



**Verified Carbon
Standard**

MONITORING REPORT: 1ST VERIFICATION



Document Prepared by

Ayen Enerji A.S. (as Project Owner)

Life İklim ve Enerji Ltd. Şti. (as Carbon Consultant)

Project Title	BÜYÜKDÜZ HYDROELECTRIC POWER PLANT, TURKEY
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Prepared By	Ayen Enerji & Life Enerji
Contact	Address : Hülya Sokak No: 37,06700 G.O.P/Ankara TURKEY Telephone : +90 312 445 04 64 (Pbx) Fax : +90 312 445 05 02 E-mail : ayen@ayen.com.tr; hakand@ayen.com.tr Website : http://www.ayen.com.tr/

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Büyükdüz Hydroelectric Power Plant (HEPP) is a run-of-river type hydrolic renewable energy facility project. It has an installed capacity of 70.844 MWm / 68.862 MWe, and an annual predicted average generation amount of 192,021,000 kWh in the Project Description document (called *Project Description* from here on). There are two turbines each having a capacity of 35.422 MWm / 34.431 MWe.¹

The project activity reduces greenhouse gas emissions as reference to the baseline scenario taking into account that it is a zero-carbon project. No greenhouse gas or particulate matter emission takes place within project boundary and no leakage emissions occur. Hence, a net emission reduction from the baseline emission level to zero level arises with the energy generated by the project that displaces the energy that would otherwise be generated by the fossil fuel fired power plants in the national grid. Although many harmful gases including the greenhouse gases and particulate matters are avoided by the emission reduction process, only CO₂ is considered in the emission reduction.

The scenario existing prior to the start of the implementation of the project activity was no electricity generation since the project is a greenfield project. Without the implementation of the project, the same amount of energy would be generated by other power plants of the national grid. Considering the general fossil fuel domination in the national grid, a natural gas or coal fired thermal power plant on average would generate this energy. This imaginary power plant would also emit greenhouse gases including CO₂ and particulate matters. Since the project emits no greenhouse gases within its boundary and no leakage is in question, an emission caused by the net electricity generation displaced by the project activity was produced prior to the implementation of the project.

The electrical energy generated by the project replaces the electrical energy of the national grid, based mainly on various fossil fuel sources like natural gas and coal. The Combined Margin Emission Factor was found to be $EF_{grid,CM,y} = 0.535 \text{ tCO}_2/\text{MWh}$ in Project Description. Hence, the expected annual emission reduction to be caused by the project has been estimated around 102,690 tonnes of CO₂e in the Project Description. For a 10-year crediting period then, the expected emission reductions result in 1,026,899 tonnes of CO₂e. For this Monitoring Period (31/05/2012-31/10/2017), the project activity achieved a total reduction of 364,219 tons of CO₂e.

The project was commissioned and the operation of the project and electricity generation started on 31 May 2012. The expected operational life of the project is assumed to be 35 years, as also explained in the Project Description.

¹ Buyukduz HEPP Generation Lincense, granted by Energy Market Regulatory Authority, dated 20/03/2008, Lincense No: EU/1539-5/1123.

When the actual results recorded during the monitoring period and the estimated values are taken into account, the difference in the actual carbon reduction has been yielded as 35% below the estimated figure.

1.2 Sectoral Scope and Project Type

Scope number : 1

Sectoral scope : Energy industries (renewable - / non-renewable sources)

The project is not a grouped project.

1.3 Project Proponent

Organization name	Ayen Enerji A.S.
Contact person	Hakan Demir
Title	Project Representative
Address	Hülya Sokak No: 37, 06700 G.O.P./Ankara/TURKEY
Telephone	+90 312 445 04 64 (Pbx) Extension: 2306
Email	ayen@ayen.com.tr ; hakand@ayen.com.tr

1.4 Other Entities Involved in the Project

Organization name	Life İklim ve Enerji Ltd. Şti.
Role in the Project	Project Developer
Contact person	İpek Topuz
Title	Carbon Consultant
Address	Oğuzlar Mahallesi, 1377. Sk. No:19, 06520 Çankaya/Ankara/TURKEY
Telephone	+90 312 481 2142 / +90 505 617 6832
Email	info@lifeenerji.com ; ipek.topuz@lifeenerji.com

1.5 Project Start Date

The Project was commissioned and started to feed energy to the grid on 31 May 2012. This is the date on which the project started to produce emission reductions.²

1.6 Project Crediting Period

The project crediting period is 10 years; 31/05/2012-30/05/2022 (both days included). The crediting period is renewable twice.

1.7 Project Location

The Project field is located in the Black Sea region, and in Eastern Black Sea regional basin, inside the borders of Gümüşhane province, and over Manastır (Dere kapı) creek that is a branch of Harşit River and confluent with that between Torul and Kürtün dams over Harşit River.

There are two weirs included in the project, namely Elmalı and Taşoba Weirs. Elmalı weir is located 11 km, and Taşoba weir is 10 km, and Büyükdüz HEPP is 5 km away, as air distance, from the centre of Kürtün District.

Elmalı weir is constructed as a radial gate concrete structure on the Kürtün branch of Manastır creek. The location of Elmalı weir is on the Kürtün branch of Manastır creek that is divided into two branches before it confluent with the Harşit River.

Taşoba weir is constructed on Cizere creek (Manastır branch) as a radial gate concrete structure. The location of Taşoba weir is on the main branch of Manastır creek that is divided into two branches before it confluent with the Harşit River.

Waters of Taşoba and Elmalı weirs and natural flows diverted from Manastır creek is fed into the turbines of Büyükdüz HEPP in order to generate electricity.

A brief summary about the project's location is provided via Table 1.

Table 1. Project Location Details of Büyükdüz Hydroelectric Power Plant^{3,4}

Item No	Item	Description
---------	------	-------------

² Buyukduz HEPP Provisional Acceptance Protocol, dated 31/05/2012.

³ Please see the feasibility report submitted to the DOE for confirming the coordinates.

⁴ Please see Buyukduz HEPP Provisional Acceptance Protocol for the items 9 to 14.

Item No	Item	Description
1	Province	Gümüşhane
2	District	Kürtün
3	Basin Name	Harsit Basin
4	DSI (SHW) Region	22. Region
5	1/25 000 Map Names	G42 - d1, d3, d4
6	Elmalı Weir 6° UTM Coordinates	4494210(N) / 503843(E)
7	Tasoba Weir 6° UTM Coordinates	4490395(N) / 510892(E)
8	Power Plant 6° UTM Coordinates	4498293(N) / 509514(E)
9	Brand and Models of the Turbines	Alstom Power Hydro - Iberica
10	Shaft Model	Vertical Pelton
11	Serial Numbers of the Turbines	2092 & 2093
12	Installed Capacity	(2x35.422) MWm / (2x3.34.431) MWe
13	Turbine Speed	600 rpm
14	Year of Turbines' Manufacturing	2011

Also, the location of the project on the map is provided via

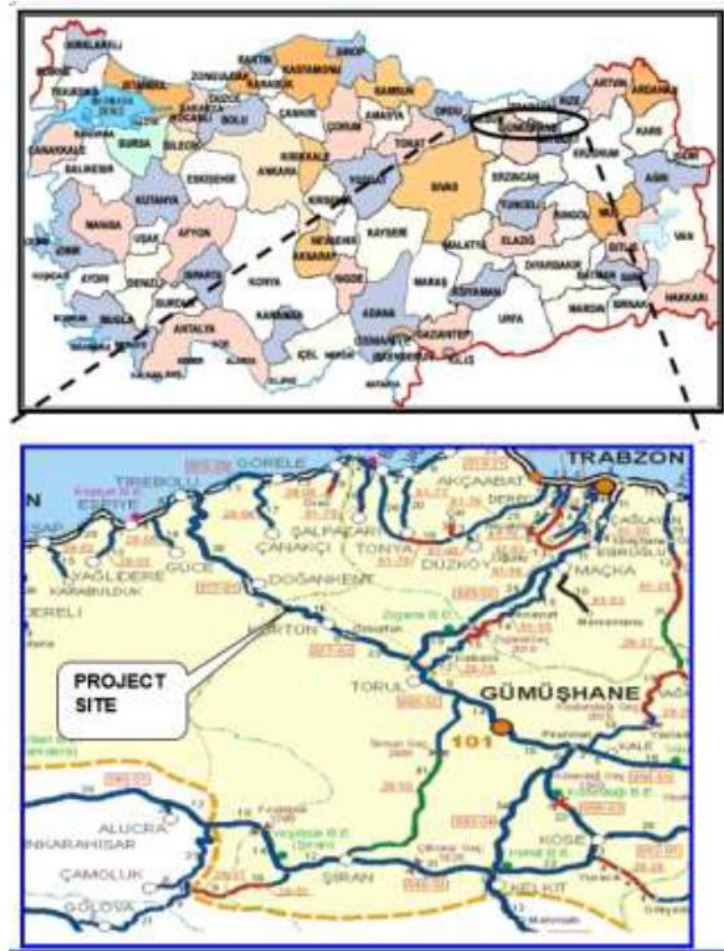


Figure 1: Project Site Location Map⁵

1.8 Title and Reference of Methodology

The approved baseline and monitoring methodology applied to the project activity is “ACM0002: Grid-connected electricity generation from renewable sources --- Version 14.0.0”. Tools referenced in this methodology:

1. Tool for the demonstration and assessment of additionality (Version 07.0.0)
2. Combined tool to identify the baseline scenario and demonstrate additionality (Version 05.0.0)

⁵ Taşoba – Elmalı Weirs, Büyükdüz HEPP and Construction Material Quarries Final EIA Report, prepared by Topcuoglu Mining, Industry and Trade Co. Ltd. Dated February 2008. English Version. Section II: Location of the Project Site, pages 17 – 18.

3. Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 02.0.0)
4. Tool to calculate the emission factor for an electricity system (Version 04.0.0)

Only two of these tools, “Tool to calculate the emission factor for an electricity system (Version 04.0.0)” for baseline emission calculation and “Tool for the demonstration and assessment of additionality (Version 07.0.0)” for the assessment of additionality are used. Since no project emission or leakage is in question regarding the project activity, “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 02.0.0)” is not used. “Combined tool to identify the baseline scenario and demonstrate additionality (Version 05.0.0)” is also not used since it is not applicable to the project according to the scope and rule defined therein.

1.9 Participation under other GHG Programs

The project has not been registered, or is seeking registration under any other GHG programs.

1.10 Other Forms of Credit

- Emission Trading Programs and Other Binding Limits: Not Applicable. The Project Activity is not embedded under any kind of Emission trading programs. Turkey is not an Annex-B country under Kyoto Protocol, neither has its set national emission reduction targets nor any related obligations.
- Other Forms of Environmental Credit: Not applicable. The project will not generate other form of environmental credits such as Green Power Certificates.

1.11 Sustainable Development

The project helps Turkey to stimulate and commercialize the use of grid-connected renewable energy technologies and markets. Furthermore, the project demonstrates the viability of grid-connected renewable energy project which can support improved energy security, improved air quality, alternative sustainable energy futures, improved local livelihoods and sustainable renewable energy industry development. The specific goals of the project are to:

- reduce greenhouse gas emissions in Turkey compared to the business-as-usual scenario;

- help to stimulate the growth of the renewable power industry in Turkey;
- create local employment during the construction and the operation phase of the project;
- reduce other pollutants resulting from power generation industry in Turkey, compared to a business-as-usual scenario;
- help to reduce Turkey's increasing energy deficit;
- differentiate the electricity generation mix and reduce import dependency;
- contribute to the development of landscaping, reforestation, making investments, such as roads, various supports for village schools.

As the project developer, Ayen Enerji believes that efficient utilization of all kinds of natural resources with a harmony coupled with responsible environmental considerations is vital for the sustainable development of Turkey and the World. This has been a guiding factor for the shareholders towards the concept of designation and installation of a hydro power project. Other than the objective of climate change mitigation through a significant reduction in greenhouse gas (GHG) emissions, the project has been carried out to provide a social and economic contribution to the region in a sustainable way. The benefits that are gained by the realization of the project compared to the business-as-usual scenario can be summarized under some main indicators.

In addition to the contribution made by Büyükdüz HEPP to the climate action, project also contribute significantly to the solution of other environmental issues such as solid waste and wastewater management. In the scenario Büyükdüz HEPP is not implemented, the electricity is to be generated by a fossil fuel combustion procedure. This kind of conventional electricity generation processes requires use of significant amount of cooling water that consequently ends with a cooling wastewater discharge into the natural water bodies such as lakes or rivers. Thus, since this project does not employ such a procedure for electricity generation, there is no wastewater discharge as a side product of its operation. Also, all the domestic wastewater and solid/hazardous wastes, that are formed due to the project's operation, are being treated in line with the regulations.⁶

In addition, the project helps to develop the renewable power industry and encouraged to the investment in the industry. Thus, for economical aspect, Turkey's increasing energy deficit and import dependency are reduced.

For social aspect, during the construction and operation of the project, local employment is enhanced and local poverty and unemployment can be partially

⁶ Please see the wastewater and solid/hazardous waste removal records.

eliminated by increasing job opportunities and project business activities. Also, the employment quality of via Büyükdüz HEPP has been enhanced by the social and technical trainings given to the employees during the monitoring period.⁷

This project's contribution status to the UN SDGs and associated achieved value are given as follow:

- **SDG 13 Climate Action:** 364,219 tonnes CO₂e has been reduced during this monitoring period
- **SDG 7 Clean and Affordable Energy:** 680,788.39 MWh renewable electricity has been generated during this monitoring period

2 SAFEGUARDS

2.1 No Net Harm

No negative environmental and socio-economic impacts have been observed/recorded for this project.

Detailed information of Büyükdüz HEPP's social and environmental performance can be gained via • Emission Trading Programs and Other Binding Limits: Not Applicable. The Project Activity is not embedded under any kind of Emission trading programs. Turkey is not an Annex-B country under Kyoto Protocol, neither has its set national emission reduction targets nor any related obligations.

- Other Forms of Environmental Credit: Not applicable. The project will not generate other form of environmental credits such as Green Power Certificates. Sustainable Development chapter.

2.2 Local Stakeholder Consultation

Stakeholder engagement procedure was conducted at the Demirciler Village and Demirkapı Village with the local stakeholders and Mukhtar of this village on 18/10/2017.

As validated during the site visit, mukhtars of (heads of the village) Demirciler Village and Demirkapı Village had already taken the contact information one of the executives in

⁷ Please see the associated training records.

Büyükdüz Hydroelectric Power Plant that the local stakeholders will be able to reach company executive whenever they have any complaints, suggestions or ideas about the project. A recent associated protocol regarding sharing the contact information among the stakeholder has been signed by the parties on 24/07/2020.⁸

Since mukhtar is the head of the village, he will be the main contact person between the project owner and the local stakeholders. Mukhtars will make sure that there is continuous communication between the two parties. The communication, as it has been proceeded to date, will be based on either face-to-face contact or remote (via phone, email etc.)

During the site visit, it is validated that there were no negative comments on the implementation of the project from the stakeholders (Mukhtar and the locals).

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The Project started to generate electricity to the Turkey's National Grid on 31/05/2012. During this monitoring period, there was no event or situation, which may impact the applicability of the methodology, have occurred.

Peltom turbines are employed for this project activity. Pelton turbines are particularly well suited for heads between 200 m and 1800 m. Since 1927, Alstom Hydro has supplied over 300 Pelton turbines worldwide, with power ranges between 1.2 MW and 202 MW, for heads between 120 m and 1247 m. Alstom Hydro Pelton turbines have either one or two injectors for horizontal shaft and between one and six injectors for vertical shaft configuration. The technical properties of these turbines are summarized as follow:⁹

Main Functions:

- Can store large amounts of energy for weeks or months
- Act as a quick response for peak load energy supply

⁸ The associated documents are submitted to the DOE.

⁹ Please see the turbine document that is submitted to the DOE.

- Provide ancillary services (network frequency & voltage regulation, reserve capacity, black start capability, reactive power production)

Key Advantages:

- Clean, renewable power source
- Relatively low cost per installed MW
- High efficiency over a wide range of power output
- Fast output adjustment capability (very complementary to thermal power plants)

The placements of electricity meters is visualized via Single Line Diagram of Büyükdüz HEPP. Also, the technical specifications of these electricity meters are provided via Table 2.

