



**Verified Carbon
Standard**

FEKE II 69.58 MW HYDROELECTRIC POWER PLANT



Document Prepared by EKI Energy Services Limited

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1 PROJECT DETAILS

1.1 Summary Description of the Project

Feke II Hydroelectric power plant project is located at the south of Turkey, in the Mediterranean Region, on the Goksu Creek, a main branch of Seyhan River, within the province of Adana, about 9 km southwest of Feke I district. Feke I and Feke II projects were first developed by General Directorate of DSI (State Hydraulic Works) as a single project, to generate energy by utilizing the water potential of Goksu Branch in Seyhan Basin. However, it was seen during the feasibility studies that the project would cause whole of Feke district to be covered with water, therefore the project was divided into Feke I and Feke II projects which are developed as individual projects.

Akenerji Elektrik Üretim A.Ş. has been awarded the project after bidding by the Turkish Energy Market Regulatory Authority (EMRA) and won the rights of the license for a period of 49 years. The project activity is located in Feke village of Adana province, Turkey, further the project is a greenfield project activity and no energy generation facility was present prior to the project activity implementation.

The project consists of compressed concrete dam with a crest length of 256 meters and a height of 60 meters from the riverbed; 317 meters long derivation tunnel, upstream and downstream cofferdams, spillway, 171 meters long penstock, a powerhouse of 44 by 32 meters dimensions and 2 vertical axis Francis turbines with a gross head of 63 meters. The maximum capacity of the dam surface is 2.47 km². Feke II HEPP project have an installed capacity of 69.58 MW and is expected to have an annual generation of about 223.410 GWh of electricity. Electricity generated by the power plant is being delivered to the grid by a 7 km long 154 kV, 795 MCM overhead transmission line. An expected annual emission reduction of the project is approximately 103,126 tCO₂e/year and a total reduction of 1,031,260 tCO₂e over the 10-year crediting period.

Furthermore, during the monitoring period between 01-October-2018 to 31-December-2020, the project has resulted in emission reductions of 210,923 tCO₂e meanwhile total emission reduction achieved for the monitoring period between 01-January-2021 and 31-December-2021 is equal to 48,802 tCO₂e. Thus total emission reductions achieved during the current monitoring period is 259,725 tCO₂e.

Major milestones of project activity are given at Table 1:

Table 1: Main Project Activities

Activity	Date
Issuance of Generation License	17-May-2007
Establishment of Plant Facilities	01-May-2008
Access Road Construction	01-June-2008
Start of Tunnel Construction	01-July-2008
Start of Dam Construction	01-December-2008
Start of Powerhouse Construction	01-December-2008
Start of EM Installation	01-January-2009
Start of Energy Transmission Line Construction	01-May-2009
Validation Report Date	26-July-2010

Provisional Acceptance & Commissioning	24-December-2010
First Monitoring Period	01-January-2011 to 30-September-2012
Second Monitoring Period (submitted to Verra on 07/12/2022)	01-October-2012 to 30-September-2018
First Crediting Period	01-January-2011 to 31-December-2020
Second Crediting Period	01-January-2021 to 31-December-2030
Third Monitoring Period	01-October-2018 to 31-December-2021

1.2 Sectoral Scope and Project Type

The project activity is a large-scale project activity involves electricity generation from renewable sources therefore it is categorized in the sectoral scope 1 “Energy Industry – Renewable -/Non-renewable Sources” according to the UNFCCC definition.¹

It is an independent project with its own dam and its own powerhouse. It is not part of a grouped project.

1.3 Project Eligibility

Not applicable. This is the renewal of crediting period stage of project activity hence; its eligibility had been already demonstrated at the start of the first crediting period.

1.4 Project Design

The project involves setting up a hydroelectric power plant of 69.58 MW (“Project) in the province of Adana, Turkey. Hence, the project has been designed to include a single installation of an activity and is not a grouped activity.

Eligibility Criteria

Not applicable to this project activity as this is not a grouped project.

1.5 Project Proponent

Organization name	Akenerji Elektrik Üretim A.Ş.
Contact person	MS. Özlem Palabıyık
Title	Strategic Planning and Risk Manager

¹ <http://cdm.unfccc.int/DOE/scopes.html>

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1.6 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the project	Project Consultant
Contact person	Manish Dabkara
Title	MD/CEO
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1.7 Ownership

The generation license issued by Energy Market Regulatory Authority (EMRA) of Turkey is the proof of the ownership of Akenerji Enerji Elektrik Üretim A.Ş. Feke II HEPP. GHG emission reductions are also owned by project owner.

1.8 Project Start Date

The project has started to feed energy to the grid as of 24-December-2010². The same has been considered as the start date of the project activity.

1.9 Project Crediting Period

Crediting Period Start date	: 01-January-2021
Crediting Period End date	: 31-December-2030
Total Crediting Period	:10 Years

² Project commissioning certificate forms the basis of project start date.

This is the second crediting period of this project activity. The first crediting period of this project activity was from 01-January-2011 to 31-December-2020.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Estimated average annual GHG emission reductions from the project activity are 103,126 tCO₂e per year, which is less than 300,000 tCO₂e per year. Hence the project scale of the project activity becomes “Projects” as shown below:

Project Scale	
Project	√
Large project	-

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
2021	103,126
2022	103,126
2023	103,126
2024	103,126
2025	103,126
2026	103,126
2027	103,126
2028	103,126
2029	103,126
2030	103,126
Total estimated ERs	1,031,260
Total number of crediting years	10
Average annual ERs	103,126

1.11 Description of the Project Activity

Hydroelectric power is a renewable energy source which generates power by using a dam or diversion structure to change the flow of a water body.

Hydroelectric power plants capture the energy of falling water to generate electricity. A turbine transforms the kinetic energy of falling water into mechanical energy. Later, a generator converts the mechanical energy into electrical energy. Since power is generated from hydro energy, no emissions are attributed to the project emissions and emissions due to fossil-fuel based grid has been displaced due to the project activity. Hence, the operation of the hydroelectric power project is considered as environmentally safe.

The electricity delivery to the grid by Feke II Hydroelectric Power Plant is estimated to be 223.410 GWh per annum. The quantity of electricity required for operation of the plant is at a negligible level. The technology used in the plant is a state-of-the-art technology with extensive automatization. The equipment to be provided is brand new according to the electromechanical equipment agreement.

Detailed specifications of the technology used are given in the Table 2:

Table 2: Technical Specifications

Location	Göksu River/Feke District/Adana Province
Design Discharge	127.50 m ³ /s
Length Of Tunnel	317 m
Average Natural Flow	51.17 m ³ /s
Gross Head	63 m
Riverbed Height	485 m
Crest Height	545 m
Total Installed Capacity	69.58 MW
Reservoir Volume	1610.5 hm ³
Max. Reservoir Surface Area	2.477 km ²
Number Of Units	2 Each
Turbine Type	Francis Type – Vertical Axis
Turbine Manufacturer	Ecdi
Generator Type	3 Phase Synchronous With 0.98 Efficiency
Length Of Energy Transmission Line	7 km
Energy Transmission Line Capacity	154 KV
Number Of Penstocks	1
Length Of Penstock	171 m
Average Annual Power Generation	223.410 GWh
Grid Connection	The Grid Connection Shall Be Provided by Means of A 7 Km Long 795 MCM Energy Transmission Line To Feke I Transformer Substation

1.12 Project Location

The project site lies between 35° 51' 41.7" - 35 ° 52' 2.2" E longitudes and 37° 44' 35.9" - 37° 44' 52.6"N latitudes. The closest settlement is the Feke Village, about 10 km north of the project site, within the province of Adana. The project lies on the Goksu creek basin, which is a branch of Seyhan River. The location of project is shown below:

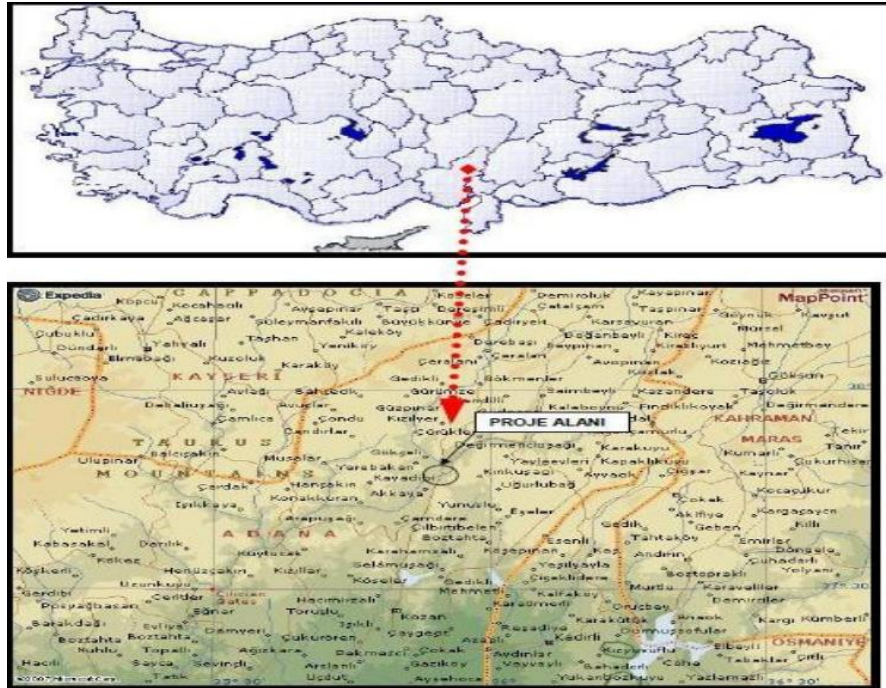


Figure 1. Location of the project site

1.13 Conditions Prior to Project Initiation

The project is a Greenfield hydroelectric power project and does not involve generation of GHG emissions for the purpose of their subsequent reduction, removal or destruction. Thus prior to project initiation, there was nothing at site. In absence of project activity, the continuation of current practice i.e. generation of equivalent amount electricity would have been generated from grid connected fossil fuel dominated power plants. Thus, for project activity baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The following applicable mandatory laws and regulations have been identified:

