VALIDATION REPORT

FOR

BÜYÜKDÜZ HYDROELECTRIC POWER PLANT, TURKEY

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Summary:

TÜV Rheinland has been contracted for the validation of the Büyükdüz HEPP with total installed capacity of 68.862 MWe against the VCS Standard version 3.4. The validation is performed by applying CDM methodology ACM0002 “Large-scale Consolidated Methodology: Grid-connected Electricity Generation From Renewable Sources” version 14.0 in combination with the latest methodological tools and guidelines. During the desk review, VSC PD, emission reduction calculation workbook, investment analysis workbook and supporting evidence were assessed, resulting in a concise list of Clarification and Corrective Action Requests (CL/CAR). The last is enclosed as Appendix A to the current Validation Report. In order to be in compliance with VCS requirements, the obligatory on-site assessment was conducted on 20/05/2014 on Büyükdüz HEPP.

Finally, based on the performed documents review, responses to CLs/CARs, disclosure of confidential substantial information and revision of project design document lead to issuance of validation report with positive opinion. GHG emissions data and information are fairly represented without material discrepancies and declared estimated GHG emission reductions are materially correct.

The V/VB asserts that Büyükdüz HEPP project is in line with the VCS version 3.4 requirements and is identified to be additional in accordance with the CDM methodology ACM0002 v14.0.

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1 INTRODUCTION

The validation report summarises outcomes of the assessment of Büyükdüz HEPP project, i.e. evaluation of project description document, additionality assessment and emission reduction calculations, against the VCS standard version 3.4 criteria by means of CDM Methodology ACM0002 v14.0 and referred methodological tools and guidelines as well as criteria given to provide for consistency in project operations, monitoring and reporting.

Name	Position	Scope	Location
Roland Wollenweber	Auditor	1, 5, 6	Cologne/ Germany
Norbert Heidelmann	TR	1, 3, 6	Cologne/ Germany

1.1 Objective

Validation of project documentation is the 2nd major step in development of VCS project cycle. It is PP responsibility to develop VCS PD and contract approved VVB for the validation process. The objective of a validation is to have an independent third party assessing project design, i.e. VCS PD, emission reduction calculations, monitoring plan, etc., and projects compliance with VCS version 3.4 as well as with relevant UNFCCC and host country criteria. In particular, VVB ensures that the VCS PD, including monitoring plan, additionality analysis and emission reduction calculations, is comprehensive, accurate and credible and meets the identified criteria.

Validation is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of project's quality and intended amount of voluntary 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 description (VCS PD), which includes among others the assessment of monitoring plan, emission reduction calculations and additionality assessment.

Validation is performed in compliance with VCS criteria stated in the VCS standard v3.4 and VCS program guide v3.5. In addition criteria stipulated by the approved methodology ACM0002 "Large-scale Consolidated Methodology: Grid-connected Electricity Generation from Renewable Sources" version 14.0 and the methodological tools "Tool to calculate the emission factor for an electricity system" v4.0 and "Tool for the demonstration and assessment of additionality" v7.0, since the mentioned are implemented in project description.

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

1.3 Level of Assurance

The final validation is based on the latest project description, VCS PD v2.0, dated 26/05/2014, supporting documents disclosed to the validator, own background research and investigations and information collected through performing interviews during on-site assessment. The validation opinion is assured throughout the credibility of the above mentioned sources of information.

The Validation Conclusion (See Validation conclusion 4) is made to a reasonable assurance level, and a materiality threshold of 5% is applied for identification of material omissions as required by VCS v3.4 paragraph 5.3.1 item 4. In general it shall be adhered to the procedures as defined in ISO 14064-3.

1.4 Summary Description of the Project

The proposed project activity, Büyükdüz Hydroelectric Power Plant (HEPP) is a run-off-river type HEPP. It has an installed capacity of 70.844 MWm / 68.862 MWe facilitating two turbines with a nominal output of 34.431 MWe each. On 20/03/2008 the Energy Market Regulatory Authority (EMRA) issued the Energy Generation License for the Büyükdüz HEPP to Ayen Enerji A.S..

Büyükdüz HEPP was commissioned on 31/05/2012 and is estimated to generate annually 192,021,000 kWh renewable energy. Based on the latest available CDM methodologies on grid-connected electricity generation from renewable sources, PO estimated combined emission factor of the Turkish national electricity grid of $EF_{CM,grid}$ = 0.535 tCO2/MWh and determined an annual average emission reduction generated by the proposed project activity of 102,731 tCO2e.

Important milestones for the proposed project activity are listed in Table 1

Table 1: Milestone of Büyükdüz HEPP

08/02/2008	Initial EIA certificate is awarded to the Büyükdüz HEPP
04/03/2008	Water Usage Agreement between General Directorate of State Hydraulic Works of Ministry of Forestry and Water Affairs and Ayen Enerji A.S. for Buyukduz HEPP, dated
20/03/2008	Buyukduz HEPP Generation Licence, granted by Energy Market Regulatory Authority, dated, Licence No: EU/1539-5/1123. Accessible at http://kap.gov.tr/en/search/notice-results.aspx?id=51652
19/03/2010[1]	Purchase agreement for turbine and service agreement with turbine supplier (Alstom)
12/08/2010	Financing agreement with Creditor Bank Turkiye Is Bankasi A.S.
07/02/2011 08/09/2011	Amended water agreement is issued to Büyükdüz HEPP, Additional Water Usage Agreement between General Directorate of State Hydraulic Works of Ministry of Forestry and Water Affairs and Ayen Enerji A.S. The second amendment is related to a capacity addition of the plant.
31/05/2012	Commissioning date
18/04/2014	Ayen Enerji A.S.provided the listing representation for Büyükdüz HEPP to the VCS registry
20/05/2014	Site-visit with the VVB

[1] Date of investment decision, as in the sense of CDM methodology

2 VALIDATION PROCESS

2.1 Method and Criteria

Validation of Büyükdüz HEPP has been performed in accordance to the internal procedures of TÜV Rheinland Energie und Umwelt GmbH for validation of VCS projects, which strictly follows ISO 14046-3. The validation body holds ANSI accreditation to ISO 14065[2]. During preparation stage following tasks are accomplished:

- Selection of an appropriate validation team
- Development of the audit plan
- Preparation of project and standard specific validation protocol, which shows in a transparent manner, criteria and requirements, means of validation and the results from validating the different identified issues

The core validation consisted of the following phases:

- desk review of the project design document and complementary documents
- on-site visit (site inspection) and follow-up interviews with project stakeholders
- resolution of outstanding issues including material discrepancies and the issuance of the draft validation report
- Internal technical review and issuance of final validation report.

The following sections outline each step in more detail.

[2] TÜV Rheinland was awarded a Certificate of Accreditation by ANSI on 22/06/2012

2.2 Document Review

The desk review phase is characterised with the assessment of project description and emission reduction workbooks substantiated by additional supportive documents, all of which have been provided by the carbon consultant.

The following table outlines the documents reviewed as part of the validation process:

Ref No.	***Reference Document***	***Date***
/1/	Project Description template, v3.2	08/10/2013
/2/	VCS Program Guide, v3.5	08/10/2013
/3/	VCS Standard, v3.4	08/10/2013
/4/	VCS Program Definitions, v3.5	08/10/2013
/5/	ACM0002 "Large-scale Consolidated Methodology Grid-connected electricity generation from renewable sources" Version 14.0	04/10/2013
/6/	TOOL07 "Methodological tool: Tool to calculate the emission factor for an electricity system" Version 04.0	04/10/2013
/7/	TOOL01 "Methodological tool: Tool for the demonstration and assessment of additionality" Version 07.0.0	23/11/2012
/8/	EB62 Annex 5 "Guidelines on the assessment of investment analysis", Version 05	15/07/2011
/9/	CDM-EB73-A08-CLAR Clarification: Applicability of the "Guidelines on the assessment of investment analysis" Version 01.0	31/05/2013
/10/	EB69 Annex 8 "Guidelines on common practice" Version 02.0	13/09/2012
/11/	EB66 Annex 63 "Glossary of CDM terms" Version 6.0	02/03/2012
/12/	VCS PD Büyükdüz Hydroelectric Power Plant, Turkey i. Version 1.0 ii. Version 2.0	 06/05/2014 26/05/2014
/13/	IRR calculation for Büyükdüz Hydroelectric Power Plant, Turkey i. Version 1 ii. Version 2	 06/05/2014 26/05/2014
/14/	Baseline and ER calculations study Büyükdüz Hydroelectric Power Plant, Turkey i. Version 0	 06/05/2014
/15/	Listing representation by Ayen Enerji A.S. for Büyükdüz Hydroelectric Power Plant, Turkey	18/04/2014
/16/	Extracts from the Loan Agreement between the PO (the Borrower) and the IS Bankasi	12/08/2010
/17/	Turbine purchase and service agreement with turbine supplier (Alstom).	19/03/2010
/18/	Contract Agreement about the Supply of Electrical Equipment for the Power Plant (Control Systems and Control Cables, Auxiliary Equipment, AC/DC Supplies and Power Cables, 12 kV Medium Voltage, except HV switchyard and main	07/04/2010

