Voluntary Carbon Standard 2007
Validation Report Template

19 November 2007

Validation Report:

Name of Verification company:	Date of the issue:
TÜV Rheinland Japan Ltd.	2009-01-15
Report Title:	Approved by:
Aydin Salavatli Dora-1 Geothermal Power Plant	Ralf Kober
Client:	Project Title:
South Pole Carbon Asset Management Ltd.	Aydin Salavatli Dora-1 Geothermal Power Plant

Summary:
The validation team, assigned by the Certification Body of TÜV Rheinland Japan Ltd. (TÜV Rheinland) has performed on behalf of Southpole Carbon Asset Management Ltd. a validation of the "Aydin Salavatli Dora-1 Geothermal Power Plant" in Turkey. The validation was performed on the basis of UNFCCC criteria for the Clean Development Mechanism, requirements of the Voluntary Carbon Standard, version VCS 2007 and host Party criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting. The review of the project design documentation and the subsequent follow-up interviews have provided TÜV Rheinland with sufficient evidence to determine the fulfilment of stated criteria. The project correctly applies AMS-I.D. "Grid connected renewable electricity generation" and the relevant methodology tool "Tool to calculate the emission factor for an electricity system". By constructing a new geothermal power plant with a net capacity of 6.5 MW that is connected to the local grid, the project results in reductions of GHG emissions that are real, measurable and give long-term benefits to the mitigation of climate change. It is demonstrated that the project is not a likely baseline scenario. Emission reductions attributable to the project arehence additional to any that would occur in the absence of the project activity. The total emission reductions from the project are estimated to be on average 30,309 tCO2e per year during the selected renewable 10 year crediting period. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change. Adequate training and monitoring procedures have been implemented. In summary, it is TÜV Rheinland's opinion that the "Aydin Salavatli Dora-1 Geothermal Power Plant" in Turkey, as described in the PDD, Version 1, revision 4, dated 14 May 2008, meets the stated requirements and identified criteria and correctly applies the relevant baseline and monitoring methodology. TÜV Rheinland thus requests the registration of the project as a CDM project activity.

Work carried out by:	Number of pages:
Kurt Seidel	27

[Table of Contents]

1 Introduction

South Pole Carbon Asset Management Ltd. has commissioned TÜV Rheinland to perform a validation of the "Aydin Salavatli Dora-1 Geothermal Power Plant" in Turkey (hereafter called "the project"). This report summarises the findings of the validation of the project, performed on the basis of UNFCCC criteria for the CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures and the subsequent decisions by the CDM Executive Board and the requirements for Voluntary Offset Projects under the Voluntary Carbon Standard VCS 2007.

1.1 Objective

The purpose of a validation is to have an independent third party to assess the project design. In particular, the project's baseline, monitoring plan, and the project's compliance with relevant UNFCCC and host Party criteria are validated in order to confirm that the project design, as documented, is sound and reasonable and meets the identified criteria. Validation is a requirement for all CDM projects as well as Voluntary Offset projects under the Voluntary Carbon Standard VCS 2007 and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of verified emission reductions (VERs) or so-called voluntary carbon units (VCUs).

1.2 Scope and Criteria

The validation scope is defined as an independent and objective review of the project design document (PDD). The PDD is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords, the requirements for Voluntary Offset Projects under the Voluntary Carbon Standard VCS 2007 and the relevant decisions by the CDM Executive Board, including the approved baseline and monitoring methodology. The validation team has, based on the recommendations in the Validation and Verification Manual employed a risk-based approach, focusing on the identification of significant risks for project implementation and the generation of VERs (VCUs).

The validation is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

1.3 VCS project Description

Turkey has significant potential for geothermal energy production, enjoying one-eighth of the world's total geothermal potential. This potential has been estimated at 4.5 GW of electric capacity (GWe) and 31.1 GW of thermal capacity (GWth) according to IEA /24 / ; most of this is of relatively low enthalpy making it unsuitable for electricity generation but can still be used for direct heating applications. The project activity aims to generate electricity from high-enthalpy geothermal energy at a heat between 78°C and 170°C. The geothermal fluid, a mixture of steam and brine 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, based on the principle of Organic Ranking cycle (ORC), 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. Hence it does not deplete the geothermal reservoir since all fluids are reinjected and no abatement of non-condensable gases is needed. The project uses advanced technology of the company Ormat Technologies Inc., which is based in Israel and USA respectively. The applied system reflects superior technology and represents a technology and know-how transfer to Turkey. The Dora-I project as first privately invested project is first of its kind and groundbreaking for the further development of this environmental friendly technology.

1.4 Level of assurance

The validation is based on the project design, as described in the Voluntary Carbon Standard Project Description Template, dated 14 May 2008, supporting documents made available to the validator, own background research and investigations and information collected through performing interviews and during on-site assessment. The validation opinion is assured throughout the credibility of the above mentioned sources of information. Total installed capacity of the Project will be 7.350 MW, with an actual net capacity of 6.500 MW. The plant will utilize 2 turbines (two with installed capacities of 3.975 MW each, and one generator 8.500 MW, 9.444 KVA with 11,000 V) and has a predicted power generation of 51,284 MWh per annum. The purpose of the project is to utilise the geological resources of the Aydın-Salavatli-Sultanhisar Geothermal Field in a technologically superior air cooled binary cycle geothermal power plant to generate renewable energy and dispatch it to the Turkish national grid. The electricity currently generated by the grid is relatively carbon intensive, with an operating margin emission factor of 0.679 tCO2/MWh and a build margin emission factor of 0.503 tCO2/MWh. The project is therefore expected to reduce emissions of greenhouse gases by an estimated 30,309 t CO2e per year during the first crediting period.