1. Electricity Market Law³
2. Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy⁴
3. Energy Efficiency Law⁵

³ <https://www.epdk.gov.tr/Detay/DownloadDocument?id=2yCfTgbBBIM=>

⁴ <https://www.epdk.gov.tr/Detay/DownloadDocument?id=TvsoxEB+ZmM=>

⁵ <https://www.resmigazete.gov.tr/eskiler/2007/05/20070502-2.htm>

4. Forest Law⁶

5. Environment Law⁷

The resultant alternatives to the project are in compliance with the applicable laws and regulations which is assessed by EMRA before issuing license. The renewable energy generation license for Feke-II HEPP has been issued considering Electricity Law and Law on utilization of Renewable Energy Resources for the purpose of generating electricity energy. The project is also within the scope of and in compliance with Energy Efficiency Law (Article 2 of Part One). Environment Law is also satisfied in terms of sustainable development principles and EIA conducted for the project activity. Finally, 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.

1.15 Participation under Other GHG Programs

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

The project is not registered under any other GHG program except VCS.

1.15.2 Projects Rejected by Other GHG Programs

Not Applicable. Project has not applied and rejected for any other GHG program except VCS.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The project is not used for compliance with an emissions trading program or to meet binding limits on GHG emissions.

1.16.2 Other Forms of Environmental Credit

The project has not created neither any other form of GHG-related environmental credit for GHG emission reductions nor any renewable energy certificate.

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

As a party to the Paris Agreement, the Republic of Turkey gives importance to the contributions to the SDGs. In this context, the project participants' view on the contribution of this project activity towards sustainable development follows these four indicators as explained below:

Social well-being:

⁶ <https://www.mevzuat.gov.tr/MevzuatMetin/1.3.6831.pdf>

⁷ <https://www.mevzuat.gov.tr/mevzuatmetin/1.5.2872.pdf>

- **Generating Local Employment:** The installation of hydroelectric power project in rural areas results in generating local employment opportunities and capacity building of the local employees. The project activity would create both direct and indirect employment throughout the life-cycle of the project activity.
- **Encouragement to entrepreneurs:** The project provides encouragement to other entrepreneurs to invest into renewable energy sources.
- **Project investors have ensured productive employment to people in the region which has boosted the local economy.**

Economic well-being:

- **Rural Development:** The installation of hydroelectric power project results in rural and infrastructural development in the surrounding rural areas
- **Economic Development:** The generation of hydroelectric power results in improvising the reliability of the Grid and thereby enhance economic development in the region.

Environment well-being:

- **Reduction in the consumption of fossil fuels:** The installation of power plant generating electricity through renewable resource such as hydroelectric power, would lead to reduction in usage of fossil fuels e.g. Coal, oil, natural gas.
- **Reduction in GHG emissions:** The reduction in usage of fossil fuels for electricity generation results in reduction of the release of associated GHG emissions (CO₂ and CH₄ emissions).
- **Improvement of Air Quality:** The use of renewable energy for power generation avoids the emission of air pollutants such as Suspended Particulate Matter (SPM), Sulphur Dioxide (SO₂) and Nitrogen Oxides (NO_x) thereby improvising the surrounding air quality
- **Conservation of Natural Resources:** Installation of hydroelectric power plant results in conserving fast depleting natural resources such as coal, oil etc.

Technological well-being:

- **Advanced Technology:** The technology used in the plant is a state-of-the-art technology with extensive automatization. The equipment to be provided is brand new according to the electromechanical equipment agreement.
- **Safe and Sound Technology:** The project activity deploys the technology, which is environmentally safe and sound, as it does not produce greenhouse gases and any toxic or radioactive waste.

1.17.2 Sustainable Development Contributions Activity Monitoring

Akenerji Elektrik Üretim A.Ş., which is the investor of this project activity set up of 69.58 MW Hydro power Project to provide affordable and clean energy. Also, project investors have ensured productive employment to people in the region which has boosted the local economy. Job opportunities for total 24 people were provided during the monitoring period.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.2	7.2.1: Renewable energy share in the total final energy consumption	Implemented activities to increase	The project has resulted in generation of 385,602.425 MWh of renewable energy during the monitoring period belong to the first CP from 01-October-2018 and 31-December-2020. The project has resulted in generation of 105,723.839 MWh of renewable energy during the monitoring period belong to the second CP from 01-January-2021 and 31-December-2021. Hence the total project contributions during the current monitoring period is found to be 491,326.264 MWh	The project generated 1,543,059.518 MWh of renewable energy from the beginning of its first crediting period until now, which is from 01-January-2011 to 31-December-2021. 1,437,334.951 MWh of generated energy belongs to first crediting period meanwhile the rest, 105,723.839 MWh, was generated in the second crediting period.

2)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	Due to implementation of 69.58 MW Hydro Power Project, the project has prevented release of 210,923 Tonnes of carbon dioxide into the atmosphere during the monitoring period belong to first CP from 01-October-2018 and 31-December-2020. Due to implementation of 69.58 MW Hydro Power Project, the project has prevented release of 48,802 Tonnes of carbon dioxide into the atmosphere during the monitoring period belong to the second CP from 01-January-2021 and 31-December-2021. Thus total emission reductions achieved during the current monitoring period is found to be 259,725 tCO₂e.	The project prevented release of 834,982 Tonnes of carbon dioxide into the atmosphere from the beginning of its first crediting period until now, which is from 01-January-2011 to 31-December-2021. Prevented 786,180 tCO₂e belongs to first crediting period meanwhile the rest, which is 48,802 Tonnes of carbon dioxide release was prevented in the second crediting period.
3)	8.5	Decrease Unemployment rate by providing employment opportunities	Implemented activities to decrease	The project has employed 24 workers who are permanently working for the operation of the project.	The project has employed 24 workers annually who are permanently working for the operation of the project.

1.18 Additional Information Relevant to the Project

Leakage Management

Not applicable to this project activity.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Further Information

Not applicable to this project activity.

2 SAFEGUARDS

2.1 No Net Harm

The project does not have any negative effects on the environment because it is operated based on national and international regulations. The Hydro Electric Power Project does not change any water volume or cause any water pollution. Thus, the environmental impacts of the implemented project are not considered to be significant. All necessary permissions including, environmental, health and safety, have been acquired from relevant agencies and all precautions have been applied strictly by Investor Company.

2.2 Local Stakeholder Consultation

Stakeholder consultation for the project has been carried out at validation stage. Since the project was registered under previous version of VCS standard, hence, no specific mechanism defined for on-going stakeholder consultations post implementation.

Prior to validation, According to Article 9. of the Environmental Impact Assessment Regulation, a stakeholders meeting was held on 09-October-2007, at Karacaoglan Culture Center (Marriage Saloon) of Feke District, a location which was determined together with the Governor. The meeting hours and its location was announced on 04-October-2007 in the national (Aksam) newspaper and the local (Adana 5 Ocak) newspaper. During the meeting, information on the importance of the project, reasons for selection of the project location, employment, seismic activities and action required for environmental issues has been explained to the participants and stakeholders' views, considerations and questions were answered. Since no request for a change in the project was asked, no changes in the project were made. Participants mostly asked questions about employment and how the expropriation is going to be made. They pointed to the fact that the project shall be useful for the economy of the region as well as the whole country.

The second stakeholder meeting of the project was held on 13-November-2008 in Kisacikli region of Feke district in Adana. Stakeholders were invited through invitation letters sent by mail, newspaper

announcements and thorough village heads. Since Turkey had not then ratified Kyoto Protocol there was no official DNA in the country. However, as the most relevant government agencies, Ministry of Environment and Forestry and Ministry of Energy and Natural Resources were invited. In addition to local and national authorities, local and national NGOs and were also invited and informed about the meeting by mail. The meeting was held between 14:00 and 16:00 hours and about one hour were dedicated to the presentation about the project, climate change and carbon markets. Initial Stakeholder consultation meeting has been recorded to video and minutes have been noted. Comments have also been requested from government agencies and invitees by letters sent by mail. Mr. Guvenc Emre Sener, project manager of Akenerji Elektrik Üretim A.Ş. made the consultant company gave explanations regarding the carbon emissions savings of the renewable energy projects and the carbon trade. After the presentations and explanations, questions from the participants were answered by Mr. Guvenc Emre Sener, the project manager of Akenerji Elektrik Üretim A.Ş.