	transformers) for Büyükdüz Hydroelectric Power Plant made between the Supplier Company (ABB Austria) and the Project Proponent	
/19/	EMRA Generation Licence *http://kap.gov.tr/en/search/notice-results.aspx?id=51652 for 49 years of operation* i. Latest Revision, Buyukduz HEPP Generation Licence, granted by Energy Market Regulatory Authority, dated 04/08/2011, Licence No: EU/1539-5/1123.	20/03/2008
/20/	Water Usage Agreement between General Directorate of State Hydraulic Works of Ministry of Forestry and Water Affairs and Ayen Enerji A.S. for Buyukduz HEPP including two following amendments related to changes in administrative requirements and later a capacity addition for the plant.	04/03/2008 07/02/2011 08/09/2011
/21/	Feasibility Study Report for Büyükdüz Hydroelectric Power Plant, Turkey. Latest (3rd) revision of FSR made by Mühendislik Müşavirlik Ltd. Şti.	10/2010
/22/	EIA Positive Certificate for Büyükdüz Hydroelectric Power Plant, Turkey issued by Cevre ve Orman Bakanligi indicating and referencing the plant as in ref. No.: /23/	08/02/2008
/23/	Environmental Impact Assessment (EIA) Report for Büyükdüz Hydroelectric Power Plant, Turkey made by Topcuoglu	02/2008
/24/	Initial index detection protocol for the meters at Büyükdüz HEPP, commissioning date 31.05.2013; Meters 419678, 419679, 419680, 419681	04/06/2012
/25/	Signed Temporary Acceptance Protocols for Büyükdüz Hydroelectric Power Plant, Turkey, proof of commissioning date	31/05/2012
/26/	Turkish National Grid Line Diagram (http://www.teias.gov.tr/4grupmd/atcharita.htm)	
/27/	Turkish Electricity Transmission Corporation; Research Planning and Coordination Department (2011) 10-year projection of Turkish electrical energy generation capacity (2011-2020) http://www.epdk.gov.tr/documents/elektrik/rapor_yayin/Elk_Yayin_Uretim_Kapasite_Projeksiyonu_2011_2020.pdf	11/2011
/28/	Turkish Electricity Transmission Corporation; Research Planning and Coordination Department (2012) 10-year projection of Turkish electrical energy generation capacity (2012-2021) http://www.epdk.gov.tr/documents/elektrik/rapor_yayin/Elk_Yayin_Uretim_Kapasite_Projeksiyonu_2012_2021.pdf	07/2012
/29/	Turkish Electricity Transmission Corporation; Research Planning and Coordination Department (2013) 5-years projection of Turkish electricity generation capacity (2013-2017) http://www.epdk.gov.tr/documents/elektrik/rapor_yayin/UretimKapasiteProjeksiyonu_2013_2017.pdf	11/2013
/30/	ELECTRICITY MARKET BALANCING AND SETTLEMENT REGULATION TEIAS	2004
/31/	Haselsteiner, R., Heimerl, St., Kohler, B., Recla, R., Bilmez, C., Mesci, Ü. and Arch, Al. (2009) Efficient Design, Construction and Maintenance of Hydropower Plants in Turkey.	2009

/32/	The Law on Utilization of Renewable Energy Resources	2005
/33/	Simplified single line diagram of connection of Büyükdüz to 154 kV TEIAS Grid	30/052012
/34/	Notarial acted copy of Board Decision of 17/03/2008 on Carbon Financing. Signed and recorded by the board.	12/03/2008
/35/	Final Payment Report for the entire project construction works including weir and tunnel structures. The file substantiates the construction costs.	Various dates
/36/	Detailed volume-area diagrams for both weir structures	N/A
/37/	TEIAŞ spreadsheets	2013
/38/	ENERGY MARKET REGULATORY AUTHORITY (2011) Electricity Market Report 2010	17/11/2011
/39/	Damodaran, Aswath (2011) Country Default Spreads and Risk Premiums for 2010 http://people.stern.nyu.edu/adamodar/pc/archives/ctryprem10.xls	07/01/2011
/40/	Damodaran, Aswath (2011) Equity Risk Premium (ERP): Determinants, Estimation and Implications – The 2011 Edition. Stern School of Business http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1769064	February 2011
/41/	Central Bank of the Republic of Turkey (2008) Financial Stability Report May 2008, Volume 6 http://www.tcmb.gov.tr/yeni/evds/yayin/finist/finistv6eng.php	05/2008
/42/	IEA ETSAP (2010) Technology Brief E12; Hydropower http://www.iea-etsap.org/web/e-techds/pdf/e07-hydropower-gs-gct.pdf	May 2010
/43/	IRENA (2012) Renewable Energy Technologies: Cost analysis series; Volume 1: Power Sector; Issue3/5; Hydropower http://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-HYDROPOWER.pdf	June 2012
/44/	ICE/TSE 62053-22: Electricity metering equipment (a.c) – Particular requirements - Part 22: Static meters for active energy (Classes 0,2 S and 0,5 S) https://intweb.tse.org.tr/TSEIntWeb/Standard/Standard/Standard.aspx?081118051115108051104119110104055047105102120088111043113104073086088122106098111043069103078065	29/04/2005
/45/	Gözen, Mustafa; Istanbul University Journal of the School of Business Administration (2012) Determining the cost of capital for Turkish electricity distribution utilities: Analysis and recommendations	2012

2.3 Interviews

In the course of the site inspection, TÜV Rheinland validation team carried out interviews with project representatives, carbon consultant, and relevant project stakeholders.

Name	Organisation	Topic
Hakan Demir (Specialist / PDD Developer)	Ayen Enerji A.S.	▪ Project start; ▪ Project implementation; ▪ Local permits and local requirements ▪ Applied project technology ▪ Physical conditions ▪ Project history ▪ Project barriers ▪ Project status ▪ Discussion on additionality, baseline scenario and emission reduction calculation; ▪ Feasibility study; ▪ Environmental and social impacts and/or community benefits; ▪ Financial issues; ▪ Supporting documents; ▪ Substantiation of loan and loan conditions;
Hasan Aydil Administrative Manager	Ayen Enerji A.S.	▪ General project description ▪ Geological conditions. Expropriation ▪ Visit to the weir structures
Mr Korkut Iskender Plant Manager	Ayen Enerji A.S.	▪ Project history and implementation; ▪ Technical issues and detailed functioning ▪ Supporting documents; ▪ Alstom turbines ▪ OSOS remote system ▪ TEIAS protocols ▪ SCADA system and backup ▪ Data management ▪ Plant management

2.4 Site Inspections

The tentative audit plan was provided to PO on 15.05.2014 and agreed upon, after the listing representation was sent to the VCS.

The on-site inspection took place on 20/05/2014 on project site (Büyükdüz HEPP) in the republic of Turkey. The objective of the on-site audit is

- to confirm rightness of project description, as per VCS PD, including project components and location
- to acquire details on project development and operation, and

- to prove validity and authenticity of delivered supporting documents.

The site inspection was carried out by means of interviews with PO, Plant manager and engineers, as indicated in section 2.3 (above).

2.5 Resolution of Findings

In the process of project validation, 15 findings have been identified and recorded in a CAR/CL list, which has been communicated to PO. Subsequently, PO responded to the raised issues by providing clarification, disclosing additional supporting evidences to VVB and accordingly revising VCS PD, investment analysis and emission reduction calculations. Eventually all recognised outstanding issues have been resolved and the resolution process has been tracked in CAR/CL table, which is included as Appendix A.

2.6 Forward Action Requests

N.A

3 VALIDATION FINDINGS

3.1 Project Details

The outcomes of the validation process and the VVB opinion on the Büyükdüz HEPP are summarised below, as required per VCS Standard, v3.4 /3/

- Project scope, type, technologies and measures implemented, and eligibility of the project

Proposed project activity is proved to refer to sectoral scope 1: Energy industries (renewable and non-renewable sources), by scrutinising the VCS PD /12/ and additional project distinctive documents such as EMRA Generation Licence /19/, EIA report /23/, Feasibility Study Report /21/, DSI water Usage Agreement **Error! Reference source not found.**, etc. Based on the mentioned documents as well as in the process of the site inspection, validation team ensured that the project is designed as and is operational as Hydroelectric Power Plant, which delivers electricity to the Turkish national grid, i.e. proposed project activity belongs to the type electricity generation from renewable sources.

During the site inspection, the validation team witnessed that the proposed project activity is an operational hydroelectric power plant with using run-off river technology at the sites Elmali Weir and Tasoba Weir, which utilize water of the Demirkapi and Kürtün River in the Gumushane province. It was observed that 2 Vertical Axis Pelton turbines of identical type, with total installed capacity of 68.862 MWe, are installed at the open power station. This confirms the information provided in the VCS PD /12/ and substantiated by the EMRA generation licence /19/, FSR report /21/, obligatory permits and the signed Temporary Acceptance Protocols /25/, where total installed capacity of Büyükdüz HEPPis given as 68.862 MWe, i.e. 2 x 34.431, and estimated annual electricity generation of 192,021 MWh.

The representative of PO, Mr. Demir, declared as part of the follow-up interview that the proposed project activity is not grouped3, but stand-alone project, which consists of 1 generation unit (plant site) from a single project activity. The visit to the project site and inspection of project components and common practice analysis as well as the contractual basis support the statement. In addition, the flow diagram of the project activity, which was also submitted to the V/VB was thoroughly explained by Büyükdüz HEPP's plant leader, Iskender.

In addition, the validation team witnessed that the proposed project activity fulfils VCS program specific issues4, i.e.

- Handle CO_2, one of the six Kyoto protocol greenhouse gasses
- VSC project design and validation report are provided in English, site inspection and interviews are also conducted in English.
- PP claims real and measurable emission reduction credits.

