BATISOKE SOKE CIMENTO SANAYII T.A.Ş. 5.5 MW CEMENT WHR PROJECT

Document Prepared By FutureCamp

Project Title	BATISOKE Soke Çimento Sanayii T.A.Ş. 5.5 MW Cement WHR Project
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Contact	Address: Çetin Emeç Bulvarı 19/18 Çankaya/Ankara e-mail: info@futurecamp.com.tr phone:0090 312 481 21 42 fax: 0090 312 480 88 10

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The project shall be staged at line 2 of BATISOKE Soke cement plant which started clinker production in 1966. The capacity of line 2 is 2,100 t of clinker per day.

The project shall implement a 5.5 MW waste heat recovery solution at BATISOKE Soke cement plant. It entails the installation of

- One 5.5 MW turbine
- One 6 MW generator
- One AQC boiler
- One SP boiler

AQC boiler will be installed next to the kiln head of the cement line, producing superheated steam and hot water, and a dedusting chamber will be set up to alleviate the boiler abrasion

SP boiler will be connected to the pre-heater exit, producing a superheated steam.

For AQC boiler, the heat-receiving surface of the boiler is divided into three stages: The first stage is main superheated steam stage, and the second stage is low pressure superheated steam stage, and the third stage is hot water stage.

For SP boiler, the heat-receiving surface of the boiler is divided into two stages: The first stage is main superheated steam stage, and the second stage is low pressure superheated steam stage.

Water after being deaerated is pumped to AQC boiler second and third stage, and also SP boiler second stage. The outgoing hot water from AQC third stage is used as feed water of AQC boiler second stage and SP boiler first stage. The superheated steam produced in AQC boiler first stage and SP boiler second stage merge together and then is introduced to the turbine main stream inlet. At the same time, the low pressure superheated steam produced in AQC boiler second stage and SP boiler second stage merge together, and then is introduced to the turbine supplement inlet. The main stream and low pressure steam is used to promote the turbine for power generation. Exhaust steam of turbine after work is condensed to water, and then pumped to a deaerator, thus a complete thermodynamic circulation system forms.

1.2 Sectoral Scope and Project Type

The project applies a CDM EB-approved methodology and related tools in their latest version. The CDM program is a VCS approved program. The respective CDM sectoral scopes are scope 01 (Energy industries) – and scope 04 (Manufacturing industries).

The project is not a grouped project.

1.3 Project Proponent

The VCS project proponent is BATISOKE Soke ANADOLU CIMENTO CO. Ltd (short: Batı-Soke). Batı-Soke is involved in the engineering tasks of the project and also responsible party for the management of the VER project. The following directions apply:

Table 1-1: Project Contact Data – Batı-soke

Organization:	Batısoke Soke Çimento San. T.A.Ş.
Street/P.O.Box:	Atatürk Mah. Aydın Cad.
Building:	No:234 Soke
City:	Aydın
State/Region:	Aydın
Postcode/ZIP:	09200
Country:	Turkey
Direct FAX:	0256 518 11 23
Direct tel:	0256 518 22 50/ 367
Personal e-mail:	celalsargut@batisoke.com.tr

1.4 Other Entities Involved in the Project

The project documentation at hand was defined by Batı-Soke in cooperation with FutureCamp Türkiye (PD consultancy).

Table 1-2: Project Contact Data – FC-T

Organization:	FutureCamp Türkiye
Street/P.O.Box:	Çetin Emeç Bulvarı 19/18
City:	Ankara
State/Region:	Ankara
Postcode/ZIP:	06460
Country:	Turkey
Personal Contact:	Engin MERT
Direct FAX:	0090 312 480 88 10
Direct tel:	0090 312 481 21 42
Personal e-mail:	info@futurecamp.com.tr

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1.5 Project Start Date

The anticipated project start date is 20st of May 2012.

1.6 Project Crediting Period

A once renewable crediting period of 10 years shall apply. The project shall remain operational for at least 20 years. This is consistent with the project equipment supplier's indication of the equipment lifetime (25[1] years). First verifiable emission reductions shall be achieved in May 2012. Thus the first crediting period shall last from 20st of May 2012 until 19th of May 2022.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project	X
Mega-project	

[1] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf, Page 4

Table 1-3: Emission reduction volume during first crediting period

Years	Estimated GHG emission reductions or removals (tCO2e)
2012*	10,394
2013	16,993
2014	16,993
2015	16,993
2016	16,993
2017	16,993
2018	16,993
2019	16,993
2020	16,993
2021	16,993
2022**	6,599
Total estimated ERs	“169,930
Total number of crediting years	10
Average annual ERs	16,993

* from 20th of May 2012
** till 19th of May 2022

1.8 Description of the Project Activity

The proposed WHR system will efficiently utilize the waste heat from the clinker production process to generate electricity. The project developer plans to install one captive power stations (5.5 MW), based on waste heat recovery. The steam generated from the boilers will be sent to a turbine that feeds a generator for electricity production. Lifetime of the project is 20 years.

The generated electricity will be consumed within the plant only, thereby substituting electricity for cement production that would otherwise be purchased from the Turkish power grid.

The project will thus lead to indirect reduction of CO_2 emission via reduced plant electricity consumption. The volume of this reduction is defined by the plants net electricity generation (32,620 MWh) and the respective grid emission factor of the Turkish power grid. . The figure is calculated by multiplying average power-self consumption of the system (%6.8[2]) by annual electricity generation (35,000,000[3] kWh).

1.9 Project Location

The cement production plant BATISOKE Soke of BATISOKE Soke CIMENTO CO. Ltd. is located in Soke district of Aydın province.

The exact address is:
Atatürk Mahallesi Aydın Caddesi No:234
Soke / AYDIN, Turkey

[2] Efficiency Table Document

[3] Estimated Amount reference will be provided soon

GPS coordinates of the plant:
Lat: 37° 46’ 13’’ N
Lon: 27° 26’ 00’’ E

The following figures give an overview of the location on different levels (national, municipal, plant level).

Figure 1-1: Location of the plant in Turkey

Figure 1-2: Location of the plant in Soke (marked: BATISOKE)

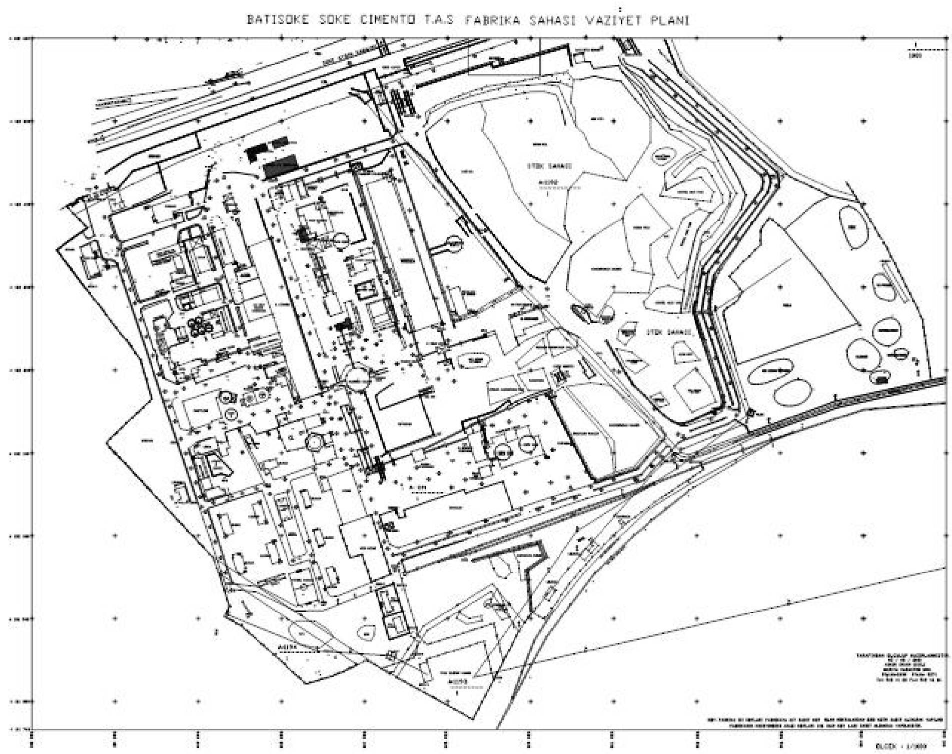

Figure 1-3: Overview of the plant[4]

[4] More detailed drawing will be provided to the DOE.

1.10 Conditions Prior to Project Initiation

Clinker/cement is an indispensable ingredient in modern construction. Clinker is manufactured by combining a homogenous blend of carefully proportioned raw materials (chalk and clay/shale) at a very high temperature (1400 ºC) in a rotary kiln. The raw materials fuse together to form a hard granular material, called clinker. To make cement, clinker is ground to a powder along with gypsum.

By altering the chemistry of the raw material and selecting specific materials for grinding alongside the clinker and gypsum, different types of cement can be made with properties suited to their intended use.

The industry process of cement production is highly energy intensive. In a conventional plant like BATISOKE-SOKE plant, the substantial energy content from the waste heat is not energetically utilized but lost. This substantial energy loss occurs at the pre-heater stage (where exhaust gasses from the heaters are cooled and waste heat is vented into the atmosphere) and during the cooling of clinker product at the air quenching coolers (AQC stage).

The status quo prior to the project initiation at BATISOKE-SOKE plant fits to the above described situation of a conventional plant with no heat recovery and respective heat energy losses. The waste heat figures for the two lines are as follows:

Table 1-4: Waste heat data

SP stage	Volume of the hot air	133,000 Nm^3/h
	T inlet	380 ℃
	T outlet	170 ℃
	Quantity	1
AQC stage	Volume of the hot air	166,000 Nm^3/h
	T inlet	352 ℃
	T outlet	106 ℃
	Quantity	1

Equipment supplier of the project is Sinoma Energy Conservation Ltd. this is located in P.R. China. Also technical data of the equipments can be seen below;

Table 1-5 Technical Data of the Equipments

	Efficiencies (%)
AQC Boiler	75.80%
SP Boiler	50.10%
Turbine	80.5%
Generator	97%

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

Laws as relevant to the project are (Law No. and Enactment Date):

(1) Electricity Market Law[5] (Nr. 4628 / 03.03.2001)

(2) Electricity Market License Regulations (11.08.2011)[6]

[5] See: http://www.epdk.gov.tr/documents/10157/351a7a0c-52a9-40d5-8e12-f8e61afe7247

(4) Environment Law[7] (Nr. 2872 / 16.12.2003) – for results of the Environmental Impact Assessment please see also section 5.

(5) Occupational Health and Safety Regulation[8] (Nr. 25311, 09.12.2003)

1.12 Ownership and Other Programs

1.12.1 Proof of Title

BATISOKE-SOKE plant is a project by BATISOKE SOKE CIMENTO CO. Ltd.

Respective documentation regarding the ownership will be available at validation.

1.12.2 Emissions Trading Programs and Other Binding Limits

Not applicable: The project activity is neither included in an emissions trading program nor does it take place in a jurisdiction or sector in which binding limits are established on GHG emissions.

1.12.3 Participation under Other GHG Programs

The project does not participate/has not participated under any other GHG program.

1.12.4 Other Forms of Environmental Credit

The project has not created any form of other credit. Batısoke does not obtain any public funding.

