a) and (c) while scenario (b) is excluded.

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

[12] The additionality tool (see footnote number 4) also reflects these investor/technology specific circumstances: "For example, a coal-fired power station or hydropower may not be an alternative for an independent power producer investing in wind energy or for a sugar factory owner investing in a co-generation, but may be an alternative for a public utility. Alternatives are, therefore, related to technology and circumstances as well as to the investor."

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 (a), 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 Annex 1.

Sub-step 2a: Determine appropriate analysis method

After exclusion of scenario (b) in step 1b, scenario (a) is the only remaining feasible "investment scenario" (scenario (c) refers to the continuation of the status-quo/non-investment). Accordingly in order to evaluate the attractiveness of scenario (c) the benchmark analysis has to be applied.

Sub-step 2b: Option III: Apply 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 document[13], 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 financial indicators

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 6.

Table 6: Financial Inputs

Installed Power[14]	6.00	MW_e
Annual Electricity Generation[14]	23.230	*GWh*
Total Project Cost	*- Confidential- (cf. 1.17)*	*USD*
Operational Duration	36	*years*

[13] 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. Please copy the link and paste to web browser if clinking will not work).

[14] Installed power and annual electricity generation figures are from Licence

Income Tax Rate[15]	20	%
Electricity Selling Price (Base Case)	55	*€/MWh*
Annual Operating Cost	*-Confidential- (cf. 1.17)*	*USD*
EUR/USD Exchange Rate	1.42	*€/USD*
USD/TL Exchange Rate	1.21	*USD/TL*

The resulting IRRs after Tax for Base Case Scenario (55 €/MWh) for 36 year period is stated in below (Table 7):

Table 7: Equity IRR values (after tax) for project activity

Period	**IRR**
36 years	12.34%

As resulting IRR for the project activity is 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, 55 €/MWh - maximum regulated price - is used as base case and varied -/+10%. 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 is given in Table 8 below. 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 is considerably below the 15% benchmark.

*Table 8: Equity IRR results according to different parameters (after tax)**

Parameter	**Electricity Price**			**Investment Cost**		
Variance	-10%	0%	+10%	-10%	0%	+10%
IRR	10.15 %	12.34%	14.63%	14.60%	12.34%	10.58%
Parameter	**Energy Yield**			**Operating Cost**		
Variance	-10%	0%	+10%	-10%	0%	+10%
IRR	10.15 %	12.34%	14.63%	12.79%	12.34%	11.90%

(*) For other parameters than electricity price (EP), 55 €/MWh EP is applied.

[15] See, http://www.kpmgvergi.com/tr-tr/PratikBilgiler/vergimevzuatibilgileri/oranlar/Pages/KurumlarVergisiOrani.aspx (for 2009).

Step 4: Common Practice Analysis

Sub-step 4a. Analyse 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.[16] Therefore while still hydro power capacity is added to the grid, hydro power generation is only a marginal technological choice in the market. This is illustrated in Figure 7 below.