[3] As defined in the VCS Program Definition v3.5

[4] Refer to section 2 of the VCS Standard v3.4

- PP applies for 10 years crediting period
- Project is submitted to VCS registry within 2 years after operation (Project was commissioned on 31/05/2012)

- Project proponent

AYEN ENERJI A.S. is identified as project proponent (PP) and project owner (PO) within the VCS PD /12/, by reference to the EMRA generation licence /19/, Water Usage Agreement **Error! Reference source not found.** and other permits and project-relevant documents especially the Temporary Acceptance Protocols /25/, which was reviewed and evidently signed on the 31st of May 2012. (also proof of project start date, below)

In addition, the project is developed as renewable energy project under the Voluntary Carbon Standard (VCS) by Mr Hakan Demir, Carbon Expert of Ayen Enerji A.S., who was intensively involved in the preparation of VCS PD /12/, ER calculations /14/, Additionality Analysis /13/ as well as Common Practice analysis **Error! Reference source not found.** and attended the obligatory on-site *audit.*

- Project start date

The starting date of the proposed project is identified as 31/05/2012, which is the first date of delivering electricity generated by the Büyükdüz HEPP to the Turkish national grid. The date is substantiated by the Temporary Acceptance Protocol /25/, which is issued by the Ministry of Energy and Natural Resources, the Republic of Turkey. Taking into account the VCS Standard v3.4 /3/ section 3.8 and the definition of project start date per VCS Program Definition v3.5 /4/ and the listed evidences, the project start date indicated in the VCS PD /12/ is confirmed to be accurately identified.

- Project crediting period

PP selected project crediting period of 10 years, beginning from 31/05/2012 to 30/05/2022, which is in compliance with the VCS Standard v3.4 /3/ section 3.9.1.

- Project scale and estimated GHG emission reductions or removals

In compliance with the VCS Standard v3.4 /3/ and substantiated by the emission reduction calculation, which are validated and proved as accurate by the VVB in the subsequent sections, the proposed project activity is referred to as project, since the expected annual GHG emission reductions are estimated to be 102,731 tCO2e.

With regard to the CDM methodology, which is implied for the assessment of project additionality and for the determination of emission reductions, Büyükdüz HEPP is classified as large scale project, i.e. project's installed capacity (68.862 MWe) goes beyond the 15 MW benchmark as defined in the Glossary of CDM terms v6.0 /11/.

- Project activities

As observed during the site inspection, Büyükdüz HEPP is run-off hydro project with two intake structures at different sites and an open powerhouse station. The project diverts water from the Elmali and Tasoba weirs (see ***Figure 1***) which are approximately 10 km distanced from the power house. Both weirs are

designed as a radial gate structure and connect through various tunnels into a Y-shaped headrace and a two-section penstock of approximately 1000 meters.

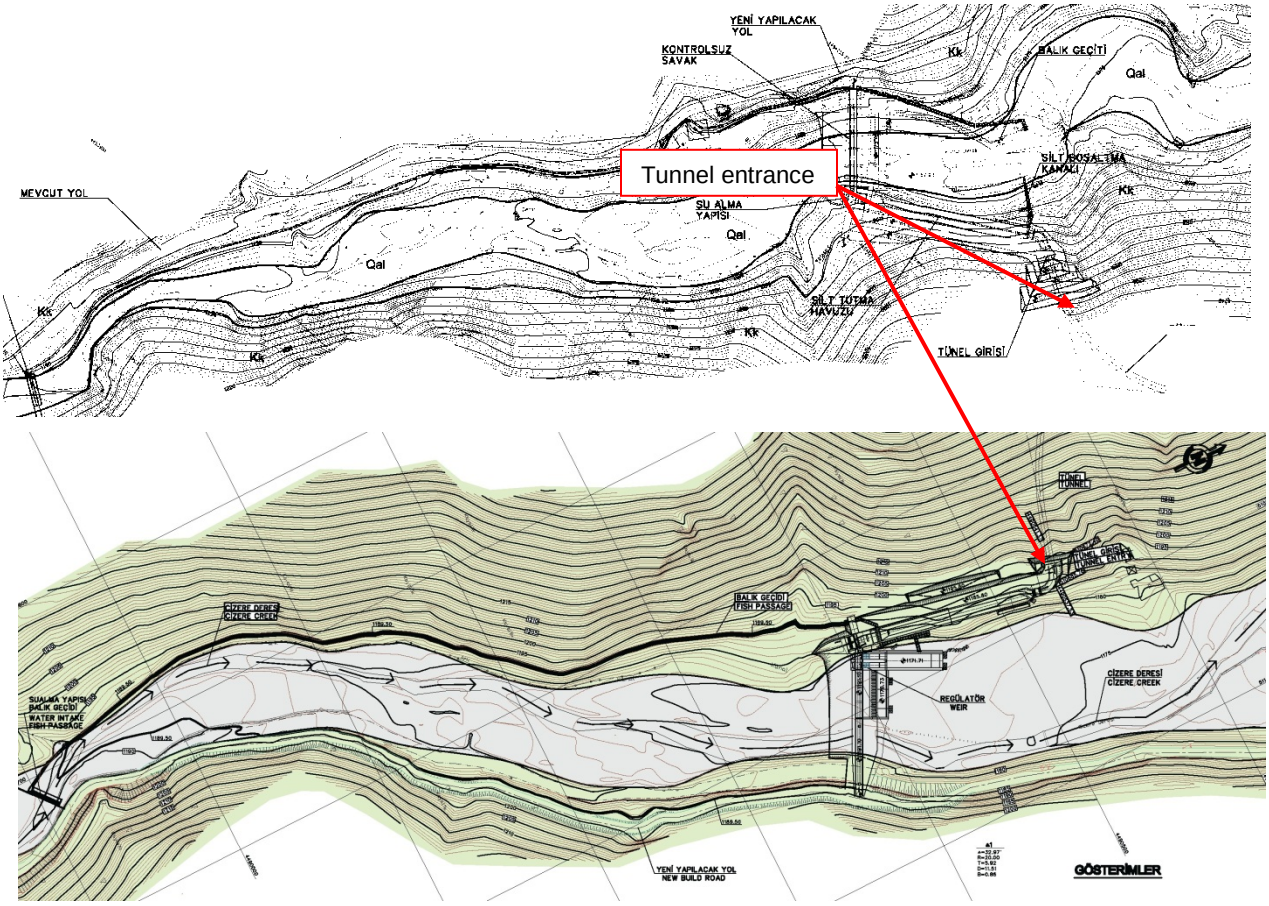


Figure 1: Elmali and Tasoba weir structures.

The total installed capacity of 68.862 MWe and estimated annual electricity generation of 192,021 MWh/year are accordingly denoted within the VCS PD /12/, based on the FSR /21/ and EMRA Generation Licence /19/. In addition, the validation team confirms the total installed, by reference to the turbine name plates (see Figure 2), which were perceived during the site visit.

Figure 2: Nameplates of the 2 turbines installed at Büyükdüz HEPP

- Project location

The proposed project activity is located on the Harşit River, in the Kürtün district of Gümüshane province (eastern Black Sea region) within the boundaries of Harsit Basin. During the site inspection, geographic coordinates of the weirs and the powerhouse are confirmed to be as indicated in the VCS PD /12/.

The geographic coordinates of project's structures are defined in the FSR report /21/ as well as in the EIA report /23/ and are confirmed by means of on-site measurements and Google Maps.

- Project compliance with applicable laws, statutes and other regulatory frameworks

Projects compliance with the regulation of the host country (i.e. the Republic of Turkey) was demonstrated within VCS PD /12/ section 1.11, where all relevant legally binding regulation are listed. The EMRA Generation Licence /19/, the EIA Positive Certificate for Büyükdüz Hydroelectric Power Plant, Turkey /22/ and the Water Usage Agreement are some of obligatory documents. Without legal compliance the PO would not have acquired those licenses and statements, hence it is assessed as proven that legal compliance has been established.

- Ownership and other programs

By reference to EMRA generation licence /19/ and other legal document, validation team confirms that the project owner is accurately indicated in the VCS PD /12/ as AYEN ENERJİ A.Ş.

The interviews with PO representatives during site inspection indicated that the project has not participated and is not registered under other GHG Programs and has not generated any other form of environmental credits.

3.2 Application of Methodology

3.2.1 *Title and Reference*

The latest version of Official methodology ACM0002 "Large-scale Consolidated Methodology: Grid-connected Electricity Generation from Renewable Sources" Version 14.0 /5/ (hereafter ACM0002 v14) is used to develop the proposed project activity under VCS. Additionally methodology related tools and relevant guidelines are applied, namely

- TOOL07 "Methodological tool: Tool to calculate the emission factor for an electricity system" Version 04.0 /6/
- TOOL01 "Methodological tool: Tool for the demonstration and assessment of additionality" Version 07.0.0 /7/
- EB62 Annex 5 "Guidelines on the assessment of investment analysis", Version 05 /8/
- EB69 Annex 8 "Guidelines on common practice" Version 02.0 /10/

3.2.2 *Applicability*

The selected approved methodology ACM0002 v14 /5/ covers large scale projects activities which occur as grid-connected electricity generation from renewable sources. The applicability of the methodology to the proposed project activity is discussed in detail in the VCS PD /12/, following the applicability criteria listed within the methodology.