1.12.5 Projects Rejected by Other GHG Programs

Batısoke WHR has not applied for crediting under any other GHG program nor has it been rejected from any other GHG program.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

Not applicable.

Leakage Management

Not applicable.

Commercially Sensitive Information

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[6] http://www.epdk.gov.tr/documents/10157/4282ee6d-0518-4e82-be91-8303f682569d

[7] See: http://www2.cevreorman.gov.tr/yasa/k/2872.doc

[8] See: http://www.alomaliye.com/issagligi_guvenligi_yonetmeligi.htm

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

/FAD/ Financial analysis documentation

Further Information

Not applicable.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

The project at hand applies CDM-EB approved consolidated baseline and monitoring methodology ACM0012, Version 04.0.0, “Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects”.

Also along ACM0012 requirements, five CDM EB-approved methodological tools shall be applied. As per project design, three of those are relevant to the project at hand, i.e.

- “Tool to calculate the emission factor for an electricity system”, Version 02.1.0;
- “Tool for demonstration and assessment of additionality”, Version 05.2;
- “Tool to determine the remaining lifetime of equipment, Version 01.

2.2 Applicability of Methodology

In the following applicability discussion, only ACM0012 requirements that apply to the project installation design shall be discussed. Thus all requirements for different waste heat recovery modes or utilization purposes other than in the project case (e.g. waste pressure utilization) are not further considered.

The project is applicable as respective applicability requirements set by ACM0012 are fulfilled:

(1) The project recovers and utilizes waste heat at an existing facility for the generation of electricity, while in the absence of the project activity all waste gas would continue to be released to the atmosphere.

(2) There are no regulations that require the project facility to recover and/or utilize the waste energy prior to the implementation of the project activity.

(3) It is guaranteed that energy that is released under abnormal operation of the project facility (for example emergencies or shut downs) shall not be included in the emission reduction calculations.

(4) The extent of use of waste energy from the waste energy generation facilities in the absence of the VCS project activity will be determined in accordance with the procedures provided in Annex 2 (for existing project facilities) to this methodology.

(5) Applicability conditions of the Tools (see section 2.1 above) are considered.

2.3 Project Boundary

The generated power from the waste heat recovery shall substitute the plant utilization of conventional electricity from the local grid. The spatial boundary of the project is illustrated in figures 2-1 and 2-2 below. It includes the relevant WECM stream(s), equipment and energy distribution system in the following two facilities:

The "project facility"

- Cement production facility including waste heat exhausts at SP and AQC stages (facility where waste energy accrues)
- Waste heat utilization equipment, including two waste heat recovery boilers (SP and AQC), steam turbine/generator unit and auxiliary devices such as the de-aerator, condenser, water pre-heater and cooling towers (facility where the electricity from waste heat is produced).

The "recipient facility"

- The cement plant as consumer of the generated electricity, including the electricity grid (from where electricity is taken/substituted to feed the power needs of the cement plant).

The spatial extent of the grid is defined in the "Tool to calculate the emission factor for a electricity system".

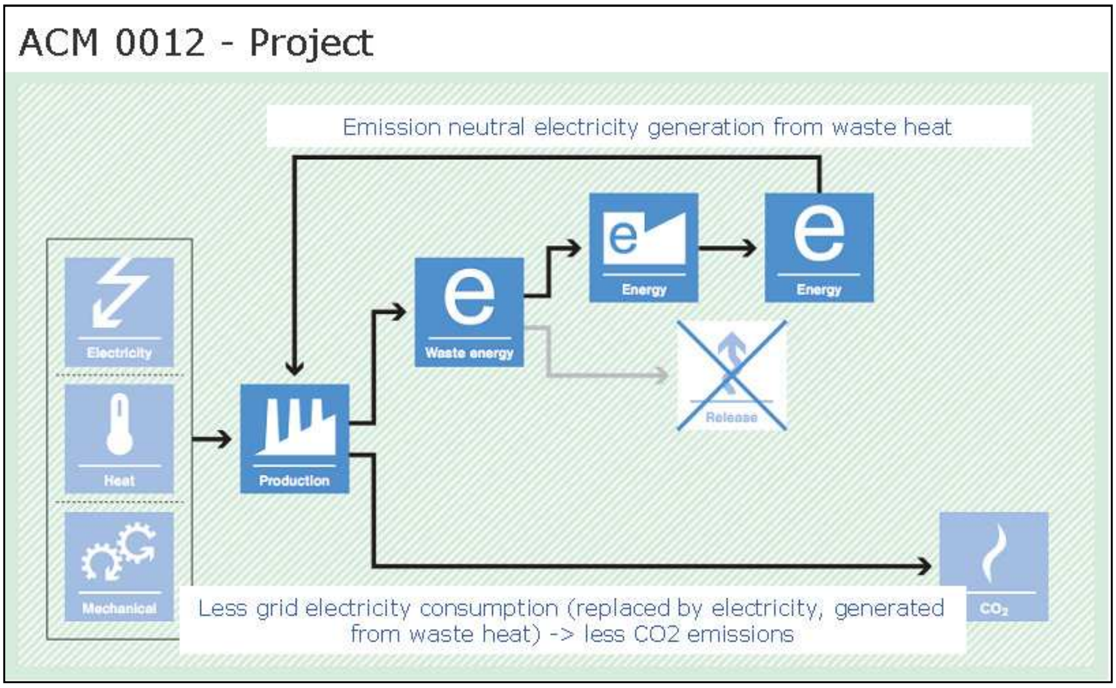

Figure 2-1: ACM0012 project flow-diagram

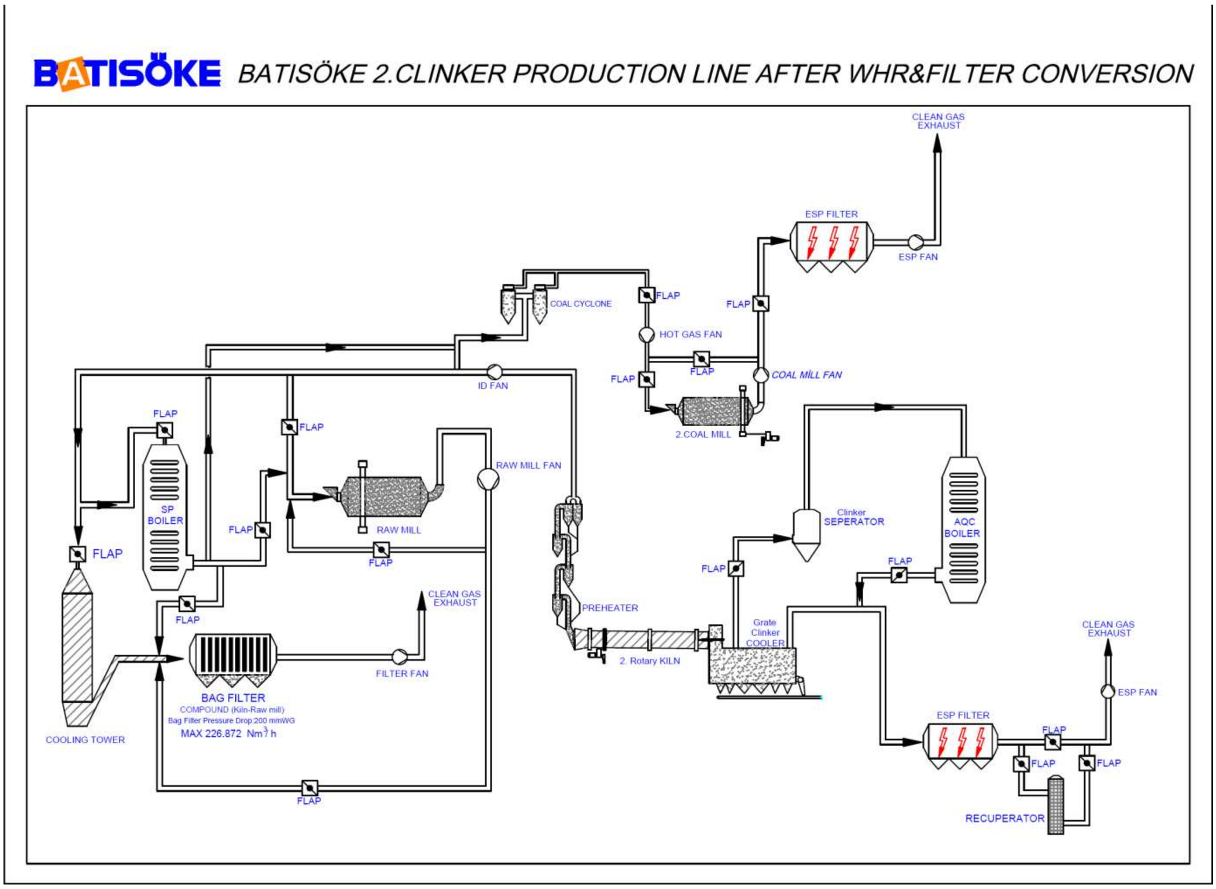

Figure 2-2: Project boundary – energy mass flow diagram

Gases and sources included in the project boundary with justification for inclusion/exclusion are presented in table 2-1 below. Emission sources which are technically not applicable are marked accordingly (n.a.) while discussion of technologically applicable emissions is highlighted.

Table 2-1: Overview of emission sources included or excluded from the project boundary

	Source	Gas	Included?	Justification
Baseline	Electricity generation, grid or captive source	CO2	Included	Main emission source.
		CH4	Excluded	Excluded for simplification. This is conservative.
		N2O	Excluded	Excluded for simplification. This is conservative.
	Fossil fuel consumption in element process for thermal energy	CO2	n.a.	n.a.
		CH4		
		N2O		
	Fossil fuel consumption in cogeneration plant	CO2	n.a.	n.a.
		CH4		
		N2O		
	Generation of steam used in the flaring process, if any	CO2	n.a.	n.a.
		CH4		
		N2O		
	Fossil fuel consumption for supply of process heat and/or reaction heat	CO2	n.a.	n.a.
		CH4		
		N2O		
Project	Supplemental fossil fuel consumption at the	CO2	n.a.	n.a.
		CH4		

	project plant	N_2O		
	Supplemental electricity consumption	CO_2	Included	Main emission source.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Electricity import to replace captive electricity, which was generated using waste gas in absence of project activity	CO_2	n.a.	n.a.
		CH_4		
		N_2O		
	Energy consumption for gas cleaning	CO_2	n.a.	n.a.
		CH_4		
		N_2O		

2.4 Baseline Scenario

The identification of the baseline scenario follows the prescribed 5-step approach of ACM0012. There the baseline scenario is identified as the most plausible baseline scenario among all realistic and credible alternative(s).

Generally applicable as realistic and credible alternatives and thus further analysed here are both

- Waste energy use in the absence of the project activity, and
- Power generation in the absence of the project activity.

The following two alternatives are in the same sense not applicable (as they are incompatible with the plant design):

- Heat generation (process heat and/or heat reaction) in the absence of the project activity for each recipient facility
- Mechanical energy generation in the absence of the project activity for each recipient facility.

In the following, plausible, baseline scenarios is discussed.