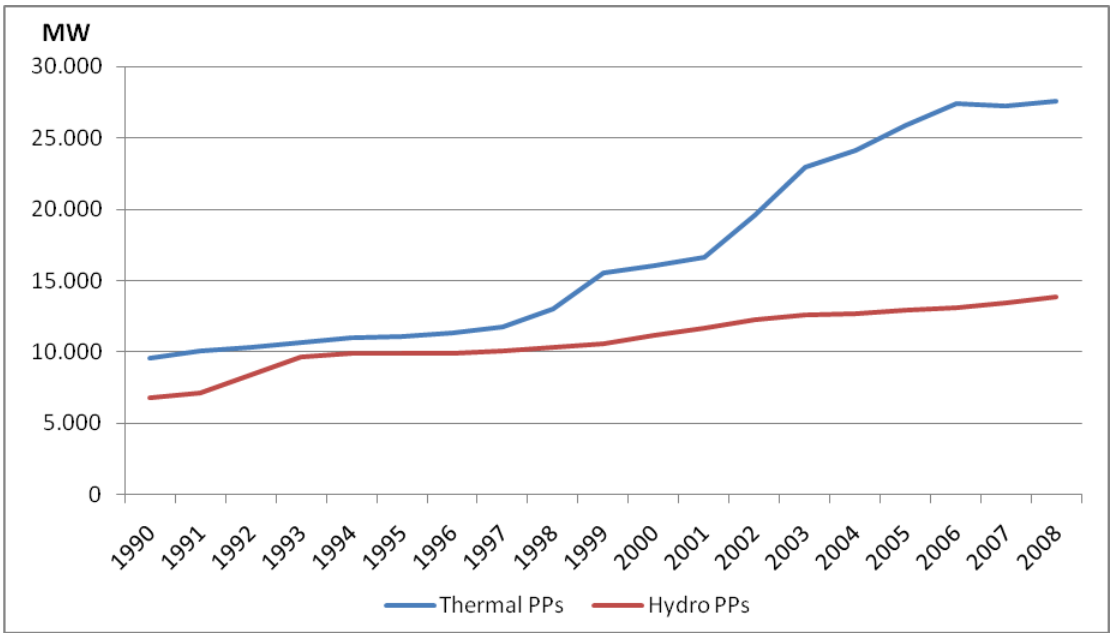

Figure 7: Annual Development of Turkey's Installed Capacity[17]

Exceptional plant operator/business model

Sırma HPP is operated by Beyobası Enerji Üretimi A.Ş., a private utility. The HPP license[18] 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 9 provides a breakdown of the market in 2008.

[16] http://www.teias.gov.tr/istatistik2008/33.xls

[17] http://www.teias.gov.tr/istatistik2008/1.xls

[18] Licence for Sırma HPP is available to DOE.

Table 9: Breakdown of Installed Capacity of Turkey by the end of 2008[19]

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	
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 companies[20];
- Mobile Plants are selling electricity to EUAŞ;
- ToR, BO and BOTs utilities are selling electricity to TETAŞ (State Electricity Wholesale Co.) with long term purchase contracts[21].
- Autoproducers are private companies building utilities primarily for their own needs[22].

Hence all those power plants not belonging to these companies cannot be considered similar to the proposed project activity. According to

[19] See, http://www.TEİAŞ.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf (page 16, Table 9)

[20] See, Website of EÜAŞ, http://www.euas.gov.tr/

[21] See, http://www.TEİAŞ.gov.tr/eng/ApkProjection/CAPACITY%20PROJECTION%202008-2017.pdf (page 37)

[22] See, Licence Regulation: http://www.epdk.org.tr/english/regulations/electric/license/licensing.doc (page 3)

the business model parameter, only 1.93% of the installed capacity is potentially similar to Sırma HPP.

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 10 below:

Table 10: All hydro projects in operation belonging to IPPs by the end of 2008[23]

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
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

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

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?id1=264

e) VER Project registered under VCS:https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?id1=111

There are a number of voluntary standards and registries to which project participants having carbon reduction projects can apply for registration. Identified VER projects listed above are only from VCS and Gold Standard registries which are widely preferred in Turkey. However, unlike CDM projects, having more than one registry for VER projects preventing the identification the whole VER applicants or registered projects.
Considering information at hand, from similar projects having 807.1 MW total installed capacity, total installed capacity of the projects which cannot be identified as VER projects is 735.6 MW, and share of these projects in total capacity of Turkey in 2008 is **1.76%.**

Project specific cost structure
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%). [24] Hence, for a typical small scale hydro project, site specific costs (special construction demands especially due to difficult topography) affect the economical feasibility of the project to a far larger degree.

[24] See, http://www.kuleuven.be/ei/Public/publications/EIWP01-02.pdf (page 4)

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

For small scale hydro projects, site (topography) and resource (water availability) specific factors are the most important parameters for financial return of the project and investment decision. To be able to discuss and elaborate the similar or most likely to be similar projects with the proposed project, at least we shall know the general characteristics of the projects. However, there is no transparent project related financial or technical characteristic at hand for these similar projects. On the other hand, considering the very small share of the similar projects, comparing the total installed capacity, i.e. 1.76%, we can conclude that the proposed project activity is not common practice.