The comments from stakeholder have been positive in general. The main concerns raised by the participants were climate change which would occur due to the dams and power plants, so that the rain and snow would decrease. They have seen other examples of hydraulic dams which have caused less rain and snow causing draught. Also, they have seen agricultural lands turn into salty lands. Akenerji Elektrik Üretim A.Ş. has taken into account all comments and in general replied positively to the concerns and comments by the participants. It was explained that the project would not affect the climate negatively; otherwise, it would never get an approval for the Environmental Impact Assessment report and decrease of rain and river waters are not because of hydroelectric power plants, but mostly due to climate change. Also, it is pointed out that the change of land into salty lands is not due to dams and hydro power plants but due to excessive irrigation by landowners after the construction of dams and irrigation facilities.

As a part of continuous feedback from stakeholders, the grievance register is placed at project site and is being continuously monitored and addressed through the grievances cell on regular basis and maintained in a register at site office. The contact information of Company Executive of the company was given to mukhtar (head of the village) so that the local stakeholders are able to reach company executive whenever they have any complaints, suggestions, or ideas about the project. Since mukhtar is the head of the village, he is the main contact person between the project owner and the local stakeholders. Mukhtar made sure that there is continuous communication between the two parties. Moreover, logbook was delivered to the head of village. This logbook is being checked at regular intervals to see whether there have been any complaints from the local stakeholders. Thus it can be confirmed that regular and ongoing stakeholder inclusivity is being practiced by the project owner.

Further, no major grievances were being reported during the current monitoring period.

2.3 Environmental Impact

EIA assessment for Feka II HEPP project has been performed by PRD Planlama, Araştırma, and Geliştirme ve Danışmanlık Co. as defined by the regulations. An Environmental Impact Assessment report has been prepared on 21-January-2008. The report has been approved by Ministry of Environment and Forestry (MoEF) on 31-January-2008. EIA report prepared for the project covers all aspects of the project including capacity, interaction with other plants in the vicinity, natural resources used, waste management, social and economic impacts, technology and materials used, current land use in the region, any historical or protected site within the project boundaries, geological assessment of the project site and any communities affected with the project. This report has been evaluated by relevant local government

agencies and Ministry of Environment and Forests. After evaluation of the project and comments of local agencies, Ministry of Environment and Forestry has concluded that project does not have significant environmental effects and EIA assessment is positive for the project activities.

2.4 Public Comments

The Stakeholder Consultation commenting period had been completed and no comments had been received in the commenting period.

2.5 AFOLU-Specific Safeguards

Not applicable since this is a non-AFOLU project.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Following methodology has been followed:

The United Nations approved consolidated baseline methodology applicable to this project is ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources”, Version 21.0⁸

The project activity also uses ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources”, Version 10.0⁹ for the first crediting period.

ACM0002 refers to the following tools:

“Tool to calculate the emission factor for an electricity system”, Version 07.0.¹⁰

Methodological Tool Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (Version 03.0.1)¹¹

3.2 Applicability of Methodology

The applicability conditions of the methodology on the project activity are demonstrated as follows:

Applicability Criterion	Project Case
Applicability conditions of ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources”, Version 21.0	

⁸ <https://cdm.unfccc.int/methodologies/DB/HF3LP6O41YY0JIP1DK6ZRJO9RSCX3S>

⁹ <https://cdm.unfccc.int/methodologies/DB/TQ93XE42QG4RY9YKSZX8E9NJ92JQQI/view.html>

¹⁰ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>

¹¹ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf>

4. This methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Install a Greenfield power plant; (b) Involve a capacity addition to (an) existing plant(s); (c) Involve a retrofit of (an) existing operating plants/units; (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s).	The project activity is a grid-connected renewable energy power generation project i.e. Hydroelectric Power Project which falls under applicability criteria option 3 (a) i.e., “Install a Greenfield power plant”. Hence the project activity meets the given applicability criterion.
5. 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: (a) Integrate BESS with a Greenfield power plant; (b) Integrate a BESS together with implementing a capacity addition to (an) existing solar photovoltaic¹ or wind power plant(s)/unit(s); (c) Integrate a BESS to (an) existing solar photovoltaic or wind power plant(s)/unit(s) without implementing any other changes to the existing plant(s); (d) Integrate a BESS together with implementing a retrofit of (an) existing solar photovoltaic or wind power plant(s)/unit(s).	Not applicable since the methodology does not involve the integration of a BESS.
6. 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	The project activity is a Hydroelectric Power Project with reservoir which falls under applicability criteria option 6 (a) i.e., “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” Hence the project activity meets the given applicability criterion.

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.	
7. In case of hydro power plants, one of the following conditions shall apply: (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:	The project activity is a Hydroelectric Power Project which falls under applicability criteria option 7 (c) i.e., “The project activity results in new single or multiple reservoirs and the power density, calculated using equation (7), is greater than 4 W/m²”. Hence the project activity meets the given applicability criterion.

(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.	
8. In the case of integrated hydro power projects, project proponent 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.	Not applicable since the plant is not integrated.
9. 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.	The project activity is a Hydroelectric Power Project, and the estimated energy generation is entirely from renewable energy source i.e. hydropower.
10. In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the	Not applicable, the project is a Greenfield project activity and thus the applicability criteria is not applicable.

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”.	
Applicability conditions of “Tool to calculate the emission factor for an electricity system” Version 07.0	
3. 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).	This condition is applicable. OM, BM and CM are estimated using the tool under section 4.1 for calculating baseline emissions.
4. 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, the conditions specified in “Appendix 2: Procedures related to off grid power generation” should be met. Namely, the total capacity of off-grid power plants (in 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 offgrid 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.	Since the project activity is grid connected, this condition is applicable and the emission factor has been calculated accordingly.
5. 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.	Not applicable as the project is not located in any Annex I country.
6. Under this tool, the value applied to the CO₂ emission factor of biofuels is zero.	Not applicable as the project is a hydro power project and does not involve use of biofuels.

Applicability conditions of “Methodological Tool Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (Version 03.0.1)”	
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 condition is applicable and the stepwise procedure has been applied in section 3.4.
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.	This project activity current baseline remains same and there is no impact if circumstances, existing at the time of requesting renewal of crediting period. Therefore, the first step is met for the project activity.

3.3 Project Boundary

GHG gases included in the project boundary and used in calculation of emission reduction by the project activity are given in table below.

Source		Gas	Included?	Justification/Explanation
Baseline	Electricity generation in baseline (Turkey Grid)	CO ₂	Yes	Yes, Main Emission Source
		CH ₄	No	Minor emission source. Excluded for simplification.
		N ₂ O	No	Minor emission source. Excluded for simplification.
Project	Emission from the reservoir of the project.	CO ₂	No	Minor emission source. Excluded for simplification.
		CH ₄	Yes	CH ₄ emissions have been considered in the project boundary. However, since the power density is higher than 10W/m ² , it has been taken as “0” as per the applied methodology.

Source	Gas	Included?	Justification/Explanation
	N ₂ O	No	Minor emission source. Excluded for simplification.

The project boundary is limited by the National Electricity Grid of Turkey. The Geographical and physical boundaries of the Turkish grid and location of the power plants are clear. Import data obtained from the relevant government agencies (EUAS - Turkish Electricity Generation Corp., TEIAS – Turkish Electricity Transmission Corp., Ministry of Energy and Natural Resources) have been included in the calculations of the combined margin emissions.

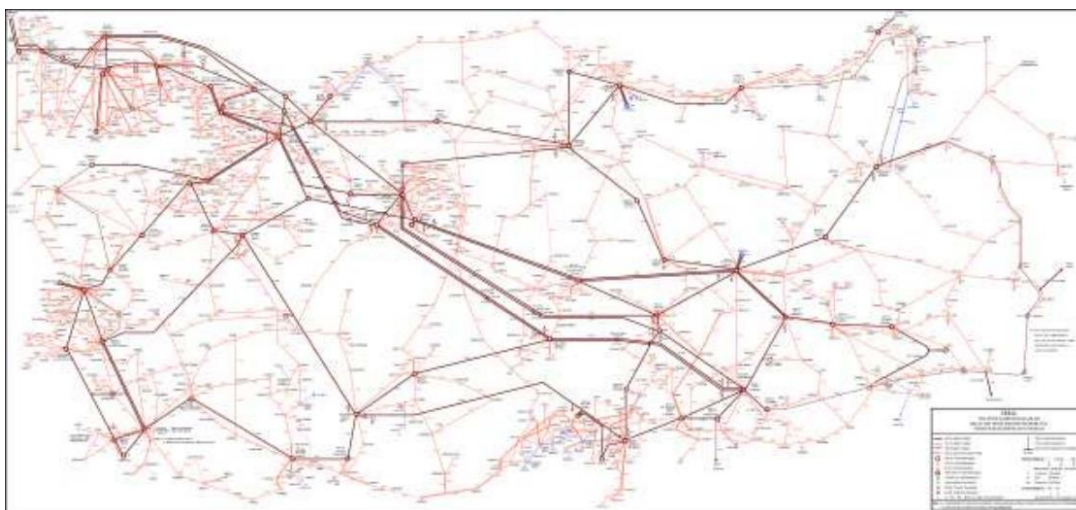


Figure 2. Turkish Electricity Grid

3.4 Baseline Scenario

As per the Methodological Tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” Version 03.0.1 (para. II. METHDOLOGY PROCEDURE), the validity of baseline scenario has been justified for the project activity.

