Voluntary Carbon Standard
Project Description

19 November 2007

Date of the VCS PDD: 14 May 2008

1 Description of Project:

1.1 Project title

Title: Aydin Salavatli Dora-1 Geothermal Power Plant (hereafter referred to as "the Project")

Version 01

Date: 14 May 2008

1.2 Type/Category of the project

- *According to UNFCCC sectoral scopes definition for CDM projects, the Project Activity is included in the Sectoral Scope 1, category "Energy industries (renewable - / non-renewable sources)".*

- *The project is a single Greenfield investment and is not part of a project group or bundle.*

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

- *The Project is a small-scale project achieving 30'309 CO_2e per annum.*
- ***Table 1** provides details about the estimated Emission reductions achieved by the project over the crediting period.*

Table 1: Ex-ante estimation of emission reductions

Year	Estimation of project emissions (tCO_2e)	Estimation of baseline emission (tCO_2e)	Estimation of leakage emission (tCO_2e)	Estimated Emission Reductions (tCO_2e)
2008 (1st July to 31st December)	0	15'154	0	15'154
2009	0	30'309	0	30'309
2010	0	30'309	0	30'309
2011	0	30'309	0	30'309
2012	0	30'309	0	30'309
2013	0	30'309	0	30'309
2014	0	30'309	0	30'309
2015	0	30'309	0	30'309
2016	0	30'309	0	30'309
2017	0	30'309	0	30'309
2018 (1st January to 30th June)	0	15'154	0	15'154
TOTAL	**0**	**303'090**	**0**	**303'090**

1.4 A brief description of the project:

MENDERES Geothermal Elektrik Üretim A.Ş, (hereafter referred to as "the Project Owner") is the owner and the license holding company for

the grid connected 7.951 MW Aydin Salavatli Dora-I Geothermal Power Plant.
The company has been established in 1999 and is headquartered in Aydın. It was set up as an investment company to provide electricity to both facilities within the MB Holding and other industrial complexes through the generation of electric power from geothermal energy. The company was established as a "generation company" in accordance with the terms and conditions stated in the Electricity Market Licensing Regulation published in the Official Gazette dated 04.08.2002, numbered 248336. The Project Owner continues to invest in the renewable energy sector.
The first drilling activities as part of the project assessment had been started in 2003. Construction was initiated close to the city of Aydın in the village of Salavatlı almost two years later in May 2005 and had been taken one year. The Project commissioned in May 10, 2006 and emission reduction credits will be claimed for the period after July 1st, 2008.

The project activity aims to generate electricity from geothermal energy at a heat between 78°C and 170°C. The geothermal fluid is pumped up to the surface through production wells located in the "Aydın, Sultanhisar-Salavatlı geothermal field".
The thermal fluid is passed through a heat exchanger and the heat from the fluid is transferred to a secondary fluid - hydrocarbon. The secondary fluid is vaporized to generate electricity via the turbine and the generator. After having passed the heat exchanger, the geothermal fluid drops to 78°C and is re-injected back to the reservoir via a re-injection well. The production cycle is closed due to complete re-injection of the geothermal brine; thus avoiding any adverse effects to the environment and the performance parameters of the geothermal reservoir. The inhibitor and the dosing pump installed at the well prevent the fluid from causing corrosion and silica sediment deposits.

The Project is the first private geothermal power plant in Turkey, which was taken into operation and the first employing the specific "Organic Rankine Cycle & Binary technology" for increased efficiency. [1] *Thus, it can be considered as the pioneer private geothermal power plant in whole Turkey.*
Further the renewable energy market in Turkey is very young and investments in renewable energy face several insecurities as there is specifically in the case of geothermal power plants very high investment costs in comparison to other renewable and non-renewable sources. The Project proves the viability of grid connected renewable energy projects and is an outstanding stimulation for other investors to invest into renewable energy and especially to use the geothermal potential of Turkey. Additionally, the project supports improvement of energy security, air quality, alternative sustainable energy future, local livelihood and sustainable renewable energy. The importance of the Project becomes apparent when looking at the increased energy demand of Turkey and the increasing number of financial more attractive and less investment-intensive fossil fuel fired power plants.

The specific goals of the project are:

- *being one of the first projects demonstrating the operational capability of geothermal power plants and thereby taking first mover risks*

[1] www.ormat.com

- *reduce greenhouse gas emissions in Turkey compared to the business-as-usual scenario,*
- *help to stimulate the growth of the geothermal power industry in Turkey,*
- *create local employment during the construction and the operation phase of the geothermal power plant,*
- *reduce other pollutants resulting from power generation industry in Turkey, compared to a business-as-usual scenario,*
- *help to reduce Turkeys increasing energy deficit,*
- *diversify the electricity generation mix and reduce import dependency,*
- *save energy for the greenhouses, which are planned to be supplied with the waste heat of the Project.*

The Turkish electricity grid is characterized by being fed to a relevant extend with fossil fuels, including lignite, oil and gas. The emission reduction can be achieved by substituting the grid-connected electricity with electricity generated from the geothermal source. The emission reductions will be calculated based on the Combined Margin (CM) emission factor, which is calculated according to the requirements of the "Tool to calculate the emission factor for an electricity system".

The project's specific contribution on sustainable development and environmentally friendly energy production can be summarized as following:

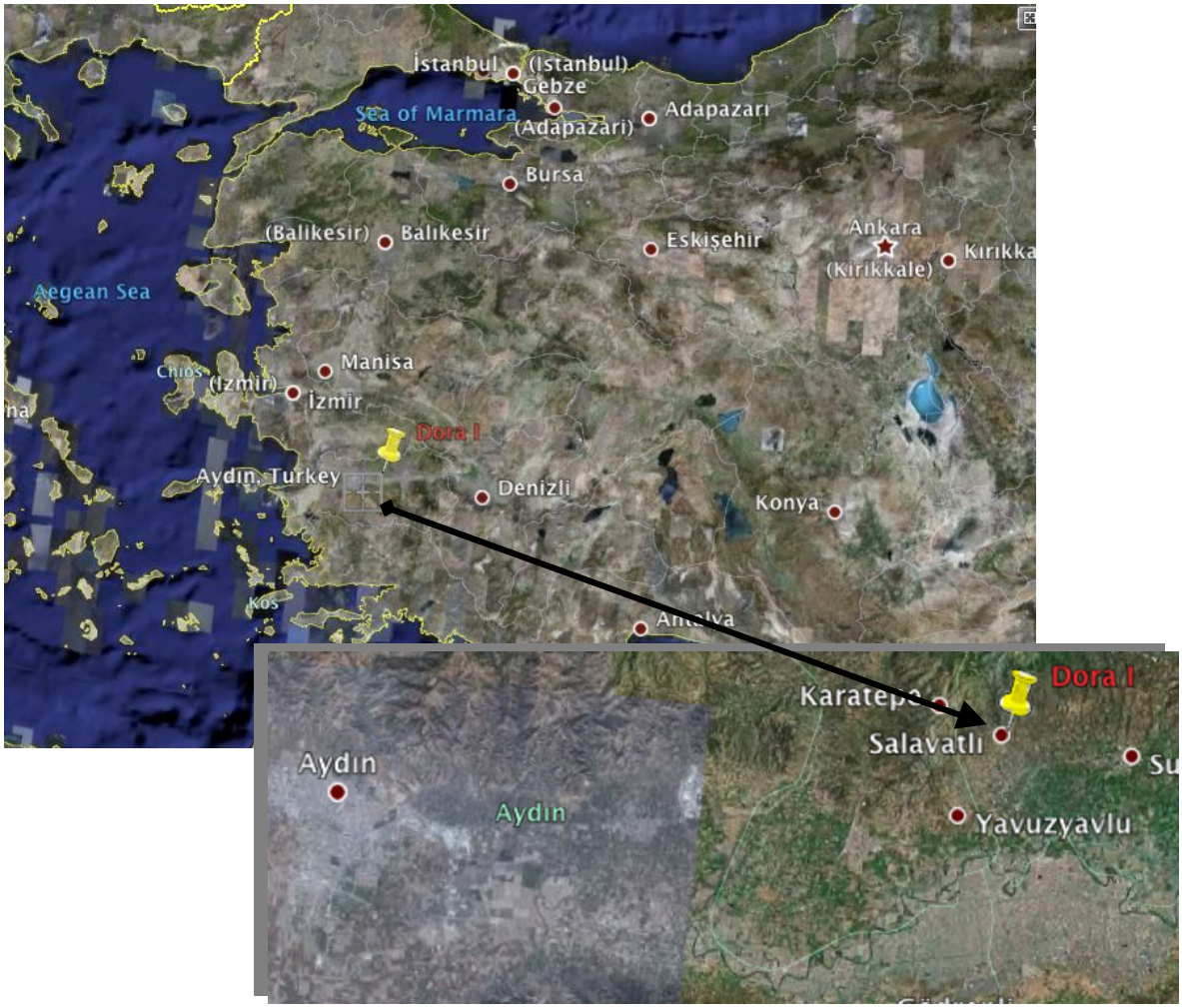
- *it does not emit residuals that can have a negative impact on soil and water quality*
- *as a renewable energy source geothermal energy can be used without putting the supply of primary energy sources into danger for future generations.*
- *it reduces the dependence of Turkey for fossil fuel*
- *it results in extra employment in the region during both construction phase (100 additional employees) and operation (25 permanent jobs).*
- *it is planned to deliver waste heat to regional greenhouses, which will enhance the development of greenhouse agriculture and hence the local economy.*

Given this, the Dora-I project was first of its kind and groundbreaking for the further development of this environmental friendly technology.