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 small-scale baseline and monitoring methodology AMS-I.D. ("Grid connected renewable electricity generation", Version 16) is applied here.

This methodology was chosen as it is VCS accepted. Furthermore it is adjusted to small-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 AMS-I.D. stipulations.

Purpose of monitoring

The monitoring serves 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 TEIAS substation. These meters are sealed by TEIAS and intervention by project proponent is not possible.

Table 11: Meter Characteristics

	MAIN	**SPARE**
Manufacturer	Elster	Elster
Serial No	00368721-2008 Alpha A1500	00368720-2008 Alpha A1500
Type	A1500-W045-741-OLS-1165X-V3H00	A1500-W045-741-OLS-1165X-V3H00
Frequency	50 Hz	50 Hz
Current	5 A	5 A
Voltage	58/100 V	58/100 V
Accuracy Class	0.5s	0.5s

[25] See, http://www.epdk.org.tr/mevzuat/yonetmelik/elektrik/dengeleme/yeni/degisiklik06112010.doc page 13

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. Monthly settlement notifications of PMUM consist hourly electricity production and withdrawn electricity from the grid.

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. The measurement is done hourly while readings are conducted on a monthly basis.

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 market[26]: "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.

Paragraph b of Article 9 of the "Regulation of Metering and Testing of Metering Systems"[27] (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 Agreement[28] between Beyobası Enerji Üretimi A.Ş and distribution company (AYDEM) 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

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

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

[28] See, http://www.teias.gov.tr/sistemkullanim1.doc , page 3, 2-b)

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)

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 continuous monitoring and 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	**23,230 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. Measured hourly and readings monthly. Monthly settlement notifications of PMUM consist hourly electricity production and withdrawn from the grid. 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.
QA/QC procedures to be applied:	Cross check measurement results with internal records for electricity generated shall be applied. On redundant metering and high data quality please also refer to the text passage on data quality management in section 3.2 above.
Any comment:	

Parameter A_{PJ} (area of the newly built reservoir) as per ACM0002 (AMS I.D. refers to ACM0002 for estimation of project emissions) is not applicable to the project at hand as the plant is constructed at an existing reservoir.

Parameters for validation

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	**0.5502 tCO_2/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:	

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.TEİAŞ.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.TEİAŞ.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.TEİAŞ.gov.tr/istat2004/7.xls For plants in 2005: http://www.TEİAŞ.gov.tr/istatistik2005/7.xls For plants in 2006: http://www.epdk.org.tr/yayin_rapor/elektrik/yayin/uretimKapasiteProjeksiyonu.pdf (page 76 and 77 for installed power of new plants, page 67-75 for generation amounts. For capacity additions, interpolation method is used for generation amounts) For plants in 2007: http://www.epdk.org.tr/yayin_rapor/elektrik/yayin/uretimKapasiteProjeksiyonu2008_2017.pdf (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.TEİAŞ.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)
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:	No plant specific and national emission factor data is available in Turkey. So, IPCC default data is used.

	For Fuel Oil Power Plants: 'Gas/Diesel Oil' data is used for conservativeness. 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 Antharcite. 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_Taskömuru-Jeotermal)
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$\eta_{m,y}$
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"
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:	For Lignite and Coal power plants, plants specific values are applied. There are two lignite power plant in Sample Group. These are Çan and Elbistan PPs. For efficiency factor of Çan PP is taken form presentation of Mr. Sefer Bütün (General Manager of EUAS, state production company) which is 'Thermal Power Plants and Environment'. This presentation is submitted to DOE. In page 18 of the presentation, it is stated that the for pulverized lignite power plants the highest achieved electrical efficiency rate is 38%. So this rate is applied also for Elbistan-B PP. Weighted average of these efficiency rates which turns to be 38.63% is used for lignite power plants. For coal power plants, the highest efficiency rate for 'fluidized bed' technology which is 41.5% 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) 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
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.TEİAŞ.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.TEİAŞ.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 in sections 3.2 and 3.3 above, the relevant data that has to be monitored is the electricity supplied to the grid (EG_y) per year.

