SARACBENDI HPP RUN-OF-RIVER HYDRO PROJECT

Document Prepared by Life Enerji

Elen Enerji Üretimi Sanayi Ticaret A.Ş. (As Project Owner)
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Project Title	Saracbendi HPP Run-of-River Hydro Project
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1 PROJECT DETAILS

1.1 Summary Description of the Project

Saracbendi HPP is a 24.608 MWm/23.67 MWe[1] low head run-of-river power plant using a new weir structure to deviate river water of the Kızılırmak River into an intake structure with three settlement basins. From there it enters an open trapezoidal canal of 25.6 km length which runs along the left bank of the river. At the end a head pond is located with an intake to two steel penstocks of 3.90 m diameter and 159.9 m length each which lead to the powerhouse with the turbines. From there the water is released to the Kızılırmak River by an open canal. The powerhouse is an open type in a rock cut and houses 4 units vertical Francis turbines with vertical shaft and 5.918 MWe each, i.e. 23.67 MWe installed capacity.

The purpose of the Project is to export the generated electricity to the regional grid, thereby contributing to the Turkey's electricity demand and rapidly growing economy. Since the Project generates electricity from renewable energy resources, it makes a significant contribution to climate protection. According to the validated VCS-PD, the Project was expected to generate 100,470 MWh of electricity annually, and to reduce 46,376 tonnes of CO_2 emissions per year for 1st crediting period, by supplying renewable energy that would have been supplied by the existing power grid that generates electricity predominantly from fossil fuel powered thermal power plants.

The land was mostly field prior to the implementation of the project activity. The project involves the construction of a greenfield plant, i.e. installations on the left bank area of Kızılırmak River.

The electricity produced by project activity will result in an emission reduction of 46,376 tonnes of CO_2e/year and total emission reduction by the project activity is estimated to be 463,760 tonnes of CO_2e for the 2nd CP, which is 06-May-2021 to 05-May-2031.

Third monitoring period that covers the 1st CP and 2nd CP including 2.8 years from 01-August-2019 to 31-May-2022 (both days included). The emission reductions achieved in 1st crediting period are 45,619 tons of CO_2e for 01-August-2019 to 05-May-2021 and the emission reductions achieved in 2nd crediting period are 19,324 tons of CO_2e for 06-May-2021 to 31-May-2022. Thus, total emission reductions achieved in this monitoring period are 64,923 tons of CO_2e.

As a result, 305,637 tons of CO_2e avoidance and 556,627.10 MWh electricity generation will be implemented at the end of this monitoring period throughout the 1st crediting period of project.

[1] Please see: Provisional Acceptance Letter (page 7)

Audit Type	Period	Program	VVB Name	Number of years
Validation	N/A	VCS Program	Burea Veritas Certification Holding SAS	N/A
1st Verification	06-May-2011 to 31-July-2013	VCS Program	RINA Services S.p.A.	2.2
2nd Verification	01-August-2013 to 31-July-2019	VCS Program	Re Carbon Gözetim Denetim ve Belgelendirme Ltd. Şti.	6
3rd Verification of 1st CP + RCP + 1st Verification of 2nd CP	01-August-2019 to 31-May-2022	VCS Program	LGAI Technological Center, S.A. (Applus+)	2.8
Total	06-May-2011 to 31-May-2022	VCS Program	N/A	11

1.2 Sectoral Scope and Project Type

Title: Grid-Connected Electricity Generation from Renewable Sources

Reference: ACM0002 (Version 21.0)[2]

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

Scope Number: 1

1.3 Project Eligibility

"Saracbendi HPP Run-Of-River Hydro Project" is classified in the Renewable Energy Source category as electricity from non-fossil and non-depletable energy sources with scope number 1, in this case from hydro power, is fed into the Turkish electricity grid.

1.4 Project Design

The project includes a single location and installation only and the project activity is not a grouped project activity.

Eligibility Criteria

This is not a grouped project activity.

1.5 Project Proponent

Organization name	Elen Enerji Üretimi Sanayi Ticaret A.Ş.
Contact person	Melis Ünal

[2] Please see https://cdm.unfccc.int/UserManagement/FileStorage/ZPFJL01OU2RYC6N3HASIXV7K84QBG9

Title	Deputy Manager
Address	Akfen Yenilenebilir Enerji A.Ş. Turan Güneş Bulvarı Galip Erdem Cad. No: 3 Çankaya/ANKARA
Telephone	+90 (312) 408 10 00
Email	munal@akfen.com.tr

1.6 Other Entities Involved in the Project

Organization name	Life İklim ve Enerji Ltd. Şti.
Role in the project	Project Developer
Contact person	Kerem Aslan
Title	Carbon Consultant
Address	Oğuzlar Mahallesi, 1377. Sk. No:19, 06520 Çankaya/Ankara/ TURKEY
Telephone	+90 312 481 2142
Email	kerem.aslan@lifeenerji.com

1.7 Ownership

The project is owned by individual Elen Enerji Üretimi Sanayi Ticaret A.Ş. and the project owner has the legal right to control and operate the project activity as per the project license[3].

1.8 Project Start Date

Project start date is 06-May-2011 since project has started to feed national grid and generated the first GHG emission reduction as per the definition in VCS Standard.

1.9 Project Crediting Period

A two-times renewable crediting period shall apply over 10-years. Thus, the second crediting period shall begin just after the date of end of first crediting period (06-May-2021 and last until the end of 10-year period 05-May-2031).

First Crediting Period (1st CP):

Start of 1st CP : 06-May-2011

End of 1st CP : 05-May-2021

Second Crediting Period (2nd CP):

Start of 2nd CP : 06-May-2021

End of 2nd CP : 05-May-2031

[3] Please see the appendix 3 for the generation license of the project activity.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	X
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
2021 (06-May-2021 to 31-December-2021	30,494
2022 (01-January-2022 to 31-December-2022)	46,376
2023 (01-January-2023 to 31-December-2023)	46,376
2024 (01-January-2024 to 31-December-2024)	46,376
2025 (01-January-2025 to 31-December-2025)	46,376
2026 (01-January-2026 to 31-December-2026)	46,376
2027 (01-January-2027 to 31-December-2027)	46,376
2028 (01-January-2028 to 31-December-2028)	46,376
2029 (01-January-2029 to 31-December-2029)	46,376
2030 (01-January-2030 to 31-December-2030)	46,376

2031 (01-January-2031 to 05-May-2031)	15,882
Total estimated ERs	**463,760**
Total number of crediting years	**10**
Average annual ERs	**46,376**

1.11 Description of the Project Activity

Saracbendi Run-of-River Hydro Project is a 24.608 MWm / 23.67 MWe [4*(6.152 MWm /5.918 MWe) run-of-river hydro power plant. Commercial electricity production on 06-May-2011. Produced electricity is being fed into the national grid.

The project generates a substantial emission reduction by bringing carbon neutral electricity production to the Turkish grid. The hydro project shall be registered as a voluntary emission reduction project under the Voluntary Carbon Standard. The expected co-financing from carbon market proceeds has enabled the projects implementation.

The 23.67 MWe Saracbendi run-of-river HPP produces electricity for transmission into the national grid, using the kinetic energy of the water in Kızılırmak River. For this purpose, an 8 m high (from riverbed) weir is constructed. From there the water is sent via a new approximately 26 km long conveyance canal on the left bank of Kızılırmak River to a head pond. Two penstocks channel the water to four turbines powering four 1 production of the project activity is expected to be 100.47 GWh. Detailed technical characteristics of Saracbendi HPP are given Table 1 and Figures below.

Operational lifetime of the HPP is calculated as 39 years for the Saracbendi HPP by using the 'Tool to determine the remaining lifetime of equipment'' version 01[4]. In the tool it is said that lifetime for the Hydro Turbines is 150,000 hours. In order to determine operational lifetime of the HPP firstly capacity factor of the HPP should be calculated because HPP will not be in operation for whole year. By dividing annual generation (100,470 MWh/year) to the installed capacity (23.67 MW), the operation time in a year is 4,244.61 h/year. Since operation lifetime is related to the economic analysis, in the calculation of operational lifetime annual generation and installed capacity figures are taken from Generation License of the HPP. Finally dividing lifetime of the equipment (150,000 hours) to the operational time per year, lifetime of the equipment is found in terms of year which is 35.3. To be conservative operational lifetime of the hydro turbines is 35 years. Also, the operational lifetime is in line with the technical lifetime of the electromechanical equipment.