The validation team determined the applicability of ACM0002 v14 /5/ to the Büyükdüz HEPP considering the methodology-specific conditions as follows:

Applicability criteria of the methodology ACM0002 v14.0.0	Criteria fulfilled	Determination by the validation team
This methodology is applicable to grid-connected renewable power generation project activities that a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); b) involve a capacity addition c) involve a retrofit of (an) existing plant(s) d) involve a replacement of (an) existing plant(s)	☒ Yes ☐ No	Per EMRA generation licence /19/, EIA report /23/, Water Usage Agreement **Error! Reference source not found.** and revised FSR /21/, the project is developed as hydroelectric power plant, which delivers electricity to the Turkish national grid. In addition during the site inspection it was experienced that the power plant is commissioned and supplies electricity to the grid. According to the Feasibility Study Report /21/, the project was developed as a green field one. Mr Demir confirmed that no renewable power plant was operated at the site before. This could also be observed from the EIA study where photos of an apparent greenfield site are included. To b), c) and d) – N.A.
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	☒ Yes ☐ No	According to the EMRA generation licence /19/ and the revised FSR /21/, proposed project activity is developed and operated as hydroelectric power plant with run-off technology.
In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 10 to calculate the parameter EGPJ,y): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	☒ Yes ☐ No	N.A.

Applicability criteria of the methodology ACM0002 v14.0.0	Criteria fulfilled	Determination by the validation team
In case of hydro Power Plants one of the following conditions must apply: • The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or • The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m2; • The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2	☒ Yes ☐ No	Büyükdüz HEPP is a green-field project (see above), i.e. no power plant or reservoirs existed before the project activity. Hence the project is designed as a hydro power plant with a dam structure, resulting in a single reservoir, which was perceived during the site inspection. Mr Demir gave explanation on calculation of power density, parameters that were applied and references. The calculation was redone using the construction drawings of the FSR. As two weirs are used a power factor determines the combined density of the project activity. Power density was confirmed to be 853 W/m^2, which is greater than the benchmark of 4W/m^2 and 10 W/m^2. Underlying documentation were the volume-area-diagrams submitted /36/.
In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m2 all the following conditions must apply.	☒ Yes ☐ No	No. The two single densities are 970 and 746 W/m^2 respectively.
The methodology is not applicable to the following: • Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; • Biomass fired power plants; • A hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the power plant is less than 4 W/m2.	☒ Yes ☐ No	In the revised FSR /21/, the proposed project does not involve switching from fossil fuel to renewable energy source, neither is it a biomass fired power plant. Furthermore, It was already revealed that the power plant entails 2 new reservoirs with power density > 4 W/m^2 each.
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	☒ Yes ☐ No	N.A. Proposed project activity was confirmed to be green-field one.

Provided that all applicability criteria defined within the approved methodology ACM0002 v14 are proved to be fulfilled, Validation team reasons that the selected methodology is applicable for the proposed project activity.

3.2.3 *Project Boundary*

According to the ACM0002 v14 /5//5/, "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system[5] that the CDM project power plant is connected to."

During the site inspection and interviews with plant leader, it was determined that electricity generated in the power plant is transferred to the substation. From there, the electricity is supplied to the Turkish national grid via 3 lines, i.e.

- 154 kV Switchyard and TEIAS Havza Substation

Thus, project boundary is accurately characterized within the VCS PD /12/ section 2.3 and depicted on Figure 2 of the same document as the "*net electricity generated and supplied to the Turkish national grid*". Furthermore, emission sources and gasses included in or excluded from the project boundary are clearly identified within *Table 5* of the VCS PD, so that CO_2 is justified to be the main GHG resulting in the baseline scenario.

3.2.4 *Baseline Scenario*

The baseline scenario for a new grid-connected renewable power plant is prescribed by the selected methodology ACM0002 v14 /5/ as

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

and accordingly implemented within project description for Büyükdüz HEPP, considering that the last was confirmed to be a new grid-connected renewable power plant (see section 3.1 Project Details).

Therefore, it is applied that the "baseline emissions are equal to power generated by the project activity that is delivered to the Turkish national grid, multiplied by the baseline emissions factor (EFy) which is calculated as the Combined Margin (CM)".

Therefore, reported baseline scenario is consistent with the ACM0002 v14 /5/.

3.2.5 Additionality

According to the VCS standard v3.4 /3/ "Additionality shall be demonstrated and assessed in accordance with the requirements set out in the methodology applied to the project." Consequently the selected approved methodology ACM0002 v14 /5/ together with the referred methodological TOOL01 "Tool for the Demonstration and Assessment of Additionality" v07 /7/, "Guidelines on the assessment of investment

[5] Refer to the latest approved version of the "Tool to calculate the emission factor for an electricity system" for definition of an electricity system.

analysis" v05 /8/ and the Clarification on Applicability of the Guidelines /9/, are used for the demonstration of additionality of Büyükdüz HEPP. In the additionality tool v07 /7/ the assessment is performed in 3 steps, i.e. Step 1: Identification of alternatives to the project activity consistent with the mandatory laws and regulations; Step 2: Investment analysis and Step 4: Common practice analysis. Step 3: Barrier analysis is optional and is to be performed in case that the project activity deems likely to be the most financially attractive, which apparently is not the case.

As indicated in the Table 1: Milestone of Büyükdüz HEPP (section 1.4 of the document), project start date (i.e. date of investment decision, as in the sense of CDM methodology) is identified as 19/03/2010, i.e. the signing of Purchase agreement for Electromechanical (EM) Equipment for Büyükdüz HEPP **Error! Reference source not found.**, which is the first actual commitment of PO to the proposed project activity.

Validation team examined thoroughly the provided additionality assessment within the VCS PD /12/ and the supplementary "IRR calculation for Büyükdüz HEPP" workbook /13/. Details on the assessment are provided in the following subchapters.

- Step 1: Alternatives

One of the 3 identified scenarios is determined to be credible and realistic alternative to the proposed project activity, namely

"*Continuation of the current situation (in the situation that Büyükdüz HEPP is not built)*"

which corresponds to the prescribed baseline scenario. Within the VCS PD, PP provides sufficient arguments for considering the alternative as credible and realistic option to the proposed project activity. Upon the knowledge of the validation team and the competence of PO representatives, the continuation of current situation (without any project) is consistent with all relevant mandatory laws and regulations which are listed in the VCS PD /12/ section 1.11.

- Step 2: Investment analysis

The benchmark approach (Option III) was selected by PP to be the only applicable and most appropriate method for assessment of projects additionality, where the financial indicator was identified to be the internal rate of return on equity (Equity IRR) before taxation.

The PP selected in line with the requirements a corresponding benchmark as expected return on equity on a pre-Tax basis, which is also suggested by the Guidelines on assessment of investment analysis v05 /8/. The components were identified according to the Capital Asset Pricing Model including the Risk Free Rate of the country and a beta-corrected market risk premium.

The market risk premium references to Prof. Damodaran's article Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2011 Edition /40/ and data on Country Default Spreads and Risk Premiums for 2010 /39/. It is assumed that all companies in the republic of Turkey are equally exposed to country risk and therefore the expected cost of equity is calculated as

Expected cost of Equity = Riskfree rate + ß*(Equity Risk Premium for mature equity market)

+ Country Risk Premium

Where following values are applied:

- Risk-free rate = 4.46%, i.e. US treasury bond rate[6] as with maturity of 20 years
  - The source was reviewed and the average of 2005 – 2009 data was recalculated
- Equity Risk Premium for mature equity market = 5.05 %, where the US market is assumed to be a mature market, as stated in Prof Damodaran's article[7]
  - The data of the calculated equity risk premium has been reviewed. Data was applied for the same period.[8]
- Country Risk Premium = 5.51 %, which is specified as the country risk premium for the Republic of Turkey as of 2009 in the Prof. Damodaran worksheets on Country Default Spreads and Risk Premium */39/*.
- Beta factor of 1.88 is applied
  - The data was reviewed and traced to the source, whereas the calcualation of the average was checked as well as the applicability of the sector specific values.

Thus the expected cost of equity was calculated to equal 19.48%. After detailed clarification by Mr Demir in the course of on-site-visit, it was concluded that the implemented data are credible, conservative and accurate.

Furthermore the V/VB observed that the implemented equity and debt portion originate from the feasibility study for Büyükdüz HEPP, which is relevant at the time of investment decision.

Therefore, the validation team confirms that the calculated benchmark for the proposed project activity in the republic of Turkey for expected return on equity at the time of investment decision equals 19.48%, which was demonstrated to be credible and conservative.

A detailed workbook on the financial analysis for the Büyükdüz HEPP /13/ is provided to the validation team. The file demonstrates the calculation of the benchmark and the internal rate of return on project, including all assumptions, references and intermediate calculations. The calculations and assumptions have been reviewed for correctness and traced back to the original source. The parameters are presented in transparent and traceable manner, so that the validation team was able to prove the correctness and credibility of any input data and assumption.