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

The Dora-I power plant has been constructed in the West of the village Salavatlı, which is located in the Northeast of the city of Aydın. It was built in a free area in the marginal lands of the village and covers an area of 25'000 square meter including two sides. One of them hosts the production wells named AS-1 and ASR-2. They are connected to the electricity generation facility through 900 meter long isolated tubes in the case of well AS-1 and 100 meter for the ASR-2 well. The re-injection well, named AS-2, is located right at the generation facility.

Figure 1: Project location



The geographical location of the Project is 37°53’22 85 N and 28°06’33.50 E.

1.6 Duration of the project activity/crediting period:

The project reached financial closure on 4 April 2003. Following financial closure drilling activities commenced. The construction of the power plant was concluded in May 2005. One year later on 10 May of 2006 the project commissioned energy generation, which at the same time was the first day of operation of the geothermal power plant delivering electricity to the national grid through the TEİAŞ department Piyasa Mali Uzlastirma Merkezi.
The crediting period start date will be on July 1, 2008. Due to CO_2 fractions, which are contained in the geothermal brine and that have not been monitored yet no emission reductions will be claimed. The monitoring plan elaborated according to the approved small scale methodology, which is been applied in the underlying document will be used for monitoring the requesting data. The crediting period of the project will be 10 years, which can be renewed twice.

1.7 Conditions prior to project initiation:

The project is a Greenfield project; at project location, prior project initiation, there was no geothermal or electricity production activities.

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

As discussed above the project covers an area of 25'000 square meter including two sides. One of them hosts the production wells named AS-1 and ASR-2. They are connected to the electricity generation facility through a 900 meter long isolated tubes in the case of well AS-1 and 100 meter for the ASR-2 well. The re-injection well, named AS-2, is located right at the generation facility. The electricity is being fed to the national grid through a 3.5-kilometer long underground cable, which has been constructed by the Project Owner. The generation process works as follows:
3% Steam and 97% hot brine are pumped from four wells from a depth between 1300 meter (ASR-2) and 1510 (AS-1) meter. The thermal fluid is passed through a heat exchanger and the heat from the fluid is transferred to a secondary fluid, hydrocarbon. The secondary fluid is vaporized to generate electricity via the turbine and the generator. After leaving the heat exchanger water will then be re-injected back to the reservoir through the additional 962-meter deep re-injection well.
Thus, a closed system is formed where any adverse effect to the environment can be avoided. Additionally, some of the waste heat – instead of reinjecting the fluid directly to the earth- is planned to be used in various greenhouses in the future.

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

The Project employs latest geothermal technology. As the first private geothermal power plant in Turkey the Project uses the specific "Organic Rankine Cycle & Binary technology" for increased efficiency. The employed turbines have been purchased in Israel[2]*. Installation works have been accompanied by expertise and consultancy from Istanbul and abroad. The Dora-I power plant operates for 8125 hours a year. The rest of the time is dedicated to maintenance works at the power plant for assuring proper condition of the production facilities.*

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

Relevant laws have been identified and summed up in Table 2*.*

[2] Please see footnote 1.

Table 2: Relevant laws applicable to the Project

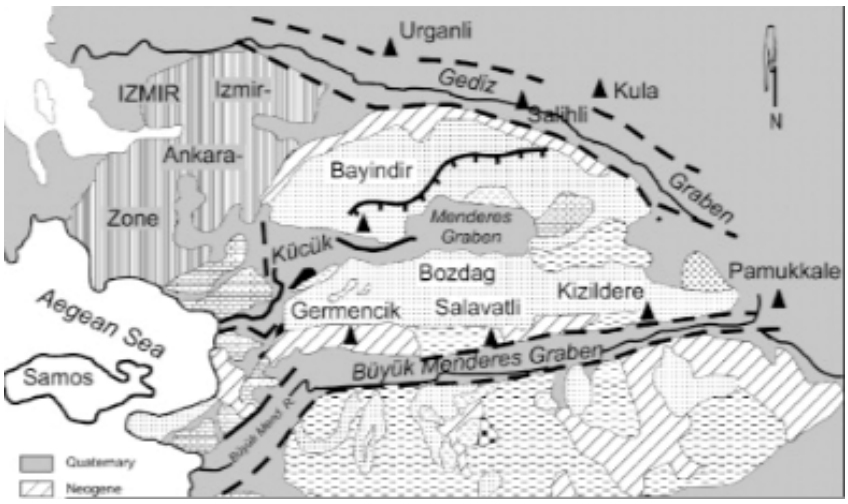
Relevant Laws	Number / Enactment Date
Environmental Law	Nr. 2827 / 11.08.1983
Electricity Market Law	Nr. 4628 / 03.03.2001
Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy	Nr. 5346 / 18.05.2005
Energy Efficiency Law	Nr. 5627 / 02.05.2007

The project received all authorizations and permits to operate, proving that the project is in compliance with all laws and regulations of Turkey.

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

The project is operating normally for almost two years now; the specific risks linked to the use of a sophisticate and state-of-the-art technology cannot be considered any more.
Only earthquake is being seen as a significant risk by the project owner.
The Menderes Graben contains a geothermal reservoir with a very high potential of geothermal brine and steam. This can be explained by the specific location of Turkey, which in the South adjoins to the Arabian tectonic plate. Hence, the Western regions of Turkey are being exposed to the risk of strong tectonic activity, as had been the case already several times in the history of the country. 7 large earthquakes have been erupting the earth since 1933 being a threat to the population as well as to investment activities. The last earthquake, affecting the region of the Project, erupted in 1999.[3] *Nevertheless, the Project Owner decided to invest in the Region using the big potential of the geothermal field, as can be seen in* Figure 2.

Figure 2: Menderes Graben geologic map



[3] URL: http://www.allaboutturkey.com/deprem.htm, (28/04/2008).

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.

Not applicable, the project is a Greenfield project implemented for the purpose of energy production.

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

The project has not created another form of environmental credit or renewable energy certificate.

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

Not applicable.

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

Table 3: Project participants

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Turkey (host)	Menderes Geothermal Elektrik Uretim A.Ş. (private entity)	No
Switzerland	South Pole Carbon Asset Management Ltd. (private entity)	No

Menderes Geothermal Elektrik Üretim A.Ş. (hereafter referred to as the Project Owner) is the Project Owner[4] *whereas South Pole Carbon Asset Management Ltd. (hereafter referred to as South Pole) acts as a consultant responsible for carbon consulting and transaction issues of the emission reduction certificates. Contact details can be seen in* Annex 1.

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.):

1.17 List of commercially sensitive information (if applicable):

[4] Trade registry entry as scanned copy in Annex 3

All commercial and financial information are considered as confidential by the Project Owner and will only be disclosed to the validator.

2 VCS Methodology:

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

The emission reductions of the Project have been calculated in accordance with the approved small scale CDM-methodology AMS-I.D.: "Grid connected renewable electricity generation", version 13[5]*. For baseline calculations the AMS-I.D refers to the "Tool to calculate the emission factor for an electricity system", which offers two options of which the Combined Margin (CM) approach has been chosen. The CM consists of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the above-mentioned tool.*

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

The choice of the methodology can be justified through its applicability criteria because the Project:

- *is a small scale activity due to its installed capacity with less than 15 MW;*
- *is a geothermal project activity exporting electricity to the national grid.*

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

The greenhouse gases and emission sources included in or excluded from the Project boundary are compiled in **Table 4** *below:*

Table 4: Emission sources included or excluded from the Project boundary.