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf

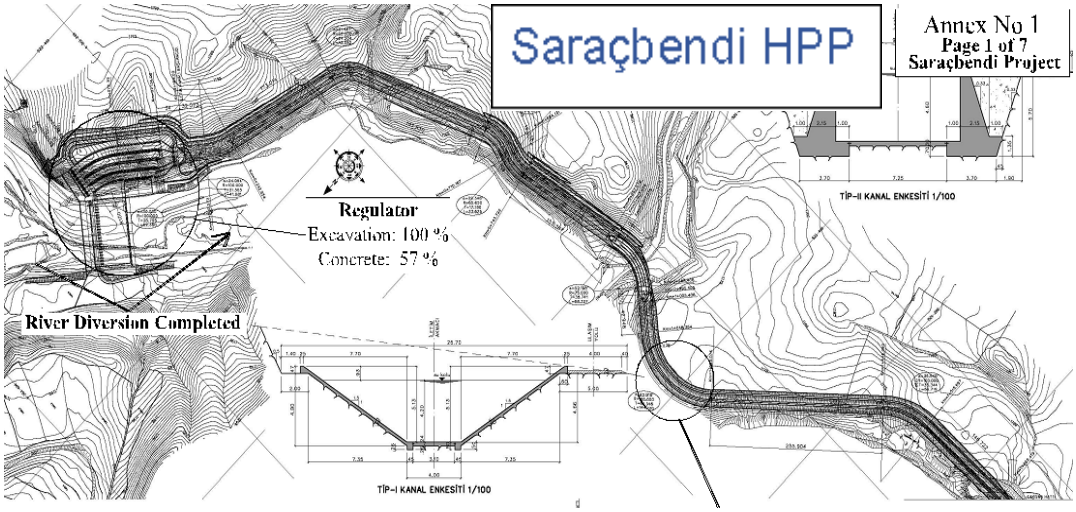


Figure 1 - Technical Overview – Weir and Conveyance Canal

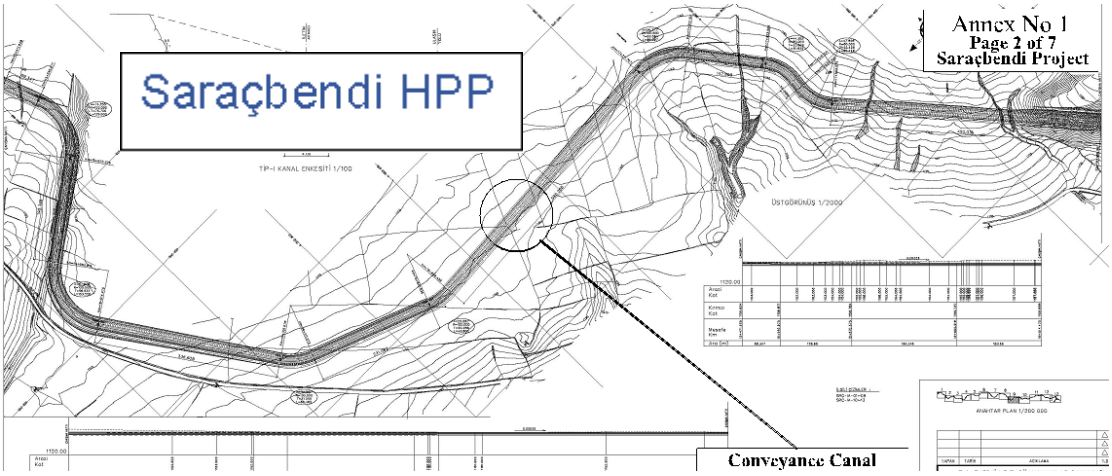


Figure 2 - Technical Overview – Conveyance Canal

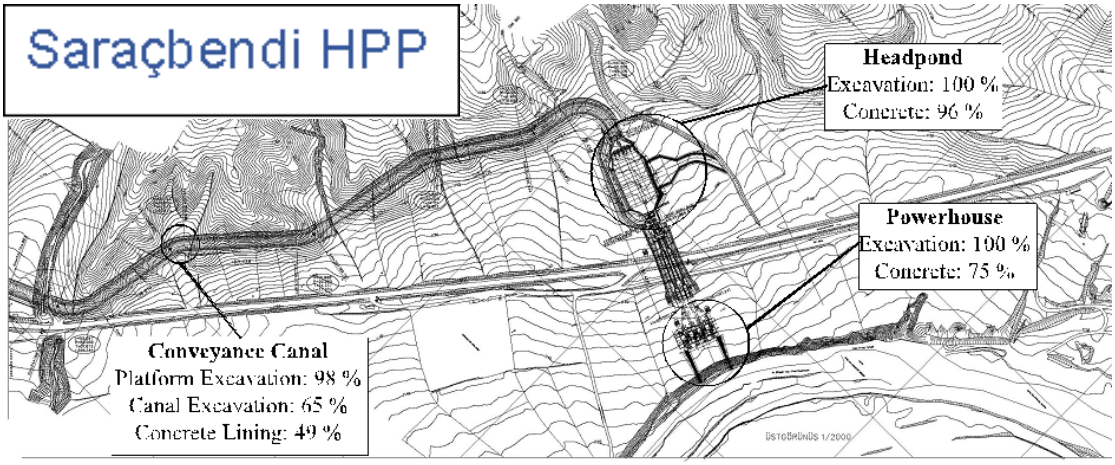
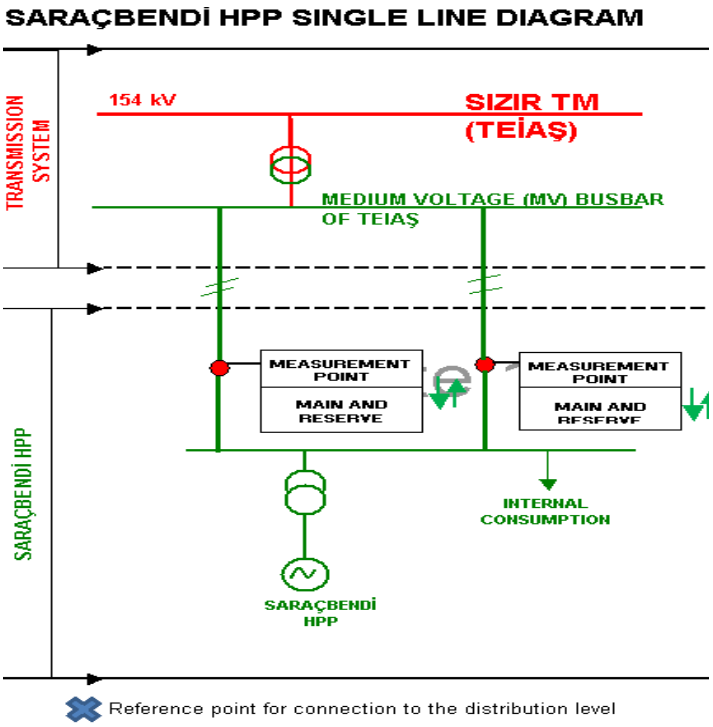


Figure 3 - Technical Overview – Conveyance Canal, Head pond, Powerhouse



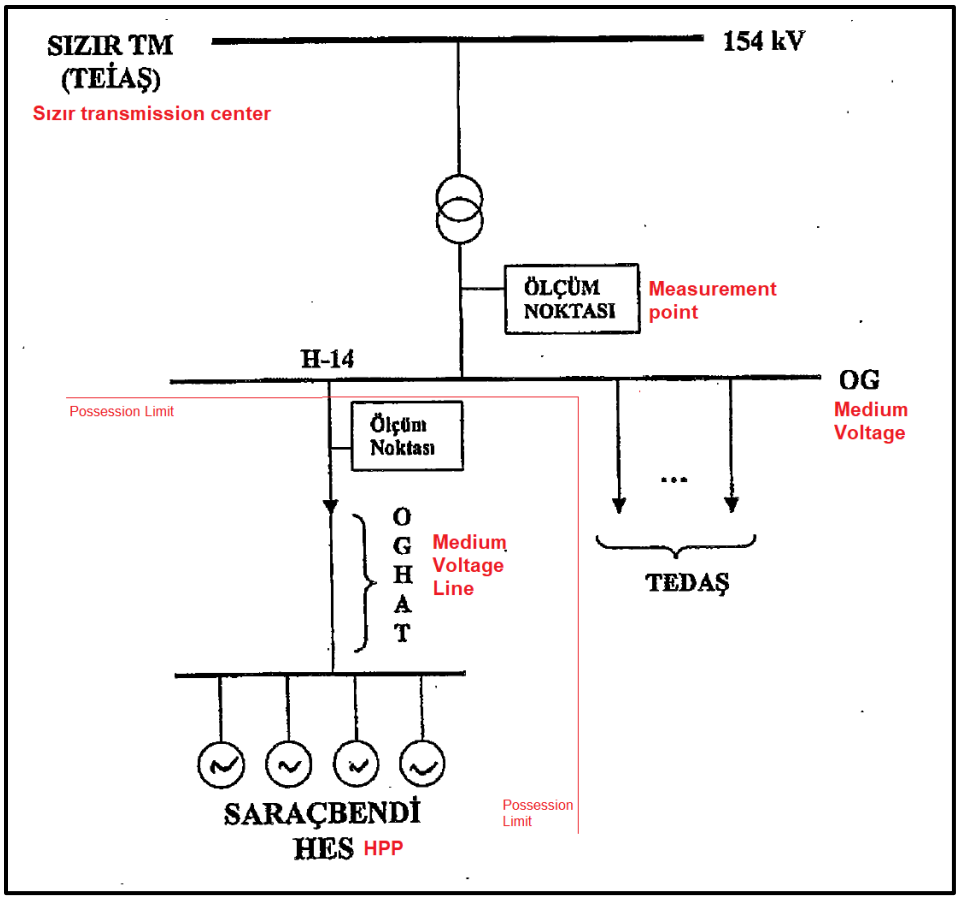
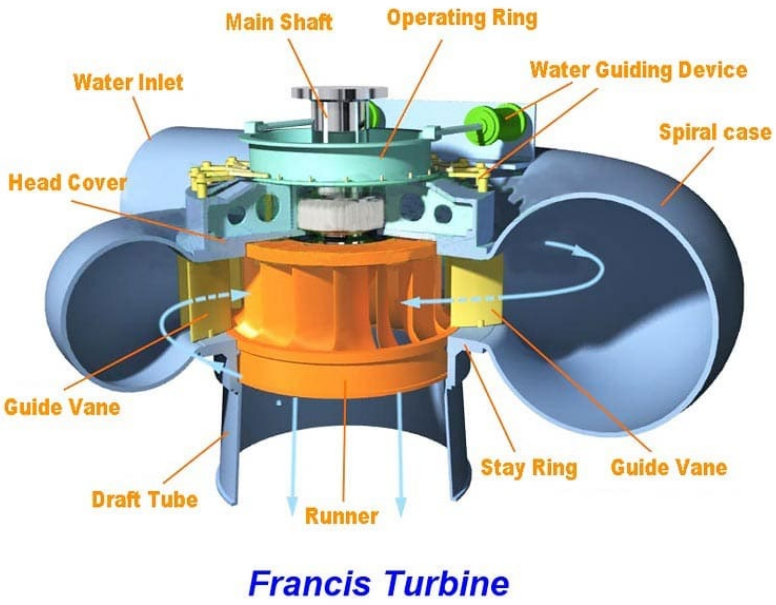


Figure 4 - Single Line Diagrams of Saracbendi HPP

Table 1 - Technical Characteristics of Saracbendi HPP

Project Main Characteristics	Type:	Run-of-river HPP
	Total Installed Power:	23.67 MWe
	Power Generation:	100.47 GWh /year
Weir	Type:	Concrete, free overflow
	Construction dimensions:	8 m high; 84 m wide; 1.165 m elevation at crest
	Project (Max.) Discharge	50.00 m^3/s
Turbine	Turbine Type	Vertical Francis
	Number of Units	4
	Unit Power	6.152 MW
	Installed Power	23.67
Generator	Number of Generators	4
	Power	5,918 MW
Transformers and transmission line	Number of Transformers	4
	Voltage	6.3/3.1.5±2x%2.5kV
	Frequency	50 Hz
	Transmision line	Connection to Şarkışla District Transformer Center 34.5 kV, 477 MCM section, 30 km transmission line.
Hydraulic Turbine	Type	HLA551C-LJ-170
Generator	Type	SF5918-22/3250
Turbine-1 and Generator-1	Product no of sets	ND2009022-01
Turbine-2 and Generator-2		ND2009022-02
Turbine-3 and Generator-3		ND2009022-03
Turbine-4 and Generator-4		ND2009022-04



[5]

Figure 5 - Illustration of Francis Turbine

Plant Load Factor (PLF) is calculated as follows;

PLF= Annual Gen. / (Installed Cap. * working hours)

=100,470 / (23.67 * 8760)

=0.4845

1.12 Project Location

The project is located downstream of Yamula River on Kızılırmak River; it lies within the boundaries of Gemerek municipality, Sivas province, in Central Anatolian Region of Turkey. The closest settlements to the project site are Çepni village and Saraç village. The project area is 19 km northeast of Gemerek city (Sivas province), 22 km southwest of Şarkışla city (Sivas province) and 37 km north of Akkışla village (Kayseri province).

Table 2 - Geographical coordinates of the Weir and the Power plant[6]

	Weir	Power Plant
Latitude	36° 9' 40.638" E	36° 6' 43.128" E
Longitude	39° 19' 28.184" N	39° 8' 30.730" N

[5] Picture is taken from: https://theconstructor.org/practical-guide/francis-turbines-components-application/2900/

[6] Please see; Table 2 in approved PD

Figure 6 - Location of the plant

1.13 Conditions Prior to Project Initiation

The pre-project scenario is the same as baseline scenario. Please refer to Section 3.4 (Baseline Scenario) for the description of baseline scenario.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

Laws as relevant to the project are (Law No. and Publication Date in Official Gazette):

(1) Electricity Market Law (6446, 30-03-2013)[7]

(2) Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy (5346, 18-05-2005)[8]

(3) Environment Law (2872, 11-08-1983)[9]

(4) Occupational Health and Safety Regulation (6331, 30-06-2012)[10]

(5) Forest Law (Nr. 6831)[11]

The renewable Energy generation license for Saracbendi HPP has been issued considering Electricity Law and Law in utilization of Renewable Energy Resources for generating electricity energy. The proposed project is also within the scope of and in compliance with Energy Efficiency

[7] See: https://www.resmigazete.gov.tr/eskiler/2013/03/20130330.pdf

[8] See: https://www.resmigazete.gov.tr/eskiler/2005/05/20050518-1.htm

[9] See http://www.mevzuat.gov.tr/MevzuatMetin/1.5.2872.pdf

[10] See: http://www.mevzuat.gov.tr/MevzuatMetin/1.5.6331.pdf

[11] See: https://www.mevzuat.gov.tr/MevzuatMetin/1.3.6831.pdf

Law. Environment Law is also satisfied, and it has been confirmed by Ministry of Environment that the Saracbendi HPP is out of Environmental Impact Assessment Regulation. Forest Law, which specifies that forest areas can be allocated by Ministry of Environment and Forestry to institutions or individuals for energy, plants if the project implementation serves common good for public. As in Turkey there is no applicable local regulations to HPP constructions the list above includes national regulation only.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

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

1.15.2 Projects Rejected by Other GHG Programs

Saracbendi HPP has not applied for crediting under any other GHG program, nor has it been rejected by any other GHG program.

1.16 Other Forms of Credit

1.16.1 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.

1.16.2 Other Forms of Environmental Credit

The project has not created any form of other credit. Elen Enerji Üretimi Sanayi Ticaret A.Ş. does not obtain any public funding.

1.16.3 Supply Chain (Scope 3) Emissions

This project activity does not impact the emissions of goods and services in a supply chain and, therefore, Scope 3 emissions. Thus, this section is not applicable.

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

The project is expected to contribute 3 SDGs which are SDG 7, 8 and 13 for the second crediting period.