Confidential information such as the Extracts from the Loan Agreement between the PO (the Borrower) and the IS Bankasi /7/, Turbine purchase and service agreement with turbine supplier (Alstom)./17/ ans the Contract Agreement about the Supply of Electrical Equipment for the Power Plant (Control Systems and Control Cables, Auxiliary Equipment, AC/DC Supplies and Power Cables, 12 kV Medium Voltage, except HV switchyard and main transformers) for Büyükdüz Hydroelectric Power Plant made between the Supplier Company (ABB Austria) and the Project Proponent/18/ were disclosed to the validation team in

[6] U.S. Department of the Treasury, Resource Centre, Interest Rate Statistics, Daily Treasury Yield Curve Rates.

http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield

[7] Damodaran, Aswath (2011) Equity Risk Premium (ERP): Determinants, Estimation and Implications – The 2011 Edition. Stern School of Business /38/

[8] Implied Equity Risk Premiums for US Market, Archived Historical Data from the Personal Homepage of Aswath Damodaran,
Professor of Finance at the Stern School of Business at New York University.
http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/implpr.html

http://www.stern.nyu.edu/~adamodar/pc/datasets/histimpl.xls

order to substantiate actual values and/or prove the accuracy of assumptions, which are employed in the investment analysis.

The most important parameters, incl. source, value and substantiation are listed below.

Parameter 1	Total investment cost
Value applied for the IRR calculation:	85,497,603 EUR
Source of the value:	Initial Feasibility Study Report
Justification by the validation team according to §113 of VVM: (cross checking and comparison as applicable)	The investment cost for Büyükdüz HEPP is applied as in the Initial FSR, including costs for civil works, electromechanical equipment, contingency, site studies and final design and expropriation. VVB confirms that the investment cost, which is considered for the calculation of equity IRR for the proposed project activity, has been available at the time of investment decision. The investment decision date is determined as 19/03/2010, therefore the time between data availability of the FSR which was issued in the 3rd revision 10/2010 and investment decision is 6 months, which is reasonably short and is in compliance with *TOOL01 Tool for the demonstration and assessment of additionality v07 /7/* and *Guidelines on the assessment of investment analysis v05 /8/* The pointed figure result in cost per unit energy of $85{,}497{,}603\ {}^{EUR}/_{68.862\ MW} \cong 1.242\ {}^{EUR}/_{kW}$, which is comparable to the unit investment cost for green-field hydro power plant estimated by the IEA ETSAP /42/ for the year 2010, namely 1,750 to 6,250 USD/kW. It is also indicated that the unit cost is not country specific and very site-specific. The International renewable Energy Agency (IRENA) /43/ published in 2012 similar typical installed cost, i.e. 1,300 to 8,000 USD/kW.

Parameter 2	Annual operation cost (excl. insurance)
Value applied for the IRR calculation:	796,110 EUR
Source of the value:	Feasibility Study Report /21/ Economic model of Ayen Enerji A.S. for HEPP
Justification by the validation team according to §113 of VVM: (cross checking and comparison as applicable)	VVB experienced that OM costs, incorporated in the calculation of equity IRR for Büyükdüz HEPP are obtained from the initial FSR, which was available at the time of investment decision. In the course of the site-visit, PO indicated that consideration of insurance cost within the investment analysis is essential. In

	addition it was revealed that the insurance costs are based on an economic modelling sheet developed by PO for HEPP projects. PO declared that the modelling of the OM costs was based on assumptions and data available at the time of investment decision. The average O&M costs for the proposed project activity are summing up to 1.0% of total investment costs, which is within the range estimated by the IRENA /43/ research, i.e typical O&M cost correspond to 1% to 4% of total investment. The calculation of the O&M costs was thoroughly checked by the validation team, with the outcome that provided estimations are reasonable and based on reliable sources.

Parameter 3	Loan – to – equity ratio
Value applied for the IRR calculation:	56% to 44%
Source of the value:	Extracts from the Loan Agreement between the PO (the Borrower) and the Bank /16/
Justification by the validation team according to §113 of VVM: (cross checking and comparison as applicable)	The ration is defined by the Bank within the Loan Agreement for the proposed project activity. The ratio is calculated by applying a fixed value for the loan as this value was stated and reviewed by the V/VB during the on-site assessment.

Parameter 4	Electricity feed in tariff
Value applied for the IRR calculation:	0.05 EUR/kWh
Source of the value:	The Law on Utilization of Renewable Energy Resources /32/
Justification by the validation team according to §113 of VVM: (cross checking and comparison as applicable)	The implemented electricity feed in tariff corresponds to the guaranteed electricity feed in tariff for HEPP ensured by EMRA with the Law on Utilization of Renewable Energy Resources /32/. It has been justified as the only reasonable assumption at the time of investment decision, since electricity price is highly dependent on the market demand and supply and electricity generation for hydroelectric power plant is dependent on climatic conditions and river water regime. In particular higher electricity price is experienced in the summer months when the HEPP experience lower electricity generation. VVB witnessed that the initial FSR is based on lower electricity feed-in tariff, namely 0.06 USD/kWh, which assures that the made assumption is conservative.

Parameter 5	Electricity generation
Value applied for the IRR calculation:	192,021 MWh/a
Source of the value:	• PO experience on HEPP, which was outlined in the revised FSR • Plant factor of the proposed project activity
Justification by the validation team according to §113 of VVM: (cross checking and comparison as applicable)	The expected annual electricity generation is justified by the location, river regime and other specific characteristic of the proposed project activity. Also it was the only assumption available based on the latest version of the feasibility assessment available before the time of investment decision.

Parameter 6	Operational lifetime
Value applied for the IRR calculation:	20 years
Source of the value:	Assumption made by PO according to methodology and underlying guideline
Justification by the validation team according to §113 of VVM: (cross checking and comparison as applicable)	The operational lifetime of the Büyükdüz HEPP is defined to 35 years including the construction phase, which is shorter than a typical technical lifetime of the technology (ca.45 years). The investment analysis is performed according to Guidelines /8/ over the 20 years operational lifetime and the residual book value of the project activity was taken into consideration by project IRR calculation. The calculation of the residual book value was reviewed and found to be consistent with the assumptions made regarding technical lifetime. A correct depreciation approach has been applied.

Parameter 7	Residual book value
Value applied for the IRR calculation:	45,996,532 EUR
Source of the value:	calculation made by PO
Justification by the validation team according to §113 of VVM: (cross checking and comparison as applicable)	Calculation of the residual book value is based on the assumption that EM equipment is depreciated over 35 years and civil works over 49 years. Those assumptions are found to be very conservative.

By means of transparent calculations displayed in the workbook, it is demonstrated that the internal rate of return on project for Büyükdüz HEPP before taxation corresponds to 8.73 %. The calculation was redone by tracing the excel cells and reviewing formulae and values applied. As already discussed, the validation team examined the input parameters, assumptions and any relevant statement accordingly and confirm the accuracy of the calculated parameter. Furthermore, the so established IRR for the proposed project activity is consistent with the benchmark, meaning both values are on pre-Tax basis.

Finally the proposed project activity is evaluated as financially unattractive since the estimated IRR, 8.73% is lower than the 19.48% benchmark, which is the expected return on equity for the investment in the republic of Turkey in the energy sector.

Sensitivity analysis was performed by the carbon consultant, showing that the deviation of the 3 key parameters[9], in particular investment costs, operation costs and electricity revenues, by +/- 20% leads to IRR in the range from 5.11% to 14.85%

- Step 4: Common practice analysis

The common practice analysis is a credibility check to complement the investment analysis and follows the sub-steps identified in the "*Tool for the demonstration and assessment of additionality"v07 /7/* and the *"Guidelines on Common Practice"* v02 /10/.

The analysis itself has been transparently laid out within the VCS Project Description. In addition, during the site visit, Mr Demir clarified the performed common practice analysis, explaining the rationale behind each step.

Therefore, VVB confirms that the analysis is performed in line with the *Guidelines on Common Practice v02* /10/, namely each step was performed to the best knowledge of the PO, so that

- The entire host country was considered as geographical scope for the common practice analysis for Büyükdüz HEPP project.
- Under step 1: The range 34.431 – 103.293 MWe was determined as applicable output range, which is calculated as +/- 50% of the installed capacity of Büyükdüz HEPP project.
- Under step 2: the similar projects were identified in line with the guidelines, so that they fulfil following criteria:
    a) Located within the republic of Turkey, i.e. the entire host country
    b) Power generation based on renewable energy, since the proposed project activity is renewable energy project
    c) N.A. since no technology switch measure is implemented.
    d) Electricity generation from renewable energy sources
    e) installed capacity within the range 34.431 – 103.293 MWe, as determined in step1
    f) projects connected to Turkey's national electricity grid at the end of 2012. Evidently, the project became operational on 31/05/2012.
- Under step 3: all VER projects, as well as projects submitted for registration or undergoing validation, as per the knowledge of PO, were excluded, so that the number of remaining projects is obtained, namely N_{all}=33.
- Under step 4: the number of projects which apply different technology, per definition of the Guidelines, was determined so that power plant that apply different technology in terms of energy source (i.e. hydro) and investment climate on the date of investment decision. Therefore N_{diff}=29.
- Under step 5: based on the determined parameters, the factor was calculated as

$$F = 1 - {}^{N_{diff}}\!/_{N_{all}} = 1 - 0.88 = 0.12$$

[9] Regarding the „Guidelines on the Assessment of investment analysis" v05 /8/

Finally, PO demonstrated and VVB confirmed that in accordance to the *Guidelines on Common Practice v02 /8/*, that the share of projects similar to Büyükdüz HEPP, i.e. using similar measure/technology and delivering the same output or capacity, is 0.12. Since the identified factor F=0.12 is lower than the referenced F=0.2 and the number of similar projects $N_{all} - N_{diff} = 4$, is greater than 3, the Büyükdüz HEPP is determined not to be a common practice activity in the Republic of Turkey according to the guideline as both criteria need to be fulfilled. To verify the common practice analysis the V/V team used a spreadsheet including all official plants as published by TEIAS. A filter and list function was applied according to the above criteria which led to the final results of the parameters.