Source		*Gas*	*Included?*	*Justification / Explanation*
Baseline	*CO2 emissions that are displaced due to the Project Activity from electricity generation in fossil fuel fired power plants connected to*	*CO_2*	*Yes*	*Main emission source. The dominant emissions from power plants are in the form of CO_2, therefore CO_2 emissions from fossil fuel fired power plants connected to the grid will be accounted for in baseline calculations.*

[5] AMS-I.D, version 13, valid from December 14th, 2007 onwards, URL: http://cdm.unfccc.int/methodologies/DB/GA1Z9QIWW2MFAX2GT0Y6IYNPGNH0S1/view.html, , (28/04/2008).

	national grid	CH_4	*No*	*Minor emission sources.*
		N_2O	*No*	
Project Activity	*Emissions as a result of Project Activity*	CO_2	*No*	*Minor emission source. As suggested by the baseline methodology, project emissions (PE_y) are assumed to be 0 and will not be considered.*
		CH_4	*No*	
		N_2O	*No*	

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

The project activity consists of the generation of electricity by using a renewable geothermal source. The respective baseline scenario would be the generation of grid-connected power, which would have otherwise been generated by the operation of grid-connected (to a relevant extend fossil-fuel-fired) power plants and by the addition of new generation sources. This scenario would be the continuation of the business as usual which is displayed in Figure 3. The fraction of fossil fuels identified in the national electricity grid has been around 70-75% since 2002. Due to low incentives for renewable energy investments it is expected not to change considerable in the coming years, as illustrated below.

Figure 3: Electricity Generation Forecast (2007-2016)[6]

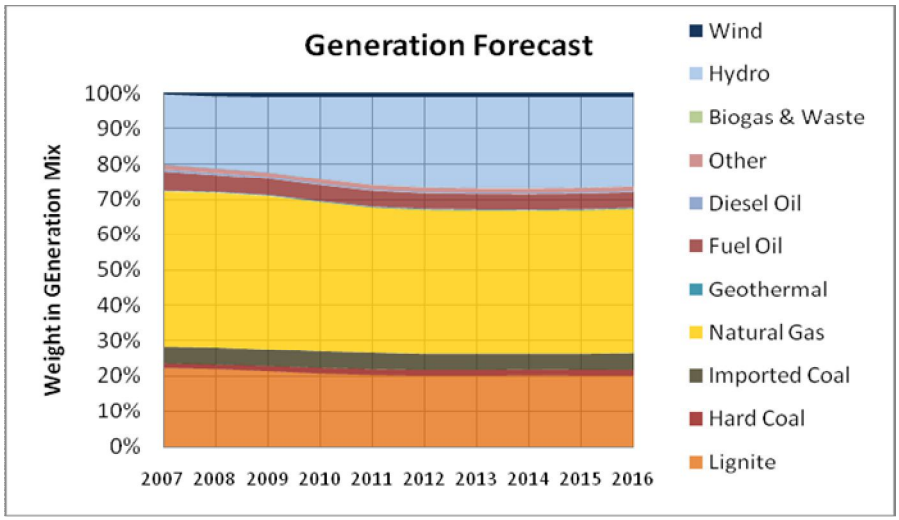


Figure 3 clearly indicates that generating electrical energy from geothermal power is most likely to stay almost negligible in short - and middle term. It will continue to be dominated by fossil fuel power plants and geothermal energy is unlikely to cover more than 1 percent of the overall energy demand within the next 10 years. From what is known to the Project participants and as stated above there are just two more geothermal power plants under operation, which provide electricity to the national grid. In 2007 the overall installed capacity for geothermal sources did not exceed 36 MW[7]*. This*

[6] Generation Forecast, in: Capacity projection, p.30, TEİAŞ.

[7] A 2007 survey on the installed geothermal power + an energy forecast has been conducted and published by Orhan Mertoglu Chairman of the Geothermal Working Group, T.R. Prime Ministry State Planning Organisation, President, of the Turkish Geothermal

can be considered as negligible compared to the overall installed capacity of all primary resources in 2007 that were 41'692 MW[8].

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):

For the demonstration of additionality the "project test" as prescribed in the VCS 2007 guidelines has been chosen.

Step 1: Regulatory Surplus

The Project has not been mandated by any enforced law, statute or other regulatory framework. Please, see section 1.10 for details.

Step 2: Implementation Barriers

According to the VCS guidelines the project shall face one (or more) distinct barrier(s) compared with barriers faced by alternative projects. Thus, technological and institutional barriers have been identified and will be elaborated in detail:

Institutional barriers:

Access to finance: The Project Owner has experienced grave difficulties in securing the finance for the Project because of the following reasons;

- *Project Financing:*
  - *Non-availability of a bank loan: The Project Owner was not able to finance the project by "Project Financing" because it was the first of its kind and banks deemed the project to be too risky. The low Annual Debt Service Cover Ratio (ADSCR) of the project further increased the non-availability of Project Financing by the banks.*
  - *Necessity of Exim credits by the Equipment supplier: As a result of the reluctance of the banks to take part of the first mover risks the Project Owner is exposed to, it had to resort to an Exim credit of the equipment supplier. Thus, only the Project Owner and the equipment supplier as an attempt to sustain its business were willing to take the risks of employing this new technology in Turkey, being exposed to non-availability of experience, high risks of tectonic activity and high country risks rates.*
  - *Equipment and land mortgage: Only a small fraction of the investment could be covered by the Project Owner's equity and the Exim credit. Thus, additional capital had to be acquired and could be secured in form of a loan by the Turkish development bank Türkiye Kalkınma Bankası A.Ş. after all the difficulties only under the non-favourable*

Association and Chairman of Board, ORME Jeotermal Inc. See.: http://www.samorka.is/Apps/WebObjects/Samorka.woa/1/swdocument/1000933/Orhan+Mertoglu+&+Sakir+Simsek,+Recent+Geothermal+Applications+in+Turkey+and+Projections+for+the+Year.pdf, (28/04/2008).

[8] According to the most recent data provided by the Turkish Energy Market Regulatory Authority EPDK. See: http://www.epdk.gov.tr/english/reports/electric/CapacityProjectionJune2006.pdf, (28/04/2008).

condition of a mortgage on the land and the equipment.[9] *Given that due to the debt the investment became possible, it did not change the situation with regard to the risk distribution for the Project.*

- *Country Risk: Turkey faces a relatively high volatility of its economy. The associated country credit ratings of Turkey lead to higher interest rates for debt financing, since commercial risks affect expected return.*[10] *This perception results in elevated investment costs and a more selective approach by banks for their financing decision, and led to non-availability of financing in the case of the Project.*
- *Regulatory framework and policy: The Energy Efficiency Law, mentioned in Table 2, on the one hand defines a minimum price of 5 Eurocent per kWh for the first 10 years for plants put in operation before 2012 whereas on the other hand a price gap of 5.5 cent per kWh limits the income to the producer. Due to increasing electricity demand in Turkey the current electricity price is higher, which let the incentive scheme of this regulation fade away.*
- *Long Payback Period: As a result of higher debt interest rates and initial investment requirements, geothermal plant investments generally have long payback periods and a low ADSCR. This created difficulties in accessing finance for the Project where its financial performance directly depends on very volatile electricity prices, inter alia due to political reasons, competition with fully depreciated old state owned power plants, which do not reflect the real costs of electricity generation onto prices. Additionally, the privatization of the distribution company will lead to additional price risks as explained below.*
- *Transmission line: An 3.5 km long underground cable has been laid in order to feed the produced electricity to the 31,5 kV Aydın – Nazilli transmission line. The financing of this transmission cable would in theory be the legal obligation of the grid operator. In the underlying case, the Project Owner privately financed it for avoiding inefficiencies due to probable and disagreeable delays.*[11]
- *Wells drilling: A main risk is wells drilling. The cost and number of wells is known only after drilling and testing the wells and this contains the risk of significant additional and unexpected investment requirements. This risk has never been taken by a private investor in the geothermal sector before and therefore posed a great investment barrier.*
- *Privatization of the national distribution system: Privatization of grid operation and distribution is enforced and ongoing in Turkey. While these activities do not bring any chances for geothermal power producers, they rather contain the risk of rising distribution fees and lower electricity prices.*

[9] For details, please see Annex 3

[10] "The summer drought affected farm production. Domestic demand, meanwhile, has felt the effects of the tightening of monetary policy implemented in May 2006. Corporate payment behavior deteriorated slightly in this context albeit remaining near the world average.
An easing of monetary policy in 2008 is not very likely due to persistent inflation and international and local uncertain environment. That could prevent higher growth this year.
The external constraint remains the main weakness. The current account deficit could approach 8.0 per cent of GDP compared to 7.7 per cent a year earlier. Although foreign direct investment inflows have covered an increasing proportion of financing needs, the large stock of volatile capital — short-term debt, portfolio investment — raise the specter of capital flight.", see: http://www.cofacerating.com/ (28/04/2008)

[11] For details please see Annex 3.

With the mentioned privatization the new distribution companies are being obliged to buy a certain fraction of energy from renewable sources thereby looking for the lowest possible price. This will expose the Project Owner to lower prices due to the lack of bargaining power of a small geothermal project in comparison to very large electricity suppliers.