Step 1: Define the most plausible baseline scenario for the generation of heat and electricity using the following baseline options and combinations

Sub-step 1a: Scenarios for utilization of waste heat energy

For the use of waste energy, ACM0012 mentions the following scenarios:

W1: WECM is directly vented to the atmosphere without incineration;

W2: WECM is released to the atmosphere (for example after incineration) or waste heat is released (or vented) to the atmosphere or waste pressure energy is not utilized;

W3: Waste energy is sold as an energy source;

W4: Waste energy is used for meeting energy demand at the recipient facility(-ies);

W5: A portion of the quantity or energy of WECM is recovered for generation of heat and/or electricity and/or mechanical energy, while the rest of the waste energy produced at the project facility is flared/released to atmosphere/ unutilised;

W6: All the waste energy produced at the facility is captured and used for export electricity generation or steam.

W1/W2 is applicable: As scenarios W1 and W2 are identical they are discussed here together. They correspond to the current practice at BATISOKE cement plant that is also a feasible scenario to the project activity: The waste heat that is used in the project scenario would be released to the atmosphere.

W3 is not applicable as there is neither demand at a close enough distance nor infrastructure available that would make such utilization economical.

W4 (if interpreted as use of waste heat other than generating power which is discussed below), is not applicable as the cement plant will be self-sufficient in heat in accordance with its design. Such alternative is also not consistent with current practice of cement production facilities in the project area. Alternative W4 is applicable and cannot be rejected to the extent that it implies the use of waste heat for power generation.

W5 is not applicable as it does not make sense to down-scale the WHR installation, thereby making its all-over performance less efficient and also less attractive. Batı-Soke taking risks of this new technology project and not using all available waste energy will increase the risks of the projects. So the purpose of the project is generate electricity from waste heat as much as possible.

W6 is not applicable as the generated electricity will be used in the plant because the amount of generated electricity will not exceed the plant demand so the exportation of electricity won’t be feasible.

Conclusion of step 1a / applicable alternatives are:
W1/W2: WECM is released to the atmosphere;
W4: Waste energy is used for meeting energy demand at the recipient facility(-ies).

Sub-Step 1b: Scenarios for power supply

For power supply, ACM0012 mentions the following scenarios:

- P1: Proposed project activity not undertaken as a CDM project activity;
- P2: On-site or off-site existing fossil fuel fired cogeneration plant;
- P3: On-site or off-site Greenfield fossil fuel fired cogeneration plant;
- P4: On-site or off-site existing renewable energy based cogeneration plant;
- P5: On-site or off-site Greenfield renewable energy based cogeneration plant;
- P6: On-site or off-site existing fossil fuel based captive power plant;
- P7: On-site or off-site existing identified renewable energy or other waste energy based captive power plant;
- P8: On-site or off-site Greenfield fossil fuel based captive plant;
- P9: On-site or off-site Greenfield renewable energy or other waste energy based captive plant;
- P10: Sourced from grid-connected power plants;
- P11: Existing captive electricity generation using waste energy (if the project activity is captive generation using waste energy, this scenario represents captive generation with lower efficiency or lower recovery than the project activity);
- P12: Existing cogeneration using waste energy, but at a lower efficiency or lower recovery.

P1 and P10 are applicable.

P2, P3, P4 and P5 are not applicable as the proposed project activity has no heat supply component (there is no congruence with project scenario output features).

P6, P7 and P11 are not applicable as there is no existing captive power generation involved at the plant.

P8 is not applicable; construction of such a thermal energy power generation facility is technically feasible at the cement plant. However It is economically unfeasible to produce electricity by using fossil fuel instead of available waste energy. For this reason, this alternative is not applicable. In addition, Batı-Soke has made the investment by considering the risks of Whr being a new technology and applied for the first time in Turkey

P9 (renewable Greenfield plant) is not applicable as there are no relevant available sources at the plant/in the vicinity of the plant.[9] For waste energy use, the scenario is – though applicable – identical to scenario P1 and shall be considered there.

P12 is not applicable as there is no existing cogeneration plant.

[9] On-site or close to the plant there are no special natural sources available (e.g. river); there is also no existing other facility with respective waste heat features for tapping; the requirements for permanent electricity supply generally foreclose the construction of a wind warm. In general a renewable energy solution (including biomass) would by far exceed the costs of a thermal power solution and even more so of grid-connected supply (see P10).

Conclusion of step 1b / applicable alternatives are: P1: Proposed project activity not undertaken as a CDM project activity, i.e. waste to electricity generation; P10: Sourced from grid-connected power plants.

Step 1c: Discussion of combinations from sub-steps 1a and 1b as well as overall conclusion:

The matrix below illustrates the possible combinations/baseline scenarios. Of the four combinations, two combinations are applicable (marked with colour) while two other combinations have to be excluded as they are generally incompatible.

	P1	**P10**
W2	Not applicable as P1 and W2 are incompatible.	**Combination scenario 1 (S1) is applicable.** It corresponds to the status-quo situation before WHR project implementation.
W4	**Combination scenario 2 (S2) is applicable.** It corresponds to the project scenario without CDM support, i.e. the captive power generation for substitution of grid-based electricity supply.	Not applicable as P10 and W4 are incompatible.

Step 2: Step 2 and/or Step 3 of the latest approved version of the "Tool for the demonstration and assessment of additionality" shall be used to identify the most plausible baseline scenarios by eliminating non-feasible options (e.g. alternatives where barriers are prohibitive or which are clearly economically unattractive).

After steps 2 and 3 of the additionality tool, only one scenario remains applicable. For these discussions, please refer to PD section 2.5 (assessment and demonstration of additionality) below.

Conclusion of step 2 / only applicable alternative that remains after barrier analysis: S1: Scenario that corresponds to the status-quo situation before WHR project implementation, i.e. all waste energy is vented while electricity supply is provided from the grid.

Step 3: If more than one credible and plausible alternative scenario remain, the alternative with the lowest baseline emissions shall be considered as the baseline scenario

With only one scenario (S1) remaining after barrier discussion, conclusions of step 2 above are valid. The identified scenario is also consistent with table 2 of the methodology/is among the scenarios for which the methodology is applicable (Situation-1 of baseline scenario-1).

2.5 Additionality

For demonstration of additionality, the latest version (version 05.2) of the "Tool for demonstration and assessment of additionality", approved by the CDM Executive Board, is applied.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

For the application of step 1 of the "Tool for demonstration and assessment of additionality", please refer to baseline scenario determination above (2.4), which is consistent with the respective procedure. Accordingly only results from that discussion are reiterated here:

Applicable alternatives are:	
S1 (W2/P10)	**Combination scenario 1 (S1):** It corresponds to the status-quo situation before WHR project implementation.
S2 (W4/P1)	**Combination scenario 2 (S2):** It corresponds to the project scenario without VCS support, i.e. the captive power generation for substitution of grid-based electricity supply.

Step 2: Investment Analysis

Sub-step 2a: Determine appropriate analysis method

Benchmark analysis is chosen as applied method in this investment analysis (Option III as per Tool).

Sub-step 2b: Option III. Apply benchmark analysis

The applicable benchmark is from World Bank. It was calculated as a benchmark for IBRD and CTF investments schemes. It is indicating an IRR threshold on equity of 40%.[10]

Sub-step 2c: Calculation and comparison of financial indicators

The considered techno-economical parameters show up in table 2-2 below.

Table 2-2 Parameters for equity IRR calculation

Parameter for equity IRR calculation	Data	Unit	Source
Lifetime of project	25	years	Tool
Electro Mechanical Equipment Cost - confidential -	n.a.	USD	FSR
Others (construction) - confidential -	n.a.	USD	FSR
Project Development – confidential -	n.a.	USD	FSR
Operating and Maintenance – confidential -	n.a.	USD	FSR
Estimated annual power supply	32,620	MWh	FSR
Avoided power costs (excluding VAT) - confidential -	n.a.	TL/MWh	FSR
Exchange rate	1,502	USD/TL	

[10] The World Bank document will be available for validation.

Based on above indicated input parameters, a project-specific equity IRR (after tax) of 26.78% is calculated.

The comparison of IRR and the benchmark (40%; see step 2b above) shows that the project activity is much less attractive in terms of return on investment than the benchmark.

The comparison thereby shows that the proposed project activity faces a prohibitive barrier due to insufficient financial attractiveness. It thus cannot be considered financially attractive.

Sub-step 2d: Sensitivity analysis

For sensitivity analysis the main critical parameters/assumptions are analysed with a variation in value of +/-10%.

Table 2-3: Sensitivity analysis results for IRR

Variable	- 10%	+/- 0	+ 10%
Investment costs	29.84%	26.78%	24.25%
Power price	23.90%	26.78%	29.63%
Energy yield	23.90%	26.78%	29.63%
Operating costs	26.88%	26.78%	26.68%

In all scenarios the project attractiveness remains significantly below the benchmark. Thus the statement regarding low attractiveness is robust to reasonable variations in the critical assumptions. The planned WHR project faces significant economic constraints and thus cannot be considered financially attractive.

Sub-step 3 is skipped (barrier analysis) and directly proceeded to step 4 (common practice analysis).

Step 4: Common practice analysis

Sub-step 4a: Analyse any activities similar to the proposed project activity

Similar activities to the planned WHR project are cement production plants where WHR technology is either applied at the pre-heater stage or at the clinker cooling stage for the purpose of electricity generation.

In general there are so far no WHR installations at cement production facilities in Turkey at all. At Turkish clinker plants, it is common practice to have power supplied from the public electricity grid.

Thus Batı-soke WHR Project is a first-of-its kind in Turkey. Step 4b is thus not applicable.

2.6 Methodology Deviations

There are no deviations from the defined methodology.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

As per ACM0012 baseline emissions shall be generally calculated using the following formula:

$$BE_y = BE_{En,y} + BE_{flst,y} \quad \textbf{(1)}$$

Where:

BE_y	=	The total baseline emissions during the year y in tCO_2
$BE_{En,y}$	=	The baseline emissions from energy generated by the project activity during the year y in tCO_2
$BE_{flst,y}$	=	Baseline emissions from fossil fuel combustion, if any, either directly for flaring of waste gas or for steam generation that would have been used for flaring the waste gas in the absence of the project activity (tCO_2), calculated as per equation 26. This is relevant for those project activities where in the baseline steam is used to flare the waste gas

$BE_{flst,y}$ is not applicable as there is no such direct/indirect utilization of fossil fuels for flaring of waste gas. Therefore the BE_y is identical to $BE_{En,y}$.

According to project type and respective procedures and formulae in ACM00012, the following calculations apply:

For calculation of baseline emissions from energy generated by the project activity:

$$BE_{En,y} = BE_{Elec,y} + BE_{Ther,y} \quad \textbf{(2)}$$

Where:

$BE_{Elec,y}$	=	Baseline emissions from electricity during the year y in tCO_2
$BE_{Ther,y}$	=	Baseline emissions from thermal energy (due to heat generation by elemental processes) during the year y (tCO_2)

$BE_{Ther,y}$ is not applicable as there is no such heat generation involved. Therefore the $BE_{En,y}$ is identical to $BE_{Elec,y}$.