- Conclusion

The validation team concludes that the proposed project activity deems financially unattractive, achieving an internal rate of return on project prier taxation of 8.73% whereas the selected benchmark is 19.48% which is the expected return on equity for the investment in the republic of Turkey.

Therefore, Büyükdüz HEPP project activity is demonstrated to be additional.

3.2.6 Quantification of GHG Emission Reductions and Removals

As it has been identified in section 3.2.1 of the report, emission reductions and removals resulting from Büyükdüz HEPP are identified according to the approved CDM methodology ACM0002 v14 /5/ and the referred methodological tool “Tool to calculate the emission factor for an electricity system” v04 /6/ as

$$ER_y = BE_y - PE_y$$

The V/VB examined the emission reduction calculations against the relevant indicated methodology and methodological tools, and concluded that all assumptions applied for the calculation of ER are sufficiently explained. In addition, all involved data and parameters are listed in section 4.1. ‘Data and parameters available at validation’ and in section 4.2 ‘Data and parameters monitored’ of VCS PD of Büyükdüz HEPP /12/, including short description of the data/parameter, source of the data/parameter, value(s) applied and justification of the choice or measurement methods and procedure.

3.2.6.1 *Quantification of baseline emissions*

In order to determine the baseline emissions, the combined margin (CM) is calculated based on the “Tool to calculate the emission factor for an electricity system” v04 /6/. The described steps for identification of operating margin (OM) and build margin (BM) and all relevant assumptions are sufficiently documented within the VCS PD /12/ and accordingly applied within the ER calculation workbook (Baseline Study Büyükdüz HEPP /14/). The choice of data vintage and calculation methods are justified in a readily comprehensible manner. All calculation on OM, BM and CM are performed by means of excel file and the resulted workbook on emission reduction calculation /14/ was provided to the validation team for validation. The mentioned workbook is explored, data sources are examined and calculations are repeated in a separate workbook. Consequently, following issues are observed:

- All implemented data are referenced and based on reliable sources;
- Workbook cells are traceable and the calculations are presented in transparent and unbiased manner;
- The country specific and most recent data available at the time of submission of PDD to the validation body are applied;
- Calculations are performed in complete accordance with the mentioned tool.

- The ex-ante data vintage has been selected for both the OM and BM calculation.

Finally the OM emission factor is determined as $EF_{grid,OMsimple}$ = 0.654 $tCO_{2,eq}$/MWh and BM emission factor as $EF_{grid,BM}$ = 0.416 $tCO_{2,eq}$/MWh, which by applying the default values for weighting on OM and BM (i.e. w_{OM}=0.5 and w_{BM}=0.5) result in combined margin emission factor $EF_{grid,CM}$= 0.535 $tCO_{2,eq}$/MWh. Upon the experience of the validation team on emission factor, the determined value is realistic and comparable to similar projects in the host country. It is worth mentioning that the calculations are based on most recently available data, i.e. for the year 2012, 2011 and 2010.

Per ACM0002 v14 /5/, baseline emissions (BE_y) are the product of net electricity supplied to the grid as a result of the implementation of the CDM project activity ($EG_{BL,y}$) and CO2 emission factor of the grid ($EF_{grid,CM,y}$), in particular for Büyükdüz HEPP

$$BE_y = EG_{BL.y} \times EF_{grid,CM,y} \cong 102{,}731\ tCO_{2,eq}/year$$

3.2.6.2 Quantification of project emissions

In general, but not always, renewable power generation project are considered to have zero GHG emissions, i.e. PE_y=0. Since the Büyükdüz HEPP is a hydroelectric power plant with a run-off river weir the power density is

For determination of project emissions from water reservoirs of hydro power plants ($PE_{HP,y}$), the selected CDM methodology ACM0002 v14 /5/ suggests that

- in case 4 W/m^2 < Power density of the single or multiple reservoirs ≤10 W/m^2

$$PE_{HP,y,} = (EF_{Res} * TEG_y)/1000;$$

- in case Power density of the single or multiple reservoirs > 10 W/m^2

$$PE_{HP,y,} = 0\ tCO_{2,eq}/MWh.$$

The power density (PD) of the project activity was determined to 853 W/m2, where the validation team proved by cross check that all calculations are based on relevant formula from the methodology ACM0002 v14 and all input data refer to reliable sources, i.e. reservoirs' area and installed capacity are perceived from the revised FSR /21/. Furthermore Mr Demir explained that the considered area of the reservoirs is determined at maximum water level. Since apparently power density of Büyükdüz HEPP is greater than 10 W/m^2, validation team confirms that project emission is estimated to $PE_{HP,y}$ = 0 $tCO_{2,eq}$/MWh.

In addition, it is necessary to mention that according to the selected methodology ACM0002 v13, "the use of fossil fuels for the back up or emergency purposes (e.g. diesel generators) can be neglected", i.e. $PE_{FF,y}$ = 0

Thus the project emissions from Büyükdüz HEPP, as estimated for the first crediting period in accordance to ACM0002 v14 /5/, are confirmed to be

$$PE_y = PE_{HP,y} + PE_{FF,y} = 0\ tCO_{2,eq}/year$$

3.2.6.3 Quantification of leakage

Büyükdüz HEPP is a green field project activity, thus no leakage emissions related to the project are expected and regarded.

3.2.6.4 Summary of net GHG emission reductions or removals

Büyükdüz HEPP was considered to induce GHG emission reductions, which as per approved methodology ACM0002 v14 /5/ are estimated as $ER_y = BE_y - PE_y$ (where ER_y = emission reductions in year y; BE_y = baseline emissions in year y and PE_y = project emissions in year y).

So that

$$ER_y = BE_y - PE_y = 102.731\ \mathrm{tCO_{2,eq}/year}$$

Therefore, for the entire crediting period of 10 year, the Büyükdüz HEPP deems to cause 1,027,309 $tCO_{2,eq.}$

The validation team confirms that the emission reduction calculations are performed properly, by applying the latest version of the approved CDM methodology ACM0002 v14 /5/ and the referred methodological tool "Tool to calculate the emission factor for an electricity system" v04 /6/, which are accepted by the VCS standard. As already demonstrated in *section 2.2 'Applicability of methodology'* of VCS PD /12/ and discussed in *section 3.2.2 'Applicability'* of the current document, Büyükdüz HEPP is proved to fulfil all eligibility criteria listed under the methodology. Furthermore, considering the experience of the validation team with renewable electricity generation projects, the estimated annual GHG emission reductions are assessed as reasonable.

3.2.6.5 Uncertainties associated with the calculation of emissions

All data presented in the baseline calculations are provided from official sources. Therefore, uncertainties of data sets were not estimated. There are no uncertainties in the calculations.

3.2.6.6 Documentation used as the basis for assumptions and sources of data

The single components of the equation have been assessed by the VVB in the previous sections, providing details on the applied formulas. All steps required for the calculation of baseline-, project- and leakage emissions for Büyükdüz HEPP project are sufficiently documented and the choice of data vintage and calculation methods are justified in a readily comprehensible manner within the VCS PD /12/. The calculation are performed by means of excel workbook (Baseline and ER calculations study Büyükdüz Hydroelectric Power Plant, Turkey /14/), which was delivered to the VVB and thoroughly discussed with PP in the course of site visit. Furthermore, the mentioned workbook is explored, data sources are examined and calculations are repeated in a separate workbook by the VVB. Consequently, the following is observed:

- All implemented data are referenced and based on reliable sources; All sources are correctly quoted and interpreted
- Workbook cells are traceable and the calculations are presented in transparent and unbiased manner;

- Calculations are performed in complete accordance with the CDM methodologies ACM0002 v14 /5/ and TOOL07 "Methodological tool: Tool to calculate the emission factor for an electricity system" Version 04.0 /6/. All calculations are presented in comprehensible and replicable manner.
- The country specific and most recent data available at the time of submission of VCS PD to the validation body are applied; otherwise default values, which are acknowledged by CDM, are used.
- The data for which ex-ante data vintage has been selected are clearly listed in *section 4.1 'Data and Parameters Available at Validation'* of VCS PD /12/, indicating that the values for those parameters are determined at the time of validation and would not be altered during the entire crediting period.

Therefore, VVB confirms that the Büyükdüz HEPP will result in an average annual emission reduction $\boldsymbol{ER_{1st\ crediting\ period} = 102.731\ tCO_{2,eq}/a}$ during the first crediting period, which is calculated on ex-ante bases, being aware of the conservative principle.

3.2.7 *Methodology Deviations*

The validation team assessed the proposed project activity and related project description in detail and witnessed that the selected methodology and methodological tools are implemented accurately without any deviations.

3.2.8 *Monitoring Plan*

Assessment of the monitoring plan for the proposed project activity is an essential part of the validation process and basis for the verification of the GHG emission reductions. For that reason, considerable part of the site inspection was focused on the project monitoring. Since at the time of on-site visit, Büyükdüz HEPP has been operational, all relevant metering devices have been installed and the validation team was able to observe them, their position and calibration, etc. Furthermore, PM and PP explained in depth the concept of the designated monitoring plan and provided the validation team with substantial details from project design phase.

3.2.8.1 Data and parameters available at validation

The following 6 parameters are used for the calculations of emission reduction created by the Büyükdüz HEPP and are available at the time of project validation.