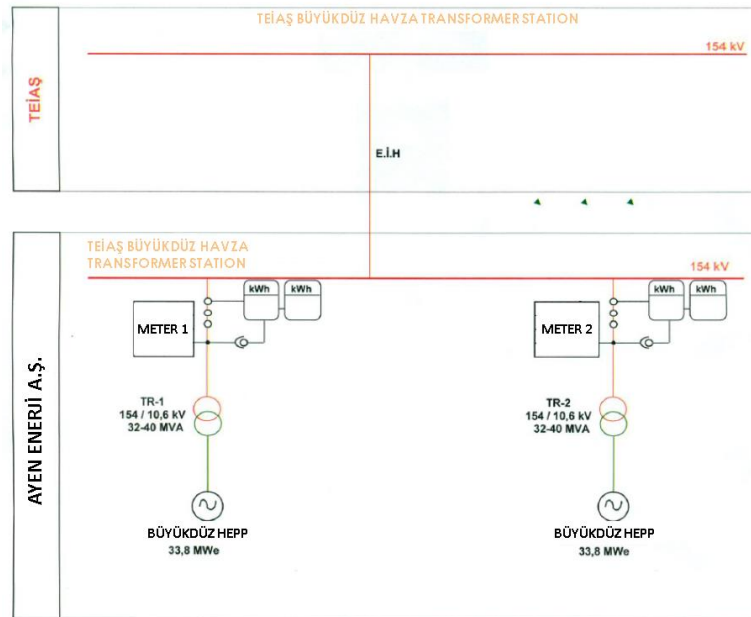


Figure 2. Single Line Diagram of Büyükdüz HEPP¹⁰

Table 2. Technical Specifications of Electricity Meters

Name	Brand & Model	Serial Number	Accuracy Class	Protocol Date
Main Meter 1	ELSTER & A1500	419678	0.5S	19/12/2013
				17/10/2014
				26/11/2015

¹⁰ Please see the original copy of Single Line Diagram in Turkish.

Name	Brand & Model	Serial Number	Accuracy Class	Protocol Date
				25/10/2016 11/10/2017 03/10/2018
Back-up Meter 1	ELSTER & A1500	419679	0.5S	19/12/2013 17/10/2014 26/11/2015 25/10/2016 11/10/2017 03/10/2018
Main Meter 2	ELSTER & A1500	419680	0.5S	19/12/2013 17/10/2014 26/11/2015 25/10/2016 11/10/2017 03/10/2018
Back-up Meter 2	ELSTER & A1500	419681	0.5S	19/12/2013 17/10/2014 26/11/2015 25/10/2016 11/10/2017 03/10/2018

The initial meter test has been conducted on 01/06/2012.¹¹

Table 3 gives an outline on the activities that took place within the Büyükdüz HEPP.

Table 3. Project Milestone

Activity	Date
Local Stakeholder and Public Participation Meeting	18/09/2007
Positive Environmental Impact Assessment for Büyükdüz HEPP.	08/02/2008
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	04/03/2008
Board Decision regarding Verified Emission Reductions	12/03/2008

¹¹ Please see the first index protocol.

Activity	Date
Initial Issuance of the Generation License	20/03/2008
The First Amendment in the Generation License. The subject of the amendment is the extension of construction and facility completion periods	18/09/2009
Construction activities commenced in the project site (Project Site Delivery to the Contractor Construction Company (Aydiner Insaat A.S.). Although the actual constructional works started later, this is the earliest date that can be documented as the construction beginning date. Hence, the date the start of constructional works has been accepted as this date).	01/11/2009
Turbine purchase and service agreement with turbine supplier (Alstom). This date is also the investment decision date, since the order of the electromechanical equipment, the main component of which are the Pelton turbines is the most important milestone for investment.	19/03/2010
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.	07/04/2010
Contract Agreement about the Supply of Electrical Equipment for the Power Plant (154 kV Switchyard and TEIAS Havza Substation) for Büyükdüz Hydroelectric Power Plant made between the Supplier Company (ABB Turkey) and the Project	13/04/2010

Activity	Date
Proponent.	
Contract for Supplying Power Transformers for Büyükdüz Hydroelectric Power Plant made Between the Supplier Company (ABB Turkey) and the Project Proponent.	14/04/2010
Completion and Submission of Financial Feasibility Report to Creditor Bank (Türkiye İş Bankası A.Ş.)	15/04/2010
Credit Agreement with Creditor Bank (Türkiye İş Bankası A.Ş.)	12/08/2010
Connection Agreement made between the Project Proponent and TEİAŞ (Turkish Electricity Transmission Company).	20/12/2010
Additional Water Usage Agreement between General Directorate of State Hydraulic Works of Ministry of Forestry and Water Affairs and Ayen Enerji A.Ş. for Büyükdüz HEPP regarding some new regulations.	07/02/2011
The Second Amendment in the Generation License. The subject of the amendment is the increase in the installed capacity and the predicted average annual generation amount.	04/08/2011
Additional Water Usage Agreement between General Directorate of State Hydraulic Works of Ministry of Forestry and Water Affairs and Ayen Enerji A.Ş. for Büyükdüz HEPP regarding the increase in the installed capacity and the predicted average annual generation amount.	08/09/2011
Validation agreement signed between the Project Proponent and the Validator DOE.	30/11/2011
Positive Environmental Impact Assessment Decision about Büyükdüz HEPP regarding the increase in the installed capacity and the predicted average annual generation	24/01/2012

Activity	Date
amount.	
The Third and the Last Amendment in the Generation License. The subject of the amendment is the extension of construction and facility completion periods.	01/03/2012
Partial Commissioning of Büyükdüz Hydroelectric Power Plant. Beginning of Operation.	31/05/2012
Start date of first monitoring period	31/05/2012
Construction activities ended in the project site.	02/07/2012
Project Description Completed and the documents uploaded to the Registry.	06/05/2014
Validation Site Visit	20/05/2014
First Verification Site Visit	18/10/2017
End date of first monitoring period	31/10/2017

NOTE: As can be seen from the implementation timeline of the project, the revenues from VER credits had been considered before electromechanical equipment order agreement and credit agreement.

3.2 Deviations

3.2.1 Methodology Deviations

There has not been any deviation with respect to project's methodology.

3.2.2 Project Description Deviations.

There has not been any deviation that alters the project description (ie. no design change has been occurred).

3.3 Grouped Projects

The Project is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	EG _{gross,y}																												
Data unit	GWh																												
Description	Total quantity of gross electricity generation of power plants connected to the grid including low-cost/must-run power plants in year y for years in the 3-year period of [2010 – 2012].																												
Source of data	Official data from TEIAS (Turkish Electricity Transmission Company), the responsible authority for the operation of Turkish National Grid.																												
Value applied	<table><tr><th colspan="5">Gross and Net Generations in [2010 - 2012] (Unit: GWh)</th></tr><tr><th rowspan="2">Primary Energy Resource or Fuel Type</th><th colspan="3">Years</th><th rowspan="2">3-Year Total</th></tr><tr><th>2010</th><th>2011</th><th>2012</th></tr><tr><td>General Total (Gross)</td><td>211,207.7</td><td>229,395.1</td><td>239,496.8</td><td>680,099.6</td></tr><tr><td>General Total (Net)</td><td>203,046.1</td><td>217,557.7</td><td>227,707.3</td><td>648,311.1</td></tr><tr><td>Net / Gross Ratio</td><td>96.14%</td><td>94.84%</td><td>95.08%</td><td>95.33%</td></tr></table>	Gross and Net Generations in [2010 - 2012] (Unit: GWh)					Primary Energy Resource or Fuel Type	Years			3-Year Total	2010	2011	2012	General Total (Gross)	211,207.7	229,395.1	239,496.8	680,099.6	General Total (Net)	203,046.1	217,557.7	227,707.3	648,311.1	Net / Gross Ratio	96.14%	94.84%	95.08%	95.33%
Gross and Net Generations in [2010 - 2012] (Unit: GWh)																													
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Net / Gross Ratio	96.14%	94.84%	95.08%	95.33%																									
Justification of choice of data or description of measurement methods and procedures applied	Official data. According to the regulations regarding the Turkish Statistical Institute, the state organization responsible for the statistical affairs in the Republic of Turkey, TEIAS is the official source of data for energy.																												
Purpose of Data	Calculation of baseline emissions.																												
Comments	No additional comments																												

