KOROGLU HYDROELECTRIC POWER PLANT MONITORING REPORT

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ABBREVIATIONS

BE	Baseline Emission
BM	Build Margin
CDM	Clean Development Mechanism
CO	Combined Margin
EF	Emission Factor
EIA	Environmental Impact Assessment
EG	Electricity Generation
EPIAS	Enerji Piyasaları İşletme A.Ş. (Electricity Market Operator Incorporation)
EPDK	Enerji Piyasaları Denetleme Kurulu (Energy Market Regulatory Authority of Government of Turkey)
FC	Fuel Consumption
GHG	Greenhouse Gas
HEPP	Hydroelectric Power Plant
J	Joule
NCV	Net Calorific Value
OM	Operating Margin
PE	Project Emission
PMUM	EPIAS-Piyasa Mali Uzlaştırma Merkezi (Market Financial Settlement Center)
SDG	Sustainable Development Goal
UNFCC	United Nations Framework on Climate Change
T	Ton
TEIAŞ	Türkiye Elektrik İletim A.Ş. (Turkish Electricity Transmission Incorporation)

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Koroglu Hydroelectric Power Plant (hereafter Project and/or Koroglu HEPP) is a run-of river type power plant with an installed capacity of 9.53 MWm (9.06 MWe). Purpose of the project is to generate renewable electricity to the Turkish National Grid System (TNGS) and to contribute global carbon emission reductions efforts. Project investor is a private enterprise, Etken Elektrik Üretim Ltd.Sti.

Project is located on the Savrun River within the perimeter of the Kadirli District of Osmaniye Province at the eastern Mediterranean Region. Project started to operation on 20 June 2014 and since then producing renewable electricity to the Turkish National Grid System.[1] Generated energy is being transmitted to the Sayan HEPP[2] transmission line via a 12.154 km transmission line which is the connection point of Koroglu HEPP to the Turkish National Grid System.

Project has three weirs in the project. One is the Main Weir located on the Savrun River, and the other two small tyrolean type weirs are located on the Kurbağalı Creek which is a side branch of the Savrun River. Main Weir is on the 875.0 m crest elevation on the Savrun River. Weir body height is 5 m from the thalweg. Catchment basin area of the main weir is 149 km2. Intake structure is placed on the right side bank of the river. Access to the main weir is very difficult due to the rough geography of the region. Therefore, an access tunnel is constructed to reach easily to the Main Weir. Due to the geographic difficulties, settling basin is placed 900 m away from the water intake. There is a conveyance tunnel between the water intake and the settling basin.

Water is taken from the Kurbagali Creek by two small Tyrolean type weirs. Each of Tyrolean weir's catchment basin area is 8 km2. Diverted water by Tyrolean weirs is conveyed to the settling basin by a pipeline. Suspended material inside the water (bigger than 0.3 mm) are settled by a settling basin. Water leaving the settling basin is conveyed to a headpond. Penstock length is 998 m and its diameter is 1.8 m. Powerhouse is placed on the right side bank of the Savrun River at the tailwater elevation of 747.0 m.

Water is turbined by three units of horizontal axis Francis turbines. Each turbine has an installed capacity of 3.177 MWm (3.02 MWe). Turbines are Francis type and horizontal axis with the model number of each WWS-F 599/128/16-SP/18 manufactured by the Wasserkraft GmbH from Austria. Project and turbines technical data is provided in the following table.

[1] For more information, "Verra VCS Koroglu HEPP Project Description Report," 7 April 2017, Section 1.1 and Section 1.8. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as PROJ_DESC_1456_07APR2015.pdf. Access date on 21 April 2022.
[2] Sayan HEPP located at the 2 km upstream of Koroglu HEPP.

Table 1 Technical Characteristic of Koroglu HEPP[3]

Project Main Characteristics	
Type	Run-of-river
Gross Head	127.28 m
Design Discharge	8.35 m3/s
Total Installed Power	9.06 MW
Power Generation	26.130 GWh/year
Weir, Water Intake Structure	
Type	Concrete Body
Elevation at Crest	875.0 m
Thailweg Elevation	870.0 m
Height from River Bed	5.0 m
Length of Weir	36.0 m
Water Intake	Right Side
Water Intake Dimension	3x2.5 m
Tyrollean Weir-1	
Type	Tyrollean
Elevation at Crest	881.8 m
Thailweg Elevation	878.0 m
Length	12.5 m
Convayance Channel	
Type	Box
Gradient	0.0005 & 0.02
Bottom Width	Variable
Length	1125.0 + 490.3 + 941.65 m
Headpond and Settling Basin	
Length	30.3 m
Width	8.0 m
Number of Span	2
Headpond Width	21.5 m
Headpond Length	27.5.0 m
Headpond Elevation	874.30 m
Penstock	
Type	Inside Tunnel
Diameter	1.8 m
Length	987.2 m
Branch	3
Branch Diameter	1.1 m