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

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

The current baseline scenario i.e. fossil fuel intensive national grid complies with all relevant mandatory national/ sectoral policies which have come into effect after the project activity has been previous submitted for registration or the submission of the previous request for renewal of the crediting period and are applicable at the time of requesting renewal of the crediting period, go to Step 1.2.

Step 1.2: Assess the impact of circumstances

The impact of circumstances existing at the renewal of the project activity has been established as per the latest scenario being prevalent in Turkey.

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.

The baseline scenario of the project activity has been updated as per latest country specific scenario and hence the step is not applicable for the project activity.

Step 1.4: Assessment of the validity of the data and parameters

The emission factor of the project activity has been updated as per the latest applicable Turkish laws and regulations.

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

The baseline scenario has been stated as “the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources” with respect to the methodology.

The project activity includes hydroelectric power plant to benefit power of the rivers to produce electricity and supply to the Turkish National Grid.

Thermal power plants are the most used type in electrical energy production in Turkey. However, that is not enough since Turkey is an upper-developing country and there is an increasing demand of electricity. Also, these plants cause a lot of carbon emissions.

Because of the slow development of alternative energy sources, thermal power plants will increase in the future to meet the demand of electricity. Furthermore, because the large natural resource availability in Turkey, thermal power plants has been increased.

In the absence of the project activity, the number of thermal power plants would increase in order to meet the electricity demand. This demand in Turkey is growing rapidly with average 5.6%¹² for previous ten years. TEİAŞ, who is responsible from the grid reliability has prepared an electricity demand projection for next ten years period (2014-2024) for Turkey and announced in July 2015, given in Table 3 and Figure 3, reflecting the continuation of current demand growth¹³.

¹² See, <http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/index.htm> (2015 report, page 8, Table 1)

¹³ See, <http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/index.htm> (2015 report, page 17-18, Table 5 for High and Table 6 for Low Scenarios)

Table 3. Low and High Demand Projection Scenarios for Ten Years Period (TWh)

Scenarios	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
High Scenario	275.14	297.01	320.47	340.58	361.81	384.22	404.92	426.61	449.32	473.10
Low Scenario	264.35	278.16	293.15	307.72	322.62	338.06	352.95	368.20	383.94	400.65

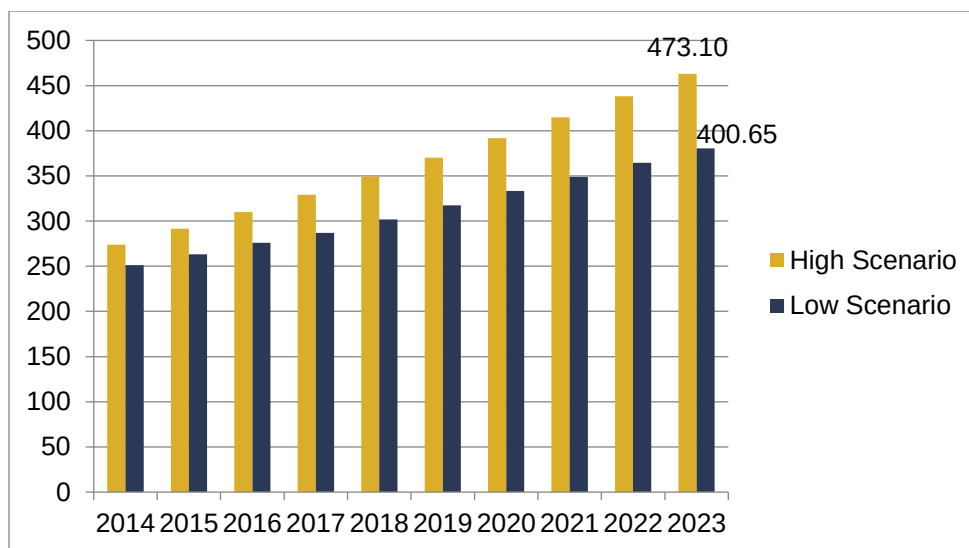


Figure 3. Electricity Demand Projections for Ten Years

In this projection, electricity supplies are also forecasted taking into account all power plants, which are operation, under construction and newly licensed. Generation projection based on project generation is given in Table 4.

Table 4. Projection of Total Generation Capacity by Fuel Types (TWh)

Years	2016	2017	2018	2019	2020	2021	Share in 2021 (%)
Lignite	61.24	61.33	61.33	61.33	61.33	61.33	13.8%
Hard Coal	5.91	5.91	5.91	5.91	5.91	5.91	1.3%
Imported Coal	37.90	39.63	39.67	39.67	39.67	26.82	9%
Natural Gas	175.07	175.15	176.01	175.79	176.01	176.01	39.7%
Geothermal	1.40	1.40	1.40	1.40	1.40	1.40	0.3%
Fuel Oil	9.22	9.22	9.22	9.22	9.22	9.22	2.1%
Diesel	0.15	0.15	0.15	0.15	0.15	0.15	0.0 %
Nuclear	0	0	0	4.200	12.60	21.00	4.7%

Other	1.41	1.41	1.41	1.41	1.41	1.41	0.3%
Thermal Total	292.30	294.21	295.11	299.08	307.71	316.11	70.79%
Biogas + Waste	1.20	1.20	1.20	1.20	1.20	1.20	0.3%
Hydro	104.44	112.71	115.78	116.56	116.56	116.56	26.3%
Wind	9.21	9.21	9.21	9.21	9.21	9.21	2.1%
Total	407148	417317	421292	426044	434670	443070	100.0%

According to the 6-year projection thermal fuels will be the main sources for electricity generation (70.79% in 2021) while fossil fuels will have 66.2% share in 2021. Hydro will account for 26.3% of the mix whereas all non-hydro renewable combined (geothermal/biogas/waste/wind) will only account for 2.7% of all electricity generation. This projection is consistent with continuing fossil fuel dependent characteristics of Turkish electricity sector, which is given in Figure 4.

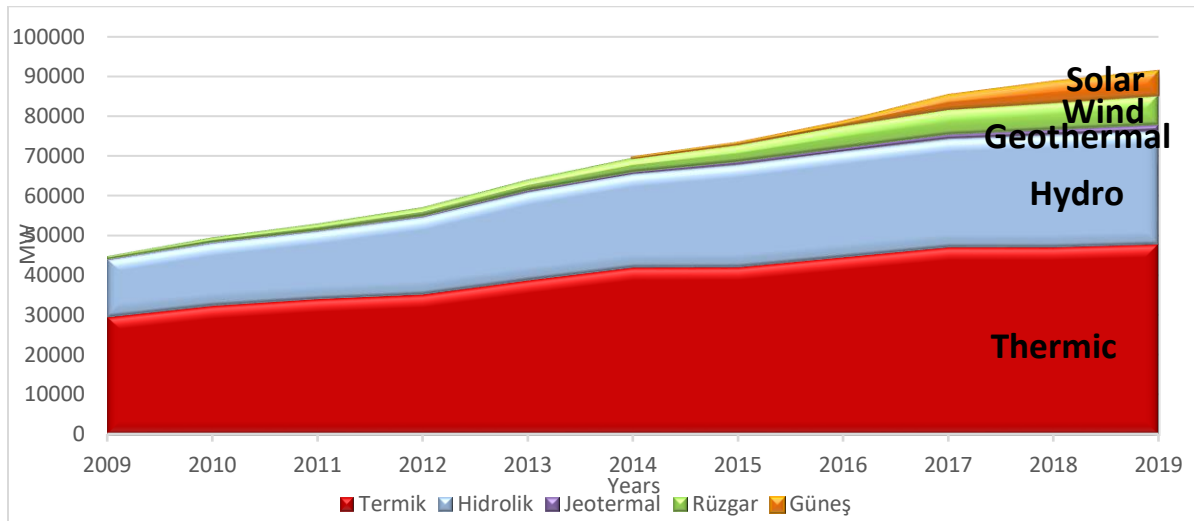


Figure 4. Development of Turkish Installed Capacity According to Primary Energy Sources (2009-2019)