Based on the process and procedures conducted, the above GHG assertion of 30,309 tCO2e per year on average:

- is materially correct and is a fair representation of the GHG data and information,
  and
- is prepared in accordance with the related International Standard on GHG quantification, monitoring and reporting, or to relevant national standards or practices.

2 Methodology

The validation consisted of the following three phases:

I) a desk review of the project design documents
II) follow-up interviews with project stakeholders
III) the resolution of outstanding issues including material discrepancies and the issuance of the final validation report and opinion.

The following sections outline each step in more detail.

2.1 Review of Document

The following table lists the documentation that was reviewed during the validation:

/1/	South Pole Carbon Asset Management Ltd. *Project design document for the "*Aydin Salavatli Dora-1 Geothermal Power Plant*",* Version 01 of 14 May 2008
/2/	International Emission Trading Association (IETA) & the World Bank's Prototype Carbon Fund (PCF): *Validation and Verification Manual*. http://www.vvmanual.info
/3/	Clean Development Mechanism Validation and Verification Manual of UNFCCC (CDM EB 44)
/4/	CDM Executive Board: *"Methodology AMS-I.D. "Grid connected renewable electricity generation",* version 13 of EB 36
/5/	CDM Executive Board: "*Tool to calculate the emission factor for an electricity system"*, version 01, Annex 12 of EB35.
/6/	CDM Executive Board: "*The tool for the demonstration and assessment of additionality"*, version 05.2 of EB39.
/7/	VCS Association: "Voluntary Carbon Standard VCS 2007"
/8/	VCS Association: "Voluntary Carbon Standard Program Guidelines", dated 19 November 2007
/9/	VCS Association: Policy Announcement from the VCS Association with the title: "Further Guidance for Projects that are Registered in Two GHG Programs", dated 19 March 2008.
/10/	South Pole Carbon Asset Management Ltd. *Project emission spreadsheet* Version 1 dated 14 May, 2008

/11/	Excerpt from Emission Reduction Purchase Agreement (Geothermal Power Plant "DORA-I") between MENDERES Geothermal Elektrik Uretim A.Ş. ("the Seller") and South Pole Carbon Asset Management Ltd. ("the Purchaser") of 14/05/2008
/12/	MENDERES GEOTHERMAL ELEKTRİK ÜRETİM A.S. SANTRAL (OEC): Equipment List (EKİPMAN LİSTESİ)
/13/	EIA Excemption Certificate for the "Aydin Salavatli Dora-1 Geothermal Power Plant" of 23 June 2003
/14/	ORMAT / MEGE: Technical Scheme of the "Aydin Salavatli Dora-1 Geothermal Power Plant"
/15/	Generation License No. EÜ/126-106/043 of 04/04/2003 for "Aydin Salavatli Dora-1 Geothermal Power Plant"
/16/	Trade Register Documents for MENDERES Geothermal Elektrik Uretim A.Ş. of 09/08/2005 and 25/06/2007
/17/	CDM Executive Board: "*Guidance on the Demonstration and Assessment of Prior Consideration of the CDM",* version 1 (EB41)
/18/	Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy (Law No. 5346) of 10 May 2005 and actual updates of 2007
/19/	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories
/20/	Communique regarding the Meters to be used in the Electricity Market (TEIAS)
/21/	Electricity Market Balancing and Settlement Regulation (TEIAS)
/22/	TurkStat, Turkey's Statistical Yearbook, 2007
/23/	Turkish Electricity Generation – Transmission Statistics (TEIAS)
/24/	Energy Policy of IEA Countries: Turkey 2005 Review (OECD/IEA 2005)
/25/	Satman, A., Serpen, U., Korkmaz Basel, E.D., Istanbul Technical University (2007): AN UPDATE ON GEOTHERMAL ENERGY POTENTIAL OF TURKEY
/26/	MUSTAFA BALAT ,Besikduzu, Trabzon, Turkey (2006): "Current Geothermal Energy Potential in Turkey and Use of Geothermal Energy"
/27/	İbrahim AKKUS, Onder AYDOGDU, Hafize AKILLI, Osman GOKMENOGLU, Sinan SARP, General Directorate of Mineral Research and Exploration, Department of Energy Raw Materials Exploration, 06520 ANKARA (2005): Geothermal Energy and Its Economic Dimension in Turkey
/28/	European Commission "Business Opportunities in the Geothermal Energy Sector in Turkey" (2003, Ref.-No. NNE5-2000-00018)
/29/	The International Bank for Reconstruction and Development / The World Bank "*Doing Business 2007/2008"*
/30/	2007 Survey of Energy Resources World Energy Council 2007 *Geothermal Energy*
/31/	Nazim Yildirim1, Onder Aydogdu and Sinan Sarp, General Directorate of Mineral Research and Exploration (MTA) Ankara-TURKEY "Constraint Problems and Solution Alternatives for Potentially Available Integrated Geothermal Energy Utilization in Turkey" (2005)
/32/	ORMAT Technologies, Inc. "ORMAT GEOTHERMAL POWER PLANT CONFIGURATIONS"
/33/	Uri Kaplan, ORMAT Technologies, Inc. (November 2007): "ADVANCED ORGANIC RANKINE CYCLES IN BINARY GEOTHERMAL POWER PLANTS"
/34/	Ormat Technologies Inc. "Sustainable Geothermal Power Solutions for the Full Range of Resource Conditions" (2008)
/35/	Rogge, S.; Kaltschmidt, M.: Strom- und Wärmebereitstellung aus Erdwärme –Eine ökonomische Analyse (2002).