For calculation of baseline emissions from electricity ($BE_{Elec,y}$) generation:

$$BE_{Elec,y} = f_{cap} * f_{wcm} * \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y}) \quad \textbf{(3)}$$

Where:

$BE_{elec,y}$	=	Baseline emissions due to displacement of electricity during the year y (tCO_2))
$EG_{i,j,y}$	=	The quantity of electricity supplied to the recipient j by generator, which in the absence of the project activity would have been sourced from source i (the grid or an identified source) during the year y in MWh
$EF_{elec,i,j,y}$	=	The CO_2 emission factor for the electricity source i (for grid and an identified source), displaced due to the project activity, during the year y (tCO_2/MWh)
f_{wcm}	=	Fraction of total electricity generated by the project activity using waste energy. This fraction is 1 if the electricity generation is purely from use of waste energy. Depending upon the situation, this factor is estimated using the equations in section 3.1 Note: For a project activity using waste pressure to generate electricity, the electricity generated from waste pressure should be measurable and this fraction is 1

f_{cap} = Factor that determines the energy that would have been produced in project year y using waste energy generated at a historical level, expressed as a fraction of the total energy produced using waste source in year y. The ratio is 1 if the waste energy generated in project year y is the same or less than that generated at a historical level. The value is estimated using the equations in section 3.2. For Greenfield facilities, f_{cap} is 1. If the procedure in Annex 1 concludes that the waste energy would have been partially utilised in the "reference waste energy generating facilities" this fact will be captured in the factor $f_{practice}$ (refer to equations 22, 23, 24 and 25 for the use of factor $f_{practice}$)

As f_{wcm} has the value "1" (electricity is purely from use of waste energy), the consolidated calculation reads as follows:

Consolidated formula for calculation of baseline emissions (1):

$$BE_y = f_{cap} * \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y}) \quad \textbf{(3a)}$$

For f_{cap}, in ex-ante calculations of emission reductions, a neutral value of "1" is applied (assuming waste heat is same or less than that generated at a historical level).
For real calculation of baseline emissions for project year y, the f_{cap} shall be derived according to method 3 case 2. Applicable formulae and parameters are the following:

The following equation should be used to determine f_{cap}:

$$f_{cap} = \frac{Q_{OE,BL}}{Q_{OE,y}} \quad \textbf{(40)}$$

Where:

$Q_{OE,BL}$ = Output/intermediate energy that can be produced (MWh), to be determined on the basis of maximum energy that could be recovered from the WECM (MER), which would have been released (or WECM would have been flared or energy content of WECM would have been wasted) in the absence of VCS project activity.

$Q_{OE,y}$ = Quantity of actual output/intermediate energy generated during year y (MWh)

In case of the proposed project activity $Q_{OE,BL}$, consists of the theoretical maximum electrical output (in kWh) that can be generated with the available waste heat, while $Q_{OE,y}$, is the actual electrical output of the project in year y (in kWh). Below determination of $Q_{OE,BL}$. is described

Table 3-1: Measurement results to determine available waste heat from the clinker production line

SP stage	Volume of the hot air	133,000 Nm^3/h
	T inlet	380 ℃
	T outlet	170 ℃
	Quantity	1
AQC stage	Volume of the hot air	166,000 Nm^3/h
	T inlet	352 ℃
	T outlet	106 ℃
	Quantity	1

Information in table 3-1 provides an indication of total available waste energy, which is the only energy used for the boilers to produce steam, but not all waste energy can be utilized by currently available waste heat utilization technologies as part of the waste energy will still be released into the atmosphere as heat contained in the exhaust of the waste heat recovery boilers. Calculated waste heat which can be sensibly utilized by applying the following approach:

- First, gross energy content (relative to 0°C) of the hot air released from the SP and AQC stage is calculated by applying the standard specific heat capacity of dry air (i.e. 1005.7[11] J/kg*K).
- Second, the energy contained in the exhaust air of the waste heat boilers is calculated by applying the design exhaust temperature specifications of the equipment to be used in the proposed project activity (380°C for the SP Stage and 352°C for the AQC stage) to account for waste heat which will remain unused by the waste heat utilization equipment.
- Third, the net available energy for the proposed project activity is calculated by subtracting the energy contained in the exhaust air from the gross available energy and calculate the net available energy for the proposed project activity as approximately $3.04*10^7$ kJ/h (see table 3-2 below).

Table 3-2: Energy data

Total available	531.30	TJ
Exhaust heat	195.18	TJ
pre-gen losses	163.86	TJ
Aux consumption	0.00	TJ
Net Supply	172.26	TJ
Total usage	531.30	TJ

Subsequently the annual electrical output that can theoretically be produced on the basis of available waste heat ($Q_{OE,BL}$) is calculated by multiplying the above figure by the yearly working hours of the plant (7,700 h). On the basis of the above data annual available electrical output is calculated by considering design specifications and efficiencies listed in the table 3-3 below and available heat data. The result for $Q_{OE,BL}$ is 47,849 MWh.

Table 3-3: Efficiency data and power factor

	Efficiencies (%)
AQC Boiler	75.80%
SP Boiler	50.10%
Turbine	80.5%
Generator	97%

$$f_{cap} = \frac{Q_{OE,BL}}{Q_{OE,y}}$$

As per the methodology, the ratio is 1 if the waste heat generated in the project year y is same or less then that generated in base year. This is the case in the project scenario.
Thus, f_{cap} = 1

Consolidated formula for calculation of baseline emissions (2):

$$BE_y = \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y}) \qquad \textbf{(3b)}$$

[11] http://amsglossary.allenpress.com/glossary/search?id=specific-heat-capacity1

3.2 Project Emissions

Project Emissions are calculated as follows:

$$PE_y = PE_{AF,y} + PE_{EL,y} \quad \textbf{(41)}$$

Where:

PE_y	=	Project emissions due to the project activity (tCO_2)
$PE_{AF,y}$	=	Project activity emissions from on-site consumption of fossil fuels by the unit process(es) and/or co-generation plant(s) if they are used as supplementary fuels due to non-availability of waste energy to the project activity or due to any other reason (tCO_2)
$PE_{EL,y}$	=	Project activity emissions from on-site consumption of electricity for gas cleaning equipment or other supplementary electricity consumption (tCO_2) (as per Table 1: Summary of gases and sources included in the project boundary)

$PE_{AF,y}$ is zero as there is no technologically possible supplementary fossil fuel consumption at the project's electricity generating facilities.

$PE_{EL,y}$ is zero as there will be no emissions from consumption of electricity for gas cleaning or other supplementary electricity consumption.

Thus PE_y is zero.

3.3 Leakage

No leakage is applicable under this methodology.

3.4 Summary of GHG Emission Reductions and Removals

Emission reductions due to the project activity during the year y are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{(42)}$$

Where:

ER_y	=	Total emissions reductions during the year y in tons of CO_2
PE_y	=	Emissions from the project activity during the year y in tons of CO_2
BE_y	=	Baseline emissions for the project activity during the year y in tons of CO_2, applicable to Scenario 2

Since PE_y is 0 (see 3.2 above), the emission reduction is equivalent to the determined baseline emissions.

Baseline emissions are calculated as per consolidated formula for calculation of baseline emissions (see section 3.1 above). In ex-ante calculations here, the value f_{cap} is assumed to be 1 (implying that all accruing waste energy in considered years are equal or lower to historical level of last three years before project implementation). The calculation reads as follows:

Consolidated formula for ex-ante calculation of baseline emissions:

$$ER_y = BE_y = \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y}) \quad \textbf{(42c)}$$

Years	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2012	10,394	0	0	10,394
2013	16,993	0	0	16,993
2014	16,993	0	0	16,993
2015	16,993	0	0	16,993
2016	16,993	0	0	16,993
2017	16,993	0	0	16,993
2018	16,993	0	0	16,993
2019	16,993	0	0	16,993
2020	16,993	0	0	16,993
2021	16,993	0	0	16,993
2022	6,599	0	0	6,599
Total	“169,930	0	0	“169,930

* from 20th of May 2012

** till 19th of May 2022

4 MONITORING

4.1 Data and Parameters Available at Validation

Data Unit / Parameter:	$Q_{OE,BL}$
Data unit:	MWh
Description:	Output/intermediate energy that can be theoretically produced (in appropriate unit), to be determined on the basis of maximum recoverable energy from the WECM, which would have been released (or WECM would have been flared or energy content of WECM would have been wasted) in the absence of VCS project activity.
Source of data:	Calculated on the basis of a test report and equipment specifications
Description of measurement methods and procedures to be applied:	The value has been calculated on the best data available which includes a test report of the available waste heat which provides an accurate estimate of total usable waste heat and the specifications of the waste heat recovery equipment.
Frequency of monitoring/recording:	-
Value applied:	47,849
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	-

Parameters for calculation of grid emission factor:

Data Unit / Parameter:	Gross electricity generation
Data unit:	MWh
Description:	Gross Electricity supplied to the grid by relevant sources (2007-2009)
Source of data:	Turkish Electricity Transmission Company (TEİAŞ), Annual Development of Turkey's Gross Electricity Generation of Primary Energy Resources (1940-2009) TEİAŞ, see http://www.teias.gov.tr/istatistik2009/32(75-09).xls
Value applied:	See Table A1-3.
Justification of choice of data or description of measurement methods and procedures applied:	--
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data Unit / Parameter:	$EF_{elec\ i,j,y}$

Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"
Source of data:	As per "Tool to calculate the emission factor for an electricity system"
Value applied:	0.5267 tCO_2/MWh
Justification of choice of data or description of measurement methods and procedures applied:	As per "Tool to calculate the emission factor for an electricity system" Calculated from data provided by the TEIAS for Turkish Power Sector; Operating Margin = 0.6532 KgCO2e/KWh Build Margin = 0.4003 KgCO2e/KWh Combined Margin = 0.5267 KgCO2/KWh Calculated as weighted sum of OM and BM emission factor
Any comment:	Emission Factor is fixed at ex-ante calculation.