- *All these uncertainties had to be considered within the financial planning of the project and complicated the access to equity and loans for the geothermal power investment.*

Technological Barriers:

- *Technology transfer: Turkey is a developing country and technology / know how transfers are significant factors for its sustainable development. The successful implementation of geothermal power plants in Turkey will enable a faster exploration of the geothermal potential and a more diversified local renewable energy market. However, since geothermal plants are not a proven technology in Turkey, the procurement of specific services and equipments in Turkey is almost impossible, at least at a desired level of quality. A significant portion of the required technology –practically all the electricity generating equipment and know how- had therefore to be imported.*
- *Equipment Selection: The Project is the first private investment employing the specific "Organic Rankine Cycle & Binary technology"[12]. The ORC - turbines, have higher prices than comparable turbines. This choice is justified by their high quality, reliability, extensive technical support, grid friendliness, low maintenance requirements and acceptable noise level. However, it amplifies the investment volume, thus posing another barrier.*
- *Lack of Skilled Labour: Skilled and properly trained technical staff in the construction and operation of geothermal plants is unavailable in Turkey, which causes difficult maintenance and operation conditions and a considerable risk of underperformance. Experienced staff is crucial for geothermal power plants as any malfunctioning, disrepair or poor maintenance of the equipment and the turbines may result in long and costly interruptions in electricity generation.*

Step 3: Common Practice

Common Practice Analysis checks whether the proposed project type has already diffused in the relevant sector and region.

Sub-step 3a. Analyze other activities similar to the proposed project activity

At the time of VCS-PD compilation only two more operating geothermal power plants exist, which are used for electricity generation and which export electricity to the national electricity grid:

[12] www.ormat.com

Table 5. Geothermal power plants in operation

Project Name	Company	Operational Start	Installed Capacity [MW]	Business Model
Kizildere	EÜAŞ	1984	15	State owned
Denizli-Sarayköy	Bereket Jeotermal Enerji Üretim Anonim Şirket	2008	6.85	Usage of waste heat from the already running geothermal power plant Kizildere

It is more difficult to get an impression of the ongoing developments regarding geothermal power plants that are under construction or shall soon be built. From what is known at the date of PDD compilation there are five more geothermal projects in the planning stage. In the Çanakkale region in the west of Turkey, the Tuzla power plant is at project phase and wells have been drilled for reaching a final capacity of 22 MWe. Further there are the 10 MW Simav and the 10/20 MW Seferihisar projects – both not yet under operation. Another plant – the Aydın Germencik Geothermal Power Plant will start operation by the end of 2008 at 45 MWe installed capacity and 9 wells have been drilled by the Mineral Research and Exploration Institute. A power extension is planned to reach 100 MWe installed capacity[13].

Additionally, the Project Owner itself is currently assessing the construction of another geothermal power plant, which is planned to commission by the end of 2010. This future project will benefit from carbon credits.

Sub-step 3b. Discuss any similar options that are occurring

The 15 MW geothermal power plant in Kizildere in the region of Denizli was operated by EÜAŞ since 1984, a state owned utility. It was an investment by the state under completely different economical and political conditions in a period, where private investment could not be undertaken in the energy market since it had been a state monopoly. It is not comparable with a risky private investment under present conditions. Besides there is one additional geothermal power plant currently operating, where the conditions for its realization have been completely different from those for the Dora-I project.[14] *The recently commissioned Denizli-Sarayköy 6.85 MW Geothermal Power Plant uses the waste heat of the Kizildere Geothermal power plant,*

[13] See: http://www.guris.com.tr/en/index.php?p=devam_detay&gid=1&cid=2, (28/04/2008).
[14] The 15 MW Kizildere Geothermal Power Plant started operation in 1984 and was 100 percent state owned and financed. See: http://www.osti.gov/energycitations/product.biblio.jsp?osti_id=6210201, (28/04/2008).

which did not impose the same risk of non-performance to the project since wells have been drilled and work proven[15].

Geothermal energy so far has been used mainly for district - and green house heating, producing electricity from a geothermal source is still marginal (<100 MW out of 41'692 MW, the total capacity installed in Turkey). The proposed geothermal project is also the first one in the region and the first where private investment started with drilling of production wells, thus taking all risks from the beginning. Thus the project activity cannot be considered common practice.

Conclusion:

As opposed to common practice fossil fuel based power plants, the project activity faces several barriers. VCU revenues help the project activity to overcome these barriers by reducing the overall risk profile of the project through an improved financial feasibility. The emissions reductions from the proposed Project are therefore additional to what would have occurred in absence of the project activity.

[15] See: http://www.bereketenerji.com.tr/eng/tesisler_kizildere.asp, (28/04/2008).

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:

According to AMS-I.D. monitoring shall consist of metering the net electricity generated by the renewable technology if there is no fossil fuel usage by the plant. Since this is the case at the Project only the net electricity generated and exported to the grid has to be metered.

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

The objective of the monitoring plan is to ensure the complete, consistent, clear, and accurate monitoring and calculation of the emissions reductions during the whole crediting period. The Project Owner is mainly responsible for the implementation of the monitoring plan. The grid company (TEİAŞ) uses its own measurements and payment of electricity delivery to the grid takes place against receipt. The measurements are in accordance with the relevant Measurement Regulation of Turkey (Turkish Standards, International Electro-technical Commission Standards), and are not accessible by the project participants or any other party except TEİAŞ. This prevents any intervention and assures the accuracy and quality of the measurements.

1. Monitoring Objective
The only parameter to be monitored is the amount of electricity supplied to the grid since the baseline emission factor is fixed by ex-ante calculations.

2. Monitoring Organization
The Project Owner supervises and verifies metering and recording, collects data (meter's data reading, sales/ billing receipts), calculates emission reductions and will use a monitoring report prepared by South Pole. Additionally the switchgear station, where the measurement instruments are read periodically by TEİAŞ, is only accessible to trained TEİAŞ staff. On the last day of each month, the TEİAŞ staff performs the reading, upon which the invoicing will be based. The data collected before PDD compilation has been in accordance with the Measurement Regulations of Turkey and receipts have been obtained against delivery. These receipts will be provided for validation and verification.

3. Monitoring Equipment and program
The electric energy metering equipments include two electric energy meters (or kilowatt meter). The grid company (TEİAŞ) has installed a kilowatt meter and measures the amount of electric power supplied to the power grid.
The electricity recorded by the electric energy meter will suffice for the purpose of billing and emission reduction verification. The monitoring process is as follows:

a) The Project Owner reads and checks the electric energy meter and records the data periodically as the firsthand record of the supplied electricity to the grid;

b) The Project Owner compiles the recorded data of the supplied electricity to the grid monthly and provides the monthly balance sheet of electricity sales to TEİAŞ;
c) TEİAŞ confirms the amount of electricity exported by the Project Owner after the verification, confirmation and acceptance of the electricity data offered by the Project Owner;
d) The Project Owner provides an electricity sales invoice to TEİAŞ according to actual amount of electricity delivery reflected by the grid company's confirmation. A copy of the invoice is kept by the Project Owner;
e) The Project Owner properly keeps the balance sheet of electricity sales to the grid company. The periodical records of the electricity meter's data readings are archived electronically and on paper.

The meter reading will be readily accessible for the verification entity. Calibration test records will be maintained for verification.

4. Data Management
The Project Owner properly keeps the electronic spreadsheets and printout of the monthly records of the amount of supplied electricity to the grid as well as the firsthand record of the electricity supplied to the grid. Besides that, the Project Owner collects sales receipts for the power delivered to the grid as a crosscheck. At the end of each crediting year, the Project Owner compiles a monitoring report. Physical documentation of relevance for the monitoring process, such as paper-based maps and diagrams, are collected in a central place, together with the monitoring plan. The Project Owner stores all paper-based information.

All data records will be kept for a period of at least 5 years following the end of the crediting period, or until 2017, whichever comes later.

5. Data quality assurance and data replacement procedures
If during a periodic meter calibration it is found that the meter has a higher error than defined in the meter's manual, the metering data will be adjusted accordingly for the last three months or beginning at the last calibration, whichever happened later.