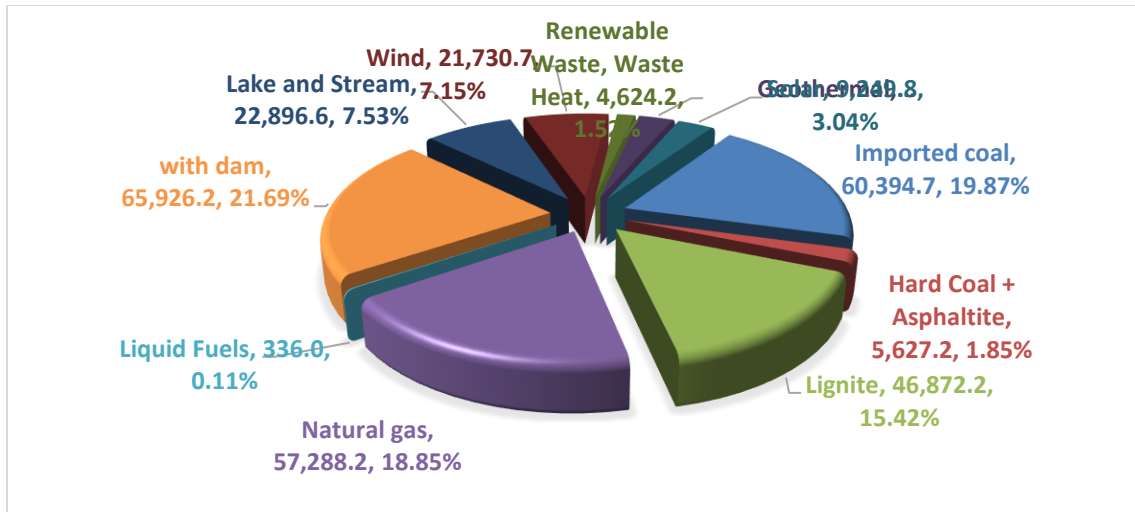


Figure 5. Distribution of Turkish Electric Energy Generation by Resources for The Year of 2019

According to above analysis for the baseline scenario (continuation of current situation), it can be concluded that:

- Conclusion-1: Energy demand in Turkey has been increasing with significant rates for ten years, and it is expected to continue at least for next ten years.
- Conclusion-2: Even all operational plants, construction phase plants and licensed ones are taken into account lack of supply is projected after five operational years¹⁴. So, there is significant need for electricity generation investments to satisfy demand, which means electricity to be generated by the project activity would otherwise be generated by new power plants to avoid power shortage in coming years
- Conclusion-3: Fossil fuels held the dominance in generation mix till the end of 2019 with 56.1% share. Hydro included renewable remained low with 29.22% share and non-hydro energy contribution stayed negligible with only 14.66% of total share by the end of that period. This also shows that most of new capacity additions are fossil fuel fired power plants.

The combination of aforementioned trends indicates that if the project would not be built, power from a new grid-connected thermal plant would be the most likely scenario.

The combined margin ($EF_{grid, CM, y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM).

Calculations for this combined margin must be based on data from an official source (where available) and made publicly available. TETC (Turkish Electricity Transmission Corporation) is the latest available data at the time of PSF submission to GCC verifier for verification, hence same is considered for emission factor calculations.

¹⁴ See, <http://www.teias.gov.tr/KAPASITEPROJEKSIYONU2013.pdf> (page 72)

The combined margin for the project activity was published in 02-September-2022¹⁵ and is as follows:

Table 5. Emission Factors

Parameter	Value	Nomenclature	Source
EF _{grid,CM,y}	0.4616 tCO ₂ /MWh	Combined margin CO ₂ emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.25) & build margin (0.75) values, sourced from Turkey National Network Grid Emission Factor Data Sheet of Ministry of Energy and Natural Resources.
EF _{grid,OM,y}	0.7424 tCO ₂ /MWh	Operating margin CO ₂ emission factor for the project electricity system in year y	Sourced from Turkey National Network Grid Emission Factor Data Sheet of Ministry of Energy and Natural Resources.
EF _{grid,BM,y}	0.3680 tCO ₂ /MWh	Build margin CO ₂ emission factor for the project electricity system in year y	Sourced from Turkey National Network Grid Emission Factor Data Sheet of Ministry of Energy and Natural Resources.

3.5 Additionality

This is the second crediting period. In the first crediting period, additionality of the project was presented. There has been no capacity change in the project between the first and the second crediting period. The Project is in compliance with all required relevant regulations but is not a mandatory Project. There is no change in the relevant national and/or sectoral regulations with respect to project activity or its technology till date through which the project activity is not found mandated by regulations. There is no breach of any legislation and all required permits are obtained. Laws and regulations that apply for power generation facilities in the host country are mentioned in PD & MR. Hence this project is a regulatory surplus.

3.6 Methodology Deviations

Not applicable since the project does not involve any methodology deviations.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

As per the tool, the following six steps for calculation of emission reductions have been applied:

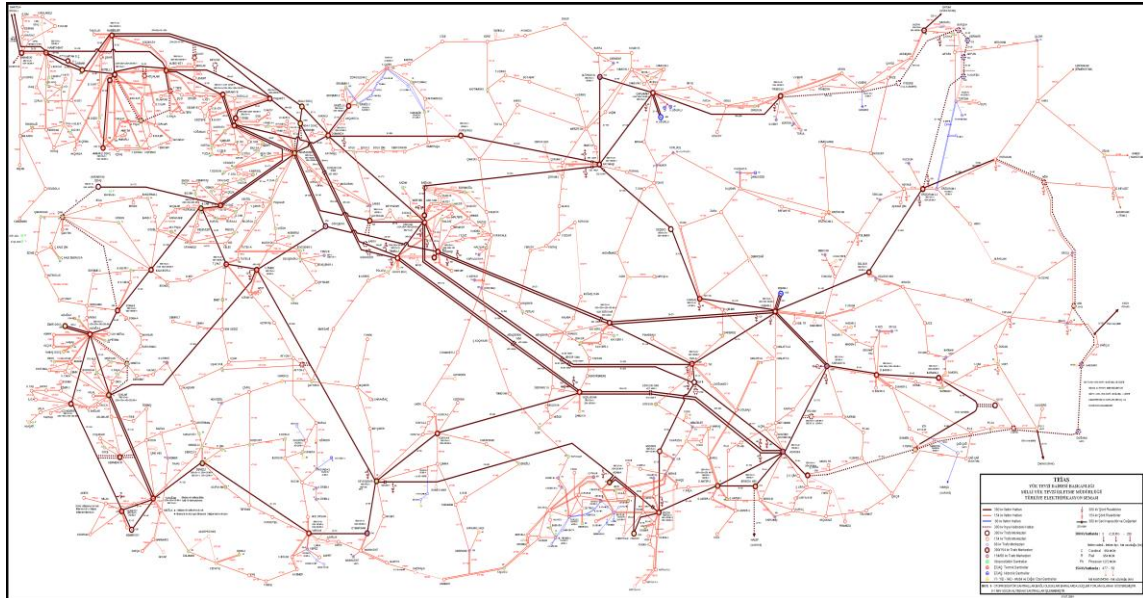
Step 1. Identification of the relevant electrical power system

¹⁵

<https://enerji.gov.tr//Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klim/%C4%B0klimDe%C4%9Fi%C5%9Fikli%C4%9Fi/TUES EmisyonFktr/Belgeler/Bform2020.pdf>

As described in tool “For determining the electricity emission factors, identify the relevant project electricity system. Similarly, identify any connected electricity systems”. It also states that “If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used”.

Keeping this into consideration the delineation of the national grid of Turkey by "TÜRKİYE ELEKTRİK İLETİM A.Ş. GENEL MÜDÜRLÜĞÜ" is considered for estimation.



Step 2. Choose whether to include off-grid power plants in the project electricity system (optional) Option I has been chosen by the project developer hence only grid power plants are included in calculations.

Step 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:

- (a) Simple OM; or
- (b) Simple adjusted OM; or
- (c) Dispatch data analysis OM; or
- (d) Average OM.

The data required to calculate Simple adjusted OM and Dispatch data analysis OM is not possible due to lack of availability of data to project developers. The choice of other two options for calculating operating margin emission factor depends on generation of electricity from low-cost/ must-run sources. In the context of the methodology low cost/must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

In accordance with Electricity Market Production Capacity Projections List (TWh)¹⁶

¹⁶ EMRA | Energy Market Regulatory Authority (epdk.gov.tr)

Years	2016	2017	2018	2019	2020	2021	Share in 2021 (%)
Lignite	61.24	61.33	61.33	61.33	61.33	61.33	14.26%
Hard Coal	5.91	5.91	5.91	5.91	5.91	5.91	1.37%
Imported Coal	37.90	39.63	39.67	39.67	39.67	26.82	6.23%
Natural Gas	175.07	175.15	176.01	175.79	176.01	176.01	40.91%
Geothermal	1.40	1.40	1.40	1.40	1.40	1.40	0.33%
Fuel Oil	9.22	9.22	9.22	9.22	9.22	9.22	2.14%
Diesel	0.15	0.15	0.15	0.15	0.15	0.15	0.03%
Nuclear	0	0	0	4.200	12.60	21.00	4.88%
Other	1.41	1.41	1.41	1.41	1.41	1.41	0.33%
Thermal Total	292.30	294.21	295.11	299.08	307.71	316.11	70.49%
Biogas + Waste	1.20	1.20	1.20	1.20	1.20	1.20	0.28%
Hydro	104.44	112.71	115.78	116.56	116.56	116.56	27.09%
Wind	9.21	9.21	9.21	9.21	9.21	9.21	2.14%
Total	407148	417317	421292	426044	434670	443070	100.0%

The above data clearly shows that the percentage of total grid generation by low-cost/ must-run plants (on the basis of average of five most recent years) for the national grid of Turkey is less than 50 % of the total generation capacity. Thus, the Average OM method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation. The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

(a) Ex-ante option: if the ex-ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required.