- $FC_{i,y}$ amount of fuel i consumed by relevant power plant in Turkey in years 2010 - 2012
- $NCV_{i,y}$ – net calorific values for fossil fuel type I in years 2010 - 2012
- $EF_{CO2,i,y}$ - CO_2 emission factor of fossil fuel type i in year y, based on IPCC default values
- $EG_{gross,y}$ - Gross electricity generated in the project electricity system (national Grid of Turkey) by primary energy sources in year y (2010-2012)
- $EG_{gross,i,y}$ - Quantity of gross electricity generation of power plants using fuel type / utilizing primary energy source i connected to the grid including low-cost/must-run power plants in year y for years in the 3-year period of (2010 – 2012)

- $EG_{m,y}$ - Net electricity generated and delivered to the national grid of Turkey by power unit m in years 2010 – 2012
- $EG_{import,y}$ - Quantity of electricity imports in year y for years in the 3-year period of (2010 – 2012).
- $\eta_{m,y}$ - Specific electrical efficiency for all relevant energy sources (natural gas, lignite, coal/anthracite, fuel/motor oil), based on default values from the TOOL07 "Methodological tool: Tool to calculate the emission factor for an electricity system" Version 04.0 /6/
- CAP_{BM} - Capacity additions forming the sample group of power units used to calculate the build margin

As it has been already mentioned, the operating emission factor and the build emission factor are calculated ex-ante. Therefore, the applied parameters are determined or/and monitored once per crediting period.

In line with the approved methodology ACM0002 v14.0 /5/, the parameters are listed in the VSC PD, together with the applied value, source of data and justification of data/description of measurement methods and procedures. The list is determined to be exhaustive, providing important information and guarantee on data consistency and reliability.

3.2.8.2 Data and parameters monitored

The applied ex-post parameters are subject to regular measurement, namely once per monitoring period. In the case of the proposed project, 3 parameters are included in the monitoring plan, i.e.

- $EG_{facility,y}$ - quantity of net electricity generation supplied by the project plant to the Turkish national grid in year y

Description of measurement for each of the identified parameters and procedures to be applied, as well as frequency of monitoring, is included in the monitoring plan. The PO is aware of its obligation to archive the recorded data for at least 2 years after the last crediting period.
It is indicated in the VCS PD /12/ and confirmed during the site inspection that the net electricity generation will be measured continuously by 3 main and 3 back up electricity meters Elster Alpha 1500 and recorded on monthly basis. VVB witnessed that the two-way metering devices (see Figure 3) are installed at the Büyükdüz HEPP Transformer Station, which is situated close to the Büyükdüz HEPP.

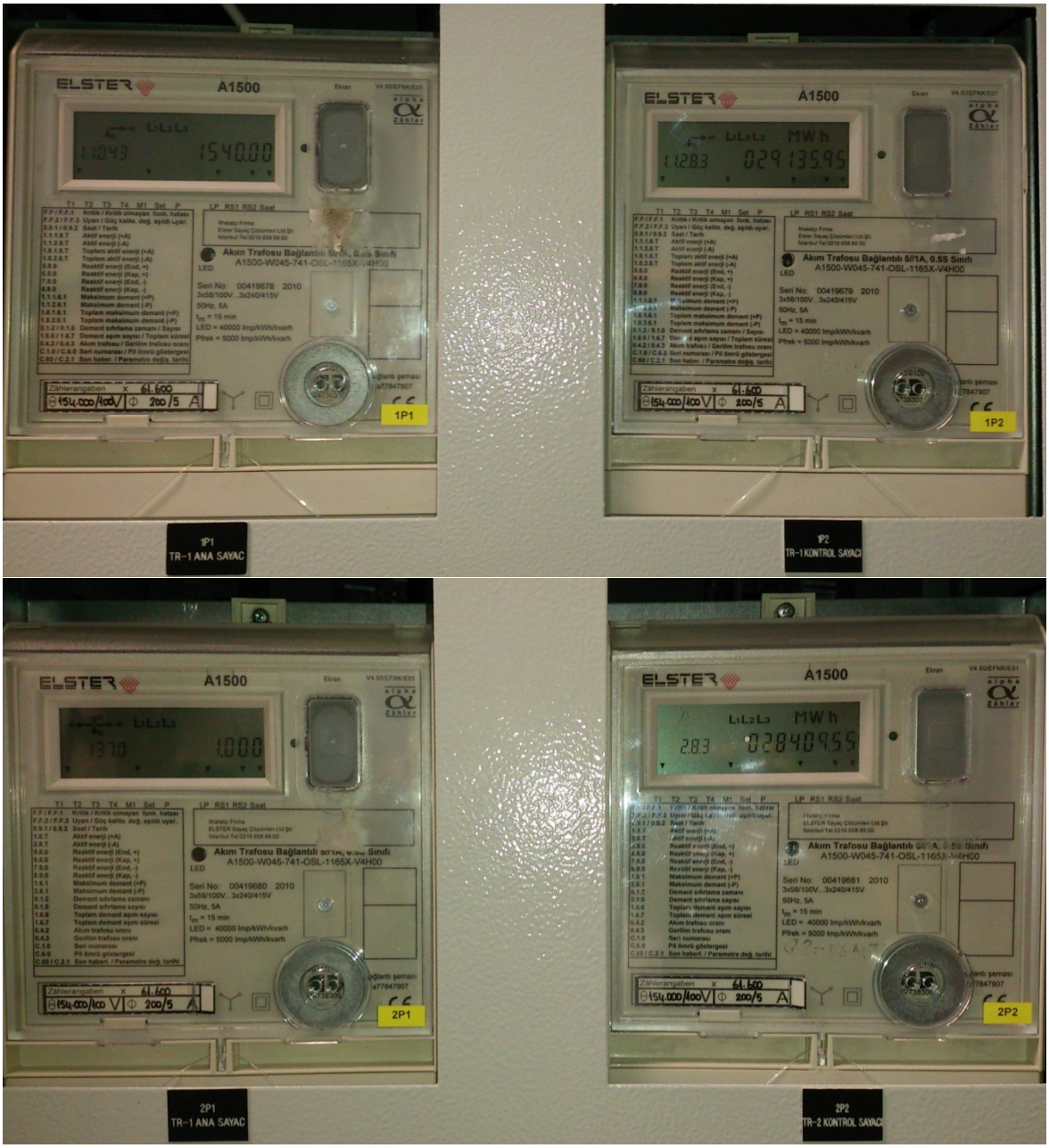


Figure 3: Main and Back-up meters for production and consumption with Serial Nr: 419678 and 419679 (419680 and 419681) respectively, measuring the gross and net generation and self-consumption for Büyükdüz

The installation, calibration and maintenance of monitoring devices is under the responsibility of the TEIAS, and is required to comply with The ICE/TSE 62053-22: Electricity metering equipment (a.c) – Particular requirements - Part 22: Static meters for active energy (Classes 0,2 S and 0,5 S) /44/. Records on electricity generation could be cross-checked with the PMUM database, which delivers information on net electricity generated excluding transmission loss.

For data acquisition purposes it was confirmed and discussed again with the plant manager that the new OSOS system installed by TEIAS will be used. This has the following impact:

- No manual data recording is necessary any more
- The production data is directly transferred to TEIAS and the PMUM system
- The previously used TEIAS manual reading sheets are only used for double-check and invoicing purposes. They are recorded manually
- The OSOS system cannot be manipulated by the PO as he has no access to the sealed installation
- TEIAS personnel will not be present at the site, hence no counter-signed stements will be available.

The previous is known to be the situation by the V/VB having local expert experience and the procedure was discussed and confirmed again by the plant manager.

Figure 4: OSOS system installed in the meter control cabinet

In summary, the validation team is convinced of compliance of the monitoring plan with the requirements of the selected approved methodology ACM0002 v14 /5/ and all supplementary implemented methodologies, and tools such as “Tool to calculate the emission factor for an electricity system” v04 /6/. As a consequence of the discussions during the on-site assessment, the validation team considers the planned monitoring arrangements as described in the monitoring plan feasible within the project design.

3.3 Non-Permanence Risk Analysis

N.A.

3.4 Environmental Impact

As per “Environmental Law” No. 2872 (Issued in 1983), Annex 2 of Environmental Impact Assessment (EIA) Regulation, PO was required to prepare a full EIA report for Büyükdüz HEPP /23/. The report was issued completed and submitted. Consequently an EIA Positive Certificate for Büyükdüz Hydroelectric Power Plant, Turkey /22/ was issued by the Ministry of Environment and Forestry, indicating that no significant impacts on the environment were identified. Possible environmental impacts during the construction and operating phases, which were discussed within the EIA report /23/ are summarised in the VCS PD. The project hence complies with all legal and environmental requirements.

3.5 Comments by Stakeholders

It is the validation team opinion that the local stakeholders were accurately identified and appropriate invited to the stakeholders’ meeting as part of EIA process. The meeting took place on 18/09/2007 in the Kurtun District Centre, the district where the project is located. The validation team was provided with extracts from the EIA report relevant to the stakeholders’ meeting and pictures from the meeting. The stakeholders’ meetings are reflected within the EIA report and evidence is included in the PD.

4 VALIDATION CONCLUSION

Ayen Enerji A.S.

Hülya Sokak No: 37, 06700

G.O.P./Ankara

TURKEY

28/05/2014

RE: Validation Statement – Büyükdüz HEPP, Turkey under VCS, first crediting period from 31/05/2012 to 30/05/2022.