Powerhouse	
Type	Semi Ground
Width	18.4 m
Length	35.8 m
Height	5.3 m
Tailwater Elevation	747.0 m
Generator	
Number of Generators	3
Nominal Power	3x3220 kVA
Frequency	50 hz
Synchronic Rotation Freq.	750 rpm
Tyrollean Weir-2	
Type	Tyrollean
Elevation at Crest	878.0 m
Thailweg Elevation	875.0 m
Length	15.0 m
Turbine	
Type	Horizontal Axis Francis
Installed Power	3 x 3.020 MW
Rotation Frequency	750 rpm
Transmission Line	
Voltage	36 kV
Connection Point	Köroğlu DM
Length	12.154 km

[3] Koroglu HEPP Feasibility Report, 2010. Document provided to the DOE during the verification.

Table 2 Koroglu HEPP Project Timeline[4]

Project Implementation Stages	Date
Water Use and Operation Agreement[5]	29 Jan 2008
Acquirement of Electricity Generation License[6]	25 Dec 2008
"Environmental Impact Assessment" Exemption Letter by the "Ministry of Environment, Urbanization and Climate Change"	13 Sep 2011
Electro-mechanical Equipment Agreement (This is also the investment decision date)	11 Oct 2011
Start of Construction Date	22 Nov 2011
Additional Protocol for Water Usage and Operation Agreement	13 Feb 2012
Commissioning Date of the Project[7]	20 June 2014

As a renewable type of energy generation project, Koroglu HEPP has been contributing to global CO_2 emission reductions efforts. Accordingly, project generated 131,100.75 MWh electricity and 69,434 tCO_2e amount of emission reduction during the first monitoring period, 20 June 2014 – 19 June 2020.

1.2 Sectoral Scope and Project Type

According to United Nations Framework Convention on Climate Change (UNFCCC) sectoral scopes definition for Clean Development Mechanism (CDM) projects, Koroglu HEPP falls under the following category:

Sectoral Scope 1: Energy Industries (renewable / non-renewable sources).

Project is a single Greenfield investment, not a part of a project group or bundle. No public funding and no Official Development Aid finance are used for the project.

[4] "Verra VCS Koroglu Hydroelectric Power Plant Validation Report," 23 October 2014, p.9. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as VALID_REP_1456_23OCT2014.pdf. Access date on 21 April 2022.
[5] Agreement with the General Directorate of State Hydraulics Works of the Government of Turkey (Devlet Su İşleri- in Turkish)
[6] License received from the Energy Market Regulatory Authority of the Government of Turkey (Enerji Piyasaları Denetleme Kurulu-EPDK)
[7] This is also the provisional acceptance date as well as the starting date of the first crediting period.

1.3 Project Proponent

Organization name	ETKEN Elektrik Uretim Ltd.Şti.
Contact person	Mr. Hanifi Doganay
Title	Chief Finance Officer
Address	Tatlısu Mah. Yesevi Sok. No.1. Dekon Plus, Kat 7/25. Umraniye ISTANBUL
Telephone	+90 216 313 21 60
Email	h.doganay@etkenelektrik.com.tr

1.4 Other Entities Involved in the Project

Kilittasi Engineering Consulting and Construction Co. Ltd. is the carbon market consultant of the project activity.

Organization name	Kilittasi Engineering Consulting and Construction Co. Ltd.
Role in the Project	Consultant on the development of Koroglu HEPP carbon assets.
Contact person	İncigul Polat Erdogan
Title	Head of Environmental Dept./ Environmental Engineer, MSc.
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1.5 Project Start Date

Project start date is 20 June 2014. This is also the provisional acceptance date as well as the starting date of the first crediting period.

1.6 Project Crediting Period

Crediting period of the project is 10 years 0 month, renewable twice.

Crediting Period starts on 20 June 2014 and ends on 19 June 2024.

1.7 Project Location

The project activity is located in Kadirli district of Osmaniye province at the eastern Mediterranean region in Turkey. The geographical coordinates of the project component are given in the following table.

The closes village to the project location is İnci village which is about 1 km away from the project site.

Table 3 Geographical Coordinates of the Project Components[8]

Project Facilities	Latitude (6° UTM)	Longitude (6° UTM)
Koroglu Main Weir	41 68 185 (N)	251 255 (E)
Koroglu Side Weir (Kurbagali Weir)-1	41 67 020 (N)	250 028 (E)
Koroglu Side Weir (Kurbagali Weir)-2	41 67 275 (N)	250 220 (E)
Powerhouse	41 66 175 (N)	251 310 (E)



Figure 1 Project Location in Turkey

[8] Coordinates were validated by the DOE. "Verra VCS Koroglu Hydroelectric Power Plant Validation Report," 23 October 2014, p.5. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as VALID_REP_1456_23OCT2014.pdf. Access date 21 April 2022.