/36/	Statement of ORMAT SYSTEMS LTD. of January 11, 2009 regarding leakage from the OEC
/37/	Notarially certified statement of Menderes Geothermal Elektrik Üretim A.Ş. about the utilization of the raw gas from the DORA-1 geothermal power plant in newly erected neighbouring LINDE GAZ A. Ş.

2.2 Follow-up Interviews

The personnel listed below have been interviewed and/or provided additional information to the presented documentation:

	Date	Name	Organization	Topic
/a/	2008-05-19; 2008-05-20	Mr. Murat Haluk TUFEKCIOGLU	General Manager, MEGE Menderes Geothermal Elektrik Üretim A.S.	- Stakeholders consultation process information - Environmental impact assessment requirements - Applied project technology - Physical conditions - Local permits and local requirements - Project history - Project barriers
/b/	2008-05-19; 2008-05-20	Mr. Baris ERGUN	General Manager AL ENERJI LIMITED SIRKETI	- Follow up stakeholder consultation process - Project background - Project permits and licenses
/c/	2008-05-20	Mr. Saffet Özbay	Muchthar, Yavuzköy village	- Project background - Possible local impacts
/d/	2008-05-20	Mr. Mesut Bilgi	Board member MEGE Menderes Geothermal Elektrik Üretim A.S.	Project background, technical issues, possible local impacts
/e/	2008-05-20	Mr. Aliksan Demircan	Member of village committee	- Project background - possible local impacts
/f/	2008-05-19; 2008-05-	Mr. Wolfgang Brückner	Country Manager, Turkey,	- Applied baseline and monitoring methodologies and

	20		South Pole Carbon Asset Management Ltd.	implementation - Additionality evaluation - Calculation of emission reductions - Local stakeholder process - Background information - Personnel
/g/	2008 (05 – 12/08)	Mr. Patrick BÜRGI	Managing Partner, South Pole Carbon Asset Management Ltd.	Project background, general issues.

2.3 Resolution of any material discrepancy

The validation protocol used for the assessment is partly based on the templates of the IETA / World Bank Validation and Verification Manual, the requirements of the Clean Development Mechanism Validation and Verification Manual of UNFCCC (CDM EB 44) and partly on the experience of the DOE TÜV Rheinland with the validation of CDM projects.

Findings established during the validation can either be seen as a non-fulfilment of CDM criteria or where a risk to the fulfilment of project objectives is identified. Corrective action requests (CAR) are issued, where:

i) mistakes have been made with a direct influence on project results;
ii) CDM and/or methodology specific requirements have not been met; or
iii) there is a risk that the project would not be accepted as a CDM project or that emission reductions will not be certified.

A request for clarification (CL) may be used where additional information is needed to fully clarify an issue.

Findings established during the validation may be that:

i) the validation is not able to obtain sufficient evidence for the predicted emission reductions or part of the reported emission reductions.
ii) the validation has identified material misstatements in the predicted emission reductions. Emission reductions with evident material misstatements shall be discounted in order to achieve a conservative and reliable result during the verification period.

A forward action requests (FAR) may be issued, where:

- the actual project monitoring and reporting practices require attention and /or adjustment for the next consecutive verification period, or
- an adjustment of the monitoring plan is recommended.

In the context of FARs, risks may be identified, which may endanger the delivery of emission reductions in the future, i.e. by deviations from good reporting or management procedures. As a consequence, such aspects should receive a special focus during the next verification.

As a result of the validation process against VCS 2007 standard no corrective action requests (CARs) and no requests for clarification (CLs) have been raised, but several forward action requests (FARs) have been addressed, which have to be resolved prior to the first periodic verification.

Technical Quality Control

The final validation report including the complete list of validation findings underwent a technical review before being submitted to the project participants and before requesting registration of the project activity. To guarantee the transparency of the validation process, the concerns raised and responses given are documented in the validation report.

The validation report including the initial validation findings underwent a technical review before being submitted to the project participants. The technical review was performed by a technical reviewer qualified in accordance with TÜV Rheinland's qualification scheme for CDM validation and verification.

Validation Team

Role/Qualification	Last Name	First Name	Affiliation
Team Leader	Seidel	Kurt	TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Germany
Technical Reviewer	Kober	Ralf	TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Germany on behalf of TÜV Rheinland Japan Ltd,, Japan

The CV of each assigned individual validation team member is available upon request.

3 Validation Findings

The findings of the validation are stated in the following sections.

3.1 Project Design

Participants and Ownership

The project participants are Menderes Geothermal Elektrik Üretim AŞ from Turkey; and South Pole Carbon Asset Management Ltd. from Switzerland. The copy of the Emission Reductions Purchase Agreement (ERPA) /11/ has been provided for validation that grants the reductions/removals for the first part of the 10 years crediting period (until 2013) to the project participant South Pole Carbon Asset Management Ltd., wheras the reductions/removals for the second part of the 10 years crediting period (until 2018) are owned to date by the project participant Menderes Geothermal Elektrik Üretim AŞ.

The trade register documents of Menderes Geothermal Elektrik Üretim AŞ from 25 June 2007 /16/ and the Generation License No. EÜ/126-106/043 of 04/04/2003 for "Aydin Salavatli Dora-1 Geothermal Power Plant" /15/ is the proof, that Menderes Geothermal Elektrik Üretim AŞ in person of Mr. Muharrem Balat and Mr. Murat Haluk Tufekcioglu are authorized to sign the above ERPA.

The host Party is Turkey and the Annex I Party is Switzerland. As Turkey has not recognized and ratified the Kyoto Protocol so far, it is not possible to develop the project as CDM project. Instead it can be developed as voluntary emission reduction project, the voluntary carbon standard VCS 2007 has been selected for the project activity. For voluntary emission reduction projects there is no authorization of the project participants and approval of the project activity by the Designated National Authorities of the Parties requested. The validation did not reveal any information that indicates that the project can be seen as a diversion of official development assistance funding towards Turkey.