SDG 7 Energy: The project contributes SDG Target 7.2 “By 2030, increase substantially the share of renewable energy in the global energy mix” and Indicator 7.2.1 by the utilization of hydro power as a renewable energy source.

SDG 8 Decent Work and Economic Growth: During the operation phase of the project, job opportunities are created. Therefore, the project contributes to SDG Target 8.8 “Protect labour

rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment" and Indicator 8.8.2 by providing employment and job-related training to the employees. SGK (Social Security Institution) Records and HSE training certificates will be provided during each monitoring period.

SDG 13 Climate Change: The project produces clean renewable energy by diminishing CO_2 emissions. Therefore, it contributes SDG Target 13.0 "Tonnes of greenhouse gas emissions avoided or removed".

1.17.2 Sustainable Development Contributions Activity Monitoring

The project will help Turkey to stimulate and commercialize the use of grid connected renewable energy technologies and markets. Furthermore, the project will demonstrate the viability of grid connected hydro power 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 hydro power industry in Turkey;
- create local employment during the construction and the operation phase of the hydro power plant;
- reduce other pollutants resulting from power generation industry in Turkey, compared to a business-as-usual scenario;
- help to reduce Turkeys increasing energy deficit; and differentiate the electricity generation mix and reduce import dependency.

The project is located downstream of Yamula River on Kızılırmak River; it lies within the boundaries of Gemerek municipality, Sivas province, in Central Anatolian Region of Turkey. Electricity generated by the project is fed into the national electricity grid, displacing energy that would otherwise be generated by fossil fuels. The project facilitated 124,905.30 MWh renewable electricity generation, 64,923 tCO_{2e} during its third monitoring period.

Table 3 - Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	64,923 tCO_{2e} emission reduction during this MP.	241,147 tCO_{2e} emission reduction over the project lifetime 2nd MP: (01-August-2013 to 31-July-2019) 3rd MP: (01-August-2019 to 31-May-2022)
2)	7.2	7.2.1 Renewable energy share in the total final energy consumption	Implemented activities to increase	124,905.30 MWh renewable electricity generation during this MP	445,845.25 MWh renewable electricity generation over the project lifetime. 2nd MP: (01-August-2013 to 31-July-2019) 3rd MP: (01-August-2019 to 31-May-2022)
3)	8.8	8.8.2 Quantitative employment and income generation	Implemented activities to increase	There are 13 employees have been working at the plant during this MP.	Throughout the construction and operation phases, employment record has been provided by the Project Activity over the project lifetime. Now, 13 employees are working, and 16 employees have worked at the plant during the project lifetime. 2nd MP: (01-August-2013 to 31-July-2019) 3rd MP: (01-August-2019 to 31-May-2022)

1.18 Additional Information Relevant to the Project

Leakage Management

There is no leakage management with respect to paragraph 61 of applied methodology ACM0002, Version 21.0[12].

Commercially Sensitive Information

Commercially sensitive information has been excluded from this document.

Further Information

Not applicable.

2 SAFEGUARDS

2.1 No Net Harm

No negative environmental and socio-economic impacts have been observed/recorded for this monitoring period as confirmed by the project participant and stakeholders during the interviews[13]. Environmental Impact Assessment was not required.

The project activity takes into account negative comments -mostly provided by mukhtar- from local stakeholders for socio-economic impacts of the project activity and implements an action plan to take necessary actions accordingly. Project activity takes precautions for possible environmental impacts of the project such as; wastewater storage and disposal of them, hazardous and domestic waste storage, lifeline water and necessary training for all employees.

2.2 Local Stakeholder Consultation

Stakeholder engagement procedure was conducted at the Saraç village on 14.00 o'clock, on Friday, 16-July-2010.
The stakeholder groups, which included the local participants directly impacted by the project and local authorities, were informed through oral and written announcement about the meeting. There was a comprehensive meeting in which villagers found a chance to participate. The meeting was held in meeting room of the village, while there was no coffee house in the village. That meeting room is often used by villagers for social meetings and celebrations. So, it was the most popular and wide place of the village. Villagers meet each other there often. This is also a place where announcements are stated.

[12] https://cdm.unfccc.int/UserManagement/FileStorage/ZPFJL01OU2RYC6N3HASIXV7K84QBG9

[13] Please see: Document of EIA is not required.

On-going communication with the stakeholders

Logbook is available for comments of local stakeholders. What's more, thanks to the Grievance Mechanism, local stakeholders have a chance to submit their requests and complaints to the project owner about the project. In addition, mukhtar (head of the village) had already taken the contact information (e.g mobile phone) of public relationships expert, project manager and assistant general director of the company so that the local stakeholders can be able to reach these people whenever they have any complaints, suggestions, or ideas about the project. They can be able to communicate with them in case of any problems. They can be able to communicate with them in case of any problems. Since mukhtar is the head of the village, he is the main contact person between the project owner and the local stakeholders. Mukhtar is made sure that there is continuous communication between the two parties. However, most of the stakeholders orally convey their complaints/requests to Mukhtar instead of using the logbook. Then, Mukhtar is getting contact with project owner and employees at the sites regarding complaints/requests. In addition, there are two different declarations by Mukhtar based on the confirmation given by the Mukhtar that the notebook is in the Mukhtar and the comments by the stakeholders conveyed to the mukhtar orally.

2.3 Environmental Impact

In Turkey, there are 35 Nature Preservation Area[14] and 33 National Parks[15]. The project is not located in any of these. Furthermore, in Turkey, there are 58-registered Monument of Nature[16] and 16 registered Nature Park. None of these Monuments of Nature and Nature Parks is located in the project area.

According to the relevant Environmental Impact Assessment Regulation[17] which is in the 1.14 section for Saracbendi HPP, an Environmental Impact Assessment is not required. The official letter from Environment and Forestry Ministry confirming the non-applicability of this regulation has been available during the re-validation process.

Environmental benefits

The project helps Turkey to stimulate and commercialize the use of grid connected renewable energy technologies and markets. The specific economic, social, and technological benefits are:

- Reducing Turkeys expanding energy deficit;
- Diversification of Turkish electricity generation mix and reduction of import dependency;
- Creation of local employment and income during construction and operation of HPP (directly as well as indirectly via contracts with local providers for supply of construction material);
- Foster infrastructural investments with connected development benefits to the local rural community in the remote project area;

[14] https://www.ktb.gov.tr/EN-99884/natural-protection-areas.html

[15] https://www.ktb.gov.tr/EN-99769/national-parks.html

[16] https://www.ktb.gov.tr/EN-99825/nature-monuments.html

[17] http://www.mevzuat.gov.tr/MevzuatMetin/1.5.2872.pdf

- Making rural electricity supply more reliable, better available and cost efficient thanks to decreasing distances between generation and consumption points.

2.4 Public Comments

There are no public comments.

2.5 AFOLU-Specific Safeguards

This is a non-AFOLU project.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Title: Grid-Connected Electricity Generation from Renewable Sources

Reference: ACM0002 (Version 21.0)[18]

For the determination of the baseline, CDM approved baseline and monitoring methodology ACM0002 version 21.0 – "Grid-connected renewable electricity generation" is applied. For baseline calculations, ACM0002 version 21.0 refers to the "Tool to calculate the emission factor for an electricity system", Version 7.0. Additionality is demonstrated via application of the "Tool for the demonstration and assessment of additionality", Version 07.0.

The methodology is used in conjunction with the following tools:

1. Tool to calculate the emission factor for an electricity system (TOOL07) (Version 07.0)[19]
2. Tool for the demonstration and assessment of additionality (TOOL01) (Version 07.0.0)[20]
3. Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (TOOL11) (Version 03.0.1)[21]

3.2 Applicability of Methodology

The choice of methodology ACM0002 Version 21 is justified as the proposed project activity meets the relevant applicability criteria:
The Hydroelectric Power Plant Project involves installation of a new 23.67 MWe grid connected renewable electricity generation plant,

The methodology is applicable under the following conditions:

Applicability Criteria	Applicability to the project activity
This methodology is applicable to grid connected renewable energy power generation project activities that: (a) Install a Greenfield power plant;	The project activity is a greenfield hydro power plant which are renewable

[18] Please see https://cdm.unfccc.int/UserManagement/FileStorage/ZPFJL01OU2RYC6N3HASIXV7K84QBG9
[19] Please see https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf
[20] Please see https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf
[21] Please see https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

Applicability Criteria	Applicability to the project activity
(b) Involve a capacity addition to (an) existing plant(s); (c) Involve a retrofit of (an) existing operating plant(s)/unit(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s).	energy generation. Thus, the project activity complies with this criterion.
In case the project activity involves the integration of a BESS, the methodology is applicable to grid-connected renewable energy power generation project activities that:	The project activity is a hydro power plant and no integration of a BESS involve within the boundary of the project activity. Thus, this criterion is not applicable for this project activity.
The methodology is applicable under the following conditions: (a) Hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; (b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects) the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity; (c) In case of Greenfield project activities applicable under paragraph 5 (a) above, the project participants shall demonstrate that the BESS was an integral part of the design of the renewable energy project activity (e.g. by referring to feasibility studies or investment decision documents); (d) The BESS should be charged with electricity generated from the associated renewable energy power plant(s). Only during exigencies 2 may the BESS be charged with electricity from the grid or a fossil fuel electricity generator. In such cases, the corresponding GHG emissions shall be accounted for as project emissions following the requirements under section 5.4.4 below. The charging using the grid or using fossil fuel electricity generator should not amount to more than 2 per cent of the electricity generated by the project renewable energy plant during a monitoring period. During the time periods (e.g. week(s), months(s)) when the BESS consumes more than 2 per cent of the electricity for charging, the project participant shall not be entitled to issuance of the certified emission reductions for the concerned periods of the monitoring period.	(a) The project activity is a hydro power plant with a run-of-river reservoir. (b) The project activity is not capacity additions, retrofits, or replacements. (c) The project activity is not greenfield project activities applicable under paragraph 5 (a) of methodology. Thus, this criterion is not applicable for this project activity. (d) The project activity is a hydro power plant and no integration of a BESS involve within the boundary of the project activity. Thus, this criterion is not applicable for this project activity.
In case of hydro power plants, one of the following conditions shall apply:	The project is resulted in construction of a new single reservoir with a power density greater than 4 $W/m^{2.}$

Applicability Criteria	Applicability to the project activity
(a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density, calculated using equation (7), is greater than 4 W/m2 ; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (7), is greater than 4 W/m2 ; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (7), is lower than or equal to 4 W/m2 , all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (8), is greater than 4 W/m2 ; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 10 W/m^2. As in the case of Saracbendi HPP this density is well above the 10 W/m^2 threshold (~23.84 W/m^2; reservoir size: 992,982.5263 m^2, installed capacity: 23,672,000 W), emissions (CH_4 and CO_2) from the reservoir are zero. For the projects having power density more than 10 W/m^2 threshold is zero. Hence, the project emission ($PE_{HP,y}$) is zero in line with the section [5.4.3 – 42 – c) – Equation (10) of the ACM0002 methodology v21.0. Thus, criterion (c) is applicable for this project activity.
In the case of integrated hydro power projects, project participants shall: (a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum of five years prior to the implementation of the CDM project activity.	The project activity is a hydro power plant with a single run-of-river reservoir. Thus, this criterion is not applicable for this project activity.
The methodology is not applicable to: (a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (b) Biomass fired power plants/units	Project activities do not involve switching from fossil fuels to renewable energy sources at the site of the project activity and project activity is not a biomass-fired power plant. Thus, this criterion is not applicable for this project activity.
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if	The project activity is not retrofits, rehabilitations, replacements, or

Applicability Criteria	Applicability to the project activity
the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	capacity additions. Thus, this criterion is not applicable for this project activity.
In addition, the applicability conditions included in the tools referred to below apply.	The methodology is used in conjunction with the following latest approved versions of the tools: 1. Tool to calculate the emission factor for an electricity system (TOOL07) (Version 07.0) 2. Tool for the demonstration and assessment of additionality (TOOL01) (Version 07.0.0) 3. Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (TOOL11) (Version 03.0.1)

Applicability Criteria for **Tool 07 version 07.0**,

Applicability Criteria	Applicability to the project activity
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand side energy efficiency projects).	The project activity uses the calculated OM, BM and CM values which published by Turkish Ministry of Energy and Natural Resources which is indicating Türkiye's National Electric Grid Emission Factor for the year of 2020[22] . Thus, re-estimating the OM, BM and CM values will not be conducted by the project activity. Because publication includes calculated Emission Factor values that are Operating Margin (OM), Growth Based Margin (Build Margin-BM) and Combined Margin (CM) Emission Factors, for the relevant year with usage of the UNFCCC's Clean Development Methodology Tool 07-V07.0[23].
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project owners, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in "Appendix 1: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in	The emission factor for only grid power plants (off grid power plants are not taken into account) have been used by Turkish Ministry of Energy and Natural Resources to calculate emission factor.