***EG_y*:**

This data is subject to the accounting quality systems of both parties to the power purchase agreement, distribution company and Beyobası Enerji Üretimi A.Ş. With this, no additional structures or processes have to be implemented to ensure the availability of necessary data for monitoring.

At the end of each monitoring period, which is planned to generally last one year, the data from the monthly meter reading records 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.

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 Sırma HPP can be given:

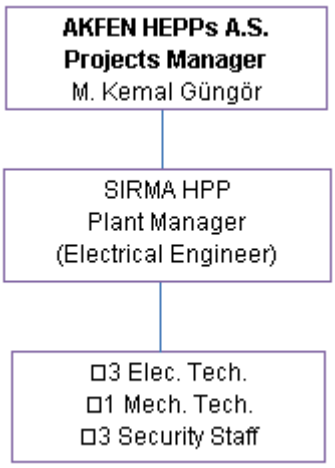

Figure 9: Plant Operational/Responsibility Structure

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

The GHG information system at Sırma 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 2 ("Baseline information").

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

CDM approved baseline and monitoring methodology AMS-I.D. ("Grid connected renewable electricity generation", Version 16) was chosen as methodological basis. This methodology defines well-established procedures and has already been successfully applied to many CDM and JI projects.

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

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

For identification of the baseline scenario AMS-I.D. 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 CO_2 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 2 of this PD. The origin of the applied data is shown in section 3.3 above.

Baseline emissions

As per AMS-I.D. Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. This is calculated as per formula 1:

$$BE_y = EG_{BL,y} \times EF_{CO2,grid,y} \quad \textbf{(1)}$$

Where:

BE_y	Baseline emissions in year y (tCO_2/yr).
$EG_{BL,y}$	Electricity supplied by the project activity to the grid (MWh).
$EF_{CO2,grid,y}$	CO_2 emission factor of grid in year y (t CO_2/MWh); This parameter is the combined margin (CM) calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".

$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$= 23,230 MWh/year * 0.5502 tCO_2/MWh
= **12,780 tCO_2/year**

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

As per applied methodology and tools there are neither project nor leakage emissions, which have to be taken into, account.

Project Emissions

Regarding project emissions of hydro power plants, AMS-I.D. (p.7) refers to ACM0002 where PD (power density) of the water reservoir is considered for determination of reservoir emissions. Thresholds and calculation procedures defined there (p.7) though are only applicable to projects with new reservoir capacity. As Sırma HPP does not include the construction of a new reservoir, such project emissions do not accrue.

Thus,
$PE_{HP,y}$ (project emissions) = 0

Leakage

As the project does not entail the transfer of energy generation equipment form another activity, leakage is also considered zero.

Thus,
LE_y (leakage emissions) = 0

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

Emission reductions due to project activity have to be calculated as per formula 13 of AMS-I.D.:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(13)}$$

Where:
ER_y Emission reductions in year y (tCO_2/yr).
BE_y Baseline emissions in year y (tCO_2/yr).
PE_y Project emissions in year y (tCO_2/yr).
LE_y Leakage emissions in year y (tCO_2/yr).

As both PE_y as well as LE_y are 0 (see 4.3 above), the emission reduction is equivalent to the determined baseline emissions. Thus emission reductions amount is **12,780 tCO_2/year.**

5 Environmental Impact:

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

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 (=business as usual) scenario;
- Reduction of other pollutants (like SO_2 from combustion of coal) from power generation in Turkey as compared to BAU.

6 Stakeholders comments:

Sırma HEPP is a small-scale hydro project with limited impact to the environment due to minimum amount of facilities built in the project area. The bodies of the project are only: head pond, penstock, power plant and energy transmission line.

During project site visit for validation, an interview with the mayor of closest village, Sırma Köyü, was conducted. During that meeting Mr. Altan Ayhan Telef (mayor) stated that, there is no complaint or concern regarding the project. He said around 15 workers from Sırma village had been employed for construction and currently three people from his village are working in the power plant. The lands of the project belong to the Treasury Ministry and they have been rented by the project developer.

Additionally, during the site visit some villagers were randomly asked for their comments about the project and their opinion about the project were positive as they said the project had no negative effects on the village but created jobs.