The project is currently not part of any other GHG program, emission trading scheme or environmental credit, that means double counting can be excempted.

FAR 1: The project proponents have to inform VCS Association with a letter prior to the first periodic verification, that the VCUs being registered have not been registered, transferred or retired prior to the registration with the VCS registry.

Project Design

The project is located in the West of the village Salavatlı, which is located in the Northeast of the city of Aydın, nearest to the small villages Yavuzköy, Kösk and Salavatli. Total installed capacity of the Project will be 7.350 MW, with an actual net capacity of 6.500 MW.
The project uses the so-called ORMAT ENERGY CONVERTER (OEC), which is a power generation unit, manufactured by Ormat Technologies Inc., which converts

low, medium and high temperature heat into electrical energy. The new power plant significantly contributes to the local authorities' efforts to develop the base load needs of Turkey through dependable, indigenous and clean geothermal power, optimizing the energy utilization by converting both geothermal steam and brine from geothermal wells into electric power.
The plant will use condensers and allow 100% geothermal fluid reinjection, which serves both to sustain the reservoir and to produce electrical power with virtually no environmental impact. The technology reflects current good practices and first-of-its kind for Turkey.

The production wells named AS-1 and ASR-2 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. 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, it is announced by the project owner, that 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.

FAR 2: It has to be clarified, if it is planned to claim the additional GHG emission reductions from replacement of potential fossil fuel based space heating in greenhouses as part of the project activity in the future.

TÜV Rheinland was able to confirm that the proposed project is in line with relevant legislation in Turkey and the technology is approved by different authorities and verified that the relevant licenses and permits are in place.

Project start date has been considered as the date of the financial closure, the 04 April 2003, shortly before the first drilling activities started as part of the project assessment, which is in line with the definition of the project start date of the Voluntary Carbon Standard VCS 2007 and also in line with the issued Generation License No. EÜ/126-106/043 of 04/04/2003 for Menderes Geothermal Elektrik Üretim AŞ.

The initial start of the construction in May 2005 and the final commission per 10 May 2006 could be verified through document check during the on-site assessment. The expected operational lifetime of the proposed project is expected to be 25 years which is deemed to be reasonable and has been verified through comparison with similar geothermal power plants. The project developer has selected a renewable crediting period of ten years starting from 01 July 2008.

3.2 Baseline

The project applies the approved baseline small-scale methodology AMS-I.D.(version 13), titled "Grid connected renewable electricity generation" and the relevant methodology tool "Tool to calculate the emission factor for an electricity system".

The applied baseline methodology is justified as it has been demonstrated that the project activity ensures that:

- It is a grid connected zero emission renewable power generation activity from wind energy.
- The installed capacity of the proposed project is 6.5 MW and hence it fulfils the qualifying limit of 15 MW for type I small scale project activities as stated in the approved baseline methodology AMS-I.D.

The spatial extent of the project boundary is clearly defined as the site of the project activity and all power plants connected physically to the Turkish national grid.

The defined project boundary is in line with AMS-I.D.(version 13). Emission sources and gases included in the project boundary are:

	GHGs involved	*Description*
Baseline emissions	*CO2*	*Turkish National Grid*
Project emissions	*N/A*	Project emission is regarded as zero as the project is a renewable energy project.
Leakage	*N/A*	There are no leakages that need to be considered in applying this methodology.

FAR 3: It has to be clarified, how much the following emission sources, account for as part of project emissions or leakage:

- fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam (based on the mass fraction of carbon dioxide in the produced steam);
- and, carbon dioxide emissions resulting from combustion of fossil fuels related to the operation of the geothermal power plant
- Fugitive carbon dioxide and methane emissions due to continuous well testing and well bleeding

Summary of Concerns:

Geothermal fluids (steam or hot water) usually contain gases such as carbon dioxide (CO2), hydrogen sulphide (H2S), ammonia (NH3), methane (CH4), and trace amounts of other gases, as well as dissolved chemicals whose concentrations usually increase with temperature.

Carbon dioxide is also present in the fluids used in the geothermal power plants, although much less CO2 is discharged from these plants than from fossil-fuelled power stations: 13 – 380 g for every kWh of electricity produced in the geothermal plants, compared to the 1042 g/kWh of the coal-fired plants, 906 g/kWh of oil-fired plants, and 453 g/kWh of natural gas-fired plants (Fridleifsson, 2001). Binary type power plants (i.e., a closed system in which a working fluid drives the turbine, not the geothermal steam or fluid) have by far the smallest impact.

Discharge of waste waters is also a potential source of chemical pollution. Spent geothermal fluids with high concentrations of chemicals such as boron, fluoride or arsenic should be treated, re-injected into the reservoir, or both.

The project emissions of this small-scale project category I incl. AMS-I.D. are assumed to be zero. It is not clear at this stage whether small-scale geothermal power projects have to consider the two project emission sources that need to be accounted for in the context of large-scale geothermal power projects, which are:
(i) Fugitive emissions of CO2 and CH4 due to release
of non-condensable gases from the produced steam,
and
(ii) CO2 emissions from operation of the geothermal power plant.

Final conclusion validation:

FAR 3, Part 1:

Fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam (based on the mass fraction of carbon dioxide in the produced steam).