[22] Latest data (published on 6th October 2021)

[23] https://enerji.gov.tr/evced-cevre-ve-iklim-turkiye-ulusal-elektrik-sebekesi-emisyon-faktoru

Applicability Criteria	Applicability to the project activity
MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity	
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	Within the framework of the 7th Conference of the Parties (COP 7), it was decided to remove Türkiye from the UNFCCC Annex-II list. In addition, Türkiye remains in Annex-I; however, with the emphasis that it is in a different position from the countries in the Annex-I list, a call was made to take into account the special conditions of Türkiye. Decision 26/CP.7 is accessible to further information. For this reason, even if a project activity developed within the borders of Türkiye cannot be developed in CDM, it can be developed in voluntary carbon standards.
Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	There is no/there will be no biofuels in this project activity which is hydro power project.

Applicability Criteria for **Tool 01 version 07.0.0**,

Applicability Criteria	Applicability to the project activity
The use of the "Tool for the demonstration and assessment of additionality" is not mandatory for project participants when proposing new methodologies. Project participants may propose alternative methods to demonstrate additionality for consideration by the Executive Board. They may also submit revisions to approved methodologies using the additionality tool.	The project activity is not proposing a new methodology. The project activity prefers to use this tool for renewal of crediting period.
Once the additionally tool is included in an approved methodology, its application by project participants using this methodology is mandatory.	Additionality tool is included in ACM0002 version 21.0 (approved methodology) and that is why Tool 01 shall be included in the project activity.

Applicability Criteria for **Tool 11 version 03.0.1**,

Applicability Criteria	Applicability to the project activity
This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 49 (a) of the modalities and procedures of the clean development mechanism.	The project activity will renew the crediting period for the first time that approved as 'two-times renewable crediting period over 10 years'.

Applicability Criteria	Applicability to the project activity
The tool consists of two steps. The first step provides an approach to evaluate whether the current baseline is still valid for the next crediting period. The second step provides an approach to update the baseline in case that the current baseline is not valid anymore for the next crediting period.	Two steps defined in the Tool11 is discussed in detail under Section 3.4 of this document.

The methodology is applicable as the proposed project is a grid connected greenfield hydropower plant project with a power density greater than 4 W/m^2. Hence, the approved consolidated methodology ACM0002 Version 21 is applicable to the project activity.

Moreover, for the emission factors, that were used to calculate estimated emission reductions, publication of Turkish Ministry of Energy and Natural Resources, which is indicating Turkey's National Electric Grid Emission Factor for the year of 2020 was used. Publication includes calculated Emission Factor values that are Operating Margin (OM), Growth Based Margin (Build Margin-BM) and Combined Margin (CM) Emission Factors, for the relevant year (which is 2020) with usage of the IPCC's Clean Development Methodology Tool 07-V07.0[24]. For this calculation, information regarding used data set is given detailed in section 4.1 of this document. In brief, the latest version of the Turkish National Electricity Grid Emission Factor was published on 20th of September 2022 and the Emission Factors included in this document belong to the 2020 calculation period[25]. Therefore, the recent available data of the emission factors (the data set used for calculation of emission factors also belongs to 2020.) used in the calculation of the baseline scenario belongs to 2020.

Emission factor calculation is not given in detail in the document published by the Turkish Ministry of Energy and Natural Resources. However, the most recent data and official values for emission factor of Turkey are those published in this report (Please see: https://enerji.gov.tr/evced-cevre-ve-iklim-turkiye-ulusal-elektrik-sebekesi-emisyon-faktoru).

3.3 Project Boundary

The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

Greenhouse's gases included in the project boundary and used in calculations of emission reductions are given in Table 4 below.

Table 4 - Emissions sources included in or excluded from the project boundary

Source		Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source: Fossil fuels fired for electricity generation cause CO_2 emissions. It is included to baseline calculation to find the

[24] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[25] https://enerji.gov.tr//Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klim/%C4%B0klimDe%C4%9Fi%C5%9Fikli%C4%9Fi/EmisyonFaktorleri/BilgiFormu.pdf

Source		Gas	Included?	Justification/Explanation
				displaced amount by the project activity.
		CH_4	No	Minor emission source. Excluded for simplification. This is conservative.
		N_2O	No	Minor emission source. Excluded for simplification. This is conservative.
Project Activity	For dry or flash steam geothermal power plants, emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	The project activity is not a dry or flash steam geothermal power plant. Therefore, there will be no CO_2 project emissions.
		CH_4	No	The project activity is not a dry or flash steam geothermal power plant. Therefore, there will be no CH_4 project emissions.
		N_2O	No	The project activity is not a dry or flash steam geothermal power plant. Therefore, there will be no N_2O project emissions.
	For binary geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	The project activity is not a binary geothermal power plant. Therefore, there will be no CO_2 project emissions.
		CH_4	No	The project activity is not a binary geothermal power plant. Therefore, there will be no CH_4 project emissions.
		N_2O	No	The project activity is not a binary geothermal power plant. Therefore, there will be no N_2O project emissions.
	For binary geothermal power plants, fugitive emissions of hydrocarbons such as n-butane and isopentane (working fluid) contained in the heat exchangers	Low GWP hydrocarbon/refrigerant		The project activity is not a binary geothermal power plant. Therefore, there will be no fugitive emissions of hydrocarbons such as n-butane and isopentane contained in the heat exchangers.
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	The project activity is not a solar thermal power plants or geothermal power plants. Therefore, there will be no CO_2 project emissions.
		CH_4	No	The project activity is not a solar thermal power plants or geothermal power plants.

Source		Gas	Included?	Justification/Explanation
				Therefore, there will be no CH_4 project emissions.
		N_2O	No	The project activity is not a solar thermal power plants or geothermal power plants. Therefore, there will be no N_2O project emissions.
	For hydro power plants, emissions of CH4 from the reservoir	CO_2	No	Minor emission source. Excluded for simplification. This is conservative.
		CH_4	Yes	As in the case of density of this project activity is well above the 10 W/m^2 threshold (~23.84 W/m^2; reservoir size: 992,982.5263 m^2, installed capacity: 23,670,000 W), emissions (CH_4 and CO_2) from the reservoir are zero. For the projects having power density more than 10 W/m^2 threshold is zero. Hence, the project emission ($PE_{HP,y}$) is zero in line with the section [5.4.3 – 42 – c) – Equation (10) of the ACM0002 methodology v21.0.
		N_2O	No	Minor emission source. Excluded for simplification. This is conservative.
	Charging of BESS using electricity from the grid or from fossil fuel electricity generators.	CO_2	No	The project activity is not a charging of BESS project. Therefore, there will be no CO_2 project emissions.
		CH_4	No	The project activity is not a charging of BESS project. Therefore, there will be no CH_4 project emissions.
		N_2O	No	The project activity is not a charging of BESS project. Therefore, there will be no N_2O project emissions.

3.4 Baseline Scenario

The methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period"[26] (version 03.0.1) is adopted to assess the continued validity of the baseline and to update the baseline. This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 49 (a) of the modalities and procedures of the clean development mechanism. According to this tool, the following steps are applied.

Step 1: Assess the validity of the current baseline for the next crediting period

[26] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

The validity of the current baseline is assessed using the following Sub-steps:

Sub Step 1.1 Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies.

The project baseline is the "Grid-connected electricity generation". It complies with the current legal framework. There are no additional laws that came into force that has an impact on the project activity and the project activity is still in line with the available law and regulations.

Sub Step 1.2 Assess the impact of circumstances.

The new national circumstances have an impact on the EF of the grid and thus on the project's current baseline emissions. Accordingly, the EF is updated for the second crediting period in conformity with the latest version of the publication of the Turkey's National Electric Grid Emission Factor for the year of 2020. There has been no major deviation or change in the market characteristic during the first crediting period.

Sub Step 1.3 Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

Operational lifetime of the HPP is calculated as 39 years for the Saracbendi HPP by using the 'Tool to determine the remaining lifetime of equipment''. In the tool it is said that lifetime for the Hydro Turbines is 150,000 hours. In order to determine operational lifetime of the HPP firstly capacity factor of the HPP should be calculated because HPP will not be in operation for whole year. By dividing annual generation (100,470 MWh/year) to the installed capacity (23.67 MW), the operation time in a year will be found which is 4,244.61 h/year. Since operation lifetime is related to the economic analysis, in the calculation of operational lifetime annual generation and installed capacity figures are taken from Generation License of the HPP. Finally dividing lifetime of the equipment (150,000 hours) to the operational time per year, lifetime of the equipment will be found in terms of year which is 35.3. To be conservative operational lifetime of the hydro turbines will be found as 35 years. Also, the operational lifetime is in line with the technical lifetime of the electromechanical equipment.

Sub Step 1.4 Assessment of validity of the data and parameters.

The emissions reduction calculations are based on two main parameters: the energy produced and the grid emission factor. The latter will be updated as explained in the next paragraph. As a requirement of the methodology, only the grid emission factor has been updated during the second crediting period renewal.

Step 2: Update the current baseline and the data and parameters

Sub Step 2.1: Update the current baseline

As confirmed in Step 1, under the current context of the sectoral policies and circumstances, the project baseline for the next crediting period is the use of electricity from the national grid. This is conformed to the provisions of the latest version of the approved applicable methodology. Therefore, there has been no deviation in the baseline scenario.

Sub Step 2.2: Update the data and parameters

The grid emission factor is updated according to the publication of Turkish Ministry of Energy and Natural Resources that is indicating Turkey's National Electric Grid Emission Factor for the year of 2020.

According to details of publication[27],
Operating Margin-OM; 0.7424 tCO_2/MWh
Build Margin-BM; 0.3680 tCO_2/MWh
Combined Margin-CM (calculated for 2nd CP); 0.4616 tCO_2/MWh

In addition, there was no change for the capacity and no change for the reservoir area during the 1st and 2nd monitoring period under 1st crediting period. Therefore, there is further no need to monitor the CAP_{PJ} and A_{PJ} parameters for the 3rd monitoring period under 1st crediting period. Even, newest version of ACM0002 version 21.0 state as the monitoring frequency[28]: "Once at the beginning of each crediting period" for CAP_{PJ} and A_{PJ} parameters. It is apparent that these two parameters, which are monitored in this (3rd) monitoring period under 2nd crediting period, do not need to be monitored for the next verifications under 2nd crediting period. Thus, only parameter will be monitored for the next verification periods under 2nd crediting period will be "$EG_{PJ,facility,y}$" which is related to electricity production.

3.5 Additionality

Alternative: the project activity undertaken without being registered as a VCS project activity,

This alternative is realistic and credible as Saracbendi HPPs may undertake project activity if it sees no risk for the project and/or if the project turns out to be financially attractive without Verified Carbon Units (VCUs) income. However, investments analyses show that the project is not economically feasible without VCUs income. Moreover, the sensitivity analysis confirms that the project activity is unlikely to be economically attractive without the revenues from VCUs as even the maximum IRR result for the best-case scenario (8.48%) is below the benchmark, which is 17.11%. Consequently, the project activity is still additional, and it still has ongoing financial need.

The energy sector in Turkey has been privatized and the installation of hydro power plants is under the initiative of private companies if they obtain a license from EMRA (Energy Market Regulatory Authority). Any legal legislation, law or regulatory framework in Turkey does not oblige hydro power plants installation. Saracbendi HPPs obtained 34-years – 2 month – 9ı days license from EMRA and sells the produced electricity in the free market.

Any enforced law, statute, regulatory surplus or other regulatory framework shall not mandate the project. The project activity is not mandated by any state or national laws. The project proponent is not bound by any legislative mandate to implement the project activity.