OR

(b) Ex-post option: if the ex-post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

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

For OM factor calculation, Chronological order of power generation plants from TEİAŞ Load Dispatch Department with, fuel types, electricity generation for the calculated year were used as input data. By using all the data which were mentioned above, Turkish Ministry of Energy and Natural Resources calculated EF_{grid,OM,y}:

$$EF_{\text{grid,OM,y}} = 0.7424 \text{ tCO}_2/\text{MWh}$$

Step 5. Calculate the build margin emission factor

As per Methodological tool: “Tool to calculate the emission factor for an electricity system” (Version 07.0, EB 100, Annex 4) para 72:

In terms of vintage of data, project participants can choose between one of the following two options:

(a) Option 1 - for the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group at the time of PDD submission to the DOE for project verification. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

(b) Option 2 - For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 as described above is chosen by PP to calculate the build margin emission factor for the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PD and is fixed for the entire crediting period.

For BM factor calculation by Turkish Ministry of Energy and Natural Resources EF_{grid,BM,y}¹⁷ 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.

$$EF_{grid,BM,y} = 0.3680 \text{ tCO}_2/\text{MWh}$$

STEP 6 - Calculate the combined margin(CM) emission factor

As per Methodological tool: “Tool to calculate the emission factor for an electricity system” (Version 07.0, EB 100, Annex 4) para 81:

The calculation of the combined margin (CM) emission factor (EF_{grid,CM,y}) is based on one of the following methods:

- (a) Weighted average CM; or
- (b) Simplified CM.

PP has chosen option (a) i.e weighted average CM to calculate the combined margin emission factor for the project activity.

The combined margin emission factor is calculated by using weighted average CM as per TOOL07 Version 07.0 formula below:

$$EF_{grid,BM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM} \quad \text{Equation 16 in TOOL07 V 07.0}$$

Where:

EF _{grid,BM,y}	Build margin CO ₂ emission factor in year y (tCO ₂ /MWh)
EF _{grid,OM,y}	Operating margin CO ₂ emission factor in year y (tCO ₂ /MWh)
W _{OM}	Weighting of operating margin emissions factor (%)
W _{BM}	Weighting of build margin emissions factor (%)

¹⁷<https://enerji.gov.tr//Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klım/%C4%B0klımDe%C4%9Fi%C5%9Fikl%C4%9Fi/TUESEmisyonFktr/Belgeler/Bform2020.pdf>

According to the Tool for power generation project activities other than wind and solar;

$w_{OM} = 0.25$ and $w_{BM} = 0.75$

Then:

$EF_{grid,CM,y} = 0.7424 \text{ tCO}_2/\text{MWh} * 0.25 + 0.3680 \text{ tCO}_2/\text{MWh} * 0.75 = 0.4929 \text{ tCO}_2/\text{MWh}$

$$EF_{grid,CM,y} = 0.4616 \text{ tCO}_2/\text{MWh}$$

Baseline emission is calculated according to the formula:

$$BE_y = EG_y \times EF_y$$

$$BE_y = 223,410 \text{ MWh} \times 0.4616 \text{ tCO}_2/\text{MWh} = 103,126 \text{ tCO}_2$$

Where:

EG_y = Net electricity delivered to the grid by the project activity in year y excluding transmission losses of the grid.

EF_y = Emission factor calculated according to selected methodology

4.2 Project Emissions

The project activity involves the generation of electricity by a hydroelectric power plant which has power density higher than 10 W/m^2 therefore emissions from reservoir is ignored as per the applied methodology.

The power density of the project activity (PD) 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 reservoir 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 reservoir 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

For project Hydro electric Power Plant (HEPP),

$$Cap_{PJ} = 69,580,000 \text{ W}$$

$$Cap_{BL} = 0.0 \text{ W}$$

$$A_{PJ} = 2,477,000 \text{ (m}^2\text{)}$$

$$A_{BL} = 0.0 \text{ (m}^2 \text{)}$$

Therefore, PD is calculated as:

$$PD = \frac{69,580,000 - 0}{2,477,000 - 0}$$

$$PD = 28.09 \text{ W/m}^2$$

Thus, $PE_y = 0$

4.3 Leakage

The energy generating equipment is not transferred from or to another activity. Therefore, leakage is also considered as “0”.

$$LE_y = 0$$

As a result: Estimated Net Emission Reductions = $BE_y - PE_y = 103,126 - 0 = 103,126 \text{ tCO}_2\text{e}$

4.4 Estimated Net GHG Emission Reductions and Removals

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
2021	103,126	0	0	103,126
2022	103,126	0	0	103,126
2023	103,126	0	0	103,126
2024	103,126	0	0	103,126
2025	103,126	0	0	103,126
2026	103,126	0	0	103,126
2027	103,126	0	0	103,126
2028	103,126	0	0	103,126

2029	103,126	0	0	103,126
2030	103,126	0	0	103,126
Total	1,031,260	0	0	1,031,260

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO ₂
Description	CO ₂ emission factor of fossil fuel type “i” in year “y”
Source of data	Turkey National Network Grid Emission Factor Data Sheet of Ministry of Energy and Natural Resources & Tool to calculate the emission factor for an electricity system”, Version 07.0
Value applied:	0.4616
Justification of choice of data or description of measurement methods and procedures applied	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM, simple y} * W_{OM} + EF_{grid, BM,y} * W_{BM}$ Where: $EF_{grid,BM,y}$ = Build margin CO₂ emission factor in year y (t CO₂/MWh) $EF_{grid,OM,y}$ = Operating margin CO₂ emission factor in year y (t CO₂/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 25% W_{BM} = Weighting of build margin emissions factor (%) = 75%
Purpose of Data	To calculate emission reduction
Comments	-

Data / Parameter	Cap _{BL}
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero
Source of data	Project site
Value applied:	0
Justification of choice of data or description of measurement methods and procedures applied	Since project involves a new reservoir, this value is zero.
Purpose of Data	To calculate the power density of the project activity
Comments	

Data / Parameter	A _{BL}
Data unit	m ²
Description	Area of the reservoir 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.
Source of data	Project site
Value applied:	0
Justification of choice of data or description of measurement methods and procedures applied	Since project involves a new reservoir, this value is zero.
Purpose of Data	To calculate power density of project activity
Comments	

5.2 Data and Parameters Monitored

Parameters given below reveals all data and parameters to be monitored during the project crediting period in RCP.

Data / Parameter	EG _{facility, y}
Data unit	GWh
Description	Net Electricity generated and delivered to the grid by Feke II HEPP in year y
Source of data	The energy generation data are obtained remotely by TEİAŞ and there are no signed meter readings. EPIAS records are used for main calculation where “Monthly Facility Reports” (signed by the project owner) are used for cross-check.
Description of measurement methods and procedures applied	Generation data were recorded by four metering devices continuously. The internal consumption of the facility was subtracted from the gross generation. EPIAS records were used for main calculation where “Monthly Facility Reports” (signed by the project owner) were used for cross-check.
Frequency of monitoring/recording	Continuous measurement at the site and daily and monthly recording were applied. The plant manager and the staff extracted the records regularly every day. The monthly records gathered by TEİAŞ remotely.
Value applied:	Yearly estimated electricity supply to grid is 223,410 MWh ¹⁸ . Thus, estimated electricity supply to grid for current monitoring period is 727,153.644 MWh.
Monitoring equipment	Four calibrated ammeters (two of them are spare) Meters used are in compliance with the regulation¹⁹ on meters issued by relevant government agencies and have 0.5S accuracy class²⁰ The meters are being tested at least once in a year and are being calibrated once in ten years. Testing of all meters were provided in the following dates: 25-November-2013, 29-September-2015, 27-September-2016, 14-

¹⁸ Generation License

¹⁹ <http://www.epdk.gov.tr/web/elektrik-piyasasi-dairesi/44>

²⁰ First index Protocol

	November-2017, 17-November-2018. After the change of all meters in 23-April-2020, no testing has been conducted.
QA/QC procedures applied	Maintenance and calibration of the metering devices is being done by TEIAS periodically. If there is a significant difference between the readings of two devices, maintenance and tests of the metering devices and the associated equipment will be done before waiting for the periodical maintenance.
Purpose of data	To calculate the baseline emission
Calculation method	Not Applicable
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	Data obtained from Scada System is being used as a primary source whereas for crosschecking purpose SPDK website is being used.
Description of measurement methods and procedures applied	The parameter was determined from the labels on the equipment and letter for approval of commissioning issued by Ministry of energy and Natural Resources.
Frequency of monitoring/recording	Yearly
Value applied:	69.58 MWe ²¹
Monitoring equipment	Not Applicable
QA/QC procedures applied	Not Applicable

²¹ FEKE II Generation licence

Purpose of data	To calculate project emission
Calculation method	Not Applicable
Comments	-

Data / Parameter	A _{PJ}
Data unit	m ²
Description	Area of the reservoir measured on the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project site
Description of measurement methods and procedures applied	Measured from topographical surveys or maps
Frequency of monitoring/recording	Yearly
Value applied:	2,477,000 ²²
Monitoring equipment	Not Applicable
QA/QC procedures applied	Not Applicable
Purpose of data	To calculate project emission
Calculation method	Not Applicable
Comments	Maximum area is already calculated in the feasibility report and considered in calculations.