Final conclusion to FAR 3, Part 1:

It was confirmed by the EPC contractor ORMAT SYSTEMS LTD. with an official letter, dated January 11, 2009 (/36/), that the binary power plant consists of integrated two level units, type Ormat Energy Converter (OEC), which are designed as a closed loop. That means that under normal conditions there is no leakage from the OEC of the geothermal and secondary fluid anticipated. Moreover a notarially certified

statement of Menderes Geothermal Electric Üretim A. Ş., dated 9 January 2009 (/37/) states the utilization of the raw gas from DORA-1 geothermal power plant in the newly erected neighbouring LINDE GAZ A Ş., that belongs to LINDE GROUP, being an internationally recognized supplier of industrial gases.

The above information could be verified and confirmed by the validation team based on further background research and evidences, see section 2.1.

FAR 3, Part 1 is considered to be resolved and closed.

FAR 3, Part 2:

Carbon dioxide emissions resulting from combustion of fossil fuels related to the operation of the geothermal power plant.

Final conclusion to FAR 3, Part 2:

Carbon dioxide emissions resulting from combustion of fossil fuels related to the operation of the geothermal power plant, considering a back-up diesel generator that is expected to run a few hours per year in case of emergencies or for start-up, should be taken into account as follows:

- "If fossil fuel is used the electricity generation metered should be adjusted to deduct electricity generation from fossil fuels using the specific fuel consumption and the quantity of fossil fuel consumed. " (AMS I.D., article 16): The diesel consumed for operation of the diesel generator has to be monitored and emissions due to consumption of diesel shall be accounted as project emissions in case these emissions will contribute for more than 1 % of the baseline emissions.

The carbon dioxide emissions of the standard operation will be taken into account automatically, because the amount of total gross electricity generated by the project and the amount of electricity consumption as well as the amount of electricity fed into the Turkish national grid (net electricity production) are monitored continuously, and the electricity production is the amount that will be converted into $C0_2$ emission reductions from the displaced fossil-fuel based electricity of the electricity grid.

The PDD has been revised under section 3.3. The additional monitoring parameter $\mathbf{PE_{Dcons}}$ (Diesel consumed from running the diesel generator) has been added for conservative reasons, see also section 4.3. Hence it has been ensured, that minor project emissions due to diesel consumption will be regularly monitored in order to have the opportunity to deduct the resulting project emissions in addition from the total emission reductions in case they might contribute for more than 1 % of the overall emission reductions of a certain verification period.

FAR 3, Part 2 is considered to be resolved and closed.

FAR 3, Part 3:

Fugitive carbon dioxide and methane emissions due to continuous well testing and well bleeding.

Final conclusion to FAR 3, Part 3:

They are considered as negligible according to best practice and the guidance from the relevant methodologies.
FAR, Part 3 is resolved and closed.

In the baseline scenario the electricity delivered from the project activity to the grid would have been generated by fossil fuels grid-connected power plants and by the addition of new generation sources.

This is reflected in the combined margin (CM) - the weighted average of the operating margin (OM) emission factor and the build margin (BM) emission factor. The weighting is set to respectively 50% and 50%, the default values stipulated by the "Tool to calculate the emission factor for an electricity system" /5/ for geothermal power plant projects.

The Turkish National Grid is dominated by fossil fuel-fired power plants (coal, lignite, natural gas and fuel oil). It is deemed likely that these fossil fuel-fired power plants will continue to dominate the power sector due to the local availability of low-cost coal and lignite. It is expected that renewable capacity additions will not have significant effects on the mix of the Turkish National Grid during the first crediting period. The baseline determination is transparent and reasonable.

The project activity is assumed to achieve annual emission reductions of 30,309 t CO2e, which is belonging to the category of large-scale projects under VCS 2007 for Voluntary Offsets with a size of 5,000 – 1,000,000 t CO2e per year.

Additionality

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

Step 1: Regulatory Surplus

The Project has not been mandated by any enforced law, statute or other regulatory framework. Under section 1.10 the applicable laws in Turkey have been listed.

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 are further substantiated in detail:

• **Investment Barrier** – Project faces capital or investment return constraints that can be overcome by the additional revenues associated with the generation of VCUs.

Project-specific evaluation:

- **Non-availability of a bank-loan because of:**
  - Low Annual Debt Service Cover Ratio (ADSCR)
  - No experience of the bank for financing of a private geothermal power plant (first-of-its kind in Turkey)

Institutional barriers – Project faces financial, organizational, cultural or social barriers that the VCU revenue stream can help overcome.

Project-specific evaluation:

- Necessity of Exim credits by the Equipment supplier ORMAT.
- Funding through a loan by the Turkish development bank based on a mortgage on the land and the equipment.
- High country risk of Turkey results in high interest rates for debt financing
- Additional financing of the transmission line by the project proponent
- Risk of uncertainty of electricity price and distribution fee
- Risk of uncertainty of wells drilling

• **Technological Barriers** – Project faces technology-related barriers to its implementation.

Project-specific evaluation:

- Non-availability of specific technology for geothermal power generation in Turkey
- Necessity for import of the specific ORC and binary technology
- Lack of skilled and properly trained staff for construction, operation and maintenance

Conclusions:

It has been stated that the unavailability of funds for geothermal power plants is the major barrier for the implementation of such type of projects, especially because of the high up-front investment costs for new geothermal energy projects ant typically small-size projects like the project activity.

International and commercial banks are reluctant to finance geothermal projects in large part due to the risks associated with resource uncertainty, local banks are reluctant because of insufficient private sector presence in this sector in Turkey and lack of local “success stories” of modern geothermal energy projects in Turkey in comparison to hydroelectric projects.