[27] (0.7424*0.25+0.3680*0.75 = 0.4616 tCO_2/MWh)
https://enerji.gov.tr//Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klim/%C4%B0klimDe%C4%9Fi%C5%9Fikli%C4%9Fi/TUESEmisyonFktr/Belgeler/Bform2020.pdf

[28] Please see: https://cdm.unfccc.int/UserManagement/FileStorage/ZPFJL01OU2RYC6N3HASIXV7K84QBG9
(Page 28 - Data / Parameter table 17.)

3.6 Methodology Deviations

No methodology deviations have applied during this monitoring period and renewal.

4 IMPLEMENTATION STATUS

4.1 Implementation Status of the Project Activity

Table 5 - Project Implementation Schedule

Date (DD-MM-YYYY)	Activity
08-04-2005	Issuance of the License
25-08-2007	Requests for proposals from consultants for VER development
17-04-2008	Start of first construction activities
28-05-2008	Contract with Hangzhou Yatai Hydro Equipment Comp.Co.Ltd. (generators/turbines)...
01-09-2008	Initial agreement with a VER consultant
25-05-2009	Financial closure with Bank
06-05-2011	Start date of the First Crediting Period
06-05-2011 – 31-07-2013	First monitoring period
01-08-2013 – 31-07-2019	Second monitoring period
01-08-2019 – 31-05-2022	Third monitoring period
05-05-2021	Last date of the First Crediting Period
06-05-2021	Start date of the Second Crediting Period
05-05-2031	Last date of the Second Crediting Period

5 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

For the emission factors, that were used to calculate estimated emission reductions, publication of Turkish Ministry of Energy and Natural Resources, which is indicating Turkey's National Electric Grid Emission Factor for the year of 2020[29] was used. Publication includes calculated Emission Factor values that are Operating Margin (OM), Growth Based Margin (Build Margin-BM) and Combined Margin (CM) Emission Factors, for the relevant year with usage of the IPCC's Clean

[29] (0.7424*0.25+0.3680*0.75 = 0.4616 tCO_2/MWh)
https://enerji.gov.tr//Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klim/%C4%B0klimDe%C4%9Fi%C5%9Fikli%C4%9Fi/TUESEmisyonFktr/Belgeler/Bform2020.pdf

Development Methodology Tool 07 - Tool to calculate the emission factor for an electricity system-V07.0[30]. For this calculation, information regarding used data set is given below in detail:

- TEİAŞ (Turkish Electricity Transmission Corporation) Turkey's electricity generation-consumption and loss statistics,
- Common prepared report under Turkey's National Greenhouse Gas Inventory Reporting Format. - Common Reporting Format (CRF) tables for electricity generation (1.A.1.a.i) emission values
- Chronological order of power generation plants from TEİAŞ Load Dispatch Department with commissioning dates, plant names, fuel types, installed power values, electricity generation for the calculated year
- Checking off Volunteers from the websites of Gold Standard (GS) and Verified Carbon Standard (VCS) and Global Carbon Council (GCC) for the ownership status of the carbon reduction certificate and,
- From Clean Development Mechanism (CDM) Tool 09 - Determining the baseline efficiency of thermal or electric energy generation systems- V3.0[31], Power plant efficiency figures are used

According to details of publication above,

Operating Margin-OM; 0.7424 tCO_2/MWh

Build Margin-BM; 0.3680 tCO_2/MWh

Combined Margin-CM (calculated for 2nd CP); 0.4616 tCO_2/MWh[32]

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

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

Where:

BE_y = Baseline emissions in year y (tCO_2/yr).

$EG_{PJ,y}$ = 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).

[30] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[31] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v3.0.pdf

[32] (0.7424*0.25+0.3680*0.75 = 0.4616 tCO_2/MWh)
https://enerji.gov.tr//Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klim/%C4%B0klimDe%C4%9Fi%C5%9Fikli%C4%9Fi/TUESEmisyonFktr/Belgeler/Bform2020.pdf

$EF_{grid,CM,y}$ = 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" v07.0. (tCO_2/MWh).

The project activity is the installation of a new grid-connected renewable power plant so, $EG_{baseline}=0$

If the project activity is the installation of a Greenfield power plant, then:

$EG_{PJ,y} = EG_{facility,y}$

Where:

$EG_{PJ,y}$ = 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).

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

Calculation of the Operating Margin Emission Factor

By using all the data which were given above, Turkish Ministry of Energy and Natural Resources calculated $EF_{grid,OMsimple,y}$:

➔ **$EF_{grid,OMsimple,y} = 0.7424$ (tCO_2/MWh)**

Calculation of the Build Margin Emission Factor

For BM factor calculation, Chronological order of power generation plants from TEİAŞ Load Dispatch Department with commissioning dates, plant names, fuel types, installed power values, electricity generation for the calculated year were used as input data. Consequently, Turkish Ministry of Energy and Natural Resources calculated $EF_{grid,BM,y}$.

➔ **$EF_{grid,BM,y} = 0.3680$ tCO_2/MWh**

Calculating of the Combined Margin Emission Factor

Emission factor calculations have been corrected with the relevant weighted calculations as stipulated by the methodology for the second crediting period. According to "Tool to calculate the emission factor for an electricity system" (Version 07), Article 86 clause (b), calculation of the combined margin for renewable energy projects (except wind and solar) second crediting period, the following values need to be used for wOM and wBM.

"All other projects [...] wOM = 0.25 and wBM = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool."

The data used to calculate the combined margin were published by Turkey's Energy and Natural Resources Ministry in 20th of September 2022. The data -which includes build margin and operating margin factors - have been obtained from the ministry's most recent factsheet. This document contains the latest available data in the country and is issued by the highest authority to make such calculations and determine the factors.

➔ $EF_{grid,CM,y} = 0.25*0.7424 + 0.75*0.3680 = 0.4616\ tCO_2/MWh$

Then:

$ER_y = BE_y - PE_y = EG_{facility,y} * EF_{grid,CM,y}$ = 100,470.0 MWh/year * 0.4616 tCO_2/MWh = 46,376 tCO_2/year (for 2nd crediting period)

Baseline scenario is identified and described in this section. Emission reductions due to project activity is calculated according to "Tool to calculate the emission factor for an electricity system" (Tool 07) version 07.0.

A brief explanation of this methodology is given in Tool as:

This methodological tool determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "combined margin" emission factor (CM) of the electricity system.

5.2 Project Emissions

The power density (PD) of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

PD = Power density of the project activity (W/m²)
Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W)
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero
A_{PJ} = Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m²)
A_{BL} = Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m²). For new reservoirs, this value is zero

Cap_{BL} and A_{BL} are zero since project activity is new hydro power plant project. Then, the project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 10 W/m². As in the case of Saracbendi HPP this density is well above the 10 W/m² threshold (~23.84 W/m²; reservoir size: 992,982.5263 m², installed capacity: 23,672,000 W), emissions (CH_4 and CO_2) from the reservoir are zero. For the projects having power density more than 10 W/m² threshold is zero.

Hence, the project emission ($PE_{HP,y}$) is zero in line with the section [5.4.3 – 42 – c) – Equation (10) of the ACM0002 methodology v21.0.

5.3 Leakage

No Leakage emissions are considered. The main emission potentially giving rise to leakage in the context of electrical sector projects is emission arising due to activities arising such as power plant construction and upstream emission from fossil fuel use (e.g. extraction, processing, and transport). These emission sources are neglected.

Then: $ER_y = BE_y$

5.4 Estimated Net GHG Emission Reductions and Removals

Year	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)
2021 (06-May-2021 – 31-December-2021)	30,494	0	0	30,494
2022 (01-January-2022 – 31-December-2022)	46,376	0	0	46,376
2023(01-January-2023 – 31-December-2023)	46,376	0	0	46,376
2024 (01-January-2024 – 31-December-2024)	46,376	0	0	46,376
2025 (01-January-2025 – 31-December-2025)	46,376	0	0	46,376
2026 (01-January-2026 – 31-December-2026)	46,376	0	0	46,376
2027 (01-January-2027 – 31-December-2027)	46,376	0	0	46,376
2028 (01-January-2028 – 31-December-2028)	46,376	0	0	46,376
2029 (01-January-2029 – 31-December-2029)	46,376	0	0	46,376

2030 (01-January-2030 – 31-December-2030)	46,376	0	0	46,376
2031 (01-January-2031 – 05-May-2031	15,882	0	0	15,882
Total	**463,760**	**0**	**0**	**463,760**

6 MONITORING

6.1 Data and Parameters Available at Validation

For the 1st Crediting Period (On the purpose of 3rd Verification which spans the 1st Crediting Period):

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_{2e}/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 02.2.0"[33]
Source of data	As per "Tool to calculate the emission factor for an electricity system 02.2.0"
Value applied	0.4448 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 02.2.0"
Purpose of Data	Calculation of baseline emissions
Comments	No additional comments

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_{2e}/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest

[33] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.0.pdf

	version of the "Tool to calculate the emission factor for an electricity system 02.2.0"[34]
Source of data	As per "Tool to calculate the emission factor for an electricity system 02.2.0"
Value applied	0.6534 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 02.2.0"
Purpose of Data	Calculation of baseline emissions
Comments	No additional comments

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_{2e}/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 02.2.0"[35]
Source of data	As per "Tool to calculate the emission factor for an electricity system 02.2.0"
Value applied	0.5491 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 02.2.0"
Purpose of Data	Calculation of baseline emissions
Comments	No additional comments

Data / Parameter	Gross electricity generation
Data unit	MWh
Description	Gross Electricity supplied to the grid by relevant sources (2006-2008)
Source of data	Turkish Electricity Transmission Company (TEİAŞ), Annual Development of Turkey's Gross Electricity Generation of Primary

[34] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.0.pdf

[35] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.0.pdf

	Energy Resources (1975-2008) TEİAŞ. Please see: https://webapi.teias.gov.tr/file/d68d12d1-7b09-4c5a-bd1d-bd29b40b97e5?download
Value applied	131,681,100 MWh; 154,982,500 MWh; 163,919,400 MWh
Justification of choice of data or description of measurement methods and procedures applied	This data 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.
Purpose of Data	Calculation of baseline emissions
Comments	No additional comments

Data / 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 (1984-2008) TEİAŞ. Please see: https://webapi.teias.gov.tr/file/ae3e13fb-9d07-4128-a1d9-d5ce9ed1458c?download
Value applied	169,543.1 GWh; 183,339.7 GWh; 189,761.9 GWh
Justification of choice of data or description of measurement methods and procedures applied	This data is used to find relation between the gross and net electricity delivered to the grid by fossil fuel fired power plants. Import and Export data is used to identify total net electricity fed into the grid in the years of 2006, 2007 and 2008. TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.
Purpose of Data	Calculation of baseline emissions
Comments	No additional comments

Data / 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, TEİAŞ: For plants in 2004: https://webapi.teias.gov.tr/file/91891c1f-f8ba-4374-87c3-588730f53a73?download For plants in 2005: https://webapi.teias.gov.tr/file/91891c1f-f8ba-4374-87c3-588730f53a73?download For plants in 2006: https://webapi.teias.gov.tr/file/56efcc33-7319-40f9-b6e0-3cb8ba963f96?download For plants in 2007: https://webapi.teias.gov.tr/file/56efcc33-7319-40f9-b6e0-3cb8ba963f96?download For plants in 2008: https://webapi.teias.gov.tr/file/56efcc33-7319-40f9-b6e0-3cb8ba963f96?download
Value applied	See Validated VCS-PD
Justification of choice of data or description of measurement methods and procedures applied	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey. The latest data available during PD preparation was for 2008.
Purpose of Data	Calculation of baseline emissions
Comments	No additional comments

Data / Parameter	$EF_{CO2,I,y}$
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. Please see: https://www.ipcc-nggip.iges.or.jp/public/2006gl/
Value applied	See Validated VCS-PD.