If the TEİAŞ meter fails, then data from the Dora-I meter are used. If both meters fail, conservative data substitution procedures are used from the calculation of energy production (for the purpose of VER calculation):

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

Data / Parameter:	***EGy***
Data unit:	***MW/h***
Description:	***Net electricity exported to the grid in the year y***
Source of data to be used:	*Measured and verified against electricity sale receipts. The calculation of emission reductions in the monitoring protocols shall be based on the measured electricity.*
Value of data	*The annual net electricity supply to the grid has been measured and was 51'284 MWh/2007. This amount is estimated to be the due amount for the coming years.*

Description of measurement methods and procedures to be applied:	*Measured continuously by a power meter and recorded monthly by monitoring employees. Only the net electricity export to the grid shall be taken into account. This means that the monitoring measurement method shall exclude electricity imported from the grid by the project activity and possible transmission losses.*
QA/QC procedures to be applied:	• *Exported electricity to the grid is measured by a kilowatt meter which is controlled by both the power plant operator and by the power grid company* • *Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter* • *Meters will be calibrated periodically according to national standards* • *Data measured by meters and will be crosschecked by electricity sales receipts. In sales receipts, incomes not deriving from electricity production but declared as electricity supplied to grid because of limitations of accounting system shall be identified and subtracted. If differences still occur, the more conservative amount shall be used.*
Any comment:	

Data / Parameter:	***PE_{Dcons}***
Data unit:	***tons***
Description:	***Diesel consumed from running the diesel generator***
Source of data to be used:	*Plant Records*
Value of data	*Value of data would be used to calculate project emissions if emissions contribute to more than 1%.*
Description of measurement methods and procedures to be applied:	*Diesel Consumption will be measured by the operating hours on the diesel generator engine.*
QA/QC procedures to be applied:	
Any comment:	

3.4 Description of the monitoring plan

The description of the monitoring plan has been provided and can be seen in section 3.2.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

The Project aims to generate electricity and CO_2 reduction through the substitution of grid electricity generation by fossil fuel fired power. According to the baseline methodology AMS-I.D., the emission reduction ER_y by the project activity during a given year y is defined as;

$$ER_y = BE_y - (PE_y + LE_y)$$ *Equation 1*

where BE_y is calculated as;

$$BE_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y}$$ *Equation 2*

where :

The operation margin refers to a cohort of power plants that reflect the existing power plants whose electricity generation would be affected by the proposed project activity. The build margin refers to a cohort of power plants that reflect the type of power units whose construction would be affected by the proposed project activity.
The combined emission factor $EF_{grid,CM,y}$ for the project activity is calculated as a weighted average of Operating Margin emission factor and Build Margin emission factor as described in the "Tool to calculate the emission factor for an electricity system" (EB35);

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$$ *Equation 3*

Table 6: Definitions regarding the equations (1), (2) and (3)

Parameter	***SI Unit***	***Description***
ER_y	tCO_2e	*Emission reductions achieved by the project activity*
BE_y	tCO_2e	*Beaseline Emission in year y*
PE_y	tCO_2e	*Project Emission in year y*
LE_y	tCO_2e	*Leakage Emission in year y*
$EG_y/EG_{baseline}$	*MWh*	*Net-electricity supplied to the grid in year y/ Net-electricity supplied to the grid in the case of modified or retrofit facilities*
$EF_{grid,CM,y}$	tCO_2e/MWh	*Combined margin CO_2 emission factor for grid connected power generation in year y*
$EF_{grid,BM,y}$	tCO_2e/MWh	*tCO_2/MWh Build margin CO2 emission factor for grid connected power generation in year y*
$EF_{grid,OM,y}$	tCO_2e/MWh	*tCO2/MWh Operating margin CO2 emission factor for grid connected power generation in year y*
EG_y	*MWh*	*Electricity supplied by the project activity to the grid*
$EG_{baseline}$	*MWh*	*Baseline electricity supplied to the grid in the case of modified or retrofit facilities*
w_{OM}	*%*	*Weighting of operation margin emissions factor; Default value 50%*
w_{BM}	*%*	*Weighting of built margin emissions factor; Default value 50%*

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

The baseline emissions are calculated as follows:

$$BE_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y}$$ ***Equation 2***

The GHG emissions of the baseline scenario equal the amount of CO_2 discharged to the atmosphere due to electricity production using fossil fuel fired power plants. As will be described in sections 4.3

and 4.4 the baseline emissions equal the emission reductions achieved by the project due to its electricity generation; thus being:

$ER_y = BE_y = 30'309\ tCO_2e/year$

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

According to AMS-I.D. Leakage Emission only have to be considered if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity. Since this is not the case in the underlying Project leakage can be considered as:

$LE_y = 0.$

Fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam aren't accounted as Project Emissions, because the non-condensable gases resulting from the produced steam are isolated and delivered to Linde Gaz A.Ş. that belongs to Linde Group being internationally recognized supplier of industrial gases.
Carbon Dioxide emissions resulting from combustion of fossil fuels are neglected as these emissions are contributing less then %1 of baseline emissions. The project emissions due to the diesel consumption will be monitored regularly and if these emissions contribute for more than 1% of baseline emissions than they will be deducted from the baseline emissions to calculate emission reductions of the project activity.
The fugitive carbon dioxide and methane emissions due to continuous well testing and well bleeding are neglected according to best practice and guidance from relevant methodologies.
The Project Emissions have to be considered in the case of the addition of renewable energy generation units at an existing renewable power generation facility, where the existing and new units share the use of common and limited renewable resources. Provided that the Project has been a Greenfield investment it is a standalone project and Project Emissions are:

$PE_y = 0.$

Thus:

$PE_y + LE_y = 0.$

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

The following formula has been used for the calculation of the emission reductions generated by the Project (for explanation see Table 6):

$$ER_y = BE_y - (PE_y + LE_y)$$ *Equation 1*

As described in detail in Annex 2*, the combined baseline emission factor of the project is 0.591 tCO_2/MWh.*

The net installed capacity of the Dora-I power plant is 6.5 MW and the measured annual electricity export to the grid has been 51'284 MWh/2007. Since data from measurements can be considered as more viable than ex-ante estimations and conditions of the geothermal reservoir have been proven to be relatively constant this amount is assumed to be generated also in the coming years. The BE_y is calculated as follows:

$ER_y = BE_y * EF_{grid,CM,y}$ = 51'284 MWh/year * 0.591t CO_2e/MWh = 30'309 tCO2e/year

As previously mentioned, there are no GHG project and leakage emissions. Thus, the amount of generated emission reductions by the project activity equals to the baseline emissions.

$ER_y = BE_y = 30'309\ tCO_2e/year$

The expected annual emission reductions are 30'309 tCO2e/year.
The total amount of estimated emission reductions in the first crediting period can be seen in **Table 1**.

5 Environmental Impact:

No Environmental Impact Assessment (EIA) has been performed because the environmental impacts of the project activity are not considered to be significant by the project participant or the host country.

The copy of the document showing that EIA is legally not needed for the Project Activity is given in Annex 3.

6 Stakeholders comments:

The project has no negative social or environmental impacts. Furthermore the project is located in the marginal lands of the village and inhabitants are not impacted by the project. Therefore no public consultation has been organised.

7 Schedule:

The following table describes the main milestones

Activity	Date
Financial closure	04 April 2003
Project Assessment and Drilling Activities	May 2003 – May 2005
Exemption of EIA	23 June 2003
Start of Operation	10 May 2006
Duration of the project	Minimum 25 years
Electricity delivery and monitoring	Monthly
GHG assessment and PDD compilation	January 2008 until May 2008
Validation	May – June 2008
Start of crediting	1st July 2008

period	
Verification	*once a year*
Issuance of VCU	*Once a year*

8 Ownership:

8.1 Proof of Title:

The Emission Reductions Purchase Agreement done between the project proponents grants the emission reductions for the first part of the 10 years crediting period from 2008 to 2013 to South Pole Carbon Asset Management Ltd. The emission reductions for the rest of 10 years crediting period are owned by the project participant Menderes Geothermal Elektrik Üretim A.Ş.

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

Not applicable.

Annex 1:

Contact details of the Project participants

Organization:	MENDERES Geothermal Elektrik Uretim A.Ş.
Street/P.O.Box:	Mugla Bulvari No: 7/1
City:	Aydın
Postfix/ZIP:	09100
Country:	Turkey
E-Mail:	egeenerji@mb.com.tr
Represented by:	Murat Haluk Tufekcioğlu
Title:	Manager
Salutation:	Mr.

Organization:	South Pole Carbon Asset Management Ltd.
Street/P.O.Box:	Technoparkstrasse 1
City:	Zurich
Postfix/ZIP:	8005
Country:	Switzerland
Telephone:	+ 41 44 633 78 70
Mobile:	+ 41 78 640 40 84
E-Mail:	t.camerata@southpolecarbon.com
URL:	www.southpolecarbon.com
Represented by:	Thomas Camerata
Title:	Managing Partner
Salutation:	Mr.

Annex 2

BASELINE INFORMATION

The Emission Factor for the Turkish Natinonal Electricity grid is calculated in accordance with the "Tool to calculate the emission factor for an electricity system" v.01.[16]
For determining the baseline the following six steps will be applied:

Step 1. Identify the relevant electric power system
Step 2. Select an operating margin (OM) method.
Step 3. Calculate the operating margin emission factor according to the selected method.
Step 4. Identify the cohort of power units to be included in the build margin (BM).
Step 5. Calculate the build margin emission factor.
Step 6. Calculate the combined margin (CM) emissions factor.