The proposed project faces risks in terms of:
- Long-term performance of the production wells
- Additional resources necessary for the exploration of extra wells
- Possible increase in operation costs in cases of emergencies
- Other unseen risks which can affect project operation

The project participant demonstrated that VCU revenues are needed to achieve the requested Annual Debt Service Cover Ratio (ADSCR). Also it was confirmed that VCU revenues will provide resources to construct if necessary additional wells that are needed to achieve project's contractual obligations for power production. In order to sustain the flow of fluids in form of steam and brine to the plant, it is projected that a new well (or major overhaul to existing wells) will have to be carried out every three to four years, which a cost per meter up to 1,000 € /35/.

This was verified as part of the background document research /28/. TÜV Rheinland was able to verify during the on-site assessment, where new well testing was carried out, that the proposed project also is facing the described barriers.
It has also been verified that Turkey has been placed under number 68 of 178 economies worldwide with regard to the economic indicator "Getting Credit" and under number 112 regarding the indicator "Closing a Business" in the Doing Business 2008 Report, a copublication of the World Bank and the International Finance Corporation /29/. Under such conditions, investing in any type of project in such a country is risky for any investor.

Step 3: Common Practice

• project type shall not be common practice in sector/region, compared with projects that have received no carbon finance.
• if it is common practice, the project proponents shall identify barriers faced compared with existing projects.
• demonstration that the project is not common practice shall be based on guidance in the GHG Protocol for Project Accounting, Chapter 7.

Project-specific evaluation:

Turkey is endowed with abundant geothermal resources which can be used for electricity generation and heating. There are, however serious geological and technical problems associated with taking full advantage of these resources. Nearly 274 geothermal occurrences and fields are known to exist in Turkey according to MTA (the state owned directorate) records. About 25 of them are already being exploited at large scale for direct and indirect geothermal energy use, many fields are mainly used for balneological purposes by local public, and while others are still to be developed. Official statistics (Ministry of Energy and Natural Resources) show that natural gas provides 40%, hydro provides 30%, coal provides 25%, and liquid fossil fuels and renewables provide 5% of the total electricity of the country. Geothermal energy remains as a small contributor to the electric power capacity and generation in Turkey. Geothermal plants constituted only 0.05% of the installed generating capacity and provides around 0.06% of the total electricity. Currently 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. The already since 1984 existing 15 MW geothermal plant in Kizildere in Denizli was build and is operated by a state owned utility, which is a essential distinction to the proposed project activity.

It can be concluded that the project activity is the first not by the state owned MTA but by a private investor on its own risk developed geothermal energy project applying the "Organic Ranking Cycle & Binary Technology", which represents the first of its kind for Turkey. The risks outlined above are primarily a result of the fact that the technology is advanced, not available locally, and not common practice.

The project activity is according to the guidance in the GHG Protocol for Project Accounting, Chapter 7 not a common practice, considering the above described law level of penetration of geothermal energy production in Turkey and the different economical and political conditions under which the other geothermal power plants in Turkey have been erected and operated. Based on above statistics, TÜV Rheinland is of the opinion that the small amount of capacity installed relative to potential that exists indicate that the development of this type of project is not a common practice in Turkey. VCU revenues help the project activity to overcome the above described 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.

TÜV Rheinland was able to verify that the incentives from VCU were seriously considered for the project activity in order to secure the continuous plant operation as outlined below:

	Start Date	End Date
Generation License No. EÜ/126-106/043 for "Aydin Salavatli Dora-1 Geothermal Power Plant"	04 April 2003	
Project Assessment and Drilling Activities	May 2003	May 2005, further ongoing
EIA Exemption Certificate for the "Aydin Salavatli Dora-1 Geothermal Power Plant"	23 June 2003	
Exim credit by equipment supplier Ormat Industries Inc.	2005	
Loan by development Turkish bank Türkiye Kalinma Bankasi A.S. based on a mortgage on the land and the equipment	2005	
Purchase contracts of MENDERES GEOTHERMAL ELEKTRİK ÜRETİM A.S. SANTRAL (OEC) according to attached Equipment List (EKİPMAN LİSTESİ)	2005	

Trade registration as MENDERES Geothermal Elektrik Uretim A.Ş.	09/08/2005	
Start of operation	10 May 2006	
GHG Assessment and PDD compilation	January 2008	May 2008
ERPA for Geothermal Power Plant "DORA-I" between MENDERES Geothermal Elektrik Uretim A.Ş. ("the Seller") and South Pole Carbon Asset Management Ltd. ("the Purchaser")	14 May 2008	
On-Site Assessment	19 & 20 May 2008	
Validation	19 May 2008	December 2008

The relevant evidences supporting this information have been provided and verified by TÜV Rheinland.

3.3 Monitoring Plan

The project applies the approved monitoring methodology AMS-I.D., version 13 "Grid connected renewable electricity generation". The selected monitoring methodology is applicable for the project activity as it involves grid-connected renewable power generation using geothermal high enthalpy energy, with the installed capacity of 6.5 MW, which is lower than the qualifying threshold of 15 MW for Type I small scale projects.

The net electricity generated from the grid connected 6.5 MW Aydin Salvatli Dora-1 Geothermal Power Plant is measured continuously and recorded monthly. Monitoring of project emissions is not required as per AMS-I.D. and therefore has not been considered for the project. Since the proposed project does not result in transfer of generation equipment to the project site nor from the project site to any other location, leakage is not in place.

See also FAR 3 under chapter 8.2.

The application of the monitoring methodology is transparent and correctly applied.

Parameters determined ex-ante

The combined margin emission factor is determined ex-ante based on the most recent information available. More detailed information is provided below.

Parameters monitored ex-post

See also FAR 3 under chapter 8.2.