Justification of choice of data or description of measurement methods and procedures applied	The Intergovernmental Panel on Climate Change (IPCC) is an intergovernmental body of the United Nations that is dedicated to providing the world with objective, scientific information relevant to understanding the scientific basis of the risk of human-induced climate change, its natural, political, and economic impacts and risks, and possible response options.
Purpose of Data	Calculation of baseline emissions
Comments	No additional comments

Data / Parameter	$\eta_{m,y}$
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 Validated VCS-*PD*.
Justification of choice of data or description of measurement methods and procedures applied	For efficiency rates of Coal and Lignite Power Plants See Annex-1 of the Tool (highest rate is applied to be conservative) For Natural Gas and Oil plants efficiencies, default value given in the tool is applied: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.0.pdf
Purpose of Data	Calculation of baseline emissions
Comments	No additional comments

Data / 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. Please see: https://webapi.teias.gov.tr/file/346a8564-97c6-4027-b674-6ac3def3ba29?download
Value applied	See validated VCS-PD

Justification of choice of data or description of measurement methods and procedures applied	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.
Purpose of Data	Calculation of baseline emissions
Comments	No additional comments

Data / Parameter	$FC_{i,y}$
Data unit	Mass or volume unit
Description	Fuels consumed for electricity generation in the years of 2006, 2007 and 2008
Source of data	Annual Development of Fuels Consumed in Thermal Power Plants in Turkey by The Electric Utilities, TEİAŞ. Please see: (2000-2005) https://webapi.teias.gov.tr/file/91891c1f-f8ba-4374-87c3-588730f53a73?download (2006-2008) https://webapi.teias.gov.tr/file/56efcc33-7319-40f9-b6e0-3cb8ba963f96?download
Value applied	See Validated VCS-PD.
Justification of choice of data or description of measurement methods and procedures applied	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.
Purpose of Data	Calculation of baseline emissions
Comments	No additional comments

Data / Parameter	$NCV_{i,y}$
Data unit	TJ/kton, TJ/million m^3
Description	Net Calorific Value of fuel types in the years of 2006, 2007 and 2008
Source of data	Calculated by using HVi,y to FCi,y as Net Calorific Values of fuel types are not directly available in Turkey.
Value applied	See Validated VCS-PD.

Justification of choice of data or description of measurement methods and procedures applied	TEİAŞ is the national electricity transmission company, which makes available the official data of power plants in Turkey.
Purpose of Data	Calculation of baseline emissions
Comments	No additional comments

For the 2nd Crediting Period (On the purpose of renewal crediting period and on the purpose of 3rd Verification which spans the 2nd Crediting Period):

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_{2e}/MWh
Description	For the emission BM factor, that were used to calculate estimated emission reductions, publication of Turkish Ministry of Energy and Natural Resources which is indicating Turkey's National Electric Grid Emission Factor for the year of 2020 was used. Publication includes calculated Emission Factor values that are Operating Margin (OM), Growth Based Margin (Build Margin-BM) and Combined Margin (CM) Emission Factors, for the relevant year with usage of the IPCC's Clean Development Methodology Tool 07-V07.0[36].
Source of data	Please see: https://enerji.gov.tr/evced-cevre-ve-iklim-turkiye-ulusal-elektrik-sebekesi-emisyon-faktoru
Value applied:	0.3680
Justification of choice of data or description of measurement methods and procedures applied	Ministry of Energy and Natural Resources makes available the official data in Turkey. The latest data available during this document preparation was for 2020. Please see section 4.1 for further description of measurement methods.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_{2e}/MWh
Description	For the combined margin CO_2 emission factor that were used to calculate estimated emission reductions, publication of Turkish Ministry of Energy and Natural Resources which is indicating Turkey's National Electric Grid Emission Factor for the year of 2020 was used.
Source of data	Please see: https://enerji.gov.tr/evced-cevre-ve-iklim-turkiye-ulusal-elektrik-sebekesi-emisyon-faktoru

[36] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

Value applied:	0.7424
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. Please see section 4.1 for further description of measurement methods.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_{2e}/MWh
Description	For the combined margin CO_2 emission factor that were used to calculate estimated emission reductions, publication of Turkish Ministry of Energy and Natural Resources which is indicating Turkey's National Electric Grid Emission Factor for the year of 2020 was used.
Source of data	Please see: https://enerji.gov.tr/evced-cevre-ve-iklim-turkiye-ulusal-elektrik-sebekesi-emisyon-faktoru
Value applied:	0.4616 (this value will be used for second crediting period)
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. Please see section 4.1 for further description of measurement methods.
Purpose of Data	Calculation of baseline emissions
Comments	-

6.2 Data and Parameters Monitored

Data / Parameter	$EG_{PJ,facility,y}$
Data unit	MWh
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 EPİAŞ. Data are gathered electronically from the meters by TEİAŞ and stored in secured website of EPİAŞ, which is accessible to project developer with a private password. For monitoring, the monthly settlement notification of EPİAŞ shall be used as source of data.
Description of measurement methods and procedures applied	Regarding the electricity meters: two meters are placed (one main and one reserve) at the TEİAŞ substation. These meters are sealed by TEİAŞ and intervention by project proponent is not possible. 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 buyers.
Frequency of monitoring/recording	Continuous monitoring, hourly measurement and at least monthly recording
Value applied:	100,470 MWh/year
Monitoring equipment	Calibration frequency: According to the Article 9 of the relevant regulation, periodical inspections of "gauges for electric, water, coal gas, natural gas and, current and voltage measuring transformers will be made once in 10 years". This is in line with the monitoring plan and national requirements. TEIAS will decide when to carry out the next calibration. The Project owner has no control over or access to the measurement devices and is not entitled to perform any type of maintenance or calibration.

The specification of previous meters from **11-March-2011 to 28-July-2020** is provided below:

Name	Serial Number	Brand - Model	Accuracy Class	Rated Frequency
Main Meter	53064431	ACTARIS – SL761B071	0.5s	50 Hz
Back-up meter	53064432	ACTARIS – SL761B071	0.5s	50 Hz

The first protocol (first calibration record) date was on 11-March-2011 for previous meters above.

The latest test record date is 28-July-2020 for both of the previous meters above during this monitoring period. Apart from the latest test protocol, there is a single test protocol reports dated 08-September-2019 for previous meters above.

The specification of the new meters from **28-July-2020 to onwards** is provided below:

Name	Serial Number	Brand - Model	Accuracy Class	Rated Frequency
Main Meter	9420245	EMH – LZQJ-XC	0.5s	50 Hz
Back-up meter	9420246	EMH – LZQJ-XC	0.5s	50 Hz

The first protocol (first calibration record) date of new meters above and replacement date with previous meters of them is 28-July-2020.

The Actaris (previous) electricity meters used in the Saracbendi HPP were purchased in 2011 and calibrated. These meters were replaced with EMH electricity meters, before they were 10 years old on 28-July-2020.

QA/QC procedures applied	According to the Article 2 of the 'Communiqué Regarding the Meters to be used in the Electricity Market '[37] (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'[38] (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. Also, according to Article 67 (page 20) of this regulation, the calibration shall be done in calibration stations which have been tested and approved by the Ministry of Trade and Industry. Article 10-d) of Communiqué requires the meters shall be three-phase four wire and Article 64 of Regulation clearly states how calibration shall be performed for this kind of meter. According to Article 3 of System Usage Agreement[39] done by 'Elen Enerji' and TEIAS; other than periodic tests, if a party alleges the meters are not working appropriately tests of the meters will be done by presence of both parties. If, after controls, it is seen that the meter is not working appropriately, the measurements of reserve meters are considered beginning from date both meters are reading the same. As above mentioned, 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. EPİAŞ (Energy Market Regulatory Authority) data is used as a main source, and cross-check is done by using the TEİAŞ receipts.
Purpose of data	Calculation of baseline emissions
Calculation method	Regarding the electricity meters: two meters are placed (one main and one reserve) at the Saracbendi HPPs which meters the electricity transferred to TEİAŞ substation. These meters are sealed by TEIAS and intervention by project proponent is not possible. 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 not only in the interest of the emission reduction monitoring, but paramount for the business relation between the plant operator and the electricity buyers.

[37] Please see, https://www.epdk.gov.tr/Detay/DownloadDocument?id=+6B2PMv4N4A=

[38] Please see, http://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.6381&MevzuatIliski=0&sourceXmlSearch=

[39] Please see; https://www.mevzuat.gov.tr/File/GeneratePdf?mevzuatNo=19357&mevzuatTur=KurumVeKurulusYonetmeligi&mevzuatTertip=5

	Measured hourly and readings monthly. Monthly settlement notifications of EPİAŞ consist of hourly electricity production and withdrawn from the grid. Since the meters are reading electricity supplied to the system and withdrawn from the system separately, the net electricity amount supplied to the grid is calculated by electricity supplied minus electricity withdrawn which is be taken from monthly settlement notifications. Thus, with this procedure is monitored sufficient and no extra Monitoring has to be implemented.
Comments	-

Data / Parameter	Cap_{PJ}
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Equipment specifications that described in the equipment contracts
Description of measurement methods and procedures to be applied	Cross-checking of instrument specifications of the installed turbines/generators (MW) and the indication in the PD.
Frequency of monitoring/recording	Once at the beginning of each crediting period
Value monitored	23,672,000
Monitoring equipment	Official documents and photos of the generator and turbine
QA/QC procedures to be applied	Producing company is responsible for the information in the instrument specifications.
Purpose of the data	Calculation of baseline emissions
Calculation method	Equipment specifications and provisional acceptance
Comments	Cross-checked value of the installed power is same as previous monitoring period and approved PD.

Data / Parameter	A_{PJ}
Data unit	m^2
Description	Area of the reservoir measured with topographic drawings in the surface of the water, after implementation of the project activity, when reservoir full

Source of data	Technical drawings from consultants
Description of measurement methods and procedures to be applied	Measured from topographical surveys or maps
Frequency of monitoring/recording	Once at the beginning of each crediting period
Value monitored	992,982.5263
Monitoring equipment	Maps
QA/QC procedures to be applied	Area of the reservoir are preparing according to necessary calculations and Ministry of Energy and Natural Resources of Turkey is the responsible ministry for the confirmation of topographical survey and calculations.
Purpose of the data	Calculation of baseline emissions
Calculation method	N/A
Comments	No additional comments

6.3 Monitoring Plan

As described above, the only relevant data that has to be monitored is the net electricity generation ($EG_{PJ,facility,y}$) per year.

$EG_{PJ,facility,y}$:

These data are subject to the accounting quality systems of both parties to the power purchase agreement, TEİAŞ and Elen Enerji Üretimi Sanayi Ticaret A.Ş. With this, no additional structures or processes must be implemented to insure the availability of necessary data for monitoring. At the end of the monitoring period, the data from the monthly meter reading records by PMUM (In approved PD, PMUM records were given as reference for electricity generation. However, the name of this institution was changed, and electricity generation records have been belonged to EPİAŞ) Therefore, EPİAŞ records are adding up to the yearly electricity generation and multiplied with the combined margin emission factor with the help of an excel spreadsheet that also contains the combined margin calculation. In addition to the EPİAŞ records, TEİAŞ is responsible for reading monthly on both main and backup meters. Meter reading protocols for the whole of the monitoring period have been provided as cross check values apart from the invoices.

The project owner has no right to intervene in electricity meters. The electricity meters are controlling remotely to ensure the uninterrupted electricity generation. Therefore, the calibration and/or test protocol of the electricity meters depend on whether project owner/TEİAŞ has any doubt on the electricity values that is steadily monitoring. TEİAŞ has a right to conduct the calibration procedure or the testing procedure if any mismatching occurs between the values monitored by themselves and values monitored by project owner. The other case is that project owner can request testing protocol or calibration protocol from TEİAŞ if any mismatching occurs

between the values monitored by TEİAŞ and values monitored by project owner. No non-conformance has been identified between follow-up by TEİAŞ and project owner's internal auditing so far. As above mentioned, the data acquisition and management and quality assurance procedures that are anyway in place, no additional procedures must be established for the monitoring plan.

Responsible personnel:

TEİAŞ is responsible for monitoring and ensuring that the measurement devices satisfy the requirements. TEİAŞ is also responsible for the calibration of the measurement devices. In case of any detected problem (e.g. failure of one of the measurement devices, inconsistency between the readings of the primary and the back-up meter etc.), the plant manager in the name of the project owner is responsible for coordinating the necessary maintenance and calibration procedure with TEİAŞ. Thus, the complete baseline approach is always transparent and traceable. Technicians in Saracbendi HPP daily reads meters and keeps record for electricity generation amount and reports to management. These records can be used for monitoring in case of any problem will arise in meters.

- Currently 13 people are working in the plant.
- All data monitored under the monitoring plan will be kept in electronic form and hard copy for 2 years after the end of the crediting period.