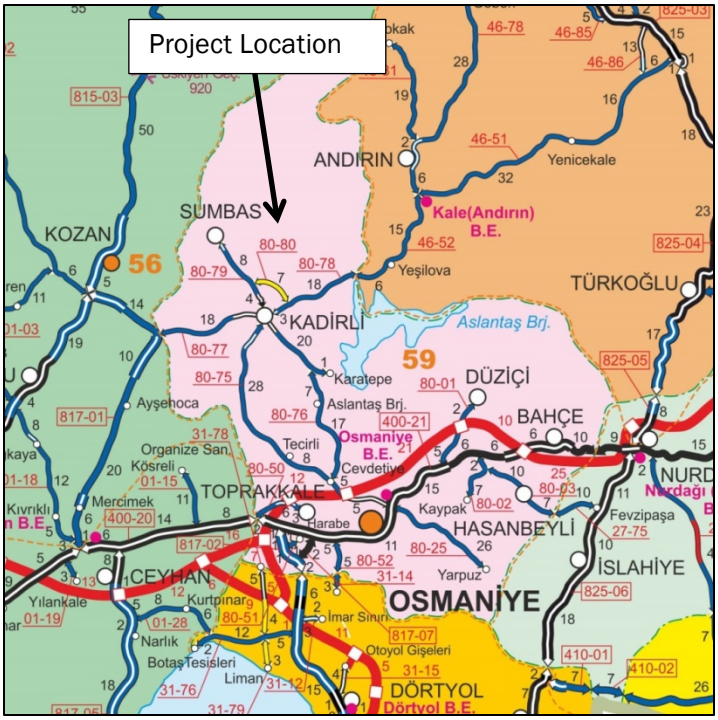


Figure 2 Project location in province of Osmaniye

1.8 Title and Reference of Methodology

AMS-I.D.: "Grid Connected Renewable Electricity Generation", Version 17.0.[9]

Tools used as per referenced by the AMS-I.D-methodology:

CDM Tool 07: "Tool to Calculate the Emission Factor for an Electricity System", Version 4.0.0.[10]

CDM Tool 01: "Tool for the Demonstration and Assessment of Additionality" Version 7.0.0.[11]

ACM0002: "Grid-connected electricity generation from renewable sources" Version 15.0.[12]

1.9 Participation under other GHG Programs

Koroglu HEPP has not been registered and/or is seeking registration under any other Greenhouse Gas (GHG) programs.

[9] UNFCC, CDM, "AMS-I.D.: Grid connected renewable electricity generation --- Version 17". Available at https://cdm.unfccc.int/filestorage/V/9/L/V9LRSXKP24Q7YT6HZDUBO3C0ING8AJ.1/EB61_repan17_Revision_AMS-I.D_ver17.pdf?t=WU98cmk1Y2k5fDBQjtTdl5pjPfqYen_NvuZx , Accessed on 12 April 2022.

[10] Available at https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf. Accessed on 12 April 2022.

[11] Available at https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf. Accessed on 12 April 2022.

[12] This methodology is used for project emission calculations.

1.10 Other Forms of Credit

In Turkey, there is no Emissions Trading Program and other legally binding limits on carbon emissions. Therefore, project activity is not involved in any other Emission Trading Programs and is not legally bound to any carbon emission limits. The only carbon emission reduction mechanism that Koroglu HEPP has been registered is Verra VCS.

1.11 Sustainable Development Contributions

Contributing to avoidance of fossil fueled power plants and to increase use of renewable energy in Turkey (SDG 7.2.1)**:** As a renewable energy generation project, Koroglu HEPP does not affect the environment in a way that fossil fueled power plants do. Waste heat and gases emitted that is common in fossil fuel driven thermal power plants are major contributor to air pollution, global warming and acid raid. Mining and drilling required to acquire fossil fuels for power plants have also significant negative environmental impacts.

Project has supported Turkey in stimulating and commercializing the use of grid connected renewable energy technologies and markets, which are far more environmentally friendly than thermal power plants. This let a diversification of Turkish electricity generation mix which is currently dominated by the fossil fueled power plants (Sustainable Development Goal 7.2.1 - SDG). This is a long term benefit for combatting global climate change.

Creating job opportunities (SDG 8.5.1.): During the construction, operation, and maintenance of this project, the project, directly and indirectly, generates job opportunities, which helps improve local employment and reduce local poverty.

Contributing to global GHG emission reduction efforts (SDG 13.2.1): Project's major contribution goes to the global GHG emission reduction efforts by reducing CO2 emission through producing renewable energy.

Project's SDG contributions are listed in the following table.

Table 4: Koroglu HEPP SDG 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	During the monitoring period (20 June 2014 - 19 June 2020) project net generated 131.10 GWh clean energy which would otherwise be produced by fossil fuel.	During the whole life time of the project (25 years[13]), it is expected that Koroglu HEPP project will contribute electricity 546.25 GWh for 25 years[14] amount of renewable electricity to the TNGS.