Interim conclusion: Prior to any relevant UNFCCC EB decision small-scale geothermal projects have not to consider these project emissions for the emission reduction calculation. Anyhow, these records are requested according to the on-site assessment from the Turkish Environmental Inspection, who will make periodic on-site observations every two to three months. The diesel consumed for operation of the diesel generator has to be monitored and emissions due to consumption of diesel shall be accounted as project emissions in case these emissions will contribute for more than 1 % of the baseline emissions. Final project emissions estimations needs to be monitored during project life.

The methodology requires monitoring of the following for small-scale renewable energy projects including geothermal power plants:

• Electricity generation from the proposed project activity;
• Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with AMS-I.D. "Grid connected renewable electricity generation";
• Data needed to recalculate the build margin emission factor, if needed, consistent with AMS-I.D. "Grid connected renewable electricity generation".

The operating margin and build margin emission factor are determined ex-ante, therefore the parameter monitored ex-post is the electricity generation from the proposed project activity.

The amount of total gross electricity generated by the project and the amount of electricity consumption as well as the amount of electricity fed into the Turkish national grid (net electricity production) are monitored continuously. There a two main electricity meters, owned and sealed by TEİAŞ: a primary meter and a secondary or back-up meter.

For the VCS project monitoring the main parameter is the net electricity production generated from the project, which will be recorded monthly.

The net electricity generation, which is to be monitored and to be used for baseline emissions, is the net electricity generation, which is read by TEİAŞ for invoicing. On the last day of each month, the TEİAŞ staff performs the reading at the switchgear station, where the measurement instruments are installed, which will be the basis for the invoicing.

This data will be cross verified against the sales receipt from the grid. A cross-check during the on-site assessment showed, that the measured and recorded electricity values are correct and traceable by verifiers. The net electricity generated and delivered to the grid can be monitored from TEİAŞ invoices, from the Market Financial Settlement Centre (MFSC) website or for control reasons also the project's SCADA system.

It could be checked during on-site assessment, that the TEİAŞ invoices are conform with the own records of the geothermal plant. Relevant data storage procedures as required are in place. The meters were sealed by TEİAŞ. The electricity meter's specifications are in line with the relevant Turkish standard /20/.

At the end of each monitoring period, the data from the monthly meter readings will be added up to obtain the total monitoring period net electricity generation. This figure will be multiplied with the combined margin, which has been calculated ex-ante. For verification, a monitoring report will be prepared by the project participants with the support of the carbon consultants using the electricity generation data acquired from the measurement devices.

Moreover, the monitoring report will contain information on the QA/QC procedures followed to assure a certain accuracy of the monitoring data.

Management system and quality assurance

The site visit demonstrated that ORMAT, responsible for the technology and project implementation, is ISO 9000 and ISO 14000 certified.

The project's operation and maintenance manual needs to include:

- A description of the responsibilities and authorities for project management,
- Procedures for monitoring and reporting, and QA/QC procedures,
- A description of the installation of metering equipment,
- Procedures for the calibration of metering equipment,
- A description of training and maintenance needs,
- Procedures for day-to-day recording and storage.

During on-site assessment it was confirmed by the project owner MENDERES Geothermal Elektrik Uretim A.Ş., that these procedures will be maintained and implemented to enable subsequent verification of emission reductions. South Pole Carbon Asset Mangement Ltd. will assist to ensure that the requirements of the monitoring plan will be be completely fulfilled.

The PDD includes a description of overall global responsibilities, monitoring, measurement and reporting procedures and activities.

3.4 Calculation of GHG Emissions

The emission reduction ERy by the project activity during the crediting period is the difference between baseline emissions (BEy), project emissions (PEy) and emissions due to leakage (Ly), as follows:
1) Baseline emissions: baseline emissions (BEy in tCO2) are the product of the baseline emissions factor (EFy in tCO2/MWh) times the electricity supplied by the project activity to the grid (EGy in MWh).
2) Project emissions: there are no emissions from the small-scale project which is a renewable energy project, applying AMS-I.D.
3) Leakage: no leakage has to be considered for the proposed small-scale project activity, applying AMS-I.D.

4) Emission reduction: ERy= BEy- PEy- Ly= BEy.

For the calculation of the operating margin (OM) emission factor, the simple OM emission factor calculation method is selected because low cost must run projects constitute less than 50% of the total grid generation and data is not available for applying the dispatch data analysis.

The aggregated generation and fuel consumption data are used due to the fact that more disaggregated data are not available in the Turkish National Power Grid (TNPG).

Country specific data for net calorific value (NCVi) of each type of fossil fuel, the IPCC 2006 default values for the oxidation factor of each type of fossil fuel and the total electricity delivered to the TNPG are selected and are deemed reasonable.

Vintage data for the years 2004, 2005 and 2006 from Statistical Yearbook 2006 and from UNFCCC National GHG Emission Inventory are used for operating margin calculation. The OM is calculated to be 0.679 tCO2/MWh as a generation-weighted average for the three years.

Because plant specific fuel consumption and electricity generation data is not public available in Turkey, the following approach approved by the CDM Executive Board for such cases deemed to be applicable for this project.
- Use of capacity additions for estimating the build margin emission factor for grid electricity.
- Use of weights estimated using installed capacity in place of annual electricity generation.
- Use the efficiency level of the best technology commercially available in the National grid of Turkey, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM).
Following the EB's guidance the build margin is calculated as follows:
- The capacity additions from the years 2003 to 2006 is chosen, which comprise 20% of total
system generation and that have been built most recently was established using public available data from the official website of the Turkish National Power Grid Company TEIAS.
- The generation efficiencies per power plant were obtained due to non-availabilty of data per power plant from the Integral Pollution Prevention and Control (IPPC) "reference document on best available techniques for large scale combustion plants" as a conservative approach, since not all power plants reach these efficiencies.
- For the conversion into t CO2 / GWh were the default emission factors of 2006 IPCC National GHG inventory applied.