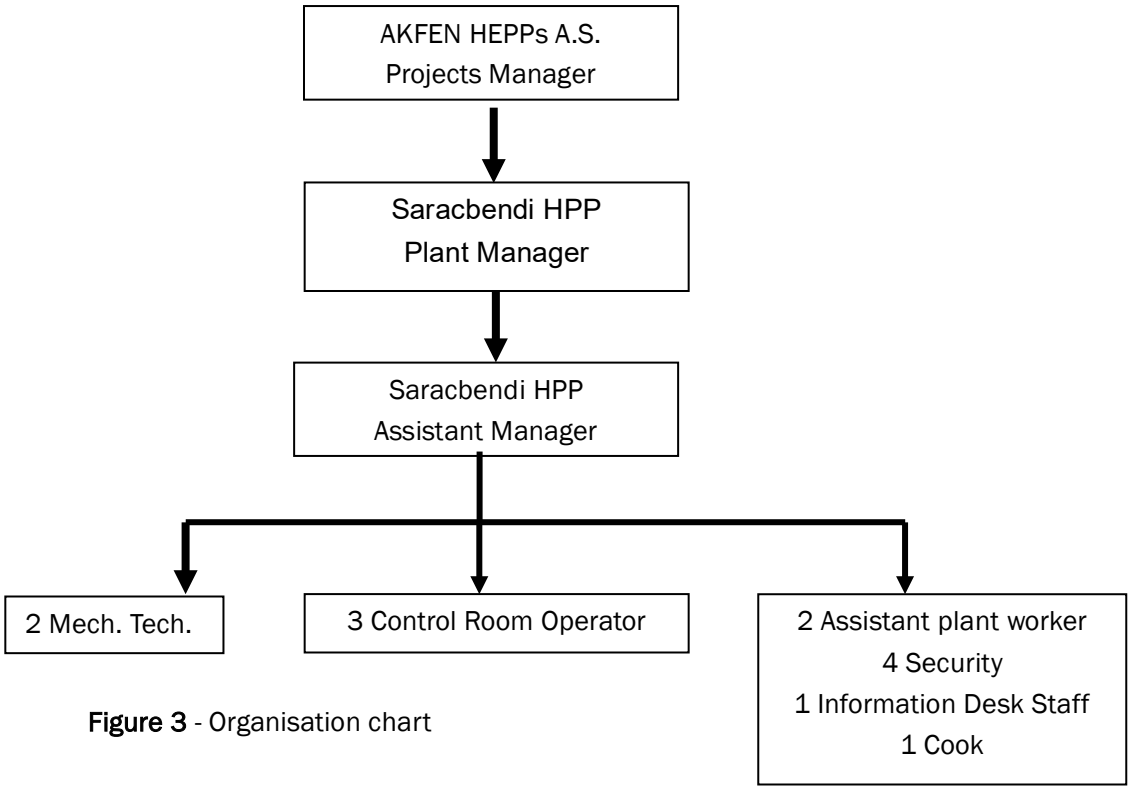


Figure 3 - Organisation chart

7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

7.1 Data and Parameters Monitored

For the 1st Crediting Period:

Data / Parameter	$EG_{facility,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Value applied:	**83,083.80 MWh**

Vintage		Electricity supplied to the grid (MWh)	Electricity consumption from the grid (MWh)	Net electricity supplied to the grid (MWh)
01-August-2019	31-December-2019	4,830.71	48.37	4,782.34
01-January-2020	31-December-2020	59,632.47	76.10	59,556.37
01-January-2021	05-May-2021	18,765.32	20.23	18,745.09
Total		**83,228.50**	**144.70**	**83,083.80**

Comments

The specification of the meters **from 01-August-2019 to 28-July-2020** is provided below:

Name	Serial Number	Brand - Model	Accuracy Class	Rated Frequency
Main Meter	53064431	ACTARIS SL761B071	0.5s	50 Hz
Back-up meter	53064432	ACTARIS SL761B071	0.5s	50 Hz

The first protocol (first calibration record) date was on 11-March-2011 for meters above.

The latest test record date is 28-July-2020 for both of the meters above during this monitoring period. Apart from the latest test protocol, there is a single test protocol reports dated 08-September-2019 for meters above.

The specification of the new meters **from 28-July-2020 to 05-May-2021** is provided below:

Name	Serial Number	Brand - Model	Accuracy Class	Rated Frequency

	Main Meter	9420245	EMH – LZQJ-XC	0.5s	50 Hz
	Back-up meter	9420246	EMH – LZQJ-XC	0.5s	50 Hz

The first protocol (first calibration record) date of new meters above and replacement date with previous meters of them is 28-July-2020.

The Actaris (previous) electricity meters used in the Saracbendi HPP were purchased in 2011 and calibrated. These meters were replaced with EMH electricity meters, before they were 10 years old in 28-July-2020.

Data / Parameter	Cap_{PJ}
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Equipment specifications that described in the equipment contracts
Description of measurement methods and procedures to be applied	Cross-checking of instrument specifications of the installed turbines/generators (MW) and the indication in the PD.
Frequency of monitoring/recording	Yearly
Value monitored	23,672,000
Monitoring equipment	Official documents and photos of the generator and turbine
QA/QC procedures to be applied	Producing company is responsible for the information in the instrument specifications.
Purpose of the data	Calculation of baseline emissions
Calculation method	Equipment specifications and provisional acceptance
Comments	Cross-checked value of the installed power is same as previous monitoring period and approved PD.

Data / Parameter	A_{PJ}
Data unit	m^2
Description	Area of the reservoir measured with topographic drawings in the surface of the water, after implementation of the project activity, when reservoir full

Source of data	Technical drawings from consultants
Description of measurement methods and procedures to be applied	Measured from topographical surveys or maps
Frequency of monitoring/recording	Yearly
Value monitored	992,982.5263
Monitoring equipment	Maps
QA/QC procedures to be applied	Area of the reservoir are preparing according to necessary calculations and Ministry of Energy and Natural Resources of Turkey is the responsible ministry for the confirmation of topographical survey and calculations.
Purpose of the data	Calculation of baseline emissions
Calculation method	N/A
Comments	No additional comments

For the 2nd Crediting Period:

Data / Parameter	$EG_{facility,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Value applied:	**41,821.50 MWh**

Vintage		Electricity supplied to the grid (MWh)	Electricity consumption from the grid (MWh)	Net electricity supplied to the grid (MWh)
06-May-2021	31-December-2021	5,877.95	90.86	5,787.09
01-January-2022	31-May-2022	36,051.60	17.19	36,034.41
Total		**41,929.55**	**108.05**	**41,821.50**

Comments	The specification of new meters **from 06-May-2021 to 31-May-2022** is provided below:

Name	Serial Number	Brand - Model	Accuracy Class	Rated Frequency
Main Meter	9420245	EMH – LZQJ-XC	0.5s	50 Hz
Back-up meter	9420246	EMH – LZQJ-XC	0.5s	50 Hz

The first protocol (first calibration record) date of new meters above and replacement date with previous meters of them is 28-July-2020.

The Actaris (previous) electricity meters used in the Saracbendi HPP were purchased in 2011 and calibrated. These meters were replaced with EMH electricity meters, before they were 10 years old on 28-July-2020.

Data / Parameter	Cap_{PJ}
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Equipment specifications that described in the equipment contracts
Description of measurement methods and procedures to be applied	Cross-checking of instrument specifications of the installed turbines/generators (MW) and the indication in the PD.
Frequency of monitoring/recording	Once at the beginning of each crediting period
Value monitored	23,672,000
Monitoring equipment	Official documents and photos of the generator and turbine
QA/QC procedures to be applied	Producing company is responsible for the information in the instrument specifications.
Purpose of the data	Calculation of baseline emissions
Calculation method	Equipment specifications and provisional acceptance
Comments	Cross-checked value of the installed power is same as previous monitoring period and approved PD.

Data / Parameter	A_{PJ}
Data unit	m^2

Description	Area of the reservoir measured with topographic drawings in the surface of the water, after implementation of the project activity, when reservoir full
Source of data	Technical drawings from consultants
Description of measurement methods and procedures to be applied	Measured from topographical surveys or maps
Frequency of monitoring/recording	Once at the beginning of each crediting period
Value monitored	992,982.5263
Monitoring equipment	Maps
QA/QC procedures to be applied	Area of the reservoir are preparing according to necessary calculations and Ministry of Energy and Natural Resources of Turkey is the responsible ministry for the confirmation of topographical survey and calculations.
Purpose of the data	Calculation of baseline emissions
Calculation method	N/A
Comments	No additional comments

7.2 Baseline Emissions

The total emission reductions can be calculated with the results of the below described equations. The emission reduction is equal to the baseline emissions minus project emissions and leakage emissions. Leakage emissions in this project are negligible. There are no project emissions in this kind of project. The general equation is as follows:

Emission reductions

For monitoring period (01-August-2019 to 05-May-2021) of 1st crediting period, baseline emissions are calculated as per ACM0002 version 12.1.0 is as below:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad (1)$$

Where:

BE_y : Baseline emissions in year y (tCO_2/yr).

$EG_{PJ,y}$: Electricity supplied by the project activity to the grid (MWh).

$EF_{grid,CM,y}$: Combined margin CO2 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 ($tCO2/MWh$)=0.5491 tCO_2/MWh.

Emission reductions achieved by the project activity are calculated as per formula 2 of ACM0002 version 12.1:

$$ER_y = BE_y - PE_y - LE_y \quad (2)$$

Where:

ER_y : Emission reductions in year y (tCO_2/yr).

BE_y : Baseline emissions in year y (tCO_2/yr).

PE_y : Project emissions in year y (tCO_2/yr); validated value = 0.

LE_y : Leakage emissions in year y (tCO_2/yr); validated value = 0.

$BE_y = EG_{facility,y} * EF_{grid,CM,y}$ = 83,083.80 MWh * 0.5491 tCO_2/MWh = 45,619 tCO_2 (round-downed)

0.5491 tCO_2/MWh is the emission factor of the 1st crediting period. Since the monitoring period specified above is a subject for the 1st crediting period, this emission factor is used in this section when calculation of emission reduction.

Emission reductions

For monitoring period (06-May-2021 to 31-May-2022) of 2nd crediting period, baseline emissions are calculated as per ACM0002 version 21.0 is as below:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad \text{Equation (11)}$$

Where:

BE_y = Baseline emissions in year y (tCO_2/yr)

$EG_{PJ,y}$ = 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 "TOOL07: Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

$$ER_y = BE_y - PE_y \quad \text{Equation (17)}$$

Where:

ER_y : Emission reductions in year y (tCO_2/yr).

BE_y : Baseline emissions in year y (tCO_2/yr).

PE_y : Project emissions in year y (tCO_2/yr); value= 0

Thus, **$ER_y = BE_y$,** Then,

$BE_y = EG_{facility,y} * EF_{grid,CM,y}$ = 41,821.50 MWh * 0.4616 tCO_2/MWh = 19,304 tCO_2 (Round-downed)

0.4616 tCO_2/MWh is the emission factor of the 2nd crediting period. Since the monitoring period specified above is a subject for the 2nd crediting period, this emission factor is used in this section when calculation of emission reduction.

As a result, emission reduction in total of the monitoring period of 1st crediting period and the monitoring period of 2nd crediting period are (45,619+19,304) = **64,923 tCO_2e**

7.3 Project Emissions

For monitoring period (01-August-2019 to 05-May-2021) of 1st crediting period,

The power density (PD) of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

PD = Power density of the project activity (W/m^2)
Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W)
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero
A_{PJ} = Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)
A_{BL} = Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 10 W/m^2. As in the case of Saracbendi HPP this density is well above the 10 W/m^2 threshold (~23.84 W/m^2; reservoir size: 992,982.5263 m^2, installed capacity: 23,672,000 W), emissions (CH_4 and CO_2) from the reservoir are zero. *Therefore, the* project emission is zero in line with the equation 4, page 8 of *ACM0002 v12.1.0*[40].