There is ongoing communication between the local community and of Sırma Köyü village and the plant management. The village mayor (muhtar) is ready to gather and bring forward all upcoming issues from the local community vis-à-vis the HPP plant manager as well as vice-versa.

Sustainable Development effects

The project supports Turkey in stimulating and commercializing the use of grid connected renewable energy technologies and markets. The specific economical, social and technological benefits are:

- Reducing Turkeys 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 HPP (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;
- Making rural electricity supply more reliable, better available and cost efficient thanks to decreasing distances between generation and consumption points.

7 Schedule:

The following schedule applies to the GHG project:

The VCS project activity began with the achievement of first emission reductions/the feeding of electricity to the grid shortly after commissioning of the hydro plant in June 2009. As starting date of the VCS project/beginning of the first monitoring and crediting period, June 7st, 2009 is indicated.

Validation of the project shall take place as soon as possible. An annual monitoring and reporting is envisaged. The first crediting period shall end on 31 Mai 2019. A comprehensive timeline of the hydro power project is provided below.

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. In line with EB41 stipulations the agreement date with construction subcontractor (23 October 2007) has been set as project starting date, since with this event the project investor committed to the largest share of investment costs.

Table 12: Implementation Schedule

Date (DD-MM-YYYY)	Activity
05-07-2007	Issuance of license
25-08-2007	Requests for proposals from consultants for VER development
16-10-2007	Contract Signature with Zhejiang Orient Engineering Co. Ltd. (generator/turbine)
23-10-2007	Contract Signature with Yapı-TEK and Bugato İnşaat, Ordinary partnership (construction)
01-11-2007	Starting construction activities with roads and site preparation
01-03-2008	Agreement with Akfen İnşaat Co. (for management of construction)
07-05-2008	Contract agreement with Hitit Sanayi İnsaat for hydromechanical equipment
25-05-2008	Contract agreement with Köseoğlu Elektrik for transmission line
01-09-2008	Initial agreement with a VER consultant
07-06-2009	Start of commercial operation/starting date of VER project, first monitoring and crediting period
27-03-2009	Financial closure with bank
13-04-2010	Signature with FutureCamp Türkiye for VER development
31-07-2010	Termination of first monitoring/reporting period; An annual reporting is envisioned.
31-05-2019	Termination of the first crediting period

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 was terminated. But since carbon reduction revenue is essential for implementation of

this project, Beyobası Enerji later signed an agreement with FutureCamp Türkiye for carbon development.

Aforementioned schedule shows 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.

8 Ownership:

8.1 Proof of Title:

Sırma HPP is a project of 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 02[29] 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*[30] '. 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) tCO_2/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.[31] 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.

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[29] See, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf

[30] See, See, http://www.epdk.org.tr/english/regulations/electric/license/licensing.doc (page 21)

[31] 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)[32]

	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 CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants. The calculation of the simple OM emission factor can be based on:

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

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

- 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:

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

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	=	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
EG_y	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year y
y	=	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 CO_2 emission due to electricity generation in Turkey for the years of 2006, 2007 and 2008 are given in Table A1-2.

Table A1-2: CO_2 emissions from electricity production 2006-2008 ($ktCO_2$)[33]

	2006	**2007**	**2008**
CO_2-Emmissions	82,562	97,649	103,352

[33] For detail calculation see Annex 2, Part B.

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 CO_2 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	43.9	43.6
LPG	0.1	0.0	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)[34]

	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.

Hata! Başvuru kaynağı bulunamadı.A2-5 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**

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

Electricity import is added to the domestic supply in order to fulfill the Baseline Methodology requirements. Imports from connected electricity systems located in other countries are weighted with an emission factor of 0 (zero) tCO_2/MWh.