[13] Within the project, all construction elements have a lifetime of 45 years according to the DSI Report. The only element having shortest lifetime is turbine which is defined as 150,000 hr as per the "Tool 10: Tool to determine the remaining lifetime of equipment" and it refers approximately 17 years if turbine operates full time. However in this project, turbines do not operate full time; and not all turbines operate at the same time. Project, during this monitoring period (6 years) generated 131,100 MWh electricity that means all three turbines together worked 131,100 hr during 6 years. Turbines operate 21,850 hr per year. As per the tool 10, three turbines together has 450,000 hr lifetime (150,000 * 3); hence 450,000 hr / 21,850 hr results in 20.6 years lifetime. Project's lifetime can be accepted as 25 years. It is important to note that routine maintenance to the turbines, which is done in this project, extends the lifetime of the turbines. However as a conservative approach, 25 years accepted as the technical life time.

[14] This approximate estimation is based on the average real annual electricity generation (131.10 GWh/6year =21.85 GWh/year) multiplied by 25 years.

2)	8.5.1.	Average hourly earnings of employees, by sex, age, occupation and persons with disabilities	Implemented activities to increase	Project has been contributing to local economy by employing local people. There are 9 people in total working at Koroglu HEPP, and 5 of them are from local villages. Besides its contribution to local people, project also indirectly contributes to prevention of migration from villages to big cities.	Project will continue to employ local people.
3)	13.2.1	Total greenhouse gas emissions per year	Implemented activities to increase	During the monitoring period (20 June 2014 – 19 June 2020) project generated 69,434 tCO2 emission reduction.	During the whole lifetime of the project, it is expected that Koroglu HEPP will create approximately 289,308 tCO2 emission reduction.[15]

[15] This approximate estimation is based on the average real annual emission reduction (69,434 tCO2/6 year=11,572 tCO2/year) multiplied by 25 years.

2 SAFEGUARDS

2.1 No Net Harm

No negative environmental and socio-economic impacts have been observed and recorded during the monitoring period. Being a small scale run off river type renewable hydropower project, it received EIA exemption on 13 Sep 2011 due to its negligible impacts on environment.

However, following precautions have been taken to prevent any possible negative impacts on environment and society during construction and operation.

- During the construction, as per the Law on Environment and its regulations, all preventive measures were taken, such as noise control, dust control, disposal of construction wastes properly etc. In Turkey, it is an obligation to conduct the construction activities as per the applicable laws and regulations.

- During the construction and operation of the project, labor health and site safety were ensured as per the laws.

- Operation of the project does not produce any wastes, except domestic wastes by the project personnel. Wastes are handled as per the waste control regulations. Sewage waste is collected in a non-permeable wastes and it is discharged by the Kadirli Municipality once or twice a year. Solid wastes are categorized, and appropriates ones are recycled. Solid wastes are also disposed by the Kadirli Municipality.

- Project has a fish way that minimizes the potential impacts of the project on local habitat on the Savrun stream.

2.2 Local Stakeholder Consultation

Koroglu HEPP project owner contacted with local stakeholders to receive their comments about the project. First of all, face to face communications were realized with the local people living in the surrounding villages. Village people were informed about the project; and in return they stated their support to the project, believing that project would not deteriorate the environment and most importantly would contribute to the local economy by providing new job opportunities and purchasing construction materials locally. Village heads, called Muhtars, also stated their support to the project. In general, project was very welcomed by the local people.

Since the first day of the start of the project activity, verbal communication was established with the local people, including village heads (muhtar). A mutual cooperation has been established and observed between the project and the local people. Local people and project personal can always reach each other by phone calls in case they needed. Local people and

muhtars can always reach to the Koroglu HEPP Plant Manager anytime if they need anything. Verbal communication is the best and efficient way to be in touch with the local people, and this is ensured since the beginning of the project activity.

After starting the operation, villagers from İnci village makes request from the Plant Manager such as pipes, construction materials, various other equipment etc. Plant Manager has always been responsive to the villagers' needs and helpful to them. Project owner also constructed a drinking water pipeline to the village, including providing all pipelines, construction vehicles, all other types of construction materials.

In addition project owner pays attention to enable some of employees from local villages. Currently, there are 5 person working at the project site are from nearby villages, including İnci village.

During the first monitoring period, 20 June 2014-19 June 2020, stakeholders have shown positive approach to the project.

Project, since the beginning, has no design change and revisions. All the project design elements have been the same.