Data / Parameter	EG _y																																																					
Data unit	GWh																																																					
Description	Total net quantity of electricity generation of power plants connected to the grid, not including low-cost/must-run power plants in year y for years in the 3-year period of [2010 – 2012].																																																					
Source of data	Official data from TEIAS (Turkish Electricity Transmission Company), the responsible authority for the operation of Turkey's National Grid.																																																					
Value applied	<table><tr><th rowspan="2">Net Electricity Generation Excluding Low-Cost/Must-Run (Thermal Power Plants) (Unit: GWh)</th><th colspan="3">Years</th><th rowspan="2">3-Year Total</th></tr><tr><th>2010</th><th>2011</th><th>2012</th></tr><tr><td>Hard Coal+Imported Coal+Asphaltite</td><td>18,366.0</td><td>25,936.3</td><td>31,683.8</td><td>75,986.1</td></tr><tr><td>Lignite</td><td>34,553.2</td><td>36,864.6</td><td>32,981.3</td><td>104,399.1</td></tr><tr><td>Fuel Oil</td><td>2,061.0</td><td>854.0</td><td>933.0</td><td>3,848.0</td></tr><tr><td>Diesel oil</td><td>4.1</td><td>2.9</td><td>625.0</td><td>632.1</td></tr><tr><td>LPG</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td></tr><tr><td>Naphtha</td><td>30.7</td><td>0.0</td><td>0.0</td><td>30.7</td></tr><tr><td>Natural Gas</td><td>94,351.2</td><td>98,678.5</td><td>99,355.1</td><td>292,384.8</td></tr><tr><td>Renewables and Wastes</td><td>439.8</td><td>445.0</td><td>685.2</td><td>1,570.0</td></tr><tr><td>Turkey's Thermal Total</td><td>149,806.0</td><td>162,781.3</td><td>166,263.4</td><td>478,850.8</td></tr></table>	Net Electricity Generation Excluding Low-Cost/Must-Run (Thermal Power Plants) (Unit: GWh)	Years			3-Year Total	2010	2011	2012	Hard Coal+Imported Coal+Asphaltite	18,366.0	25,936.3	31,683.8	75,986.1	Lignite	34,553.2	36,864.6	32,981.3	104,399.1	Fuel Oil	2,061.0	854.0	933.0	3,848.0	Diesel oil	4.1	2.9	625.0	632.1	LPG	0.0	0.0	0.0	0.0	Naphtha	30.7	0.0	0.0	30.7	Natural Gas	94,351.2	98,678.5	99,355.1	292,384.8	Renewables and Wastes	439.8	445.0	685.2	1,570.0	Turkey's Thermal Total	149,806.0	162,781.3	166,263.4	478,850.8
Net Electricity Generation Excluding Low-Cost/Must-Run (Thermal Power Plants) (Unit: GWh)	Years			3-Year Total																																																		
	2010	2011	2012																																																			
Hard Coal+Imported Coal+Asphaltite	18,366.0	25,936.3	31,683.8	75,986.1																																																		
Lignite	34,553.2	36,864.6	32,981.3	104,399.1																																																		
Fuel Oil	2,061.0	854.0	933.0	3,848.0																																																		
Diesel oil	4.1	2.9	625.0	632.1																																																		
LPG	0.0	0.0	0.0	0.0																																																		
Naphtha	30.7	0.0	0.0	30.7																																																		
Natural Gas	94,351.2	98,678.5	99,355.1	292,384.8																																																		
Renewables and Wastes	439.8	445.0	685.2	1,570.0																																																		
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Justification of choice of data or description of measurement methods and procedures applied	Official data. According to the regulations regarding the Turkish Statistical Institute, the state organization responsible for the statistical affairs in the Republic of Turkey, TEIAS is the official source of data for energy.																																																					
Purpose of Data	Calculation of baseline emissions.																																																					
Comments	No additional comments																																																					

Data / Parameter	EG_{gross,i,y}
Data unit	GWh
Description	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].

Source of data	Official data from TEIAS (Turkish Electricity Transmission Company), the responsible authority for the operation of Turkish National Grid.																																																																																													
Value applied	Gross Generations by Fuel Types and Primary Energy Resources in [2010 - 2012] (Unit: GWh) <table><tr><th rowspan="2">Primary Energy Resource or Fuel Type</th><th colspan="3">Years</th><th rowspan="2">3-Year Total</th></tr><tr><th>2010</th><th>2011</th><th>2012</th></tr><tr><td>Hard Coal + Imported Coal + Asphaltite</td><td>19,104.3</td><td>27,347.5</td><td>33,324.2</td><td>79,776.0</td></tr><tr><td>Lignite</td><td>35,942.1</td><td>38,870.4</td><td>34,688.9</td><td>109,501.4</td></tr><tr><td>Total Coal</td><td>55,046.4</td><td>66,217.9</td><td>68,013.1</td><td>189,277.4</td></tr><tr><td>Fuel-Oil</td><td>2,143.8</td><td>900.5</td><td></td><td>3,044.3</td></tr><tr><td>Diesel Oil</td><td>4.3</td><td>3.1</td><td>657.4</td><td>664.8</td></tr><tr><td>PG</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td></tr><tr><td>Naphtha</td><td>31.9</td><td>0.0</td><td>0.0</td><td>31.9</td></tr><tr><td>Total Oil (Liquid Total)</td><td>2,180.0</td><td>903.6</td><td>1,638.7</td><td>4,722.3</td></tr><tr><td>Natural Gas</td><td>98,143.7</td><td>104,047.6</td><td>104,499.2</td><td>306,690.5</td></tr><tr><td>Renewables and Wastes</td><td>457.5</td><td>469.2</td><td>720.7</td><td>1,647.4</td></tr><tr><td>Thermal</td><td>155,827.6</td><td>171,638.3</td><td>174,871.7</td><td>502,337.6</td></tr><tr><td>Hydro + Geothermal + Wind Total</td><td>55,380.1</td><td>57,756.8</td><td>64,625.1</td><td>177,762.0</td></tr><tr><td>Hydro</td><td>51,795.5</td><td>52,338.6</td><td>57,865.0</td><td>161,999.1</td></tr><tr><td>Geothermal + Wind</td><td>3,584.6</td><td>5,418.2</td><td>6,760.1</td><td>15,762.9</td></tr><tr><td>Geothermal</td><td>668.2</td><td>694.3</td><td>899.3</td><td>2,261.8</td></tr><tr><td>Wind</td><td>2,916.4</td><td>4,723.9</td><td>5,860.8</td><td>13,501.1</td></tr><tr><td>General Total (Gross)</td><td>211,207.7</td><td>229,395.1</td><td>239,496.8</td><td>680,099.6</td></tr></table>	Primary Energy Resource or Fuel Type	Years			3-Year Total	2010	2011	2012	Hard Coal + Imported Coal + Asphaltite	19,104.3	27,347.5	33,324.2	79,776.0	Lignite	35,942.1	38,870.4	34,688.9	109,501.4	Total Coal	55,046.4	66,217.9	68,013.1	189,277.4	Fuel-Oil	2,143.8	900.5		3,044.3	Diesel Oil	4.3	3.1	657.4	664.8	PG	0.0	0.0	0.0	0.0	Naphtha	31.9	0.0	0.0	31.9	Total Oil (Liquid Total)	2,180.0	903.6	1,638.7	4,722.3	Natural Gas	98,143.7	104,047.6	104,499.2	306,690.5	Renewables and Wastes	457.5	469.2	720.7	1,647.4	Thermal	155,827.6	171,638.3	174,871.7	502,337.6	Hydro + Geothermal + Wind Total	55,380.1	57,756.8	64,625.1	177,762.0	Hydro	51,795.5	52,338.6	57,865.0	161,999.1	Geothermal + Wind	3,584.6	5,418.2	6,760.1	15,762.9	Geothermal	668.2	694.3	899.3	2,261.8	Wind	2,916.4	4,723.9	5,860.8	13,501.1	General Total (Gross)	211,207.7	229,395.1	239,496.8	680,099.6
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Justification of choice of data or description of measurement methods and procedures applied	Official data. According to the regulations regarding the Turkish Statistical Institute, the state organization responsible for the statistical affairs in the Republic of Turkey, TEIAS is the official source of data for energy. Since power plant based data is unavailable, the amounts of generation for group of power plants using the same fuel type / utilizing the same primary energy source i were used.																																																																																													
Purpose of Data	Calculation of baseline emissions.																																																																																													
Comments	No additional comments																																																																																													

Data Parameter /	$EG_{i,y}$
Data unit	GWh
Description	Net quantity of electricity generation of power plants using fuel type i connected to the grid, not including low-cost/must-run power plants in year y for years in the 3-year period of [2010 – 2012].
Source of data	Official data from TEIAS (Turkish Electricity Transmission Company), the responsible authority for the operation of Turkish National Grid.