Data Unit / Parameter:	Net electricity generation
Data unit:	MWh
Description:	Net electricity fed into the grid. Used for the calculation of the net/gross relation (Including Import and Export figures)
Source of data:	Turkish Electricity Transmission Company (TEİAŞ), Annual Development of Electricity Generation-Consumption and Losses in Turkey (1984-2009) TEİAŞ, see http://www.teias.gov.tr/istatistik2009/30(84-09).xls
Value applied:	See Table A1-4.
Justification of choice of data or description of measurement methods and procedures applied:	-
Any comment:	This data is used to find relation between the gross and net electricity delivered to the grid by fossil fuel fired power plants. (See Table A1-4). Import and Export data is used to identify total net electricity fed into the grid in the years of 2007, 2008 and 2009 (See Table A1-5). TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data Unit / Parameter:	EF_i
Data unit:	tCO_2/GJ
Description:	Emission factor for fuel type i

Source of data:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the IPCC Guidelines on National GHG Inventories. See http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value applied:	See Table A1-8 and Table See Table A1-13.
Any comment:	No plant specific and national emission factor data is available in Turkey. So, IPCC default data is used. For Fuel Oil Power Plants: 'Gas/Diesel Oil' data is used for conservativeness. For Coal Power Plants: In the 205th page of official document given in the link below, it is stated that Çolakoğlu and İçdaş utilizes 'Taşkomürü' (Hardcoal). And at the Table-2 in page 157 of the same document, Taşkomürü is dived in two groups: Bituminous and Antharcite. Since Sub-Bituminous Coal is under Brown Coal in the same table and since Other Bituminous Coal has lower EF than Anthracite in 1.4 of IPCC Guidelines, EF for 'Other Bituminous Coal' is used. See: http://www.dpt.gov.tr/DocObjects/Icerik/4225/Enerji_Hammaddeleri_(Linyit_Taskomuru-Jeotermal)

Data Unit / Parameter:	Sample Group for BM emission factor
Data unit:	Name of the plants, MW capacities, fuel types, annual electricity generations and dates of commissioning.
Description:	Most recent power plants which compromise 20% of total generation
Source of data:	Annual Development of Fuels Consumed in Thermal Power Plants in Turkey by the Electric Utilities, TEIAS: For plants in 2005: http://www.teias.gov.tr/istatistik2005/7.xls For plants in 2006: http://www.epdk.org.tr/yayin_rapor/elektrik/yayin/uretimKapasiteProjeksiyonu.pdf (page 76 and 77 for installed power of new plants, page 67-75 for generation amounts. For capacity additions, interpolation method is used for generation amounts) For plants in 2007: http://www.epdk.org.tr/yayin_rapor/elektrik/yayin/uretimKapasiteProjeksiyonu2008_2017.pdf (page 121 and 122 for installed power of new plants, page 111-120 for generation amounts. For capacity additions, interpolation method is used for generation amounts) For plants in 2008: http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf (page 95 for plants and pages 82-94 for generation amounts. For capacity additions, interpolation method is used for generation amounts) For Plants in 2009: http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202010.pdf (page 98-100 for plants and pages 85-97 for generation amounts. For capacity additions, interpolation method is used for generation amounts)
Value applied:	See Table A1-7.
Any comment:	

Data Unit / Parameter:	$\eta_{i,y}$
Data unit:	-
Description:	Average energy conversion efficiency of power unit m in year y
Source of data:	Annex I the "Tool to calculate the emission factor for an electricity system"
Value applied:	See Table A1-8.
Any comment:	For Lignite and Coal power plants, plants specific values are applied. There are two lignite power plant in Sample Group. These are Çan and Elbistan PPs. For efficiency factor of Çan PP is taken form presentation of Mr. Sefer Bütün (General Manager of EUAS, state production company) which is 'Thermal Power Plants and Environment'. This presentation is submitted to DOE. In page 18 of the presentation, it is stated that the for pulverized lignite power plants the highest achieved electrical efficiency rate is 38%. So this rate is applied also for Elbistan-B PP. Weighted average of these efficiency rates which turns to be 38.63% is used for lignite power plants. For coal power plants, the highest efficiency rate for 'fluidized bed' technology which is 41.5% for PFBS is applied as coal PPs in the sample group (Çolakoğlu (Capacity Increment) and Çan Gr I-II) are utilizing fluidized bed type technology. For reference see: http://www.mimag-samko.com.tr/akiskan_yatakli_kazanlar.pdf (last paragraph of page 6) For Natural Gas and Oil plants efficiencies, default value given in the tool is applied: http://cdm.unfccc.int/methodologies/Tools/EB35_repan12_Tool_grid_emission.pdf

Data Unit / Parameter:	$HV_{i,y}$
Data unit:	Mass or volume unit
Description:	Heating Values of fuels consumed for electricity generation in the years of 2006, 2007 and 2008
Source of data:	Heating Values Of Fuels Consumed In Thermal Power Plants In Turkey By The Electric Utilities, TEİAŞ. See: http://www.teias.gov.tr/istatistik2008/46.xls
Value applied:	See Table A1-9
Any comment:	There is no national NVC data in Turkey. However, TEİAŞ announces Heating values of fuels. This data is used to calculate annual NCVs for each fuel type TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data Unit / Parameter:	$FC_{i,y}$
Data unit:	Mass or volume unit

Description:	Fuels consumed for electricity generation in the years of 2007, 2008 and 2009
Source of data:	Annual Development of Fuels Consumed In Thermal Power Plants In Turkey By The Electric Utilities, TEİAŞ. See: http://www.teias.gov.tr/istatistik2009/44.xls
Value applied:	See Table A1-10.
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data Unit / Parameter:	**$NCV_{i,y}$**
Data unit:	TJ/kton, TJ/million m^3
Description:	Fuels consumed for electricity generation in the years of 2007, 2008 and 2009
Source of data:	Calculated by using HVi,y to FCi,y as Net Calorific Values of fuel types are not directly available in Turkey. Calculation of NCVs from national HVi,y and FCi,y data, Table A1-9 and Table A1-10, is preferred to default IPCC data as these are more reliable.
Value applied:	See Table A1-11.
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of power plants in Turkey.

4.2 Data and Parameters Monitored

Data Unit / Parameter:	$EG_{i,j,y}$
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:	Net generation is found by multiplying Generation License value by self-power consumption
Description of measurement methods and procedures to be applied:	-
Frequency of monitoring/recording:	Every month data of the two meters are crosschecked
Value applied:	**32,260 MWh/year (expected)**
Monitoring equipment:	Two Meters which are approved by TEİAŞ.
QA/QC procedures to be applied:	Cross check measurement results with records for sold electricity
Calculation method:	-
Any comment:	-

Data Unit / Parameter:	f_{wcm}
Data unit:	Fraction
Description:	Fraction of total energy generated by the project activity using waste energy.
Source of data:	Feasibility study
Description of measurement methods and procedures to be applied:	The ACM0012 methodology refers to waste gas, but from the context it is clear that this value refers to waste energy resource in general. In the case of the project activity f_{wcm} has been interpreted therefore as the fraction of total energy generated using waste heat. The methodology prescribes that this fraction is 1 if the electricity generation is purely from use of the waste energy resource (i.e. waste heat).
Frequency of monitoring/recording:	-
Value applied:	**1**
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	-

Data Unit / Parameter:	f_{cap}
Data unit:	Fraction
Description:	Energy that would have been produced in project year y using waste

	heat generated in base year expressed as a fraction of total energy produced using waste energy in year y.
Source of data:	Calculated on the basis of test report / feasibility study
Description of measurement methods and procedures to be applied:	The value of f_{cap} has been calculated ex-ante on the basis of the output that can be theoretically be produced on the basis of available waste heat when the cement line is operated under normal load factors and projected power output.
Frequency of monitoring/recording:	-
Value applied:	**1**
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	-

Data Unit / Parameter:	$Q_{OE,y}$
Data unit:	MWh
Description:	Quantity of actual output/intermediate energy during year y
Source of data:	Feasibility Study Report
Description of measurement methods and procedures to be applied:	The project applies Method-3, Case-1 which needs the annual output energy which in this case consists of power supplied by the project activity to the internal power grid and data referred from FSR.
Frequency of monitoring/recording:	
Value applied:	**32,260** MWh
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	-

4.3 Description of the Monitoring Plan

The purpose of the monitoring is measurement and analysis of greenhouse gas emissions of the project within the project boundary in order to determine the amount of emission reductions that are attributable to the project.

The monitored data will be presented to the auditor.

As described above, the relevant data that has to be monitored is the electricity supplied to the internal grid of the cement factory (EG_y) per year. Electrical connection diagram will be available at the audit.

At the end of one monitoring period, which is planned to generally last one year, the data from the monthly meter reading records by PMUM (Market Financial Settlement Centre) will be added up to the yearly net electricity generation and multiplied with the combined margin emission factor with the help of an excel spreadsheet that also contains the combined margin calculation. Thus, the complete baseline approach is always transparent and traceable.

Technicians at BATISOKE conduct daily meters readings and keep records for electricity generation amount and reports to management. These records can be used for monitoring in case of any problem will arise in meters.

There will be 16 person work during the operation of the Whr plant. Energy Chief of the Batı-Cim will be in charge of the projects. The data is monitored via electricity meters. Two meters will be placed (one main and one reserve) at the power plant. These meters are sealed by TEIAS and intervention by project proponent is not possible. Meters are read by TEIAS staff monthly.Yearly electricity generation will be calculated by summing up monthly meter reading records. Data monitored will be kept in electronic form and hard copy until the end of second year after the end of crediting period.

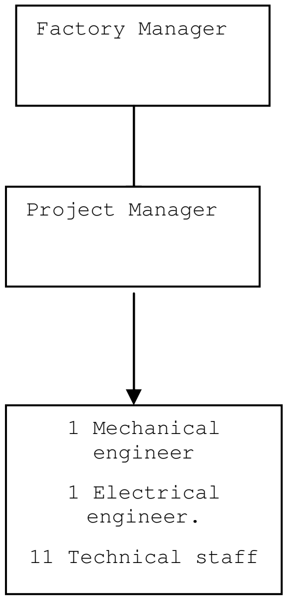

Figure 4-1: Plant organization diagram

Responsibilities of the workers in the plant:

Project Manager: Supervising the operation of power station and the implementation of monitoring plan; validating the monthly monitoring report.

Statistician staff: Compiling monthly monitoring report and archiving relevant data

Electrician engineer/ Electricity staff: Maintenance of electrical equipments.

Mechanical Engineer/ Boiler staff/ Steam turbine staff: Maintenance of WHR equipments

Technicians: Work in shifts and the monitor of each shift note the monitoring data and fill the monitoring record sheet

5 ENVIRONMENTAL IMPACT

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

As the project boundary is in the border of the plant, project does not have any impact on environment. Also in the project waste heat which already exists in the plant will be used for electricity generation and the generated electricity will be used in the plant. So all the project activities take place in the plant boundary.

6 STAKEHOLDERS COMMENTS:

There is no national requirement to conducting any local stakeholder meetings. With no external parties being affected by any effects from the project, no meeting is conducted.

Global Stakeholder consultation shall start with publication of the PD on the auditors' website.

ANNEX 1: BASELINE INFORMATION

PART A: Calculation of the Combined Margin (CM)

Stepwise approach of 'Tool to calculate the emission factor for an electricity system' version 02[12] is used to determine the combined margin (emission coefficient) as described below:

Step 1: Identify the relevant electric power system

There are 21 regional distribution regions in Turkey but no regional transmission system is defined. In Article 20 of License Regulation it is stated that 'TEİAŞ shall be in charge of all transmission activities to be performed over the existing transmission facilities and those to be constructed as well as the activities pertaining to the operation of **national transmission system** via the National Load Dispatch Centre and the regional load dispatch centres connected to this centre and the operation of Market Financial Reconciliation Centre[13]'. As it can be understood from this phrase, only one transmission system which is national transmission system is defined and only TEİAŞ is in charge of all transmission system related activities. Moreover, a communication with representative of TEİAŞ which indicates that: "There are not significant transmission constraints in the national grid system which is preventing dispatch of already connected power plants" is submitted to the DOE. Therefore, the national grid is used as electric power system for project activity. The national grid of Turkey is connected to the electricity systems of neighbouring countries. Complying with the rules of the tool, the emission factor for imports from neighbouring countries is considered 0 (zero) tCO_2/MWh for determining the OM.

There is no information about interconnected transmission capacity investments, as TEİAŞ, who operates the grid, also didn't take into account imports-exports for electricity capacity projections.[14] Because of that, for BM calculation transmission capacity is not considered.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

According to Tool project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included

For this project, **Option I** is chosen.

Step 3: Select an operating margin (OM) method

The Turkish electricity mix does not comprise nuclear energy. Also there is no obvious indication that coal is used as must run resources. Therefore, the only low cost resources in Turkey, which are considered as must-run, are Hydro, Renewables and Waste, Geothermal and Wind (according to statistics of TEİAŞ).