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

Table A1-6: Calculation of Weighted $EF_{grid,OMsimple,y}$ ($ktCO_2/GWh$)

	2006	2007	2008
CO_2-Emmissions ($ktCO_2$)	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 (tCO_2/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:

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

Where:

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

Because of only fuel types and electricity generation data are available for the sample group, *Option A2* of Simple OM method is used to calculate emission factor. The formula corresponds to formula 3 of the tool:

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

Where:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{CO2,m,i,y}$ = Average CO_2 emission factor of fuel type *i* used in power unit m in year y (tCO_2/GJ)
$\eta_{m,y}$ = Average net energy conversion efficiency of power unit m in year y (%)
y = 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 ($\eta_{m,y}$)	CO_2 Emission ($ktCO_2$)
Natural Gas	23,950.0	54.3	60.00%	7,802.9
Lignite	11,440.0	90.9	38.63%	9,691.0
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***			***19,647.2***
$EF_{grid,BM,y}$ (tCO_2/MWh)	**0.4469**			

Step 7: Calculate the combined margin emission factor

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

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

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)

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

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

According to the Tool for wind power generation project activities: w_{OM} = 0.5 and w_{BM} = 0.5. Then:

$EF_{grid,CM,y}$ = 0.6534 tCO_2/MWh * 0.5 + 0.4469 tCO_2/MWh * 0.5
= 0.5502 tCO_2/MWh

PART B: Calculation of Total CO_2 from OM Power Plants:

Table A1-9: HVi,y (Heating Values for Fossil Fuels for Electricity Generation (TCal)

Energy Sources	2006	2007	2008
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: FCi,y (Fuel Consumptions for Fossil Fuels for Electricity Generation (million m3 for Natural Gas and ton for others)

Energy Sources	2006	2007	2008
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 2006	NCVi 2007	NCVi 2008	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: **CO_2 Emission** by each Fossil Fuels Types ($ktCO_2e$)*

Energy Sources	2006	2007	2008
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 Group

Table A1-13: Sample Group PPs for BM Emission Factor Calculation

Name of Power Plant	Capacity (MW)	Average Genera-tion (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 ALİAĞA GRUP I-II	89.2	713.9	N. Gas	08.10.2004
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

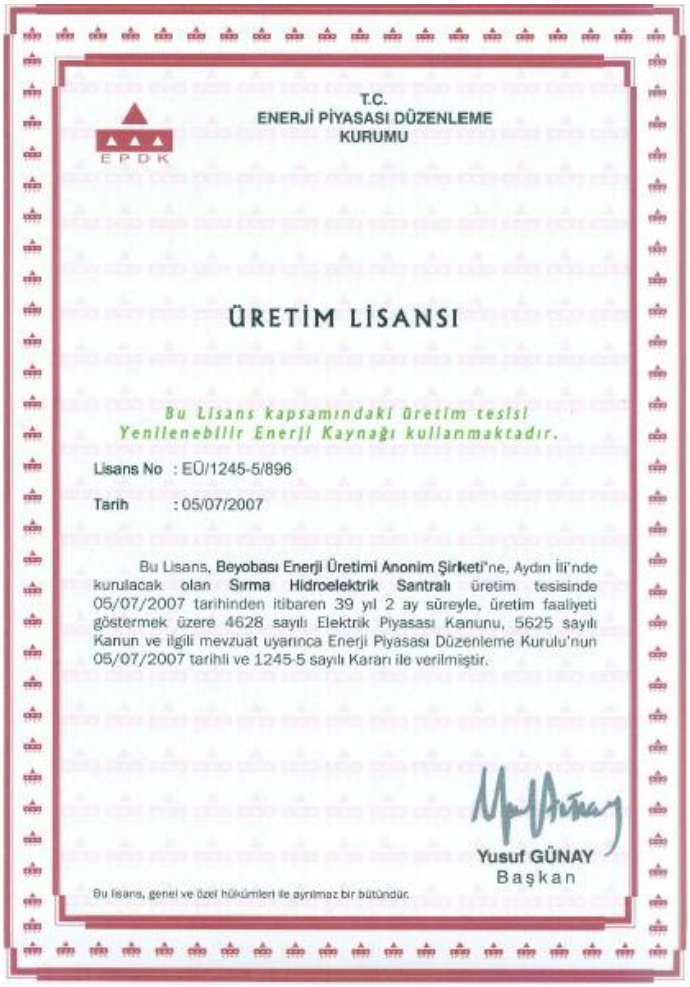
AKBAŞLAR GR-II (Isolated)	8.8	73.0	N.GAS	24.06.2005
AKÇA ENERJİ GR-III	8.7	65.4	N.GAS+NAPHTHA	14.12.2005
AYKA TEKSTİL GR-I	5.5	40.0	N. Gas	24.09.2005
BAYDEMİRLER GR IV-V-VI	6.2	51.4	N. Gas	04.02.2005
BOSEN GR-III	50.0	350.0	N. Gas	30.12.2005
ÇUMRA ŞEKER	16.0	40.0	N.GAS+LIGNITE	01.01.2005
ETİ MAD.(BAN.ASİT)GR-I	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 ALİAĞA GR III	47.7	381.6	N. Gas	02.06.2005
HABAŞ ALİAĞA GR IV	47.7	381.6	N. Gas	21.09.2005
HABAŞ ALİAĞA 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(Hacışıramat) 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
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 GİYİM 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 NİŞASTA (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 GİYİM (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 (ALİAĞA-ADDITION)	9.1	35.3	N. Gas	02.05.2007
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.(Çatalça/istanbul)	2.1	17.0	N. Gas	03.12.2007
FLOKSER TEKSTİL SAN.AŞ.(Çatalça/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
SWİSS OTEL (Anadolu Japan Turizm A.Ş (İstanbul)	1.6	11.0	N. Gas	01.08.2007
TAV Esenboğa Yatırım Yapım ve İşetme 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
Aliağa Çakmaktepe Enerji A.Ş.(Aliağa/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.(Altıntepe 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 NİŞASTA 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
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**		