Step 1. Identify the relevant electric power system

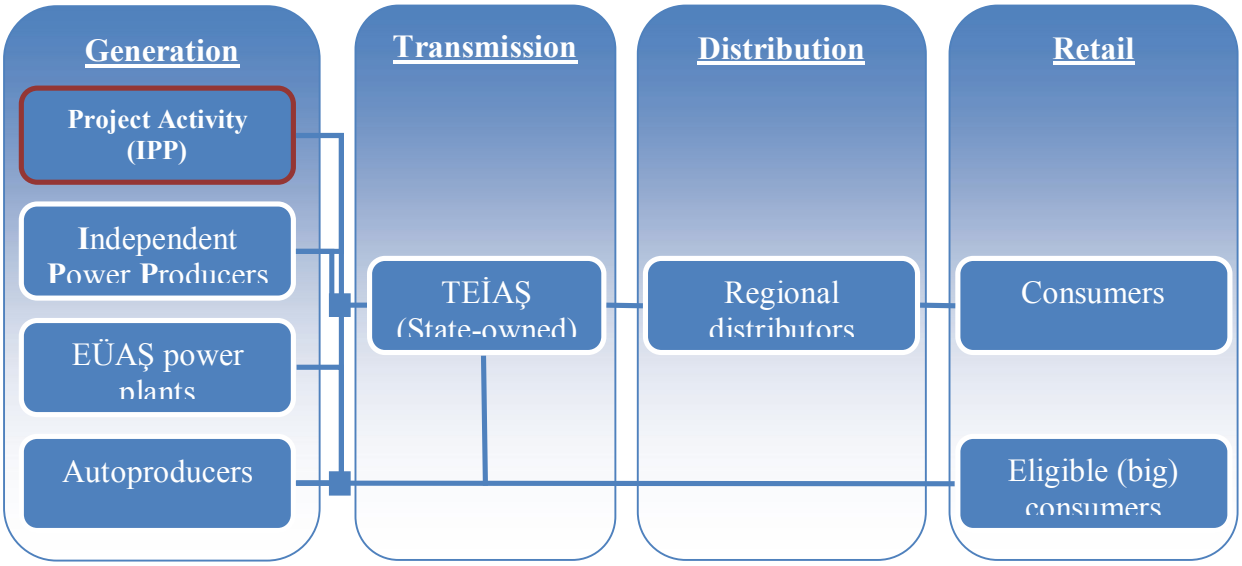
A project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

There is no officially available and published delineation of the project electricity system and connected electricity systems for Turkey. In the Turkish electricity system, power plants can be dispatched without significant transmission losses. In this respect, the spatial extent of the Project Boundary is defined as the ***national electricity grid*** *of Turkey.*

Some power plants, which are not connected to the national grid and are operated stand-alone, are included in the project boundary, since no detailed data are available to filter them out. However the share of these stand-alone power plants in overall gross generation is negligibly small[17]*. These are some of the so-called autoproducers, who mostly cover their own seasonal energy demand peaks with their own stand-alone thermal power plants.*

[16] Url: http://cdm.unfccc.int/methodologies/Tools/EB35_repan12_Tool_grid_emission.pdf, (28/04/2008).
[17] Around 0,2% for recent years, Url: (http://www.teias.gov.tr/istat2004/44.xls, http://www.teias.gov.tr/istatistik2005/45.xls, http://www.teias.gov.tr/ist2006/41.xls) , (28/04/2008).

Figure 4: Overview of the Turkish electricity system



No recent or future addition to the national transmission capacity is reported or foreseen, which would enable Turkey to significantly increase its electricity imports. Therefore, a likely transmission line construction is not considered in BM emission factor calculations.

Turkey imports electrical power from and exports to neighbour countries[18], which are defined as Electricity transfers from connected electricity systems to the project. These transfers to the electricity system are defined as electricity imports. According to option a) of the "Tool to calculate the emission factor for an electricity system" v.01, imports are regarded as being a power source delivering electricity to the grid with an OM emission factor of 0 tCO_2 per MW/h, since electricity being imported is purchased from connected electricity systems located in other countries.

Step 2. Select an operating margin (OM) method.

There exists no nuclear power plant in Turkey, and there is no indication that coal is obviously used as must-run. Hydro, geothermal, wind power plants and other renewables are included as low-cost/must-run resources (hereafter referred to as lc-mr), which turns out to be 26,5% of the total electricity generation on average between years 2002 and 2006:

Table 7:Gross and Net Electricity Generation [GWh] in Turkey

	2002	2003	2004	2005	2006	Avg. Share

[18] Since 2001: Exports to Georgia, Azerbaijan, Iraq, Syria. Imports from Bulgaria, Iran, Turkmenistan, Georgia.

Coal		4.093	8.663	11.998	13.246	14.217	6,7%
Lignite		28.056	23.590	22.450	29.946	32.433	18,0%
Fuel Oil		9.505	8.153	6.690	5.121	4.232	4,6%
Diesel oil		271	4	7	3	58	0,1%
LPG		35	3	33	34	0	0,0%
Naphtha & Asphaltite		933	1.036	940	326	50	0,5%
Natural Gas		52.497	63.536	62.242	73.445	80.691	43,6%
low cost- must run	**Renew. & Wastes**	174	116	104	122	154	0,1%
	Hydro	33.684	35.330	46.084	39.561	44.244	26,3%
	Geothermal	105	89	93	94	94	0,1%
	Wind	48	61	58	59	127	0,0%
Gross Total		129.400	140.581	150.698	161.956	176.300	**100%**
Gross Total, excluding lc-mr resources		95.389	104.985	104.360	122.120	131.681	**73,5%**
Net generation		123.727	135.248	145.066	155.469	169.543	
Net Delivery Ratio [%]		95,6%	96,2%	96,3%	96,0%	96,2%	

The baseline methodology allows a choice among four methods for the calculation of OM emission factor, of which the simple operating margin (OM) has been chosen. The simple OM calculation allows two data vintages of which the ex-ante option is selected to carry out the baseline methodology for the Project. This procedure includes taking into account a 3-year generation-weighted average based on the most recent data available. Monitoring and recalculation of the emission factor is not required.

Official emission figures of Turkey submitted to UNFCCC are available for the time period 2002-2006[19]*. Identification of the OM emission figures for a more recent time range requires calculations. Therefore, official 2005 CO_2 emissions data stemming from electricity generation are used directly, whereas 2006 emissions are calculated.*

Step 3. 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 lc-mr power plants. It may be calculated:

- *Based on data on fuel consumption and net electricity generation of each power plant / unit (Option A), or*
- *Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or*

[19] UNFCCC 2006 National GHG Emission Inventory, URL: http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/tur_2007_nir_07apr.zip , (28/04/2008).

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

Since there is no power plant specific data available for every power plant Options A and B will not be applied for the calculation. There is no nuclear power plant in Turkey and renewable power generation data is available and is been considered as lc-mr power sources. Hence, Option C is been applied for the OM calculations.

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} * NCV_{i,y} * EF_{CO2,i,y}}{GEN_y} \quad \textbf{Equation 4}$$

Table 8: Data and Definitions applied in Equation 4

Parameter	Definition	Explanation
$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)	See: Table 11
$FC_{i,y}$	Amount of fossil fuel type *i* consumed in the project electricity system in year y (ton or $1000m^3$)	
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type *i* in year y (TJ/kt or TJ/mil m^3)	See: Table 9
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/TJ)	See: Table 9
GEN_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including lc-mr power plants, in year y (GWh)	**See:** Table 10
i	All fossil fuel types combusted in power sources in the project electricity system in year y	

The OM electricity factor for the Turkish national grid as described in Table 11 has been found to be:

$EF_{grid,OMsimple,y} = 0.679\ tCO_2/MWh.$

Step 4. Identify the cohort of power units to be included in the build margin (BM).

The sample group of power plants to be included in the BM consists 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) comprises the higher electricity generation and therefore it has been chosen for BM calculation.

In terms of vintages two options are provided by the "Tool to calculate the emission factor for an electricity system" v.01 of which Option 1 is selected.

Total capacity additions between the years 2004 -2006 are not sufficiently large to constitute 20% of the system generation; therefore the Enerji-SA natural gas fired power plant from 2003 capacity additions is included as well for the sake of conservative calculation. The final sample group represents a total generation capacity addition of 35.329 GWh and exceeds 20% of the 2006 gross electricity generation, which is 176.300 GWh.
Details are provided in Table 12.

Step 5. Calculate the build margin emission factor.

The build margin emission 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 follows;

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} * EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{Equation 5}$$

Table 7: Data and Definitions applied in Equation 5

Parameter	Definition	Explanation
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y [tCO_2/MWh]	See: Table 13
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y [MWh]	See: Table 12
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y [tCO_2/MWh]	
$EF_{CO2,m,i,y}$	CO_2 emission factor of fuel type i used in power unit m in year y (tCO_2/TJ)	See: Table 9
$\eta_{m,y}$	Average net energy conversion efficiency of power unit m in year y (%)	See: Table 13
m	Power units included in the build margin	
y	Most recent historical year for which power generation data is available	

Using *Equation 5* the BM emission factor in Turkey is found to be:

$EF_{grid,BM,y}$ = **0,503** tCO_2/MWh.

Further information is available in Table 14.

Step 6. Calculate the combined margin (CM) emissions factor.