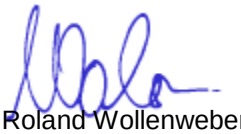
Ayen Enerji A.S. with registered office in Ankara Istanbul/ Turkey, has contracted TÜV Rheinland to review and validate the VCS PD and all assertions related to the GHG project under VCS v.3.4. The GHG assertions, revealed in the VCS PD v2.0 /12/ issued on 26/05/2014, indicate annual achievable GHG emission reductions of 102,731 t CO_2e.

By generating electricity using renewable resources, the project is likely to result in reductions of GHG emissions by partially displacing the electricity that would have been generated using fossil fuels. Investment analysis demonstrates that the proposed project activity is neither the financially attractive nor a likely baseline scenario. Emission reductions attributable to the project are hence additional to any that would occur in the absence of the project activity. Given that the project is implemented and maintained as designed, the project is likely to achieve the estimated amount of emission reductions.

The validation of the GHG assertion is conducted in accordance with the requirements of the VCS standard v3.4, the standard ISO 14064-3 and the approved UNFCCC methodology ACM002 v14 to a reasonable level of assurance by applying a materiality threshold of 5%. In the course of the validation process the VCS PD, substantiations and any additional supportive documents are reviewed and the outcomes are reflected in Chapter 3.2 in the validation report issued on 28/05/2014.

The validation team came to the conclusion that based on our review and all available documentation the GHG assertion is made in accordance with the requirements of the VCS program and is materially correct and fairly represents the GHG emissions data and information without material discrepancies.

Cologne 28/05/2014



Roland Wollenweber

TL/Auditor

APPENDIX A

Table 2: :List of Requests for Corrective Action (CAR) and Clarification (CL)

CAR/CL	Observation (CAR/CL)	Reference	Summary of project owner response	Validation team conclusion
CAR 1.	The date for the turbine purchase agreement is indicated with 19/03/2010 in the table. The referencing footnote 34 indicates 19/05/2010. Please correct the date to the actual agreement date. This is important for investment decision date.	PDD p. 21, investment decision	This was a typo. It has been corrected.	~~Will be corrected~~ OK
CAR 2.	The EIA Assessment decision accessible on the platform http://kap.gov.tr/en/search/notice-results.aspx?id=49371 indicates an installed capacity of 48,8 MW. There must be an amended EIA for the increased capacity of the plant. Please provide or clarify.	PDD p. 21	The EIA affirmative decision for the increased capacity and the decision that a new EIA Study is unnecessary is included in the Table 8.2 about the Implementation Timeline of the Project Activity, dated 24/01/2012, with footnote 44, in Section 2.5.1. of the Project Description.	The annexes to the provisional official acceptance protocol of the Ministry include an EIA acceptance letter, stating that no further EIA assessment is required and refers to the changed installed capacity. The link was not updated.
CAR 3.	The EIA certificate references to the HEPP only. There should be an EIA certificate for the dams or regulators/quarries as well. Please provide.	Documentation	The First EIA Certificate refers both the weirs and the quarries. The second certificate refers the first certificate and mentions the weirs. Since the second certificate is based on and mentions the first	On site it was confirmed and clarified that the EIA certificate references Elmali and Tasoba weir hence including those and also quarries as is consistent with the

			one, it can automatically be said that it also includes the quarries.	content of the EIA study and the certificate referencing to this study.
CAR 4.	The EIA report indicates the installed capacity of 48.8 MW. However the capacity was increased. Please explain why this was not included and also the EIA certification does not refer to this issue.	EIA report	See CAR 2.	Same as CAR2
CAR 5.	Please clearly describe whether post or pre-tax approach have been chosen for the benchmark determination and the IRR calculation. Both must be the same.	PDD 2.5.2 Substep 2b	The necessary explanations have been added.	~~Will be inserted~~ OK.
CAR 6.	The risk free rate is chosen incorrectly. A risk free rate, per definition, does not consider any country risk. You have chosen Turkish bonds which naturally reflect risk for Turkey as an investment country. Please read the rational of your source Mr. Damodaran. As a guideline you can also use the appendix (p.7) of the Guidelines to Investment analysis (EB 62) where the return on equity consists of risk free + equity premium + premium for the host country. Your rate under i) already includes the country risk, hence this risk factor would be double counted. Risk free rates are typically derived from the US Market as this market is considered mature and risk free.	Investment Analysis - Benchmark calculation: PDD p. 26, i)	The calculation of the risk free rate has been revised and corrected accordingly.	~~Will be corrected~~ The risk free rate now correctly reflects risk free return expectations as well as maturity and investment horizon. Using averages is reasonable. The source was reviewed.

CAR 7.	The reference dates for the (risk)-rates must include data ONLY which was available at the time of investment decision. This refers to ALL parameters. Meaning that any values must be from 2010 or before (as an average). Data of 2011 was not available at that time.	Investment Analysis - Benchmark calculation PDD p.26,	The reference period for the investment analysis has been changed to include only parameters that were available at the date of investment decision. The reference period is specified as the five year period between the years [2005 – 2009].	~~Will be changed.~~ All data was updated. This was checked inside the excel sheet and compared to the primary source.
CAR 8.	For the beta-factor data from 2010 (available at 2010!) shall be used. E.g. historical data can be used from your source. You have used data until 2011 which was not available at the time of investment decision.	Investment Analysis - Benchmark calculation: PDD p. 26, ii)	See CAR 7.	~~Will be changed~~ above
CAR 9.	For this risk premium data from 2010 (available at 2010!) shall be used. E.g. historical data can be used from your source. The average shall not include 2011 data.	Investment Analysis - Benchmark calculation: PDD p. 26, iii)	See CAR 7.	~~Will be changed.~~ above
CAR 10.	The investment costs shall reflect the cost ESTIMATES which were available at the time of investment decision. For the total investment amount, especially the construction costs of 54,047,619 EUR actual invoiced amounts have been used. Please substantiate why those figures reflect an estimate at the time of investment decision or use an estimate which was available at the time of	Investment Analysis - Investment costs	All investment analysis is revised and amended so as to be based on the values available at the date of investment decision.	The values have been adopted from the Feasibility Study which is correct in terms of consideration of the time of investment decision.

	investment decision (e.g. feasibility).			
CAR 11.	The costs in the PDD are given as total operation and maintenance costs of 18,189,522 EUR (PDD p. 29). The investment analysis sheet indicates Total project expenses or operation costs of 109,235,641 and 16,535,929 respectively. This is inconsistent. Please specify the O&M costs in the PDD, and name the sources especially herein. Also please establish consistency with the figures used in the financial analysis spreadsheet.	Investment Analysis - Operation and maintenance costs	This was a mistake. It has been corrected.	~~Will be corrected.~~ The source is now clear and the values have been corrected.
CAR 12.	When using a period of 20 years for the assessment a "fair value of the project activity assets at the end of the assessment period" shall be included as cash-inflow for the last year (2031). The value shall be calculated by means of the total project value and depreciation of such. The fair value has not been considered (residual book value). This leads to compromised IRR (too low).	Investment Analysis- Fair value	The fair value is considered and added to the investment analysis and the cash flow.	~~Fair value calculation will be included.~~ A fair value has been correctly included as cash flow in the last year (20). It was checked that the fair value was calculated correctly using depreciation for three different types of investments and also using the total amount of verified investment costs.
CAR 13.	The statement "...and the projects that could be detected as having started commercial operation before the start date of the proposed project activity were removed from the list	Common practice analysis PDD p. 32	This was a mistake. It has been corrected.	OK

	and taken out of consideration." Has been made upon a misinterpretation of the guidelines. Those projects cannot be excluded as when complying with those criteria they are considered "similar" and have to be added to the list. Please remove this statement and strictly follow the steps of the common practice analysis. If excluding geographic regions this must be justified.			
CAR 14.	The equation 192,021 * 0.535 = 102,690 tCO2/yr is incorrect. This resulted from a rounding error. Please correct all the figures in the PDD. For conservative reasons the EF should be rounded down.	Emission factor calculation PDD p.65	The requested change has been made.	OK
CAR 15.	BM calculation The AEG_2012 (firm generation) indicated by the PO is 264,143 GWh, where as the AEG_2012 (gross generation) per TEIAS (http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2012/istatistik%202012.htm) is 239,496 GWh. Apparently, it impacts the BM and consequently the EF_CM.	Emission factor calculation PDD p.52	This issue of difference in the generation values is explained on page 52, in paragraph 4 of the Project Description. This situation impacts BM, and as result, CM. However, as explained in the referred section of the project description , the generation values for the individual power plants (or power units as per the approach used in the project description for the calculation of Build margin Emission Factor, considering each commissioning of power plant as a power unit) are not available. The only	The issue had been discussed extensively on-site. There was a lack of understanding between of the difference between the firm generation capacity and the ex-post reported generation capacity. After reviewing the data and comparing with methodological requirement it is confirmed that the approach complies with the requirements as the restriction is merely derived from data

			available data are the firm generation values for individual power plants in the capacity projection reports referred. So, these firm generation capacities are used instead of real generation values. However, this is not a wrong approach, for power plants that have commissioned before 2012, these values are equal. The only difference is that for power plants that were commissioned in 2012, their annual generation capacities have been used instead of their real generation in the year 2012, depending on their commissioning dates. The only reason for using the firm generation capacities is the unavailability of the real generation data for individual power plants.	availability and not a generally wrong approach. Also the difference leads to a conservative deviation.