²² FEKE II Hepp Reservoir Map

5.3 Monitoring Plan

Monitoring is a key procedure to verify the real and measurable emission reductions from the implemented project. To guarantee the implemented project's real, measurable, and long-term GHG emission reductions, the monitoring plan is established.

To demonstrate the emission reduction, only required data is the net electricity delivered to the grid by the project activity and internal combustion for the auxiliary diesel generator.

Net electricity generation is measured and recorded by both TEIAS and project owners for billing purposes therefore no new additional protocol is needed monitoring emission reduction. Power Plant Manager, is responsible for the electricity generated, gathering all relevant data, and keeping the records. He is informed about VCU concepts and mechanisms and how to monitor and collect the data which is used for emission reduction calculations.

Generation data collected during crediting period is submitted to consultant who is responsible for calculating the emission reduction subject to verification: Generation data is used to prepare monitoring reports which is used to determine the vintage from the project activity. These reports are submitted to the duly authorized and appointed Validation /Verification Body (VVB) before each verification period.

The monitoring system organization chart is shown in Figure 8 below, in which the authority and responsibility of project management are defined.

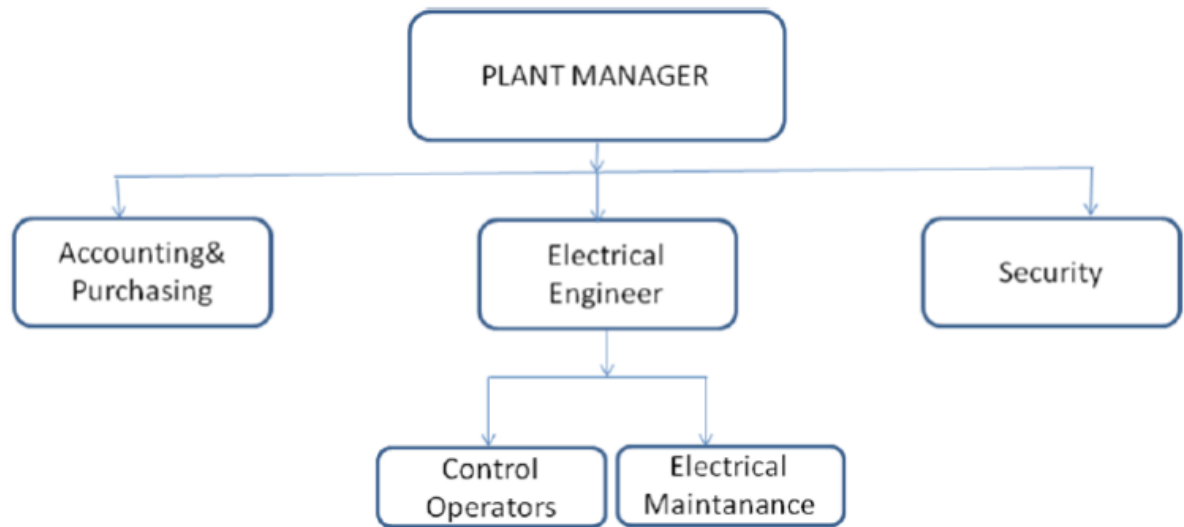


Figure 8. Operational structure of FEKE II HEPP

VCU Team Members is expected to include the following staff of the HEPP:

Plant Manager: Responsibility for running the HEPP plant and compliance with VCU monitoring plan

Electrical Engineer: Responsible for day electrical operations and recording and monitoring of relevant data and periodic reporting

Accounting Manager: Responsible for keeping data about power sales, invoicing and purchasing.

EKI Energy Services: Responsible for emission reduction calculations, preparing monitoring report and periodical verification process.

Installation of meter and data monitoring are carried out according to the regulations by TEIAS. Four metering devices (two of them used as spare) are used for monitoring the electricity generated by the power plant. Readings are done using main metering devices and spare metering device is used for comparison only. Data from metering devices is recorded by TEIAS remotely. generation of the FEKE II HEPP are taken from TEIAS – EPIAS web site(<http://EPIAS.teias.gov.tr>) which is accessible using a password provided to electricity generation. The project owner extracted these data and send to EKI. Both the EPIAS data and Monthly Facility Reports” (signed by the project owner) were taken into account for comparison and to identify any abnormalities.

Technical information of the meters is tabulated below:

Table 9. Technical Information of First Meters

Brand	Type	Serial Number	Accuracy Class	Calibration Date	Validity	Calib. Frequency
ELSTER	A1500	00416326 (main- unit 1)	0.5S	20-May-2010	19-May-2020	10 years
ELSTER	A1500	00416327 (spare- unit 1)	0.5S	20-May-2010	19-May-2020	10 years
ELSTER	A1500	00416328 (main- unit 2)	0.5S	20-May-2010	19-May-2020	10 years
ELSTER	A1500	00416329 (spare- unit 2)	0.5S	20-May-2010	19-May-2020	10 years

Change or calibration of the metering devices has been necessary during the monitoring period between 01-October-2018 and 31-December-2020. Thus, test of all the meters were done in 14-November-2017 and 17-November-2018 and later, all the meters were changed in 23-April-2020. Technical information of new meters can be found below:

Table 10. Technical Information of Meters After Change

Brand	Type	Serial Number	Accuracy Class	Calibration Date	Validity	Calibration Frequency
EMH	LZQJ-XC	9420176 (main-unit 1)	0.5S	23-March-2020	22-March-2030	10 years
EMH	LZQJ-XC	9420177 (spare-unit 1)	0.5S	23-March-2020	22-March-2030	10 years
EMH	LZQJ-XC	9420178 (main-unit 2)	0.5S	23-March-2020	22-March-2030	10 years
EMH	LZQJ-XC	9420179 (spare-unit 2)	0.5S	23-March-2020	22-March-2030	10 years

No change or calibration of the metering devices had been done during the monitoring period of 01-January-2021 to 31-December-2021.

In case of a major failure at both metering at the same time, electricity generation by the plant since the last measurement is able to be monitored by another metering device at the inlet of the main substation operated by TEIAS where the electricity is fed to the grid. Electricity generated by the power plant is also available at the SCADA (supervisory control and data acquisition system) of the grid operator TEIAS, through the RTU (remote terminal unit) installed at the power plant and supervised by the Load Dispatch Centre of TEIAS.

The net electricity fed to the grid was measured continuously and recorded monthly by the TEIAS and plant staff. For consistency, recorded data were compared with electricity sale receipts.

Calibration of the metering devices was made by TEIAS and sealed during first operation of the plant. The meters were calibrated by TEIAS when exists significant inconsistency between two devices using a fixed template²³ or upon request by either project owner or TEIAS²⁴.

The maximum area of the reservoir is provided map of reservoir, the level of water was also checked from topographical surveys and maps and didn't exceed the limit value.

ABL value was takes as zero as the project is a new project and there was no reservoir area before the project is released, thus, as per the methodology.

Project emissions resulting from use of diesel generator has been neglected as per the applied methodology ACM 0002 Version 21.0.

As a part of continuous feedback from stakeholders, the grievance register is placed at project site and is being continuously monitored and addressed through the grievances cell on regular basis and maintained in a register at site office. The contact information of Company Executive of the company was given to mukhtar (head of the village) so that the local stakeholders are able to reach company executive whenever they have any complaints, suggestions, or ideas about the project. Since mukhtar is the head of the village, he is the main contact person between the project owner and the local stakeholders. Mukhtar made sure that there is continuous communication between the two parties. Moreover, logbook was delivered to the head of village. This logbook is being checked at regular intervals to see whether there have been any complaints from the local stakeholders. Thus it can be confirmed that regular and ongoing stakeholder inclusivity is being practiced by the project owner.

Besides, single line diagram of the project can be seen below.