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

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

[14] See: http://www.epdk.org.tr/yayin_rapor/elektrik/yayin /uretimKapasiteProjeksiyonu2008_2017.pdf (page 39)

Table A1-1: Share of Low Cost Resource (LCR) Production 2005-2009 (Production in GWh)[15]

	2005	2006	2007	2008	2009
Gross production	161,956.2	176,299.8	191,558.1	198,418.0	194,812.9
TOTAL LCR Production	39,836.3	44,618.7	36,575.6	34,498.6	38,229.6
Hydro	39,560.5	44,244.2	35,850.8	33,269.8	35,958.4
Renewables and Waste	122.4	154.0	213.7	219.9	340.1
Geothermal and Wind	153.4	220.5	511.1	1,008.9	1.931.1
Share of LCRs	24.60%	25.31%	19.09%	17.39%	19.62%
Av. of last five years			21.20%		

As average share of low cost resources for the last five years is far below 50% (21.20%), the Simple OM method is applicable to calculate the operating margin emission factor ($EF_{grid,OM,y}$)

For the Simple OM method, the emissions factor can be calculated using either of the two following data vintages:

- Ex-ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the VCS-PDD to the DOE for validation, or
- Ex-post option: The year, in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

The ex-ante option is selected for Simple OM method, with the most recent data for the baseline calculation stemming from the years 2007 to 2009.

Step 4: Calculate the operating margin emission factor according to the selected method

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

- Net electricity generation and corresponding CO_2 emission factor of each power unit (Option A), or
- Total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (Option B).

Option B is chosen to calculate the Simple OM, as there is no power plant specific data available. Renewable power generation is considered as low-cost power source and amount of electricity supplied to the grid by these sources is known.

Where Option B is used, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants, and based on the fuel type(s) and total fuel consumption of the project electricity system, as per formula 1 of the tool:

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

[15] See: http://www.teias.gov.tr/istatistik2009/32(75-09).xls

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	=	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
EG_y	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year y
y	=	three most recent years for which data is available at the time of submission of the PDD to the DOE for validation

For the calculation of the OM the consumption amount and heating values of the fuels for each sources used for the years 2007, 2008 and 2009, is taken from the TEİAŞ annual statistics, which holds data on annual fuel consumption by fuel types as well as electricity generation amounts by sources and electricity imports. All the data needed for the calculation, including the emission factors and net calorific values (NCVs), are provided in part B of this Annex. Total CO_2 emission due to electricity generation in Turkey for the years of 2007, 2008 and 2009 are given in Table A1-2.

Table A1-2: CO2 emissions from electricity production 2007-2009 (ktCO2)[16]

	2007	2008	2009
CO2-Emmissions	97,649	103,352	97,863

Table A1-3 below presents the gross electricity production data by all the relevant energy sources. Low-cost/must run resources like hydro, wind, geothermal and biomass do not emit fossil CO_2 and thus are not taken into account in calculations.

Table A1-3: Gross electricity production by fossil energy sources 2007-2009[17] (GWh)

Energy Source	2007	2008	2009
Natural Gas	95,024.8	98,685.3	96,094.7
Lignite	38,294.7	41,858.1	39,089.5
Coal	15,136.2	15,857.5	16,595.6
Fuel Oil	6,469.6	7,208.6	4,439.8
Motor Oil	13.3	266.3	345.8
Naphtha	43.9	43.6	17.6
LPG	0.0	0.0	0.4
Total fossil fuels	154,982.5	163,919.4	156,583.4

Table A1-3 shows gross data, but EG_y in the above described formula means electricity delivered to the grid, i.e. net generation. Therefore following Table A1-4 shall help to derive net data by calculating the net/gross proportion on the basis of overall gross and net production numbers.

[16] For detail calculation see section PART B of Annex 1 below.

Table A1-4: Net/gross electricity production 2006-2008 (GWh)[18]

	2007	2008	2009
Gross Production	191,558.13	198,418.00	194,812.90
Net Production	183,339.70	189,761.90	186,619.30
Relation	95.71%	95.64%	95.79%

Multiplying these overall gross/net relation percentages with the fossil fuels generation amount does in fact mean an approximation. However this is a conservative approximation as the consumption of plant auxiliaries of fossil power plants is higher than for the plants that are not included in the baseline calculation. In the end this would lead to a lower net electricity generation and therefore to a higher OM emission factor and higher emission reductions.
Table A1-5 shows the resulting net data for fossil fuel generation and adds electricity imports.

Table A1-5: Electricity supplied to the grid, relevant for OM (GWh) [19]

	2007	2008	2009
Net El. Prod. by fossil fuels	148,333.3	156,768.3	149,997.7
Electricity Import	864.3	789.4	812.0
Electricity supplied to grid by relevant sources	149,197.6	157,557.7	150,809.7

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

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

Table A1-6: Calculation of Weighted EFgrid,OMsimple,y (ktCO2/GWh)

	2007	2008	2009
CO_2-Emmissions ($ktCO_2$)	97,649	103,352	97,863
Net Electricity Supplied to Grid by relevant sources (GWh)	149,197.6	157,557.7	150,809.7
$EF_{grid,OMsimple,y}$ ($ktCO_2/GWh$)	0.6545	0.6560	0.6489
3-year Generation Weighted Average $EF_{grid,OMsimple,y}$ ($ktCO_2/GWh$)	0.6532		

<u>Step 5</u>: Identify the group of power units to be included in the build margin

Build Margin calculations are performed with the sample group of power units m consisting of either:

(a) The set of five power units that have been built most recently, or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently

Option (b) is used to identify the sample group, as this option comprises the larger annual generation in Turkey. In 2009, gross electricity generation amount was 194,813 GWh and 20% of this is 38,963 GWh.

[18] For Net Production See, http://www.teias.gov.tr/istatistik2009/30(84-09).xls (column L)

The last plant of the sample group is built in 2005 and until the end of the 2009 (which is the latest year for official statistics published for plants put in operation) there were 52 VER projects. Because of the last plant of the sample group was built 4 years ago (not more than 10 years ago), VER plants are excluded from sample group.

While identifying the sample group dismantled, revised, retrofits are not included. Only new capacity additions (power plants / units) are taken into account.

Sample group for BM emission factor is given below table. The derivation of the values presented in Table A1-7 is contained in a separate excel file which is available for validation.

Table A1-7: Sample group generation for BM emission factor calculation (GWh)

Energy Source	2005	2006	2007	2008	2009	Total
Natural Gas	2,598.6	3,119.1	2,552.1	2,400.0	10,164.3	20,834.0
Lignite	0,00	7,020.0	0.0	0.0	0.0	7,020.0
Coal	0,0	0.0	0.0	0.0	1,923.3	1,923.3
Fuel Oil	99.1	0.0	800.0	103.2	1,260.0	2,262.3
Hydro	1,028.8	482.6	1,217.0	1,477.0	1,963.5	6,168.9
Renewables	2.4	453.1	0.0	50.0	313.0	788.5
TOTAL	3,728.9	11,044.7	4,569.1	4,030.0	15,624.1	38,996.95

Again, the project proponents can chose between two options according to the calculation tool: calculate the BM ex-ante based on the latest available data or update the BM each year ex post. Option 1, the ex-ante approach, is again chosen.

Step 6:. Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as per formula 13 of the tool:

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

Where:

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

Because of only fuel types and electricity generation data are available for the sample group, Option B2 of Simple OM method is used to calculate emission factor. The formula corresponds to formula 3 of the tool:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} x3.6}{\eta_{m,y}} \qquad \textbf{(3)}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type i used in power unit m in year y (tCO_2/GJ)

$\eta_{m,y}$ = Average net energy conversion efficiency of power unit m in year y (%)
y = Three most recent years for which data is available at the time of submission of the PDD to the DOE for validation

BM emission factor calculation and resulted BM factor is given in the Table A1-8. For BM factor calculation, since no official emission factors for different fuel types are available, lower confidence default values of IPCC Guidelines are applied. Explanation of emission factor selection for each energy sources and references are given in section 3.3 of the PDD.

Table A1-8: BM emission factor calculation as per tool equations 13/3

Energy Source	Sample Group Total Generation (GWh)	Effective CO_2 emission factor (tCO_2/TJ)	Average Efficiency ($\eta_{m,y}$)	CO_2 Emission ($ktCO_2$)
Natural Gas	20,834.0	54.3	60.00%	6,787.7
Lignite	7,020.0	90.9	38.63%	6,045.3
Coal	1,923.3	89.5	41.50%	1,493.3
Fuel Oil	2,262.3	72.6	46.00%	1,285.4
Hydro	6,168.9	0.0	0.00%	0.0
Renewables	788.5	0.0	0.00%	0.0
Total	38,996.95			15,611.7
$EF_{grid,BM,y}$ (tCO_2/MWh)	0.4003			

<u>Step 7:</u> Calculate the combined margin emission factor

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

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

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM} = Weighting of operating margin emissions factor (%)
w_{BM} = Weighting of build margin emissions factor (%)

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

$EF_{grid,CM,y}$ = 0.6532 tCO2/MWh * 0.5 + 0.4003 tCO2/MWh * 0.5

= 0.5267 tCO2/MWh

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

Table A1-9: $HV_{i,y}$ (Heating Values for Fossil Fuels for Electricity Generation[20] (TCal)

Energy Sources	2007	2008	2009
Hard Coal+Imported Coal	32,115	33,310	35,130
Lignite	100,320	108,227	97,652
Fuel Oil	21,434	20,607	15,160
Diesel Oil	517	1,328	1,830
LPG	0	0	1
Naphta	118	113	84
Natural Gas	179,149	189,057	186,266

Table A1-10: $FC_{i,y}$ (Fuel Consumptions for Fossil Fuels for Electricity Generation (million m^3 for Natural Gas and ton for others)[21]

Energy Sources	2007	2008	2009
Hard Coal+Imported Coal	6,029,143	6,270,008	6,621,177
Lignite	61,223,821	66,374,120	63,620,518
Fuel Oil	2,250,686	2,173,371	1,594,321
Diesel Oil	50,233	131,206	180,857
LPG	0	0	111
Naphta	11,441	10,606	8,077
Natural Gas	20,457,793	21,607,635	20,978,040

1	**Tcal=**	**4.1868**	**TJ**

Table A1-11: $NCV_{i,y}$ (Average Net Calorific Values for Fossil Fuels for Electricity Generation; TJ/million m^3 for Natural Gas and TJ/kton for others) and EF_i (Emission Factor of Fossil Fuels)[22]

Energy Sources	NCVi 2007 (TJ/Gg)	NCVi 2008 (TJ/Gg)	NCVi 2009 (TJ/Gg)	EFCO2, I (kg/TJ)
Hard Coal+Imported Coal	22.30	22.24	22.21	89.50
Lignite	6.86	6.83	6.43	90.90
Fuel Oil	39.87	39.70	39.81	72.60
Diesel Oil	43.09	42.38	42.37	72.60
LPG	0.00	0.00	37.72	61.60
Naphta	43.18	44.61	43.54	69.30
Natural Gas	36.66	36.63	37.17	54.30

Table A1-12: CO_2 Emission by each Fossil Fuels Types ($ktCO_2e$)