- The EFBM is calculated as 0.503 tCO2/MWh.

The weights ωOM and ωBM are selected as 0.50 and 0.50, respectively, as stipulated for geothermal power projects by AMS-I.D. and the relevant methodology tool. The combined margin of 0.591 tCO2/MWh is fixed exante for the entire first crediting period.

Requirements:

Project Emissions:

The validation report shall contain information regarding greenhouse gas emissions occurring within the proposed CDM project activity boundary as a result of the implementation of the proposed CDM project activity which are expected to contribute more than 1% of the overall expected average annual emissions reductions, which are not addressed by the applied methodology (Article 76 of VVM "CLEAN DEVELOPMENT MECHANISM VALIDATION AND VERIFICATION MANUAL", Version 01, EB 44 Annex 03, dated 28 November 2008).

The project activity is with 6.5 MW net capacity a small-scale project activity, applying the small-scale methodology AMS-I.D. , with the following potential of possible emission sources:
- Fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam, which needs not to be monitored according to the applied methodology and are unlikely to occur according to the further assessment, see under section 3.2. (***Final conclusion to FAR 3, Part 1).***
- Carbon dioxide emissions resulting from combustion of fossil fuels related to the operation of the geothermal power plant, considering a back-up diesel generator that is expected to run a few hours per year in case of emergencies or for start-up, have to be monitored, see under section 3.2. (***Final conclusion to FAR 3, Part 1)***
- Fugitive carbon dioxide and methane emissions due to continuous well testing and well bleeding, can be neglected according to the best practice and the guidance from the relevant methodologies, see under section 3.2. (***Final conclusion to FAR 3, Part 1)***

To ensure that project emissions are considered in case they are contributing for more than 1 % to the total emission reductions for the project activity, FAR 3 was raised.

See also under FAR 3.

Final conclusion: The diesel consumed for operation of the diesel generator has to be monitored and emissions due to consumption of diesel shall be accounted as project emissions in case these emissions will contribute for more than 1 % of the baseline emissions.

Final project emissions estimations needs to be monitored during project life.

The monitoring plan has been amended accordingly and is taking into account such project emissions.

Leakage:

According to AMS-I.D., the leakage of the proposed project is not considered. No leakage is expected unless the project power generation equipment is transferred from another activity or the equipment replaced is transferred to another activity, which was confirmed during the on-site assessment.

Emission reductions: have been estimated to be 30,309 tCO_2e per year during the first crediting period.

3.5 Environmental Impact

No Environmental Impact Assessment (EIA) has been performed, because there is no legal obligation for this small-scale geothermal power project according to the Ministry of Environment and Forestry of Turkey.

An official document, dated 23 June 2003, stating the Exemption for Environmental Impact Analysis for the "Aydin Salavatli Dora-1 Geothermal Power Plant", has been submitted to TÜV Rheinland /13 /. The potential environmental impacts have been sufficiently identified. The noise mitigation of the ORC plant itself is achieved by the installation of silencers inside the plant, which is part of the project design.

No significant environmental impacts are expected from the project activity, which re-injects the geothermal fluid back to the reservoir via a re-injection well. During the on-site assessment on 19 May 2008 it was confirmed by the project proponents, that there will be a periodic on-site observations every two to three months, executed by the Turkish Environmental Inspection.

3.6 Comments by stakeholders

There is no mandatory requirement to conduct a local stakeholder consultation for small-scale geothermal projects in place in Turkey. The planned employment of local residents for the construction phase and the later operational phase could be verified. The overall positive impact of these measures could be confirmed also during the follow-up meeting on 20 May 2008 with stakeholders of the neighbouring villages /c/, /d/, /e/. It can be concluded that the project, which is located in the marginal lands of the villages, has no negative impacts on the residents of the villages.

It was reported, that no further comments of local or global stakeholders to the project activity were received by the project proponents.

4 Validation conclusion

TÜV Rheinland has validated the project activity "Aydin Salavatli Dora-1 Geothermal Power Plant" as per the relevant requirements of the Voluntary Carbon Standard VCS 2007 and relevant CDM EB-guidelines of UNFCCC, applicable for VER project activities, as well as criteria for consistent project operations, monitoring and reporting. The validation is based on the Project Design Document (PDD) Version 1, revision 4, dated 14 May 2008, emission reduction calculation spreadsheet and supporting documents made available to the TÜV Rheinland by the project participant. The review of the PDD and additional documents was related to baseline and monitoring methodology, subsequent background investigations have been performed to validate the fulfilment of the stated criteria of the Voluntary Carbon Standars VCS 2007.

As a result of the validation, the validation team confirms that:

- All operations of the project are implemented and installed as planned and described in the validated project design document.
- The calculation of the emission reductions is carried out in a transparent and conservative manner, so that the projected emission reductions can be achieved within the 10 years (renewable) crediting period.
- The monitoring system is in place and functional. The project is ready to generate GHG emission reductions.
- The project additionality is sufficiently justified in the PDD.
- The monitoring plan is transparent and adequate.

As the result of the validation, the validator confirms that the project, as it was described in the project documentation, is in line with all criteria applicable for the validation.

Baseline Emissions:
303,090 t **CO2eq** for first renewable (10 years) crediting period
Leakage:
0 t CO2eq for first renewable (10 years) crediting period
Project Emissions:
0 t CO2eq for first renewable (10 years) crediting period
Total Emission Reductions:
303,090 t CO2eq for first renewable (10 years) crediting period

Cologne, 2009-01-15

Kurt Seidel
TÜV Rheinland
Validation Team Leader