²³ <https://www.teias.gov.tr/>

²⁴ <https://www.epdk.gov.tr/>

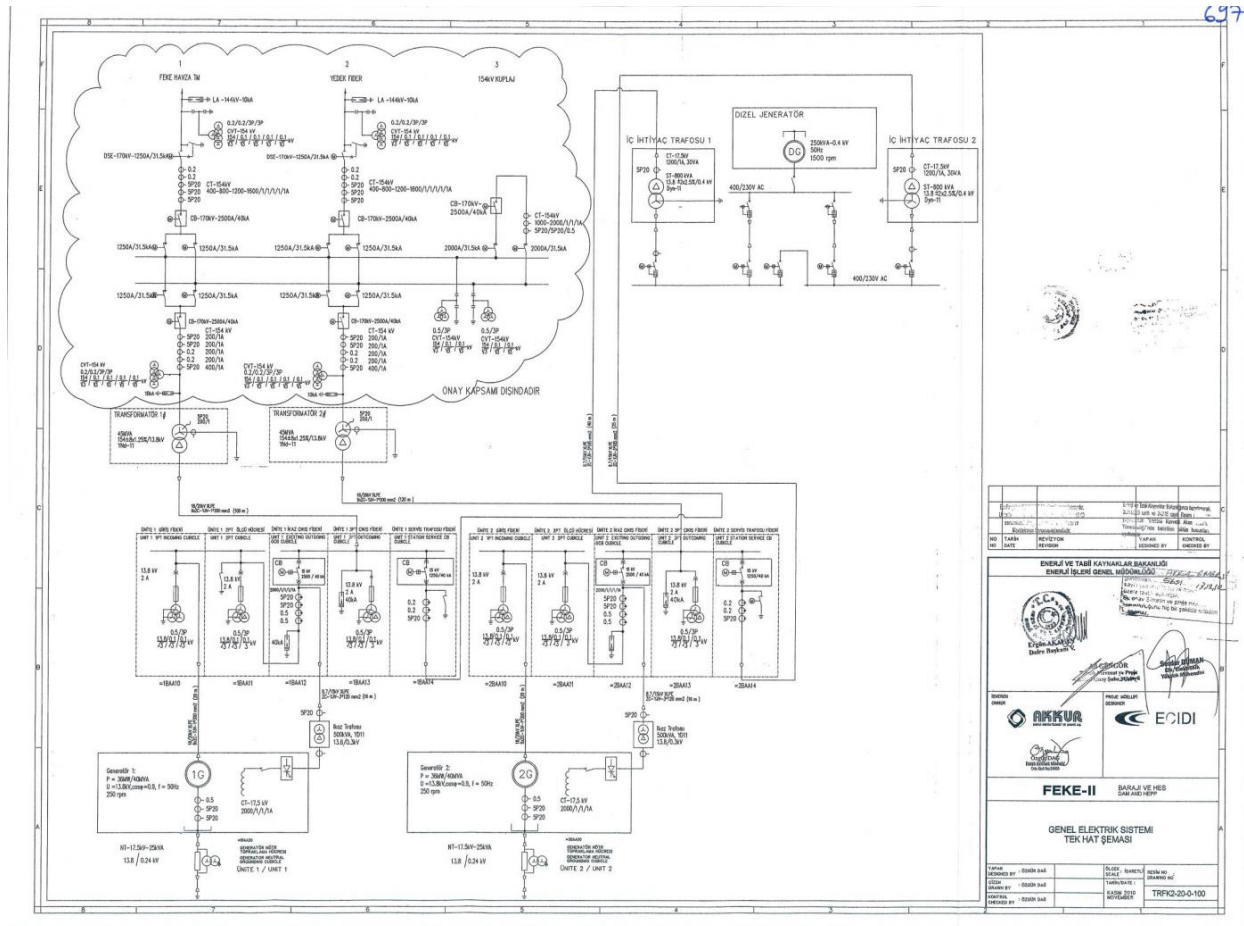


Figure 9. Single Line Diagram

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

Data / Parameter	EG _{facility, y}
Data unit	MWh
Description	Net Electricity generated and delivered to the grid by Feke II HEPP in year y

Value applied:	385,602.425 MWh (during the monitoring period of 01-October-2018 and 31-December-2020) 105,723.839 MWh (during the monitoring period of 01-January-2021 to 31-December-2021)
Comments	-

Data / Parameter	Cap _{PJ}
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Value applied:	69.58 MWe ²⁵
Comments	-

Data / Parameter	A _{PJ}
Data unit	m ²
Description	Area of the reservoir measured on the surface of the water, after the implementation of the project activity, when the reservoir is full
Value applied:	2,477,000 ²⁶
Comments	Maximum area is already calculated in the feasibility report and considered in calculations.

Data / Parameter	PE _{FF,y}
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²⁵ FEKE II Generation licence

²⁶ FEKE II Hepp Reservoir Map

Data unit	tCO ₂ e
Description	Project emissions from fossil fuel consumption in year y
Value applied:	0
Comments	The project activity involves the generation of electricity by a hydroelectric power plant which has power density higher than 10W/m ² therefore emissions from reservoir is ignored as per the applied methodology for the entire monitoring period.

6.2 Baseline Emissions

Baseline emission is calculated according to the formula:

$$BE_y = EG_y \times EF_y$$

Where:

EG_y = Net electricity delivered to the grid by the project activity in year y excluding transmission losses of the grid.

EF_y = Emission factor calculated according to selected methodology

During the Monitoring Period of 01-October-2018 and 31-December-2020:

$$EG_y = 385,602.425 \text{ MWh}$$

$$EF_y = 0,547 \text{ tCO}_2\text{e /MWh}$$

$$BE_y = 385,602.425 \times 0,547 = 210,923 \text{ tCO}_2\text{e (rounddown to nearest integer).}$$

During the Monitoring Period of 01-January-2021 to 31-December-2021:

$$EG_y = 105,723.839 \text{ MWh}$$

$$EF_y = 0.4616 \text{ tCO}_2\text{e/MWh}$$

$$BE_y = 105,723.829 \times 0.4616 = 48,802 \text{ tCO}_2\text{e (rounddown to nearest integer)}$$

6.3 Project Emissions

Project emissions were calculated as below based on applicable methodology.

These emissions are being accounted for project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y = Project emissions in year y (tCO₂e/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO₂e/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO₂e/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO₂e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

The project activity has a diesel generator, however the use of fossil fuels for the back up or emergency purposes (e.g. diesel generators) can be neglected as per applicable methodology. Therefore, $PE_{FF,y}$ is zero.

Project emissions from non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$)

The project activity is not a geothermal power plant. Hence, $PE_{GP,y}$ is zero.

Project emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

For hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for CH₄ and CO₂ emissions from the reservoir, estimated as follows:

If the power density of the project activity (PD) is greater than 10 W/m² : $PE_{HP,y} = 0$

The power density of the project activity (PD) 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 reservoir 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 reservoir 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

For project HEPP,

Cap_{PJ} = 69,580,000 W

Cap_{BL} = 0.0 W

A_{PJ} = 2,477,000 (m²)

$$A_{BL} = 0.0 \text{ (m}^2\text{)}$$

Therefore, PD is calculated as:

$$PD = \frac{69,580,000 - 0}{2,477,000 - 0}$$

$$PD = 28.09 \text{ W/m}^2$$

Thus, $PE_{HP,y} = 0$

Therefore,

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} = 0 + 0 + 0 = 0$$

Hence, Project emissions are taken as 0.

6.4 Leakage

No leakage emissions are considered as per applied methodology ACM 0002 Version 21.0

$$LE_y = 0$$

6.5 Net GHG Emission Reductions and Removals

The actual emission reductions (ER_y) are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emission reductions in year y (tCO₂e)

BE_y = Baseline emissions in year y (tCO₂e)

PE_y = Project Emissions in year y (tCO₂e)

LE_y = Leakage emissions in year y (tCO₂e)

During the Monitoring Period of 01-October-2018 and 31-December-2020:

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01-October-2018 to	15,816	0	0	15,816

31-December-2018				
01-January-2019 to 31-December-2019	110,396	0	0	110,396
01-January-2020 to 31-December-2020	84,711	0	0	84,711
Total	210,923	0	0	210,923

During the Monitoring Period of 01-January-2021 to 31-December-2021:

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01-January-2021 to 31-December-2021	48,802	0	0	48,802
Total	48,802	0	0	48,802

Since the electricity delivery to the grid by Feka II Hydroelectric Power Plant is estimated to be 223,410 MWh per annum. Estimated electricity supply to grid for current monitoring period is equal to 727,153.644 MWh. Energy generation during the monitoring period of 01-October-2018 and 31-December-2020 was 385,602.425 MWh while it was 105,723.839 MWh during the monitoring period of 01-January-2021 to 31-December-2021. So, the total net energy generation for current monitoring period (01-October-2018 to 31-December-2021) is equal to 491, 326.264 MWh.

Moreover, the net emission reduction for current monitoring period (01-October-2018 to 31-December-2021) is = (210,923 + 48,802) tCO₂e

$$= 259,725 \text{ tCO}_2\text{e (Round down)}$$

The total monitoring period (01-October-2018 to 31-December-2021) is of 1,188 days within which first 823 days are under First Crediting Period and next 365 days are under Second Crediting Period. The

estimated annual emission reduction as per PD is 122,205 tCO₂ for first crediting period. The estimated annual emission reduction as per PD is 103,126 tCO₂ for second crediting period.

So, the estimated emission reduction for the first 823 days of monitoring period which are under First Crediting Period will be

$$\begin{aligned} &= (122,205/365) \times 823 \\ &= 275,547 \text{ tCO}_2\text{e (Round down)} \end{aligned}$$

The estimated emission reduction for the next 365 days of monitoring period which are under Second Crediting Period will be

$$\begin{aligned} &= (103,126/365) \times 365 \\ &= 103,126 \text{ tCO}_2\text{e (Round down)} \end{aligned}$$

So, the estimated emission reduction in current monitoring period

$$\begin{aligned} &= (275,547 + 103,126) \text{ tCO}_2\text{e} \\ &= 378,673 \text{ tCO}_2\text{e (Round down)} \end{aligned}$$

The % fall in emission reduction in current monitoring period as compared to estimated emission reduction is = $100 \times (259,725 - 378,673) / 378,673$

$$= -31.41\%$$