Energy Sources	2007	2008	2009
Hard Coal+Imported Coal	12,034	12,482	13,164
Lignite	38,180	41,189	37,164
Fuel Oil	6,515	6,264	4,608
Diesel Oil	157	404	556
LPG	0	0	0
Naphta	34	33	24
Natural Gas	40,728	42,981	42,346
TOTAL	97,649	103,352	97,863

PART C: Identification of Sample Group

Table A1-13: Sample Group PPs for BM Emission Factor Calculation[23]

Name of Power Plant	Capacity (MW)	Average Generation (GWh)	Fuel Type	Date of Operation
ÇEBİ ENERJİ GT	43.4	340.1	N. Gas	23.08.2005
ENTEK ELK.A.Ş.KOÇ ÜNİ.GR I-II	2.3	19.0	N. Gas	07.02.2005
KAREGE GR IV-V	18.1	141.9	N. Gas	07.04.2005
KARKEY(SİLOPİ-4) GR-IV	6.2	47.2	Fuel Oil	30.06.2005
KARKEY(SİLOPİ-4) GR-V	6.8	51.9	Fuel Oil	23.12.2005
METEM ENERJİ(Hacışıramat) GR I-II	7.8	58.0	N. Gas	29.01.2005
METEM ENERJİ(Peliklik) GR I-II-III	11.7	89.0	N. Gas	29.01.2005
NOREN ENERJİ GR-I	8.7	70.0	N. Gas	24.08.2005
NUH ENERJİ-2 GR I	47.0	319.7	N. Gas	24.05.2005
ZORLU ENERJİ KAYSERİ GR-I-II-III	149.9	1,144.1	N. Gas	22.07.2005
ZORLU ENERJİ KAYSERİ GR-IV	38.6	294.9	N. Gas	26.10.2005
ZORLU ENERJİ YALOVA GR I-II	15.9	122.0	N. Gas	26.11.2005
TEKTUĞ(Kargılık) GR I-II	23.9	83.0	Hydro (Run of River)	25.04.2005
İÇTAŞ ENERJİ(Yukarı Mercan) GR I-II	14.2	44.0	Hydro (Run of River)	02.05.2005
MURATLI GR I-II	115.0	444.0	Hydro (with Dam)	03.06.2005
BEREKET EN.(DALAMAN) GR XIII-XIV-XV	7.5	35.8	Hydro (Run of River)	16.07.2005
YAMULA GRUP I-II	100.0	422.0	Hydro (with Dam)	31.07.2005
SUNJÜT(RES) GR I-II	1.2	2.4	Wind	23.04.2005
EKOTEN TEKSTİL GR-I	1.9	14	N. Gas	16.02.2006
ERAK GİYİM GR-I	1.4	10.0	N. Gas	22.02.2006
ALARKO ALTEK GR-III	21.9	173.0	Steam	23.02.2006
AYDIN ORME GR-I	7.5	60.0	N. Gas	25.02.2006
NUH ENERJİ-2 GR-II	26.1	180.1	Steam	02.03.2006
MARMARA ELEKTRİK (Çorlu) GR-I	8.7	63.0	N. Gas	13.04.2006
MARMARA PAMUK(Çorlu) GR-I	8.7	63.0	N. Gas	13.04.2006
ENTEK (Kosekoy) GR-IV	47.6	378.2	N. Gas	14.04.2006
ELSE TEKSTİL (Çorlu) GRI-II	3.2	25.0	N. Gas	15.04.2006

SONMEZ ELEKTRİK (Çorlu) GRI-II	17.5	126.0	N. Gas	03.05.2006
MENDERES ELEKTRİK GR-I	8.0	56.0	Geothermal	10.05.2006
KASTAMONU ENTEGRE (Balıkesir) GR-I	7.5	54.0	N. Gas	24.05.2006
BOZ ENERJİ GR-I	8.7	70.0	N. Gas	09.06.2006
ADANA ATIK SU ARITMA TESİSİ	0.8	6.0	Biogas	09.06.2006
AMYLUM NİŞASTA (ADANA)	14.3	34.0	N. Gas	09.06.2006
ŞIKMAKAS (Çorlu) GR-I	1.6	13.0	N. Gas	22.06.2006
ELBİSTAN B GR-III	360.0	2,340.0	Lignite	23.06.2006
ANTALYA ENERJİ GR I-II-III-IV	34.9	245.0	N. Gas	29.06.2006
HAYAT TEM. VE SAĞLIK GR I-II	15.0	108.0	N. Gas	30.06.2006
EKOLOJİK EN. (Kemerburgaz) GR-I	1.0	6.0	Waste Heat	31.07.2006
EROĞLU GİYİM (Çorlu) GR-I	1.2	9.0	N. Gas	01.08.2006
CAM İŞ ELEKTRİK (Mersin) GR-I	126.1	1,008.0	N. Gas	13.09.2006
ELBİSTAN B GR-II	360.0	2,340.0	Lignite	17.09.2006
YILDIZ ENT. AĞAÇ (Kocaeli) GR-I	6.2	40.0	N. Gas	21.09.2006
ÇERKEZKOY ENERJİ GR-I	49.2	390.0	N. Gas	06.10.2006
ENTEK (Kosekoy) GR-V	37.0	293.9	N. Gas	03.11.2006
ELBİSTAN B GR-IV	360.0	2,340.0	Lignite	13.11.2006
ÇIRAĞAN SARAYI GR-I	1.3	11.0	N. Gas	01.12.2006
ERTÜRK ELEKTRİK Tepe RES GR-I	0.9	2.0	Wind	22.12.2006
AKMAYA (Lüleburgaz) GR-I	6.9	50.0	N. Gas	23.12.2006
BURGAZ (Lüleburgaz) GR-I	6.9	54.0	N. Gas	23.12.2006
ŞANLIURFA GR I-II	51.8	124.0	Hydro (Run of River)	01.03.2006
BEREKET ENERJİ GOKYAR HES 3 Grup	11.6	43.3	Hydro (Run of River)	05.05.2006
MOLU EN. Zamantı Bahçelik GR I-II	4.2	16.7	Hydro (Run of River)	31.05.2006
SU ENERJİ (Balıkesir) GR I-II	4.6	20.7	Hydro (Run of River)	27.06.2006
BEREKET EN. (Mentaş Reg) GR I-II	26.6	108.7	Hydro (Run of River)	31.07.2006
EKİN (Başaran Hes) (Nazilli)	0.6	4.5	Hydro (Run of River)	11.08.2006
ERE (Sugozü rg. Kızıldüz hes) GR I-II	15.4	31.6	Hydro (Run of River)	08.09.2006
ERE (AKSU REG. Ve ŞAHMALLAR HES) GR I-II	14.0	26.7	Hydro (Run of River)	16.11.2006
TEKTUĞ (Kalealtı) GR I-II	15.0	52.0	Hydro (Run of River)	30.11.2006
BEREKET EN. (Mentaş Reg) GR III	13.3	54.4	Hydro (Run of River)	13.12.2006
HABAŞ (ALİAĞA-ADDITION)	9.1	35.3	N. Gas	02.05.2007
BOSEN	-123.5	0.0	N. Gas	2007
MODERN ENERJİ	5.2	38.0	N. Gas	2007
Acıbadem Sağlık Hiz.ve Tic.A.Ş(Kadıkoy Hast.)(İstanbul/Kadıkoy)	0.5	4.0	N. Gas	19.06.2007
Acıbadem Sağlık Hiz.ve Tic.A.Ş(Kozyatağı Hast.)(İstanbul/Kadıkoy)	0.6	5.0	N. Gas	23.10.2007
Acıbadem Sağlık Hiz.ve Tic.A.Ş(Nilüfer/BURSA)	1.3	11.0	N. Gas	28.08.2007
AKATEKS Tekstil Sanayi ve Ticaret A.Ş.	1.8	14.0	N. Gas	30.07.2007
FLOKSER TEKSTİL SAN.AŞ.(Çatalça/istanbul)(SüetserTesisi)	2.1	17.0	N. Gas	03.12.2007
FLOKSER TEKSTİL SAN.AŞ.(Çatalça/istanbul)(Poliser Tesisi)	2.1	17.0	N. Gas	03.12.2007

FRİTOLAY GIDA SAN.VE TİC. AŞ.	0.5	4.0	N. Gas	23.01.2007
KIVANÇ TEKSTİL SAN.ve TİC.A.Ş.	3.9	33.0	N. Gas	20.03.2007
KİL-SAN KİL SAN.VE TİC. A.Ş	3.2	25.0	N. Gas	19.02.2007
SÜPERBOY BOYA SAN.ve Tic.Ltd.Şti.(Büyükçekmece/İstanbul)	1.0	8.0	N. Gas	05.12.2007
SWİSS OTEL(Anadolu Japan Turizm A.Ş (İstanbul)	1.6	11.0	N. Gas	01.08.2007
TAV Esenboğa Yatırım Yapım ve İşetme AŞ./ANKARA	3.9	33.0	N. Gas	19.09.2007
BOĞAZLIYAN ŞEKER	16.4	0.0	Liquid Fuel + N.Gas	2007
KARTONSAN	5.0	40.0	Liquid Fuel + N.Gas	2007
ESKİŞEHİR END.ENERJİ	3.5	26.8	Liquid Fuel + N.Gas	2007
İGSAŞ	2.2	15.2	Liquid Fuel + N.Gas	2007
BİS Enerji Üretim AŞ.(Bursa)(Addition)	43.0	354.8	N. Gas	30.05.2007
Aliağa Çakmaktepe Enerji A.Ş.(Aliağa/İZMİR)	34.8	278.0	N. Gas	13.09.2007
BİS Enerji Üretim AŞ.(Bursa)(Revision)	28.3	0.0	N. Gas	11.09.2007
BİS Enerji Üretim AŞ.(Bursa)(Addition)	48.0	396.1	N. Gas	30.08.2007
BOSEN ENERJİ ELEKTRİK AŞ.	142.8	1,071.0	N. Gas	18.01.2007
SAYENERJİ ELEKTRİK ÜRETİM AŞ. (Kayseri/OSB)	5.9	47.0	N. Gas	03.07.2007
T ENERJİ ÜRETİM AŞ.(İSTANBUL)	1.6	13.0	N. Gas	04.04.2007
ZORLU EN.Kayseri (1 GT Addition)	7.2	55.0	N. Gas	17.01.2007
SİİRT	25.6	190.0	Fuel Oil	2007
Mardin Kızıltepe	34.1	250.0	Fuel Oil	2007
KAREN	24.3	180.0	Fuel Oil	2007
İDİL 2 (PS3 A- 2)	24.4	180.0	Fuel Oil	2007
BORÇKA HES	300.6	1,039.0	Hydro (With Dam)	27.02.2007
TEKTUĞ(Keban River)	5.0	32.0	Hydro (run of river)	08.05.2007
YPM Ener.Yat.AŞ.(Altıntepe Hydro)(Sivas/Suşehir)	4.0	18.0	Hydro (run of river)	06.06.2007
YPM Ener.Yat.AŞ.(Beypınar Hydro)(Sivas/Suşehir)	3.6	18.0	Hydro (run of river)	06.06.2007
YPM Ener.Yat.AŞ.(Konak Hydro)(Sivas/Suşehir)	4.0	19.0	Hydro (run of river)	19.07.2007
KURTEKS Tekstil A.Ş./Kahramanmaraş(KARASU HES-Andırın)	2.4	19.0	Hydro (run of river)	28.11.2007
İSKUR TEKSTİL (SÜLEYMANLI HES)	4.6	18.0	Hydro (run of river)	30.12.2007
OZGÜR ELK.AŞ.(K.MARAŞ)(Tahta)	6.3	27.0	Hydro (run of river)	03.05.2007
OZGÜR ELK.AŞ.(K.MARAŞ)(Tahta)(Addition)	6.3	27.0	Hydro (run of river)	24.05.2007
MB ŞEKER NİŞASTA SAN.A.Ş. (Sultanhanı)	8.8	60.0	Natural Gas	30.06.2008
AKSA ENERJİ (Antalya)	183.8	1,290.0	Natural Gas	2008
AKSA ENERJİ (Manisa)	52.4	370.0	Natural Gas	2008
ANTALYA ENERJİ (Addition)	17.5	122.3	Natural Gas	2008
ATAÇ İNŞAAT SAN. A.S.B. (ANTALYA)	5.4	37.0	Natural Gas	2008
BAHÇIVAN GIDA (LÜLEBURGAZ)	1.2	8.0	Natural Gas	2008
CAN ENERJİ (Çorlu - Tekirdağ) (Addition)	52.4	304.2	Natural Gas	2008