$PE_{HP,y}$ = 0

For monitoring period (06-May-2021 to 31-May-2022) of 2nd crediting period,

The power density (PD) of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

PD = Power density of the project activity (W/m^2)
Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W)
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project

[40] https://cdm.unfccc.int/Panels/meth/meeting/10/046/mp46_an06.pdf

activity (W). For new hydro power plants, this value is zero
A_{PJ} = Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)
A_{BL} = Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

Cap_{BL} and A_{BL} are zero since project activity is new hydro power plant project. Then, the project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 10 W/m^2. As in the case of Saracbendi HPP this density is well above the 10 W/m^2 threshold (~23.84 W/m^2; reservoir size: 992,982.5263 m^2, installed capacity: 23,672,000 W), emissions (CH_4 and CO_2) from the reservoir are zero. For the projects having power density more than 10 W/m^2 threshold is zero. Therefore, the project emission ($PE_{HP,y}$) is zero in line with the section [5.4.3 – 42 – c) – Equation (10) of the ACM0002 methodology v21.0.

$PE_{HP,y} = 0$

7.4 Leakage

For monitoring period (01-August-2019 to 05-May-2021) of 1st crediting period,

With respect to page 11 of ACM0002 v12.1.0, no leakage emissions are considered. The main emission potentially giving rise to leakage in the context of electrical sector projects is emission arising due to activities arising such as power plant construction and upstream emission from fossil fuel use (e.g. extraction, processing, and transport). These emission sources are neglected.

For monitoring period (06-May-2021 to 31-May-2022) of 2nd crediting period,

With respect to paragraph 61 of ACM0002 v21.0, no other leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected.

Then: $ER_y = BE_y$

7.5 Net GHG Emission Reductions and Removals

Baseline emissions are equal to Net GHG emission reductions.

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2019 (01-August-2019 to 31-December-2019)	2,625	0	0	2,625
2020 (01-January-2020 to 31-December-2020)	32,702	0	0	32,702

2021 (01-January-2021 to 31-December-2021)	12,963	0	0	12,963
2022 (01-January-2022 to 31-May-2022)	16,633	0	0	16,633
Total	**64,923**	**0**	**0**	**64,923**

Ex-ante emissions reductions /removals	Achieved emissions reductions /removals	Percent difference	Justification for the difference
23,126	2,625	-89%	Electricity productions and thence, emission reductions in year 2019 are calculated by considering last months of the year. The difference in emission reduction and estimated emission reduction in these months, when production is expected to be low, is normal.
55,321	32,702	-41%	It is observable that there are drastic decreases and increases in the velocity of the river course with the effect of rainfall. The difference is quite in agreement with estimated emission reductions.
51,458	12,963	-75%	For the drop in the electricity generation of project activity in 2021-year, data, and studies on changes in the related river course may not be available. But the graph of 'Yearly Rainfall and Rain Days Averages' for Sivas region is accessible via link. We can easily observe the rainfall amount of 2021 year Therefore, it is observable that there are drastic decreases and increases in the velocity of the river course with the effect of rainfall apart from the other factors such as such as freezing in the river due to the climate condition of related area. The difference in 2021 year –where electricity production has decreased significantly due to climate change in this project activity– is normal since rainfall amount is seriously decreased in related year. In addition, there were canal maintenance works in July 2021, August 2021, and September 2021. Due to maintenance works, electricity production by project activity shut down at the dates specified.
20,488	16,633	-19%	Electricity productions and thence, emission reductions in year 2022 are calculated by considering first months of the year. The difference in emission reduction and estimated emission reduction in these months, when production is expected to be low, is normal.
150,393	64,923	-57%	Despite the decreasing precipitation due to climate change, it is obvious that the estimated value for

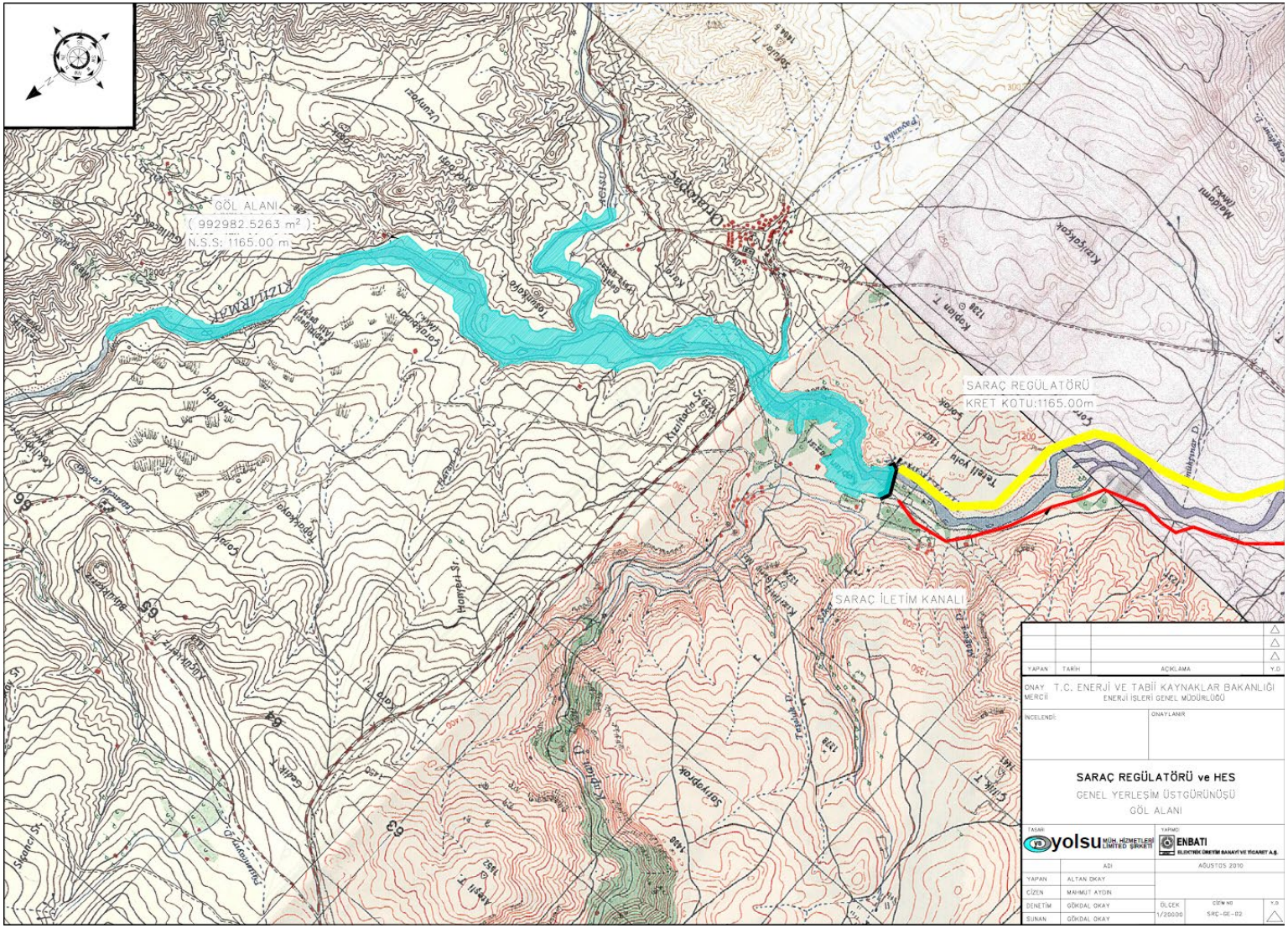
			emission reductions do not cause serious differences despite the low amount of precipitation.

APPENDIX 1: < MONTHLY ELECTRICITY GENERATION DATA >

Months		Electricity supplied to the grid (MWh) (1)	Electricity consumption from the grid (MWh) (2)	Net electricity supplied to the grid[MWh] (3) =(1)-(2)
01-Aug-2019	***31-Aug-2019***	615.91	8.89	607.02
01-Sep-2019	***30-Sep-2019***	1,228.14	5.64	1,222.50
01-Oct-2019	***31-Oct-2019***	791.45	8.82	782.63
01-Nov-2019	***30-Nov-2019***	864.13	13.79	850.34
01-Dec-2019	***31-Dec-2019***	1,331.08	11.23	1,319.85
Sum 2019		4,830.71	48.37	4,782.34
01-Jan-2020	***31-Jan-2020***	1,411.17	13.97	1,397.20
01-Feb-2020	***29-Feb-2020***	5,458.00	2.63	5,455.37
01-Mar-2020	***31-Mar-2020***	13,897.99	0.02	13,897.97
01-Apr-2020	***30-Apr-2020***	14,059.16	0.00	14,059.16
01-May-2020	***31-May-2020***	13,076.58	0.00	13,076.58
01-Jun-2020	***30-Jun-2020***	6,324.09	0.22	6,323.87
01-Jul-2020	***31-Jul-2020***	1,152.12	8.76	1,143.36
01-Aug-2020	***31-Aug-2020***	294.59	10.84	283.76
01-Sep-2020	***30-Sep-2020***	473.28	8.95	464.32
01-Oct-2020	***31-Oct-2020***	1,069.96	7.09	1,062.87
01-Nov-2020	***30-Nov-2020***	1,118.93	10.73	1,108.20
01-Dec-2020	***31-Dec-2020***	1,296.61	12.89	1,283.72
Sum 2020		59,632.47	76.10	59,556.37
01-Jan-2021	***31-Jan-2021***	1,315.85	14.70	1,301.15
01-Feb-2021	***28-Feb-2021***	1,970.04	4.39	1,965.65
01-Mar-2021	***31-Mar-2021***	5,211.98	1.13	5,210.85
01-Apr-2021	***30-Apr-2021***	9,417.00	0.01	9,416.99
01-May-2021	***05-May-2021***	850.45	0.00	850.45
06-May-2021	***31-May-2021***	2,745.10	0.99	2,744.11
01-Jun-2021	***30-Jun-2021***	1,557.60	5.72	1,551.88
01-Jul-2021	***31-Jul-2021***	98.37	11.45	86.92
01-Aug-2021	***31-Aug-2021***	0.00	11.41	-11.41
01-Sep-2021	***30-Sep-2021***	0.00	11.46	-11.46
01-Oct-2021	***31-Oct-2021***	266.75	13.96	252.80
01-Nov-2021	***30-Nov-2021***	345.84	18.83	327.01
01-Dec-2021	***31-Dec-2021***	864.29	17.04	847.25
Sum 2021		24,643.27	111.09	24,532.18
01-Jan-2022	***31-Jan-2022***	1,328.75	13.19	1,315.56
01-Feb-2022	***28-Feb-2022***	2,691.72	3.80	2,687.92
01-Mar-2022	***31-Mar-2022***	9,859.63	0.03	9,859.60

01-Apr-2022	***30-Apr-2022***	13,017.10	0.16	13,016.93
01-May-2022	***31-May-2022***	9,154.40	0.01	9,154.40
Sum 2022		36,051.60	17.19	36,034.41
Total Sum		***125,158.05***	***252.75***	**124,905.30**

APPENDIX 2: < RESERVOIR AREA >



APPENDIX 3: < GENERATION LICENSE >

EPDK

T.C. ENERJİ PİYASASI
DÜZENLEME KURUMU

ÜRETİM LİSANSI

Bu Lisans kapsamındaki üretim tesisi Yenilenebilir Enerji Kaynağı kullanmaktadır.

(5346 Sayılı Kanunda yer alan, "Bu Kanun kapsamındaki yenilenebilir enerji kaynakları" tanımı çerçevesinde olan üretim tesisleri için)

Lisans No : EÜ/9147-14/04445

Tarih : 30/01/2020

Bu lisans, ELEN ENERJİ ÜRETİMİ SANAYİ TİCARET ANONİM ŞİRKETİ'ne, Sivas ilinde kurulması planlanan Saraçbendi Hidroelektrik üretim tesisinde 30/01/2020 tarihinden itibaren 34 (otuz dört) yıl 2 (iki) ay 9 (dokuz) gün süreyle, üretim faaliyeti göstermek üzere 6446 sayılı Elektrik Piyasası Kanunu ve ilgili mevzuat uyarınca Enerji Piyasası Düzenleme Kurulu'nun 30/01/2020 tarih ve 9147-14 sayılı Kararı ile verilmiştir.(Bu lisans, 30/01/2020 tarih ve 9147-14 sayılı Kurul kararı ile 08/04/2005 tarih ve EÜ/472-1/536 numaralı üretim lisansının devamı mahiyetinde verilmiştir.)

Mustafa YILMAZ
Başkan

EÜ/9147-14/04445 1/6