The combined margin has been calculated using Equation 3:

$EF_{grid,CM,y}$ = 0,679 tCO_2/MWh * 0,5 + 0,503 tCO_2/MWh * 0,5 = **0,591 tCO_2/MWh**

Emission Reductions.

The annual emission reduction achieved due to the project activity can be calculated using Equation 2.

$ER_y = EG_y * EF_{grid,CM,y}$ = 51'284 MWh * 0,591 tCO_2/MWh = **30'309 tCO_2**

Table 9: NCVs and Emission Factors of Fuels

NCV [TJ/kt or TJ/mil m^3]	2002	2003	2004	2005	2006	Emission Factors [tCO_2/TJ]
Hard Coal	15,1	14,4	15,1	13,6	14,9	92,8
Imported Coal	25,1	25,7	25,5	24,7	24,7	89,5
Lignite	7,5	7,5	7,6	5,9	6,9	90,9
Fuel Oil	40,1	40,1	39,9	40,2	40,2	75,5
Diesel Oil	42,8	43,3	42,4	42,8	42,7	72,6
Lpg	46,1	44,1	45,9	46,0	0,0	61,6
Naphta	44,9	40,0	44,0	44,3	43,9	69,3
Natural Gas	36,5	37,2	36,9	37,3	37,0	54,3

Table 10: Electricity Supply to Grid

	2002	2003	2004	2005	2006
Net Generation, GWh	123.727	135.248	145.066	155.469	169.543
Net Delivery Ratio	95,6%	96,2%	96,3%	96,0%	96,2%
Imports, GWh	3.588	1158,0	463,5	635,9	573,2
Net Delivered to Grid, exc. lc-mr	*94.796*	*102.161*	*100.923*	*122.148*	*127.208*

Table 11: Calculation of the OM emission factor

Parameter	2004	2005	2006
CO_2 Emissions [$ktCO_2$]	76.185[20]	74.426	82.787
GEN_y [GWh]	100.923	117.864	127.208
$EF_{grid,OMsimple,y}$ [tCO_2/MWh]	0,755	0,631	0,651
OM emission factor [tCO_2/MWh]	**0,679**		

Table 12: Recent Capacity Additions 2003-2006

[20] Official 2004 emission figure stemming from electricity generation activities (Source: Statistical Year Book 2006, page 20). Applied directly since the identified lc-mr sources do not generate CO_2 emissions.

Year	Plant	Installed capacity (MW)	Average Generation (GWh)	Fuel Type	Commissionary date
2003	ENERJİ-SA(Mersin) GR GT	41,65	312	N.GAS+NAPHTA	05/10/2003
2004	TÜPRAŞ BATMAN GR V	1,5	4,1	D.OIL	2003
2004	ECZACIBAŞI BAXTER HAS.ÜRÜN.	1,0	5,8	N.GAS	13/01/2001
2004	ÇIRAĞAN SARAYI İŞL.	1,4	11,0	N.GAS	01/11/2002
2004	ANKARA D.G.(BAYMİNA) GR-I-II-III	798,0	6500,0	N.GAS	08/01/2004
2004	ENTEK GR-IV	31,1	255,7	N.GAS+NAPHTA	12/02/2004
2004	ATATEKS 2 GM	5,6	45,0	N.GAS	20/02/2004
2004	TANRIVERDİ 4 GM	4,7	38,7	N.GAS	24/03/2004
2004	ÇOLAKOĞLU(KAPASİTE ARTIRIMI)	45	337,5	IMPORTED COAL	05/05/2004
2004	TEKBOY TEXTILE 1 GM	2,2	16,0	N.GAS	18/05/2004
2004	GÜL ENERJİ GR-II	12,5	96,5	FUEL-OIL	03/06/2004
2004	KOMBASSAN KAĞIT GIDA VE TEKS	5,5	38,1	N.GAS	09/06/2004
2004	AYEN OSTİM ENERJİ ÜRETİM	31,1	264,1	N.GAS	11/06/2004
2004	BİS ENERJİ 2 GT	73,0	602,7	N.GAS	16/06/2004
2004	ENERJİ-SA ADANA 1 BT	49,8	322,9	NAPHTA	23/06/2004
2004	ŞAHİNLER ENERJİ 1 GM	3,2	22,2	N.GAS	29/06/2004
2004	BESLER GR-2, BT (5,2+7,5)	12,7	97,7	N.GAS	07/07/2004
2004	ÇELİK ENERJİ ÜR.ŞTİ. 2 GM	2,4	18,6	N.GAS	09/07/2004
2004	KOMBASSAN KAĞ. MATBAA GIDA	5,5	35,7	N.GAS	24/09/2004
2004	AYEN OSTİM ENERJİ ÜRETİM(BT)	9,9	84,0	N.GAS	01/10/2004
2004	HABAŞ ALİAĞA GRUP I-II	89,2	713,9	N.GAS	08/10/2004
2004	STANDART PROFİL 3 GM	6,7	49,2	N.GAS	22/10/2004
2004	KARKEY-II 3+3 DGM	54,3	369,7	FUEL-OIL	12/11/2004
2004	ALTINMARKA GIDA GR I-II-III	3,6	28,8	N.GAS	17/12/2004
2004	ERE(BİR KAPILI HES) GRUP-I	48,5	170,6	RUN OF RIVER	11/03/2004
2004	ELTA ELK(DODURGA) GR-I-II-III-IV	4,1	12,3	RUN OF RIVER	26/04/2004
2004	İSKUR TEKSTİL(SÜLEYMANLI) GR I-II	4,6	17,86	RUN OF RIVER	28/04/2004
2004	BEREKET EN.(Feslek Hes) Gr-1-2	9,5	41	RUN OF RIVER	05/08/2004

2005	ÇAN GR I	160,0	1.040,0	LIGNITE	14/02/2001
2005	ÇAN GR II	160,0	1.040,0	LIGNITE	14/03/2001
2005	ELBİSTAN-B GR I	360,0	2.340,0	LIGNITE	14/02/2001
2005	AKÇA ENERJİ GR-III	8,7	65,4	N.GAS+NAPHTHA	13/12/2001
2005	AYKA TEKSTİL GR-I	5,5	40,0	N.GAS	23/09/2001
2005	BAYDEMİRLER GR IV-V-VI	6,2	51,4	N.GAS	03/02/2001
2005	BOSEN GR-III	50,0	350,0	N.GAS	29/12/2001
2005	ÇUMRA ŞEKER	16,0	40,0	N.GAS+LIGNITE	31/12/2000
2005	ETİ MAD.(BAN.ASİT)GR-I	11,5	85,0	RENEW.+WASTES	14/07/2001
2005	EVYAP GR I-II	5,1	30,0	N.GAS	26/08/2001
2005	GRANİSER GRANİT GR-I	5,5	42,0	N.GAS	13/11/2001
2005	HABAŞ ALİAĞA GR III	47,7	381,6	N.GAS	01/06/2001
2005	HABAŞ ALİAĞA GR IV	47,7	381,6	N.GAS	20/09/2001
2005	HABAŞ ALİAĞA GR-V	24,6	196,8	N.GAS	23/11/2001
2005	HAYAT KAĞIT GR-I	7,5	56,0	N.GAS	26/05/2001
2005	İÇDAŞ ÇELİK GR-I	135,0	1.080,0	IMPORTED COAL	29/11/2001
2005	KAHRAMANMARAŞ KAĞIT GR-I	6,0	45,0	IMPORTED COAL	07/12/2001
2005	KORUMA KLOR GR I-II-III	9,6	77,0	N.GAS	02/12/2001
2005	KÜÇÜKÇALIK TEKSTİL GR I-II-III-IV	8,0	64,0	N.GAS	26/11/2001
2005	MERCEDES BENZ TURK GR I-II-III-IV	8,3	68,0	N.GAS	03/02/2001
2005	MODERN ENERJİ GR-III	8,4	62,9	N.GAS	13/06/2001
2005	MODERN ENERJİ GR-II	6,7	50,4	N.GAS+LPG	13/06/2001
2005	MOSB GR I-II-III-IV-V-VI-VII	84,8	434,0	N.GAS	01.03 - 01.08.2005
2005	ORS RULMAN	12,4	99,4	N.GAS	24/08/2001
2005	PAK GIDA(Kemalpaşa) GR-I	5,7	45,0	N.GAS	06/12/2001
2005	TEZCAN GALVANİZ GR I-II	3,7	29,0	N.GAS	26/05/2001
2005	YONGAPAN(KAST.ENTG) GR-II	5,2	32,7	N.GAS	24/05/2001
2005	ZEYNEP GİYİM SAN. GR-I	1,2	9,0	N.GAS	06/07/2001
2005	AK ENERJİ(K.paşa) GR-III	40,0	256,9	N.GAS	08/11/2001
2005	AK ENERJİ(K.paşa) GR	87,2	560,1	N.GAS	29/04/200