FOUR SEASONS OTEL (ATİK PASHA TUR. A.Ş.)	1.2	7.0	Natural Gas	2008
FRİTOLAY GIDA SAN.VE TİC. AŞ. (Addition)	0.1	4.0	Natural Gas	2008
KARKEY (SİLOPİ-5) (154 kV) (Addition)	14.8	103.2	Fuel Oil	2008
MELİKE TEKSTİL (GAZİANTEP)	1.6	11.0	Natural Gas	2008
MİSİS APRE TEKSTİL BOYA EN. SAN.	2.0	14.0	Natural Gas	2008
MODERN ENERJİ (LÜLEBURGAZ)	13.4	94.1	Natural Gas	2008
POLAT TURZ. (POLAT RENAISSANCE İST. OT.)	1.6	11.0	Natural Gas	2008
SARAYKOY JEOTERMAL (Denizli)	6.9	50.0	Geothermal	2008
SONMEZ Elektrik (Addition)	8.7	67.3	Natural Gas	2008
AKKOY ENERJİ (AKKOY I HES)	101.9	408.0	Hydro (with Dam)	2008
ALP ELEKTRİK (TINAZTEPE) ANTALYA	7.7	29.0	Hydro (run of river)	2008
CANSU ELEKTRİK (MURGUL/ARTVİN)	9.2	47.0	Hydro (run of river)	2008
DAREN HES ELKT. (SEYRANTEPE BARAJI VE HES)	49.7	182.0	Hydro (With Dam)	2008
DEĞİRMENÜSTÜ EN. (KAHRAMANMARAŞ)	25.7	69.0	Hydro (With Dam)	2008
GOZEDE HES (TEMSA ELEKTRİK) BURSA	2.4	10.0	Hydro (run of river)	2008
H.G.M ENERJİ (KEKLİCEK HES) (Yeşilyurt)	8.7	18.0	Hydro (run of river)	2008
HİDRO KNT. (YUKARI MANAHOZ REG. VE HES)	22.4	79.0	Hydro (run of river)	2008
İÇ-EN ELK. (ÇALKIŞLA REGÜLATORÜ VE HES)	7.7	18.0	Hydro (run of river)	2008
KALEN ENERJİ (KALEN II REGÜLAT. VE HES)	15.7	50.0	Hydro (run of river)	2008
MARAŞ ENERJİ (FIRNIS REGÜLATORÜ VE HES)	7.2	36.0	Hydro (run of river)	2008
SARMAŞIK I HES (FETAŞ FETHİYE ENERJİ)	21.0	96.0	Hydro (run of river)	2008
SARMAŞIK II HES (FETAŞ FETHİYE ENERJİ)	21.6	108.0	Hydro (run of river)	2008
TORUL	105.6	322.0	Hydro (With Dam)	2008
YEŞİL ENERJİ ELEKTRİK (TAYFUN HES)	0.8	5.0	Hydro (run of river)	2008
ERDEMİR(Ereğli-Zonguldak)	36.1	217.95	Natural Gas	2009
ARENKO ELEKTRİK ÜRETİM A.Ş. (Denizli)	12	84	Natural Gas	2009
TAV İSTANBUL TERMİNAL İŞLETME. A.Ş.	6.52	54.56	Natural Gas	2009
AKSA AKRİLİK KİMYA SN. A.Ş. (YALOVA)	70	539	Natural Gas	2009
KASAR DUAL TEKSTİL SAN. A.Ş. (Çorlu)	5.67	38	Natural Gas	2009
SONMEZ ELEKTRİK(Uşak) (Addition)	8.73	67.29	Natural Gas	2009
GÜRMAT ELEKT. (GÜRMAT JEOTERMAL)	47.4	313	Geothermal	2009
DELTA ENERJİ ÜRETİM VE TİC.A.Ş.	60	467	Natural Gas	2009
KEN KİPAŞ ELKT. ÜR.(KAREN) (K.Maraş)	17.46	73.36	Natural Gas	2009

TESKO KİPA KİTLE PAZ. TİC. VE GIDA A.Ş.	2.33	18	Natural Gas	2009
NUH ÇİMENTO SAN. TİC. A.Ş.(Nuh Çim.) (Addition)	46.95	328.65	Natural Gas	2009
SİLOPİ ELEKTRİK ÜRETİM A.Ş.	135.000	945.00	Asphaltit	2009
MAURİ MAYA SAN. A.Ş.	2.000	16.52	Natural Gas	2009
AKSA ENERJİ (Antalya) (Addition)	300.000	2310.00	Natural Gas	2009
ANTALYA ENERJİ (Addition)	41.820	302.24	Natural Gas	2009
MARMARA PAMUKLU MENS. SN.TİC.A.Ş.	34.920	271.68	Natural Gas	2009
AKSA ENERJİ (Antalya) (Addition)	300.000	2310.00	Natural Gas	2009
ZORLU ENERJİ (B.Karıştıran) (Addition)	49.530	395.21	Natural Gas	2009
İÇDAŞ ÇELİK (Addition)	135.000	961.67	Imported coal	2009
GLOBAL ENERJİ (PELİTLİK)	8.553	65.31	Natural Gas	2009
RASA ENERJİ (VAN)	78.570	500.00	Natural Gas	2009
DELTA ENERJİ ÜRETİM VE TİC.A.Ş. (Addition)	13.000	101.18	Natural Gas	2009
İÇDAŞ ÇELİK (Addition)	135.000	961.67	Imported coal	2009
DALSAN ALÇI SAN. VE TİC. A.Ş.	1.165	9.00	Natural Gas	2009
AK GIDA SAN. VE TİC. A.Ş. (Pamukova)	7.500	61.00	Natural Gas	2009
CAM İŞ ELEKTRİK (Mersin) (Addition)	126.100	1008.00	Natural Gas	2009
SELKASAN KAĞIT PAKETLEME MALZ. İM.	9.900	73.00	Natural Gas	2009
TAV İSTANBUL TERMİNAL İŞLETME. A.Ş.	3.260	27.28	Natural Gas	2009
DESA ENERJİ ELEKTRİK ÜRETİM A.Ş.	9.800	70.00	Natural Gas	2009
FALEZ ELEKTRİK ÜRETİMİ A.Ş.	11.748	88.00	Natural Gas	2009
AKSA ENERJİ (MANİSA) (Addition)	62.900	498.07	Natural Gas	2009
SİLOPİ ELEKTRİK ÜRETİM A.Ş.(ESENBOĞA)	44.784	315.00	Fuel Oil	2009
TAŞOVA YENİDEREKOY HES (HAMEKA A.Ş.)	1.980	10.00	Hydro (run of river)	2009
TEKTUĞ (Erkenek)	6.000	24.00	Hydro (run of river)	2009
BAĞIŞLI REG. VE HES (CEYKAR ELEKT.)	9.857	32.96	Hydro (run of river)	2009
DEĞİRMENÜSTÜ EN. (KAHRAMANMARAŞ)	12.850	35.28	Hydro (run of river)	2009
BAĞIŞLI REG. VE HES (CEYKAR ELEKT.)	19.714	66.04	Hydro (run of river)	2009
TOCAK I HES (YURT ENERJİ ÜRETİM SN.)	4.760	13.00	Hydro (run of river)	2009
BEYOBASI EN. ÜR. A.Ş. (SIRMA HES)	5.880	23.00	Hydro (run of river)	2009
OZYAKUT ELEK. ÜR.A.Ş. (GÜNEŞLİ HES)	1.800	8.00	Hydro (run of river)	2009
LAMAS III - IV HES (TGT ENERJİ ÜRETİM)	35.674	150.00	Hydro (run of river)	2009
YPM SEVİNDİK HES (Suşehri/SİVAS)	5.714	36.00	Hydro (run of river)	2009

YPM GOLOVA HES (Suşehri/SİVAS)	1.050	3.00	Hydro (run of river)	2009
BEREKET ENERJİ (KOYULHİSAR HES)	42.000	329.00	Hydro (run of river)	2009
KALEN ENERJİ (KALEN I - II HES)	15.650	52.17	Hydro (run of river)	2009
CİNDERE HES (Denizli)	19.146	58.00	Hydro (With Dam)	2009
ŞİRİKÇİOĞLU EL.(KOZAK BENDİ VE HES)	4.400	15.00	Hydro (run of river)	2009
AKUA ENERJİ (KAYALIK REG. VE HES)	5.800	39.00	Hydro (run of river)	2009
KAYEN ALFA ENERJİ (KALETEPE HES)	10.200	37.00	Hydro (run of river)	2009
OBRUK HES	212.400	473.00	Hydro (With Dam)	2009
ANADOLU ELEKTRİK (ÇAKIRLAR HES)	16.158	60.00	Hydro (run of river)	2009
AKÇAY HES ELEKTRİK ÜR. (AKÇAY HES)	28.780	95.00	Hydro (run of river)	2009
ELESTAŞ ELEKTRİK (YAYLABEL HES)	5.100	20.00	Hydro (run of river)	2009
ERVA ENERJİ (KABACA REG. VE HES)	4.240	16.50	Hydro (run of river)	2009
ELESTAŞ ELEKTRİK (YAZI HES)	1.109	6.00	Hydro (run of river)	2009
ERVA ENERJİ (KABACA REG. VE HES)	4.240	16.50	Hydro (run of river)	2009
TÜM ENERJİ (PINAR REG. VE HES)	30.090	138.00	Hydro (run of river)	2009
TEKTUĞ (Erkenek) (Additon)	6.514	26.00	Hydro (run of river)	2009
SARITEPE HES (GENEL DİNAMİK SİS.EL.)	2.450	10.00	Hydro (run of river)	2009
UZUNÇAYIR HES (Tunceli)	27.330	105.00	Hydro (With Dam)	2009
YEŞİLBAŞ ENERJİ (YEŞİLBAŞ HES)	14.000	56.00	Hydro (run of river)	2009
SARITEPE HES (GENEL DİNAMİK SİS.EL.)	2.450	10.00	Hydro (run of river)	2009