2.3 AFOLU-Specific Safeguards

Project is non-AFOLU, therefore this section is N/A.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project activity uses run-of-river hydropower technology which converts mechanical energy available in the water flow into electrical energy using hydro turbines and alternators. Technical details of the project can be found in the Koroglu HEPP Project Description report. [16]

Since the commencing of the project, which is the start date of the project first crediting period 20 June 2014, there has been no change in the technical characteristics of the project. In addition, since then Koroglu HEPP has been operated smoothly in full capacity. There has been no emergencies or abnormal situations occurred that could negatively affect the production of electricity, so the reduction of GHG emissions.

[16] For more information, "Verra VCS Koroglu HEPP Project Description Report", 7 April 2017, Section 1.8. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as PROJ_DESC_1456_07APR2015.pdf. Access date 21 April 2022.

Hence, in this first crediting period, the project has been operated orderly without any overhauling and/or downtimes of equipment. No special events occurred during the monitoring period which may impact the applicability of the methodology.

3.2 Deviations

3.2.1 Methodology Deviations

Koroglu HEPP is constructed as described in the VCS Validated Project Description Report. There has been no deviation happened to the project since the commencing date that could have affect the GHG emission reduction.

3.2.2 Project Description Deviations

Regarding the monitoring procedure, there is one minor change happened. Project Net Electricity Generation, which is the main monitoring parameter, was going to be defined by the Türkiye Elektrik İletim A.Ş. (Turkish Electricity Transmission Incorporation (TEIAŞ) monthly invoices as stated in the VCS validated Koroglu HEPP Project Description Report. However, on 18 March 2015, an entity was formed by the Turkish government, named Electricity Market Operator (Enerji Piyasaları İşletme A.Ş.-EPIAŞ) to provide a platform where sellers and buyers can trade electricity. On 1 September 2015, EPİAS, on behalf of Turkish government, took over the job from TEIAŞ and started to buy electricity from power plant operators.

As per this transition from PMUM to EPİAŞ, source of the "Koroglu HEPP electricity generation data ($EG_{Facility,y}$)" data is PMUM records before 1 September 2015, and EPİAŞ records after 1 September 2015.

3.3 Grouped Projects

Project is not a group project activity.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Parameters related to the calculation of emission factor, given in the following tables, were only used in ex-ante calculation of baseline emission factor. They are not required for verification.

Data / Parameter	Gross EG_y
Data unit	GWh
Description	Annual Gross Electricity Generation of Turkey in year y.

	y: 2008, 2009 and 2010
Source of data	TEIAŞ Web Site, Turkish Electricity Statistics, Year 2010. File name: Annual Development of Electricity Generation- Consumption and Losses in Turkey (1984-2010) Türkiye Elektrik Enerjisi Üretim Tüketim ve Kayıplarının Yıllar İtibariyle Gelişimi (1984-2010) Available at : http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2011/istatistik%202011.htm
Value applied	VCS approved "Koroglu HEPP Project Description Report", Annex II, Table 23.[17]
Justification of choice of data or description of measurement methods and procedures applied	TEIAŞ is the only government organization in Turkey which makes the electricity generation and transmission statistics available to the public. http://www.teias.gov.tr/
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	Net EG_y
Data unit	GWh
Description	Annual Net Electricity Generation of Turkey in year y. y: 2008, 2009 and 2010.
Source of data	TEIAŞ Web Site, Turkish Electricity Statistics, Year 2010. File name: *Annual Development of Electricity Generation- Consumption and Losses in Turkey (1984-2010)* Türkiye Elektrik Enerjisi Üretim Tüketim ve Kayıplarının Yıllar İtibariyle Gelişimi (1984-2010) Available at : http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2011/istatistik%202011.htm
Value applied	VCS approved "Koroglu HEPP Project Description Report", Annex II, Table 23.[18]

[17] "Verra VCS Koroglu HEPP Project Description Report", 7 April 2017, p.64. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as PROJ_DESC_1456_07APR2015.pdf. Access date 21 April 2022.

Justification of choice of data or description of measurement methods and procedures applied	TEIAŞ is the only government organization in Turkey which makes the electricity generation and transmission statistics available to the public. http://www.teias.gov.tr/
Purpose of Data	Calculation of baseline emissions.
Comments	This data is used to find out the ratio of the gross to net electricity generation which is later used to calculate the net electricity generation of thermal power plants. TEIAŞ does not provide the net electricity generation data of thermal power plants. However, it is essential to note that this is a conservative approach, since thermal power plants, in general, consume more electricity internally then hydro, wind power, geothermal and other similar power plants. This approach leads to higher net electricity amounts and lower emission reductions.