Value applied	Net Electricity Generation Excluding Low-Cost/Must-Run (Thermal Power Plants) (Unit: GWh)	Years			3-Year Total
		2010	2011	2012	
	<i>Hard Coal+Imported Coal+Asphaltite</i>	18,366.0	25,936.3	31,683.8	75,986.1
	<i>Lignite</i>	34,553.2	36,864.6	32,981.3	104,399.1
	<i>Fuel Oil</i>	2,061.0	854.0	933.0	3,848.0
	<i>Diesel oil</i>	4.1	2.9	625.0	632.1
	<i>LPG</i>	0.0	0.0	0.0	0.0
	<i>Naphtha</i>	30.7	0.0	0.0	30.7
	<i>Natural Gas</i>	94,351.2	98,678.5	99,355.1	292,384.8
	<i>Renewables and Wastes</i>	439.8	445.0	685.2	1,570.0
	<i>Turkey's Thermal Total</i>	149,806.0	162,781.3	166,263.4	478,850.8
Justification of choice of data or description of measurement methods and procedures applied	Official data. According to the regulations regarding the Turkish Statistical Institute, the state organization responsible for the statistical affairs in the Republic of Turkey, TEIAS is the official source of data for energy. Since power plant based and fuel/primary energy source specific data is not available, net electricity generation of each group of power plants using the same fuel i for that year y was calculated applying the same net/gross electricity generation ratio for that year y to gross generation of each group of power plants using the same fuel i in that year y.				
Purpose of Data	Calculation of baseline emissions.				
Comments	No additional comments				

Data / Parameter	EG_{import,y}			
Data unit	GWh			
Description	Quantity of electricity imports in year y for years in the 3-year period of [2010 – 2012].			
Source of data	Official data from TEIAS (Turkish Electricity Transmission Company), the responsible authority for the operation of Turkish National Grid.			
Value applied		2010	2011	2012
	Import (Unit:GWh)	1,143.8	4,555.8	5,826.7
Justification of choice of data or description	Official data. According to the regulations regarding the Turkish Statistical Institute, the state organization			

of measurement methods and procedures applied	responsible for the statistical affairs in the Republic of Turkey, TEIAS is the official source of data for energy.
Purpose of Data	Calculation of baseline emissions.
Comments	No additional comments

Data / Parameter	EF_{grid,CM,y}
Data unit	tCO ₂ /MWh
Description	Combined margin CO ₂ emission factor for grid connected power generation in year y
Source of data	Tool to calculate the emission factor for an electricity system
Value applied	0.535 tCO ₂ /MWh
Justification of choice of data or description of measurement methods and procedures applied	The baseline emissions are the product of electrical energy baseline expressed in MWh of electricity produced by the renewable generating unit multiplied by an emission factor.
Purpose of Data	Calculation of baseline emissions.
Comments	No additional comments

Data / Parameter	FC_{i,y}
Data unit	ton (liquid and solid fuels) / 10 ³ m ³ (gaseous fuels)
Description	Amount of fuels consumed in thermal power plants in Turkey by fuel type i in year y for years in the 3-year period of [2010 – 2012].
Source of data	Official data from TEIAS (Turkish Electricity Transmission Company), the responsible authority for the operation of Turkish National Grid.

Value applied	Fuel Consumption in Electricity Generation Excluding Low-Cost/Must-Run (Unit: Ton (solid and liquid) /10 ³ m ³ (gas))	Years		
		2010	2011	2012
	<i>Hard Coal+Imported Coal+Asphaltite</i>	7,419,703.0	10,574,434.0	12,258,462.0
	<i>Lignite</i>	56,689,392.0	61,507,310.0	55,742,463.0
	<i>Fuel Oil</i>	891,782.0	531,608.0	564,796.0
	<i>Diesel oil</i>	20,354.0	15,047.0	176,379.0
	<i>LPG</i>	0.0	0.0	0.0
	<i>Naphtha</i>	13,140.0	0.0	0.0
	<i>Natural Gas</i>	21,783,414.0	22,804,587.0	23,090,121.0
	<i>Renewables and Wastes*</i>	0.0	0.0	0.0
Justification of choice of data or description of measurement methods and procedures applied	Official data. According to the regulations regarding the Turkish Statistical Institute, the state organization responsible for the statistical affairs in the Republic of Turkey, TEIAS is the official source of data for energy.			
Purpose of Data	Calculation of baseline emissions.			
Comments	No additional comments			

Data / Parameter	NCV_{i,y}
Data unit	TJ/Gg, GJ/ton
Description	Net calorific value of fuel type i consumed by thermal power plants in year y in the 3-year period of [2010 – 2012].
Source of data	Official data from TEIAS (Turkish Electricity Transmission Company), the responsible authority for the operation of Turkish National Grid.

Value applied	Net Calorific Values of Fuels Consumed in Thermal Power Plants (Unit: TJ/Gg)	Years		
		2010	2011	2012
	<i>Hard Coal+Imported Coal+Asphaltite</i>	22.3	22.8	24.3
	<i>Lignite</i>	7.1	7.3	7.0
	<i>Fuel Oil</i>	40.2	41.6	41.7
	<i>Diesel oil</i>	43.1	43.2	44.7
	<i>LPG</i>	0.0	0.0	0.0
	<i>Naphtha</i>	33.5	0.0	0.0
	<i>Natural Gas</i>	54.0	53.6	53.4
Justification of choice of data or description of measurement methods and procedures applied	Official data. According to the regulations regarding the Turkish Statistical Institute, the state organization responsible for the statistical affairs in the Republic of Turkey, TEIAS is the official source of data for energy. The net calorific values are calculated using the amount of fuels used and the heating values of the fuels.			
Purpose of Data	Calculation of baseline emissions.			
Comments	In order for all the units of consumed fuels to be compatible with each other, the unit of natural gas consumed should be converted to mass units. Also, heating values given by TEIAS, which are expressed in [cal], must be converted into [J]. For this purpose, conversion factors given in International Energy Agency were used^{94,95,96}. Natural gas density was accepted as 0.692 kg/m³, and 1 cal was assumed to be equal to 4.1868 J.			

Data / Parameter	EF _{CO₂,i,y}
Data unit	kg/TJ
Description	Default CO ₂ emission factors of fossil fuel type i for combustion.
Source of data	IPCC default values at the lower limit of the uncertainty at a 95 percent confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC

	Guidelines on National GHG Inventories, pages 1.23 – 1.24.																																																						
Value applied	<table><tr><td rowspan="2">Default CO₂ Emission Factors for Combustion</td><td colspan="3">Table 1.4</td></tr><tr><td colspan="3">Effective CO₂ Emission Factor (kg/TJ)</td></tr><tr><td>Fuel Type</td><td>Default</td><td>Lower</td><td>Upper</td></tr><tr><td>Anthracite</td><td>98,300</td><td>94,600</td><td>101,000</td></tr><tr><td>Coking Coal</td><td>94,600</td><td>87,300</td><td>101,000</td></tr><tr><td>Other Bituminous Coal</td><td>94,600</td><td>89,500</td><td>99,700</td></tr><tr><td>Sub-Bituminous Coal</td><td>96,100</td><td>92,800</td><td>100,000</td></tr><tr><td>Lignite</td><td>101,000</td><td>90,900</td><td>115,000</td></tr><tr><td>Fuel Oil</td><td>77,400</td><td>75,500</td><td>78,800</td></tr><tr><td>Diesel Oil</td><td>74,100</td><td>72,600</td><td>74,800</td></tr><tr><td>LPG</td><td>63,100</td><td>61,600</td><td>65,600</td></tr><tr><td>Naphtha</td><td>73,300</td><td>69,300</td><td>76,300</td></tr><tr><td>Natural Gas</td><td>56,100</td><td>54,300</td><td>58,300</td></tr></table>				Default CO ₂ Emission Factors for Combustion	Table 1.4			Effective CO ₂ Emission Factor (kg/TJ)			Fuel Type	Default	Lower	Upper	Anthracite	98,300	94,600	101,000	Coking Coal	94,600	87,300	101,000	Other Bituminous Coal	94,600	89,500	99,700	Sub-Bituminous Coal	96,100	92,800	100,000	Lignite	101,000	90,900	115,000	Fuel Oil	77,400	75,500	78,800	Diesel Oil	74,100	72,600	74,800	LPG	63,100	61,600	65,600	Naphtha	73,300	69,300	76,300	Natural Gas	56,100	54,300	58,300
Default CO ₂ Emission Factors for Combustion	Table 1.4																																																						
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Natural Gas	56,100	54,300	58,300																																																				
Justification of choice of data or description of measurement methods and procedures applied	Country or project specific data are not available for power plants using fossil fuels in Turkey. Hence, IPCC default emission factors have been used according to the Tool (Section 7, page 29) and the UNFCCC CDM “Guidance on IPCC Default Values”.																																																						
Purpose of Data	Calculation of baseline emissions.																																																						
Comments	-																																																						

Data / Parameter	$\eta_{i,y}$
Data unit	Dimensionless (% ratio)
Description	Average net energy conversion efficiency of power units using fuel i in year y.
Source of data	For power plants using imported coal as fuel, the data given in presentation by Muzaffer Basaran in Panel about “Coal-Fired Power Plants and Investment Models”, in Middle East Technical University Alumni Association Visnelik Facility, on 23 February 2013 were used. For other types of fuels, the values in Table 1 in Appendix 1 of the Tool were applied.