	I-II				1
2005	ALTEK ALARKO GR I-II	60,1	420,0	N.GAS	13/10/2001
2005	BİS ENERJİ GR VII	43,7	360,8	N.GAS	17/03/2001
2005	CAN ENERJİ GR-I	3,9	28,0	N.GAS	24/08/2001
2005	ÇEBİ ENERJİ BT	21,0	164,9	N.GAS	26/08/2001
2005	ÇEBİ ENERJİ GT	43,4	340,1	N.GAS	22/08/2001
2005	ENTEK ELK.A.Ş.KOÇ ÜNİ.GR I-II	2,3	19,0	N.GAS	06/02/2001
2005	KAREGE GR IV-V	18,1	141,9	N.GAS	06/04/2001
2005	KARKEY(SİLOPİ-4) GR-IV	6,2	47,2	F.OIL	29/06/2001
2005	KARKEY(SİLOPİ-4) GR-V	6,8	51,9	F.OIL	22/12/2001
2005	METEM ENERJİ(Hacışıramat) GR I-II	7,8	58,0	N.GAS	28/01/2001
2005	METEM ENERJİ(Peliklik) GR I-II-III	11,7	89,0	N.GAS	28/01/2001
2005	NOREN ENERJİ GR-I	8,7	70,0	N.GAS	23/08/2001
2005	NUH ENERJİ-2 GR I	47,0	319,7	N.GAS	23/05/2001
2005	ZORLU ENERJİ KAYSERİ GR-I-II-III	149,9	1.144,1	N.GAS	21/07/2001
2005	ZORLU ENERJİ KAYSERİ GR-IV	38,6	294,9	N.GAS	25/10/2001
2005	ZORLU ENERJİ YALOVA GR I-II	15,9	122,0	N.GAS	25/11/2001
2005	TEKTUĞ(Kargılık) GR I-II	23,9	83,0	RUN OF RIVER	24/04/2001
2005	İÇTAŞ ENERJİ(Yukarı Mercan) GR I-II	14,2	44,0	RUN OF RIVER	21/05/2001
2005	MURATLI GR I-II	115,0	444,0	DAM	02/06/2001
2005	BEREKET EN.(DALAMAN) GR XIII-XIV-XV	7,5	35,8	RUN OF RIVER	15/07/2001
2005	YAMULA GRUP I-II	100,0	422,0	DAM	30/07/2001
2005	SUNJÜT(RES) GR I-II	1,2	2,4	WIND	22/04/2001
2006	EKOTEN TEKSTİL GR-I	1,9	14	N.GAS	16/02/2006
2006	ERAK GİYİM GR-I	1,4	10	N.GAS	22/02/2006
2006	*ALARKO ALTEK GR-III*	21,9	158	N.GAS	23/02/2006
2006	AYDIN ÖRME GR-I	7,5	60	N.GAS	25/02/2006
2006	*NUH ENERJİ-2 GR II*	26,1	180	N.GAS	02/03/2006
2006	MARMARA ELEKTRİK (Çorlu) GR I	8,7	63	N.GAS	13/04/2006
2006	MARMARA PAMUK (Çorlu) GR I	8,7	63	N.GAS	13/04/2006

2006	*ENTEK (Köseköy) GR IV*	47,6	378	N.GAS	14/04/2006
2006	ELSE TEKSTİL (Çorlu) GR I - II	3,2	25	N.GAS	15/04/2006
2006	SÖNMEZ ELEKTRİK (Çorlu) GR I – II	17,5	126	N.GAS	03/05/2006
2006	MENDERES ELEKTRİK GR I	8,0	56	GEOTHERMAL	10/05/2006
2006	KASTAMONU ENTEGRE (Balıkesir) GR I	7,5	54	N.GAS	24/05/2006
2006	BOZ ENERJİ GR I	8,7	70	N.GAS	09/06/2006
2006	ADANA WASTEWATER TREATMENT PLANT	0,8	6	BIOGAS	09/06/2006
2006	AMYLUM NİŞASTA (ADANA)	14,3	34	N.GAS	09/06/2006
2006	ŞIK MAKAS (Çorlu) GR I	1,6	13	N.GAS	22/06/2006
2006	*ELBİSTAN B GR III*	360,0	2340	LIGNITE	23/06/2006
2006	ANTALYA ENERJİ GR I - II - III - IV	34,9	245	N.GAS	29/06/2006
2006	HAYAT TEM. VE SAĞLIK GR I - II	15,0	108	N.GAS	30/06/2006
2006	EKOLOJİK EN. (Kemerburgaz) GR I	1,0	6	LANDFILL GAS	31/07/2006
2006	EROĞLU GİYİM (Çorlu) GR I	1,2	9	N.GAS	01/08/2006
2006	CAM İŞ ELEKTRİK (Mersin) GR I	126,1	1008	N.GAS	13/09/2006
2006	*ELBİSTAN B GR II*	360,0	2340	LIGNITE	17/09/2006
2006	YILDIZ ENT. AĞAÇ (Kocaeli) GR I	6,2	40	N.GAS	21/09/2006
2006	ÇERKEZKÖY ENERJİ GR I	49,2	390	N.GAS	06/10/2006
2006	*ENTEK (Köseköy) GR V*	37,0	294	N.GAS	03/11/2006
2006	ITC-KA EN. MAMAK TOP.M. GR I-II-III	4,2	30	LANDFILL GAS	03/11/2006
2006	*ELBİSTAN B GR IV*	360,0	2340	LIGNITE	13/11/2006
2006	ÇIRAĞAN SARAYI GR I	1,3	11	N.GAS	01/12/2006
2006	ERTÜRK ELEKTRİK Tepe RES GR I	0,9	2	WIND	22/12/2006
2006	AKMAYA (Lüleburgaz) GR I	6,9	50	N.GAS	23/12/2006
2006	BURGAZ (Lüleburgaz) GR I	6,9	54	N.GAS	23/12/2006
2006	*SEYHAN I-II*	0,3	1,7	HYDRO	20/02/2006
2006	ŞANLIURFA GR I-II	51,8	124	HYDRO	01/03/2006
2006	BEREKET ENERJİ GÖKYAR HES 3 Grup	11,6	43,3	HYDRO	05/05/2006
2006	MOLU EN. Zamantı Bahçelik GR I - II	4,2	16,7	HYDRO	31/05/2006
2006	SU ENERJİ (Balıkesir) GR I - II	4,6	20,7	HYDRO	27/06/2006

2006	*BEREKET EN.(Mentaş Reg) GR I - II*	26,6	108,7	HYDRO	31/07/2006
2006	EKİN (Başaran Hes) (Nazilli)	0,6	4,5	HYDRO	11/08/2006
2006	ERE(Sugözü rg. Kızıldüz hes) GR I - II	15,4	31,6	HYDRO	08/09/2006
2006	ERE(AKSU REG.ve ŞAHMALLAR HES) GR I-II	14,0	26,7	HYDRO	16/11/2006
2006	TEKTUĞ(Kalealtı) GR I - II	15,0	52	HYDRO	30/11/2006
2006	*BEREKET EN.(Mentaş Reg) GR III*	13,3	54,4	HYDRO	13/12/2006
Total		**5.157**	**35.329**		

Table 13: CO_2 Emissions of Recent Capacity Additions by Fuel Type

Fuel Type	Generation of New Capacity Additions, GWh	Average Efficiency, η	Emission Factor, tCO_2/TJ	CO_2 Emissions, $ktCO_2$
Coal	1.462,5	39,0%	89,5	1.208
Lignite	11.440,0	39,0%	90,9	9.599
Fuel Oil	565,3	39,5%	75,5	389
Diesel oil	4,1	39,5%	72,6	3
LPG	0,0	60,0%	61,6	0
Naphtha & Aphaltite	322,9	39,5%	69,3	204
Natural Gas	19.592,0	60%	54,3	6.383
Renewables and wastes	127,0	0%	0	0
Hydro	1.754,9	0%	0	0
Geothermal & Wind	60,4	0%	0	0
Total	**35.329**			**17.786**
Build Margin EF	**0,503**			

Table 14: Electricity Generation of Selected Recent Capacity Additions by Fuel Type

Capacity Additions by Fuel Type	Average Generation, GWh				
	2003	2004	2005	2006	Total
Coal	0	337,5	1.125,0	0,0	1.462,5
Lignite	0	0,0	4.420,0	7.020,0	11.440,0
Fuel Oil	0	466,2	99,1	0,0	565,3
Diesel oil	0	4,1	0,0	0,0	4,1
LPG	0	0,0	0,0	0,0	0,0
Naphtha & Aphaltite	0	322,9	0,0	0,0	322,9
Natural Gas	312,0	8.827,2	6.995,4	3.457,4	19.592,0
Renewables and wastes	0	0,0	85,0	42,0	127,0
Hydro	0	241,8	1.028,8	484,3	1.754,9
Geothermal & Wind	0	0,0	2,4	58,0	60,4
Total	**312**	**10.199**	**13.755**	**11.061**	**35.329**

Annex 3

Scanned documents (will not be published)