Annex 2: GENERATION LICENCE



T.C.
ENERJİ PİYASASI DÜZENLEME KURUMU

EPDK

ÜRETİM LİSANSI

Bu Lisans kapsamındaki üretim tesisi Yenilenebilir Enerji Kaynağı kullanmaktadır.

Lisans No : EÜ/1245-5/896

Tarih : 05/07/2007

Bu Lisans, **Beyobası Enerji Üretimi Anonim Şirketi**'ne, Aydın İli'nde kurulacak olan **Sırma Hidroelektrik Santralı** üretim tesisinde 05/07/2007 tarihinden itibaren 39 yıl 2 ay süreyle, üretim faaliyeti göstermek üzere 4628 sayılı Elektrik Piyasası Kanunu, 5625 sayılı Kanun ve ilgili mevzuat uyarınca Enerji Piyasası Düzenleme Kurulu'nun 05/07/2007 tarihli ve 1245-5 sayılı Kararı ile verilmiştir.

Yusuf GÜNAY
Başkan

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

English version of the Generation License:

Republic of Turkey
Energy Market Regulatory Authority

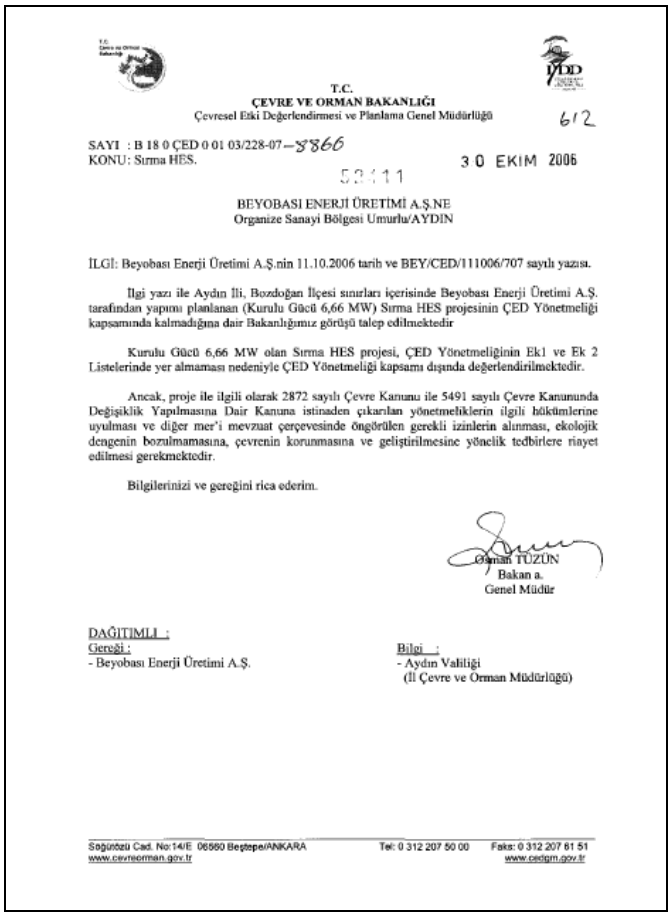
Generation License
The power plant that covered under this license utilizes renewable energy resource