Value applied	Energy Source / Fuel	Firm Generation Capacity (year 2012) (GWh)	Assumed Emission Factor (kg/TJ)	Assumed Default Efficiency (%)	Calculated Emission Factor ((tCO ₂ /MWh)	Emission (ton)
	Asphaltite	0.0	89,500	41.5%	0.776	0.0
	Biogas	75.0	46,200	60.0%	0.277	20,790.0
	Diesel Oil	0.0	72,600	46.0%	0.568	0.0
	Fuel Oil	1,319.0	75,500	46.0%	0.591	779,343.6
	Geothermal	382.0	0	0.0%	0.000	0.0
	Hard Coal	0.0	92,800	41.5%	0.805	0.0
	Hydroelectric	6,464.7	0	0.0%	0.000	0.0
	Imported Coal	14,367.7	89,500	41.3%	0.780	11,211,351.5
	Lignite	184.0	90,900	41.5%	0.789	145,089.5
	Liquefied Petroleum Gas	0.0	61,600	60.0%	0.370	0.0
	Natural Gas	29,917.7	54,300	60.0%	0.326	9,747,196.0
	Naphta	277.9	69,300	60.0%	0.416	115,545.0
	Wind	0.0	0	0.0%	0.000	0.0
	Waste	39.2	73,300	41.5%	0.636	24,930.6
	Total / Overall	53,027.2			0.416	22,044,246.2
Justification of choice of data or description of measurement methods and procedures applied	Power plant and/or fuel type specific of net energy conversion efficiencies are impossible or very hard to find. Hence, the data available for imported coal using power plants from a panel conducted at the alumni association of a technical university (Middle East Technical University) were used. For the other fuel types, default efficiency factors for power plants in Appendix 1 of the Tool were selected taking the conservativeness rule into account.					
Purpose of Data	Calculation of baseline emissions.					
Comments	-					

Data Parameter /	CAP _{BM}
Data unit	Power Plant Name, Installed Capacity [MW], Electricity Generation [GWh], Commissioning Date [YYYY-MM-DD]
Description	Capacity additions forming the sample group of power units used to calculate the build margin.
Source of data	TEIAS (Turkish Electricity Transmission Company) Capacity Projection Reports and Ministry of Energy and Natural Resources of Republic of Turkey Energy Investment Data. Operational power plants at the end of 2012 were selected as the reference group.

No	Fuel Source	POWER PLANT NAME	Installed Capacity MW	Firm Generation Capacity (year 2012) GWh	Commissioning Date	Location (Province)	Retrofit Type
1	NG	AKBAŞLAR	3.960	30.06	2003-09-13	Bursa	FS from FO to NG
2	NG	AMYLUM NİŞASTA (Adana)	6.200	34.69		Adana	FS from FO to NG
3	NG	DENİZLİ ÇİMENTO	14.000	113.00	2006-05-04	Denizli	FS from FO to NG
4	NG	ISPARTA MENSUCAT	4.300	33.00		Isparta	FS from FO to NG
5	NG	PAKGIDA (Düzce-Köseköy)	4.800	38.26		Duzce	FS from LPG to NG
6	NG	PAKMAYA (Köseköy)	4.800	38.26		Kocaeli	FS from LPG to NG
7	NG	PAKMAYA (Köseköy)	2.100	16.74	2003-07-02	Kocaeli	FS from LPG to NG
8	NG	KAREGE ARGES	26.280	209.09	2003-07-30	Izmir	FS from FO to NG
GENERAL TOTAL			66.4	513.1			

Abbreviations: FS: Fuel Switch, NG: Natural Gas, FO: Fuel Oil, LPG: Liquefied Petroleum Gas

4.2 Data and Parameters Monitored

Data / Parameter	EG_{facility,y}
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y.
Source of data	The data from the Electricity Meters are the basis for the settlement notification of EPIAŞ. Data are gathered electronically from the meters by TEIAS and stored in secured website of EPIAŞ, which is accessible to project developer with a private password. For monitoring, web screenshots of PMUM are used as source of data.
Description of measurement methods and procedures to be applied	Quantity of net electricity generation supplied by the project plant to the grid in year y
Frequency of monitoring/recording	Unless otherwise enforced by the law, or stated in the monitoring reports, the monitoring will be done on a monthly basis.
Value monitored	680,788.39 MWh. (The details for the recorded data within this monitoring period is provided in APPENDIX 1: Monthly Electricity Generation Data.)
Monitoring equipment	Regarding the electricity meters: two meters will be placed (one main and one reserve). The fact that two meters are installed in a redundant manner keeps the uncertainty level of the only parameter for baseline calculation low. High data quality of this parameter is in the interest of not only the emission reduction monitoring, but also paramount for the business relation between the plant operator and the electricity buyer. On the last day of each month, the production index will be taken from the main as well as the reserve meter by EPIAŞ (a state institution responsible for electricity market settlement operations) via Automatic Meter Reading System (OSOS). In following month, EPIAŞ issue electricity

	generation records for each generation unit that can be accessed by plant operators via logging to secured website. These records are used to monitor net monthly generation of the power plant. For each month, the net electricity amount supplied to the grid will be calculated by electricity fed into grid minus electricity withdrawn from the grid available in EPIAŞ records. However, as of 01/09/2015, EPIAS took over the PMUM procedures from TEIAS. After that date, EPIAS will supply the PMUM data. This means that the main source is the EPIAS data. TEIAS notices are used to cross-check the EPIAŞ records. TEIAS sends an electronic spreadsheet that includes daily and monthly electricity generation and withdrawn amounts for each power plant. Thus, cross-check source is the TEIAS meter readings. Since the meters are reading electricity supplied to the system and withdrawn from the system separately, the net electricity amount supplied to the grid will be calculated by electricity supplied minus electricity withdrawn. Thus, with this procedure, monitoring is sufficient and no extra monitoring has to be implemented. The above described measurement method follows Article 81 of the official regulation "Electricity Market Balancing and Settlement Regulation". The specification of electricity meters is provided in Table 2.
QA/QC procedures to be applied	The calibration of the monitoring equipment was carried out according to the information provided in the GS-VER PDD. Technicians, employees of Ayen Enerji conduct readings

	from two meters from the project site and sends it to TEİAŞ. By this way, a cross-check is done. Moreover, continuously these two meters are compared with each other and if any differences are detected the necessary control measures are taken. According to the Article 2 of the Communiqué: 'The meters to be used in the electricity market shall be compliant with the standards of Turkish Standards Institute or IEC and have obtained "Type and System Approval" certificate from the Ministry of Trade and Industry.' Therefore, Ministry of Trade and Industry (Ministry) is responsible from control and calibration of the meters. paragraph b) of the Article 9 of the 'Regulation of Metering and Testing of Metering Systems' 7 (Regulation) of Ministry states that: ' b) Periodic tests of meters of electricity, water, coal gas, natural gas and current and voltage transformers are done every 10 years' . Therefore, periodic calibration of the meters will be done every 10 years.
Purpose of the data	Calculation of baseline emissions
Calculation method	The net electricity is calculated by: a) Subtracting self-consumption value from gross generation value for each month to find the net electricity supplied to the grid. b) Adding up all monthly net electricity values to calculate the total net electricity supplied to the grid during the monitoring period. c) Multiplying the total net electricity value with the CM emission factor.
Comments	-

4.3 Monitoring Plan

Monitoring will be done according to the methodology "ACM0002: Grid-connected electricity generation from renewable sources --- Version 14.0.0". As per the methodology,

all data collected as part of monitoring has been archived electronically and kept at least for two years after the end of the last crediting period. All measurements have been conducted with calibrated measurement equipment according to relevant industry standards.

There is no sampling procedures and all the data related with the electricity measurements will be used for monitoring purposes.

At the end of each month, the data about the electricity measurements from EPIAŞ has been collected from the official web site after it has become definite. This data will be copied to spreadsheets to make the calculations easier. The web pages containing the relevant data will be saved as screenshots and/or in suitable file formats and be kept for future reference. The monthly electricity meter reading protocols signed by authorized TEİAŞ officials has also been kept, if these are available. This procedure has been applied monthly, too.

The collected data will be kept by Ayen Enerji during the crediting period and until two years after the last issuance of VERs for the Büyükdüz HEPP activity for that crediting period. Given a data vintage based on ex ante monitoring and selection of a renewable 7-year crediting period, the Combined Margin will be recalculated at any renewal of the crediting period using the valid baseline methodology.

Potential leakage emissions in the context of power sector projects are emissions arising due to activities such as power plant construction, fuel handling and land inundation. However, according to the methodology, those emission sources are treated as negligible.

An approximately 6-year period has been monitored for the first verification of Büyükdüz HEPP. All the documents collected monthly have been compiled and an emission reduction calculation spreadsheet has been prepared to show the actual results of the emission reductions of the corresponding verification period.

Moreover, there are always internal reviews of the meters data that is checked by different parties. First, data of the meters is collected by technicians daily in written forms. The data collected daily is saved in plant manager computer and backed up. Besides the data that can be get from meters, production amount can be checked from the SCADA system. SCADA figures differ a bit with meter data due to internal losses.