Data / Parameter	EI_y
Data unit	GWh
Description	Net electricity imported to the grid in year y. y: 2008,2009 and 2010.
Source of data	TEIAŞ Web Site, Turkish Electricity Statistics, Year 2010. File name: *Annual Development of Electricity Generation- Consumption and Losses in Turkey (1984-2010)* Türkiye Elektrik Enerjisi Üretim Tüketim ve Kayıplarının Yıllar İtibariyle Gelişimi (1984-2010) Available at : http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2011/istatistik%202011.htm
Value applied	VCS approved "Koroglu HEPP Project Description Report", Annex II, Table 22.[19]
Justification of choice of data or description of measurement methods and procedures applied	TEIAŞ is the only government organization in Turkey which makes the electricity generation and transmission statistics available to the public. http://www.teias.gov.tr/

[18] "Verra VCS Koroglu HEPP Project Description Report", 7 April 2017, p.64. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as PROJ_DESC_1456_07APR2015.pdf. Access date 21 April 2022.
[19] "Verra VCS Koroglu HEPP Project Description Report", 7 April 2017, p.63. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as PROJ_DESC_1456_07APR2015.pdf. Access date 21 April 2022.

Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$FC_{i,y}$
Data unit	Tonnes or 1000 m^3
Description	Annual Fuel Consumption by fuel type in year y. y: 2008, 2009 and 2010.
Source of data	TEIAŞ Web Site, Turkish Electricity Statistics, Year 2010. File name: Fuels Consumed In Thermal P.Ps In Turkey By The Electricity Utilities (2006-2010) Türkiye Termik Santrallarında Kullanılan Yakıt Miktarlarının Üretici Kuruluşlara Dağılımı (2006-2010) Available at : http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2011/istatistik%202011.htm
Value applied	VCS approved "Koroglu HEPP Project Description Report", Annex II, Table 14.[20]
Justification of choice of data or description of measurement methods and procedures applied	TEIAŞ is the only government organization in Turkey which makes the electricity generation and transmission statistics available to the public. http://www.teias.gov.tr/
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$HV_{i,y}$
Data unit	TCal/Mass or TCal/Volume
Description	Heating Values of fuels consumed for electricity generation by fuel type in year y. y: 2008,2009 and 2010.
Source of data	TEIAŞ Web Site, Turkish Electricity Statistics, Year 2010. File name: Fuels Consumed In Thermal P.Ps In Turkey By The Electricity Utilities (2006-2010) Türkiye Termik Santrallarında Kullanılan Yakıt Miktarlarının Üretici Kuruluşlara Dağılımı (2006-2010)

[20] "Verra VCS Koroglu HEPP Project Description Report", 7 April 2017, p.60. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as PROJ_DESC_1456_07APR2015.pdf. Access date 21 April 2022.

	Available at : http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2011/istatistik%202011.htm
Value applied	VCS approved "Koroglu HEPP Project Description Report", Annex II, Table 15 and Table 16. [21]
Justification of choice of data or description of measurement methods and procedures applied	TEIAŞ is the only government organization in Turkey which makes the electricity generation and transmission statistics available to the public. http://www.teias.gov.tr/
Purpose of Data	Calculation of baseline emissions.
Comments	There is no national Net Calorific Value (NCV) data in Turkey. However, TEIAŞ announces Heating values of fuels. This data is used to calculate the annual NCVs for each fuel type via dividing it with the $FC_{i,y}$.

Data / Parameter	$NCV_{i,y}$
Data unit	TJ/kton, TJ/million m^3
Description	Net Calorific Values of fuels consumed for electricity generation by fuel type in year y
Source of data	NCV data is not available; therefore, NCV is calculated by dividing the Heating Value by the Fuel Consumption. Both data ($HV_{i,y}$ and $FC_{i,y}$) are provided by the TEIAS. $NCV = \frac{HV_{i,y}}{FC_{i,y}}$
Value applied	VCS approved "Koroglu HEPP Project Description Report", Annex II, Table 17.[22]
"	TEIAŞ is the only government organization in Turkey which makes the electricity generation and transmission statistics available to the public. http://www.teias.gov.tr/
Purpose of Data	Calculation of baseline emissions.
Comments	-

[21] "Verra VCS Koroglu HEPP Project Description Report", 7 April 2017, p.60-61. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as PROJ_DESC_1456_07APR2015.pdf. Access date 21 April 2022.
[22] "Verra VCS Koroglu HEPP Project Description Report", 7 April 2017, p.61. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as PROJ_DESC_1456_07APR2015.pdf. Access date 21 April 2022.

Data / Parameter	Electricity Capacity Additions
Data unit	-
Description	Capacity addition to the national grid between 2009-2010, which comprises 20% of the total electricity generation in 2010.
Source of data	TEIAS, "10 Year Energy Generation Capacity Projection Report", 2011 (In Turkish). pp.88-106. Available at: http://www.teias.gov.tr/KapasiteProjeksiyonu.aspx. TEIAS, "10 Year Energy Generation Capacity Projection Report", 2010 (In Turkish). pp.85-100. Available at: http://www.teias.gov.tr/KapasiteProjeksiyonu.aspx.
Value applied	VCS approved "Koroglu HEPP Project Description Report", Annex III, Table 24 and Table 25.[23]
Justification of choice of data or description of measurement methods and procedures applied	TEIAŞ is the only government organization in Turkey which makes the electricity generation and transmission statistics available to the public. http://www.teias.gov.tr/
Purpose of Data	Calculation of baseline emissions.
Comments	The source did not provide the commissioning date of the capacity additions in terms of day/month/year. Therefore, this missing data was completed by requesting it from TEIAŞ through the Bilgi Edinme Yasasi (Information Requesting Law).