License No: EÜ/1245-5/896
Date : 05/07/2007

In accordance with the decision of Energy Market Regulatory Authority dated 05/07/2007 and no 1245-5, in compliance to law no 5625 and related legislations, this license is issued to the Beyobası Enerji Üretimi Anonim Şirketi for the purpose of electricity generation in Sırma Hydroelectricity Plant in Aydın province for 39 years and 2 month period after the date of 05/07/2007.

Yusuf Günay
President

Annex 3: OUT OF EIA REGULATION LETTER



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

612

SAYI : B 18 0 ÇED 0 01 03/228-07-8866
KONU: Sırma HES.

30 EKIM 2006

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BEYOBASI ENERJİ ÜRETİMİ A.Ş.NE
Organize Sanayi Bölgesi Umurlu/AYDIN

İLGİ: Beyobası Enerji Üretimi A.Ş.nin 11.10.2006 tarih ve BEY/CED/111006/707 sayılı yazısı.

Ilgi yazı ile Aydın İli, Bozdoğan İlçesi sınırları içerisinde Beyobası Enerji Üretimi A.Ş. tarafından yapımı planlanan (Kurulu Gücü 6,66 MW) Sırma HES projesinin ÇED Yönetmeliği kapsamında kalmadığına dair Bakanlığımız görüşü talep edilmektedir

Kurulu Gücü 6,66 MW olan Sırma HES projesi, ÇED Yönetmeliğinin Ek1 ve Ek 2 Listelerinde yer almaması nedeniyle ÇED Yönetmeliği kapsamı dışında değerlendirilmektedir.

Ancak, proje ile ilgili olarak 2872 sayılı Çevre Kanunu ile 5491 sayılı Çevre Kanununda Değişiklik Yapılmasına Dair Kanuna istinaden çıkarılan yönetmeliklerin ilgili hükümlerine uyulması ve diğer mer'i mevzuat çerçevesinde öngörülen gerekli izinlerin alınması, ekolojik dengenin bozulmamasına, çevrenin korunmasına ve geliştirilmesine yönelik tedbirlere riayet edilmesi gerekmektedir.

Bilgilerinizi ve gereğini rica ederim.

Osman TÜZÜN
Bakan a.
Genel Müdür

DAĞITIMLI :
Gereği :
- Beyobası Enerji Üretimi A.Ş.

Bilgi :
- Aydın Valiliği
(İl Çevre ve Orman Müdürlüğü)

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English version of the Letter:

Republic of Turkey
Ministry of Environment and Forest

No: B 18 0 ÇED 0 01 03/228-07-8866
Subject: Sırma HPP.

BEYOBASI ENERJİ ÜRETİMİ A.Ş.
Organize Sanayi Bölgesi, Umurlu/AYDIN

Ref: Letter of Beyoabası Enerji Üretimi A.Ş. dated 11.10.2006 and BEY/CED/111006/707

With the letter given in reference, the opinion of or Ministry is requested by Beyobasi Elektrik Üretimi A.Ş. who plans to build Sırma HPP (with installed power 6.66 MW), on project relevance of EIA Regulation.

Having 6.66 MW installed capacity Sırma HPP is not covered by Annex-1 and Annex-2 of EIA Regulation thus it is considered that the project is out of scope of this regulation.

However, the project shall comply to related provisions of Environment law with no 2872 and regulation issued regarding Law of Amendment in Environment Law with no 5491 and shall obtain

permissions in accordance with related regulations and comply to ecological balance and perform necessary measures to preserve and develop the environment.

Osman TÜZÜN
General Manager
in the name of Minister