4.3.1 Operational and Management Structure

As described before, there are two main factors important for the calculation of emission reductions. The only relevant data that have to be monitored is only net electricity generation ($EG_{\text{facility},y}$) per year. Since project emission is zero no additional monitoring is required. The generation data are subject to the strict internal quality control systems of both parties. The monthly meter reading documents are stored by Büyükdüz HEPP and TEİAŞ. The settlement notification, which is issued by TEİAŞ and includes the meter reading data, is stored on a TEİAŞ file server and accessible for Büyükdüz via a secured website. The meters themselves can always be read as plausibility check for verification. The other important parameter is the emission factor. It is approved according to strict quality control parameters from an independent external party. With this, no additional structures or processes have to be implemented to insure the availability and high quality of the necessary data for monitoring.

At the end of each monitoring period, from the monthly meter reading records the net electricity generation amounts as calculated by electricity supplied to the grid minus withdrawn from the system is added up to the yearly net electricity generation and total project emissions is subtracted from this amount and result data is multiplied with the combined margin emission factor with the help of an excel spread sheet that also contains the combined margin calculation. Thus, the complete baseline approach is always transparent and traceable. For the elaboration and quality assurance of the monitoring report, Life Enerji, an expert in the project mechanisms who already supported in the project design, is assigned. However, in order to continue improving the monitoring procedures and therefore also the future monitoring reports, internal quality check shall be fulfilled by Life Enerji. The monitoring reports are checked and in cases of mistakes and inconsistencies in the monitoring report, revisions with improvements shall be done. Furthermore, external year verification assures that the emission reductions calculations are transparent and traceable.

There are 26 employees within Büyükdüz HEPP covering this monitoring period. 16 of them are responsible for conducting maintenance and operations tasks. Also, 5 workers have been assigned for security and 3 workers for service tasks. All these workers from maintenance & operation, security and service departments are reporting to two administrative employees. The list of employees and their departments are provided by Table 4 whereas the overall operational flow is provided via Figure 3.

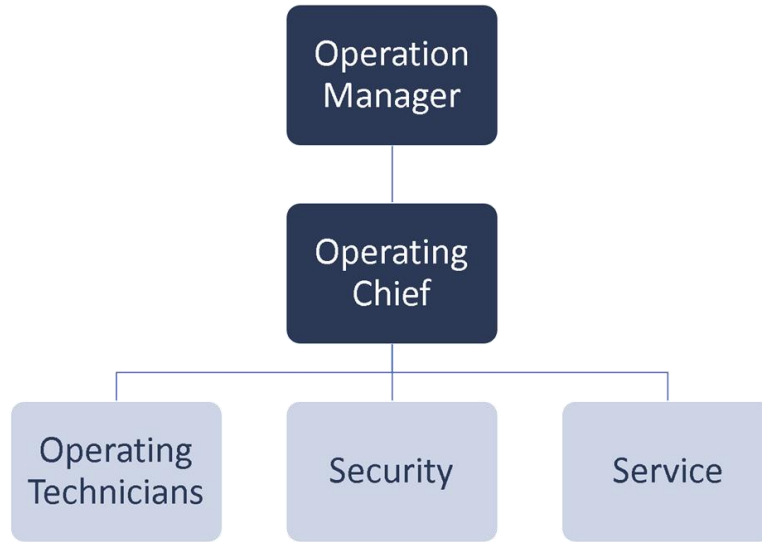


Figure 3. The Operational Flow of Büyükdüz HEPP

Table 4. List of Employees

Employee	Department
KORKUT İSKENDER	Manager
FATİH YAHYA HACIAHMETOĞLU	Operation Chief
SİNAN GÜMRÜKÇÜ	Manager
TAYFUR İBİŞOĞLU	Maintenance & Operation
AYHAN (TAYFUN) GÜMRÜKÇÜ	Maintenance & Operation
HASAN İSKENDER	Service
OZAN ÖZDEMİR	Maintenance & Operation
AYHAN SEYİS	Maintenance & Operation
TOLGA DURUM	Maintenance & Operation
HAKAN KOCA	Maintenance & Operation
EMİR KAHVECİ	Maintenance & Operation
AYHAN GÜMRÜKÇÜ	Maintenance & Operation
ÇETİN YILMAZ	Maintenance & Operation

Employee	Department
İSMAİL SARI	Maintenance & Operation
SÜLEYMAN İSKENDER	Maintenance & Operation
ZEYDİ VURAL	Service
ZAFER ÖZEN	Service
SERDAR COŞKUN	Maintenance & Operation
SONER GÜMRÜKÇÜ	Maintenance & Operation
TUNCER NARİN	Maintenance & Operation
CEMİL ATALAY	Security
HALİL OLGUN	Security
ÖZCAN BAYRAM	Security
YAVUZ BAHADIR	Security
ALİ KARAKAŞ	Security
SONER ARAZ	Security

Büyükdüz HEPP keeps all the data needed for the calculation of emission reductions during the crediting period and until two years after the last issuance of GS VERs for Büyükdüz HEPP.

Because of the data acquisition and management and quality assurance procedures that are anyway in place, no additional procedures have to be established for the monitoring plan. Dedicated emergency procedures are not provided, as there is no possibility of overstating emission reductions due to emergency cases.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline scenario is identified according to the “Baseline Methodology Procedure” of ACM0002 Version 14¹². Baseline emissions include only CO₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated via the following formulae:

$$BE_y = E_{PJ,y} \times EF_{grid,CM,y}$$

Where:

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

The calculation of $E_{PJ,y}$ is different for Greenfield plants, retrofits and replacements; and capacity additions. If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$BE_y = E_{PJ,y}$$

Where:

$E_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
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¹² Please visit [the methodology](#).

$EF_{\text{facility},y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

The Combined margin CO₂ emissions factor in year y (tCO₂/MWh), $EF_{\text{grid},CM,y}$ is fixed ex-ante for the duration of the crediting period, and is 0.535 tCO₂e/MWh.

The following table shows the original data as reported in the monthly meter reading records:

Table 5: Baseline Emissions (31/05/2012-31/10/2017)

Months	A- Gross Electricity Production (MWh)	B-Internal Consumption (MWh)	C-Net Electricity Production (MWh) (A-B)	Baseline Emissions (tCO ₂ e)
31-May-12	-	25.32	- 25.32	- 14
Jun-12	34,523.14	10.24	34,512.90	18,464
Jul-12	9,121.54	34.31	9,087.23	4,862
Aug-12	4,051.83	41.43	4,010.40	2,146
Sep-12	1,567.80	42.19	1,525.62	816
Oct-12	1,969.19	42.52	1,926.67	1,031
Nov-12	7,842.50	32.67	7,809.82	4,178
Dec-12	5,733.18	49.73	5,683.45	3,041
Sum 2012	64,809.17	278.41	64,530.76	34,523
Jan-13	3,840.99	72.38	3,768.61	2,016
Feb-13	3,121.31	45.68	3,075.63	1,645
Mar-13	18,076.45	38.98	18,037.47	9,650
Apr-13	25,812.60	16.44	25,796.15	13,801
May-13	42,941.46	4.23	42,937.23	22,971
Jun-13	21,223.74	21.68	21,202.06	11,343
Jul-13	6,534.11	37.32	6,496.79	3,476
Aug-13	1,527.46	48.03	1,479.43	791

Sep-13	1,250.69	45.86	1,204.84	645
Oct-13	4,480.99	34.57	4,446.42	2,379
Nov-13	2,321.97	48.94	2,273.03	1,216
Dec-13	1,375.51	67.85	1,307.66	700
Sum 2013	132,507.28	481.95	132,025.33	70,633
Jan-14	1,013.84	64.76	949.08	508
Feb-14	1,397.31	55.95	1,341.37	718
Mar-14	5,390.79	45.79	5,345.00	2,860
Apr-14	19,902.46	23.21	19,879.25	10,635
May-14	38,995.29	9.24	38,986.05	20,858
Jun-14	18,503.89	26.45	18,477.44	9,885
Jul-14	4,138.26	39.77	4,098.49	2,193
Aug-14	1,494.72	43.89	1,450.83	776
Sep-14	2,278.99	42.69	2,236.30	1,196
Oct-14	8,109.70	34.79	8,074.91	4,320
Nov-14	8,363.72	30.27	8,333.46	4,458
Dec-14	8,252.22	39.18	8,213.04	4,394
Sum 2014	117,841.18	455.98	117,385.20	62,801
Jan-15	3,632.45	61.60	3,570.84	1,910
Feb-15	3,298.72	58.80	3,239.92	1,733
Mar-15	9,462.03	50.34	9,411.69	5,035
Apr-15	15,323.19	36.78	15,286.41	8,178
May-15	4,272.28	48.42	4,223.87	2,260
Jun-15	22,146.50	24.85	22,121.65	11,835
Jul-15	12,720.53	31.35	12,689.18	6,789
Aug-15	2,790.64	43.47	2,747.17	1,470