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the UNFCC CDM Tool 07: "Tool to calculate the emission factor for an electricity system", Version 04.0.
Source of data	VCS approved "Koroglu HEPP Project Description Report", Section 3.1., p.41.[24]
Value applied	0.5299 tCO2/MWh
Justification of choice of data or description of	UNFCC CDM Tool 07: "Tool to calculate the emission factor for an electricity system", Version 04.0.

[23] "Verra VCS Koroglu HEPP Project Description Report", 7 April 2017, p.65. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as PROJ_DESC_1456_07APR2015.pdf. Access date 21 April 2022.
[24] "Verra VCS Koroglu HEPP Project Description Report", 7 April 2017, p.41. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as PROJ_DESC_1456_07APR2015.pdf. Access date 21 April 2022.

measurement methods and procedures applied	
Purpose of Data	Calculation of baseline emissions.
Comments	-

4.2 Data and Parameters Monitored

Main parameter monitored in line with the methodology is the net electricity supplied to the grid, which is be the basis of the amount of CO2 emission reduction achieved by the project.

Data / Parameter	Net Electricity Generated by the Koroglu HEPP ($EG_{Facility,y}$)
Data unit	MWh/y
Description	Net electricity supplied to the national grid by the Koroglu HEPP in year y. Electricity generation has been continuously measured by the power meters, which are operated and controlled by the TEIAŞ.
Source of data	EPIAŞ screenshots
Description of measurement methods and procedures to be applied	EPIAŞ screenshots for both electricity generation and consumption. Appendix I: Koroglu HEPP Monthly Net Electricity Generation
Frequency of monitoring/recording	Continuous measurement and at least monthly recording.
Value monitored	3,286.36 MWh – 20.06.214-31.12.2014 20,263.13 MWh - 2015 16,429.01 MWh- 2016 18,328.14 MWh- 2017 23,670.27 MWh- 2018 27,334.13 MWh- 2019 21,789.71 MWh -01.01.2020-19.06.2020

<table>
<tr><td>Monitoring equipment</td><td>Monitoring equipment is the power meters located at the TEIAŞ substation. They measure the amount of electricity supplied to the grid and withdrawn from the grid. One power meter is the main one, and the other one serves as the backup. Power meters are sealed by the TEIAŞ to prevent any possible interventions. Their calibrations are also within the responsibility of TEIAŞ and the project owner has no control over the calibration process.

Power meters measure the electricity generation continuously; however, readings are done on a monthly basis. Collected data is stored at the EPIAŞ platform.

Details of metering devices within the monitoring period 20.06.2014-19.06.2020 are;
<table>
<tr><td>Specification</td><td>Main Meter</td><td>Backup Meter</td></tr>
<tr><td>Brand</td><td>ELSTER</td><td>ELSTER</td></tr>
<tr><td>Type</td><td>Alpha A1500</td><td>Alpha A1500</td></tr>
<tr><td>Serial No</td><td>00484541</td><td>00484542</td></tr>
<tr><td>Accuracy Class</td><td>0.5S</td><td>0.5S</td></tr>
</table></td></tr>
<tr><td>QA/QC procedures to be applied</td><td>TEIAS is responsible for calibration and maintenance of the devices. The periodic calibration or maintenance is under the responsibility of TEIAS and has been fixed as once in 10 years.[25]

However, in practice, instead of applying calibration to power meters, they are replaced with the brand new ones every 10 years. Therefore, calibration is not a necessity in the prevailing practice in the energy sector. Because of this approach of TEIAŞ, routine tests are not applied to the power meters. Electricity distribution company, which is contracted by the TEİAŞ to transmit electricity from Koroglu to the NGST, made a spot check to the power meters on 29.05.2019.