Sep-15	1,312.05	41.56	1,270.49	680
Oct-15	2,419.84	40.65	2,379.19	1,273
Nov-15	5,223.43	41.14	5,182.29	2,773
Dec-15	3,735.79	57.28	3,678.51	1,968
Sum 2015	86,337.43	536.24	85,801.20	45,903
Jan-16	3,868.59	62.67	3,805.92	2,036
Feb-16	10,010.28	47.01	9,963.27	5,330
Mar-16	14,279.75	32.74	14,247.00	7,622
Apr-16	33,358.21	8.43	33,349.78	17,842
May-16	38,759.12	8.04	38,751.08	20,732
Jun-16	36,396.19	3.22	36,392.97	19,470
Jul-16	12,936.79	25.71	12,911.07	6,907
Aug-16	3,723.77	43.25	3,680.52	1,969
Sep-16	2,191.82	45.80	2,146.01	1,148
Oct-16	1,606.33	49.66	1,556.67	833
Nov-16	1,105.68	55.31	1,050.37	562
Dec-16	1,110.65	67.07	1,043.58	558
Sum 2016	159,347.15	448.92	158,898.23	85,010
Jan-17	1,309.75	66.26	1,243.49	665
Feb-17	1,185.72	60.26	1,125.46	602
Mar-17	6,647.62	49.61	6,598.01	3,530
Apr-17	24,979.79	15.83	24,963.95	13,356
May-17	47,496.95	0.29	47,496.66	25,411
Jun-17	29,405.52	1.74	29,403.78	15,731
Jul-17	6,889.76	36.85	6,852.92	3,666
Aug-17	1,798.96	44.76	1,754.20	938

Sep-17	627.18	46.65	580.53	311
Oct-17	2,179.00	50.32	2,128.67	1,139
Sum 2017	122,520.24	372.57	122,147.67	65,349
Total Sum (31/05/2012- 31/10/2017)	683,362.45	2,574.07	680,788.39	364,219

5.2 Project Emissions

The project activity involves no emissions, except from a diesel generator used for emergency backup purposes. The possible emissions from the use of fossil fuels for the back up or emergency purposes by the operation of this diesel generator are neglected according to the methodology¹³.

The power density (PD) for the Büyükdüz HEPP is calculated according to the directions given in the methodology¹⁴:

$$PD(W/m^2) = \frac{\text{Installed Capacity}}{\text{Reservoir Surface Area}}$$

$$PD (W/m^2) = \frac{68,862,000}{80,766}$$

Neither the installed capacity nor the surface area has not changed since the registration, project's power density stay constant as given in the PD.

5.3 Leakage

Leakage emissions are neglected and assumed as zero as per the Methodology.¹⁵

¹³ Please visit [the methodology](#): Section 5.4.1. Fossil fuel combustion (PEFF,y), Paragraph 32, page 11.

¹⁴ Please visit [the methodology](#) (paragraph 37, pages 12-13).

¹⁵ Please visit [the methodology](#): Section 5.6 Leakage, Paragraph 53, page 17.

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2012 (31/05-31/12))	34,523	0	0	34,523
2013	70,633	0	0	70,633
2014	62,801	0	0	62,801
2015	45,903	0	0	45,903
2016	85,010	0	0	85,010
2017(31/01/2017-31/10/2017)	65,349	0	0	65,349
Total	364,219	0	0	364,219

APPENDIX 1: Monthly Electricity Generation Data

There are two main and two back-up electricity meters in the plant. The below data reflects the aggregation of the overall electricity generation.

Months	METERING DEVICE Electricity supplied to the grid (MWh) (1)	METERING DEVICE Electricity consumption from the grid (MWh) (2)	METERING DEVICE Net electricity supplied to the grid[MWh] (3) =(1)- (2)
31-May-12	-	25.32	- 25.32
Jun-12	34,523.14	10.24	34,512.90
Jul-12	9,121.54	34.31	9,087.23
Aug-12	4,051.83	41.43	4,010.40
Sep-12	1,567.80	42.19	1,525.62
Oct-12	1,969.19	42.52	1,926.67
Nov-12	7,842.50	32.67	7,809.82
Dec-12	5,733.18	49.73	5,683.45
Sum 2012	64,809.17	278.41	64,530.76
Jan-13	3,840.99	72.38	3,768.61
Feb-13	3,121.31	45.68	3,075.63
Mar-13	18,076.45	38.98	18,037.47
Apr-13		16.44	25,796.15

Months	METERING DEVICE Electricity supplied to the grid (MWh) (1)	METERING DEVICE Electricity consumption from the grid (MWh) (2)	METERING DEVICE Net electricity supplied to the grid[MWh] (3) =(1)- (2)
	25,812.60		
May-13	42,941.46	4.23	42,937.23
Jun-13	21,223.74	21.68	21,202.06
Jul-13	6,534.11	37.32	6,496.79
Aug-13	1,527.46	48.03	1,479.43
Sep-13	1,250.69	45.86	1,204.84
Oct-13	4,480.99	34.57	4,446.42
Nov-13	2,321.97	48.94	2,273.03
Dec-13	1,375.51	67.85	1,307.66
Sum 2013	132,507.28	481.95	132,025.33
Jan-14	1,013.84	64.76	949.08
Feb-14	1,397.31	55.95	1,341.37
Mar-14	5,390.79	45.79	5,345.00
Apr-14	19,902.46	23.21	19,879.25
May-14	38,995.29	9.24	38,986.05
Jun-14	18,503.89	26.45	18,477.44
Jul-14	4,138.26	39.77	4,098.49

Months	METERING DEVICE Electricity supplied to the grid (MWh) (1)	METERING DEVICE Electricity consumption from the grid (MWh) (2)	METERING DEVICE Net electricity supplied to the grid[MWh] (3) =(1)- (2)
Aug-14	1,494.72	43.89	1,450.83
Sep-14	2,278.99	42.69	2,236.30
Oct-14	8,109.70	34.79	8,074.91
Nov-14	8,363.72	30.27	8,333.46
Dec-14	8,252.22	39.18	8,213.04
Sum 2014	117,841.18	455.98	117,385.20
Jan-15	3,632.45	61.60	3,570.84
Feb-15	3,298.72	58.80	3,239.92
Mar-15	9,462.03	50.34	9,411.69
Apr-15	15,323.19	36.78	15,286.41
May-15	4,272.28	48.42	4,223.87
Jun-15	22,146.50	24.85	22,121.65
Jul-15	12,720.53	31.35	12,689.18
Aug-15	2,790.64	43.47	2,747.17
Sep-15	1,312.05	41.56	1,270.49
Oct-15	2,419.84	40.65	2,379.19
Nov-15		41.14	5,182.29

Months	METERING DEVICE Electricity supplied to the grid (MWh) (1)	METERING DEVICE Electricity consumption from the grid (MWh) (2)	METERING DEVICE Net electricity supplied to the grid[MWh] (3) =(1)- (2)
	5,223.43		
Dec-15	3,735.79	57.28	3,678.51
Sum 2015	86,337.43	536.24	85,801.20
Jan-16	3,868.59	62.67	3,805.92
Feb-16	10,010.28	47.01	9,963.27
Mar-16	14,279.75	32.74	14,247.00
Apr-16	33,358.21	8.43	33,349.78
May-16	38,759.12	8.04	38,751.08
Jun-16	36,396.19	3.22	36,392.97
Jul-16	12,936.79	25.71	12,911.07
Aug-16	3,723.77	43.25	3,680.52
Sep-16	2,191.82	45.80	2,146.01
Oct-16	1,606.33	49.66	1,556.67
Nov-16	1,105.68	55.31	1,050.37
Dec-16	1,110.65	67.07	1,043.58
Sum 2016	159,347.15	448.92	158,898.23
Jan-17	1,309.75	66.26	1,243.49

Months	METERING DEVICE Electricity supplied to the grid (MWh) (1)	METERING DEVICE Electricity consumption from the grid (MWh) (2)	METERING DEVICE Net electricity supplied to the grid[MWh] (3) =(1)- (2)
Feb-17	1,185.72	60.26	1,125.46
Mar-17	6,647.62	49.61	6,598.01
Apr-17	24,979.79	15.83	24,963.95
May-17	47,496.95	0.29	47,496.66
Jun-17	29,405.52	1.74	29,403.78
Jul-17	6,889.76	36.85	6,852.92
Aug-17	1,798.96	44.76	1,754.20
Sep-17	627.18	46.65	580.53
Oct-17	2,179.00	50.32	2,128.67
Sum 2017	122,520.24	372.57	122,147.67
Total Sum (31/05/2012- 31/10/2017)	683,362.45	2,574.07	680,788.39