Electricity generation data from EPIAŞ is crosschecked onsite power meters readings in the form OSF (Otomatik Sayaç Formu -Automatic Meter Form) records.</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Calculation method</td><td>The difference between the amount of electricity supplied to the national grid and electricity drawn from the national grid provides the “net electricity generation”.</td></tr>
<tr><td>Comments</td><td>-</td></tr>
</table>

[25] https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6381&MevzuatTur=7&MevzuatTertip=5

Data / Parameter	CAPpj
Data unit	MWe
Description	Installed capacity of the hydropower plant after the implementation of the project activity
Source of data	Nameplates of the project turbines
Description of measurement methods and procedures to be applied	Reading the nameplates of the project turbines
Frequency of monitoring/recording	Annually
Value monitored	9.53 MWm (9.06 MWe)
Monitoring equipment	Reading turbine's name-plants
QA/QC procedures to be applied	This parameter is fixed, and not measured. The proof is the nameplates of turbines. Hence, there is no applicable QA/QC procedure for this parameter.
Purpose of the data	Calculation of project emissions
Calculation method	This parameter is fixed, and not measured. Therefore there is no applicable calculation method.
Comments	N/A

Data / Parameter	AP_{pj}
Data unit	m^2
Description	Area of the Project reservoir measured on the surface of the water, after the implementation of the Project activity, when the reservoir is full.
Source of data	Project Final Design drawings (Official detailed design document of the project) Koroglu HEPP Weir Layout KRG-UY-RG-02.pdf
Description of measurement methods and procedures to be applied	Official detailed design document of the project.
Frequency of monitoring/recording	Annually (Reservoir area does not change).
Value monitored	1450 m^2 (Reservoir area does not change)
Monitoring equipment	Not measured due to that storage volume, by design, does not

	change, therefore there is no monitoring equipment.
QA/QC procedures to be applied	Koroglu HEPP is run of river type HEPP without storage volume. Operation elevation of the plant is not changing; therefore reservoir elevation and area is not changing. AP_{pj} value is not changing, it is fixed.
Purpose of the data	Calculation of project emissions
Calculation method	This parameter is fixed, and not measured. Therefore there is no applicable calculation method.
Comments	N/A

4.3 Monitoring Plan

The purpose of Koroglu HEPP Monitoring Plan is to ensure a complete and accurate measurement of the net electricity generation by the project activity. Net electricity generation can be defined as the amount of electrical energy, referring to the difference between gross electricity generation and project's own internal electricity consumption. Multiplying the annual net electricity generation data with the CM emission factor provides the Koroglu HEPP's annual CO2 emission reduction.

At the project facility, there are two power meters to measure the electricity supplied to the grid and drawn from the grid. Among these two power meters, one serves as a main one, the other serves as backup of the main meter. Power meters were installed by the project owner, but checked and approved by TEIAŞ before the commissioning.

Technical specifications of the power meters should comply with the Communiqué for Power Meters[26] as announced by the Energy Market Regulatory Authority of Government of Turkey (Enerji Piyasaları Denetleme Kurulu-EPDK).

TEIAS is responsible for calibration and maintenance of the devices. The periodic calibration or maintenance is under the responsibility of TEIAS and has been fixed as once in 10 years by law.[27] However, in practice in Turkey, instead of testing the power meters every 10 years, TEIAŞ replaced power meters with the brand new ones. Testing and calibrating power meters requires robust works such as installing a spare/backup power meter when the main power meter is taken for testing and calibration. To prevent such works and possible risks, in practice, TEİAS changes power meters every 10 years with new ones, and hence calibration does not become a necessity.

Because of this approach of TEİAŞ, routine tests are not applied to the power meters.

[26] Elektrik Piyasasında Kullanılacak Sayaçlar Hakkında Tebliğ (in Turkish), enacted on 22.4.2011 with the number of 27913. http://www.epdk.gov.tr/web/elektrik-piyasasi-dairesi/44.
[27] https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6381&MevzuatTur=7&MevzuatTertip=5

Table 5 Specifications of Power Meters

Specification	Main Meter	Backup Meter
Brand	ELSTER	ELSTER
Type	Alpha A1500	Alpha A1500
Serial No	00484541	00484542
Accuracy Class	0.5S	0.5S

Besides that if one of the parties of the agreement feels that power meters are not working appropriately, power meters are tested by the presence of both parties any time. If test results show that the power meter is not working properly, then measurements of backup meter are used, beginning from the last measurement value when both meters are reading the same data (page 3, 2-c). In case of the main meter has a breakdown, the readings of the back-up meter are used. If both meters failed, the internal SCADA-Supervisory Control and Data Acquisition System data is used.

Power meters provide two types of data on an hourly basis. These are gross electricity generated and electricity consumed by the power plant. The difference between these two parameters provides the net electricity data. For electricity generation and consumption, EPIAS screenshots are used.

Regarding procedures for handling internal auditing and non-conformities, as above mentioned, the data acquisition and management, and quality assurance procedures are in place as per the agreements with TEIAŞ and related regulations; therefore there is no need to establish additional procedures for the monitoring plan.

As a note, the two power meters are installed in a redundant manner and keep the uncertainty level of the monitoring parameter (net electricity generated) as low. Higher quality of this data is not only in the interest of the emission reduction monitoring, but also paramount for the business relation between the plant operator and the electricity buyers.

Electricity generation data from EPIAŞ is crosschecked onsite power meters readings in the form OSF (Otomatik Sayaç Formu -Automatic Meter Form) records.

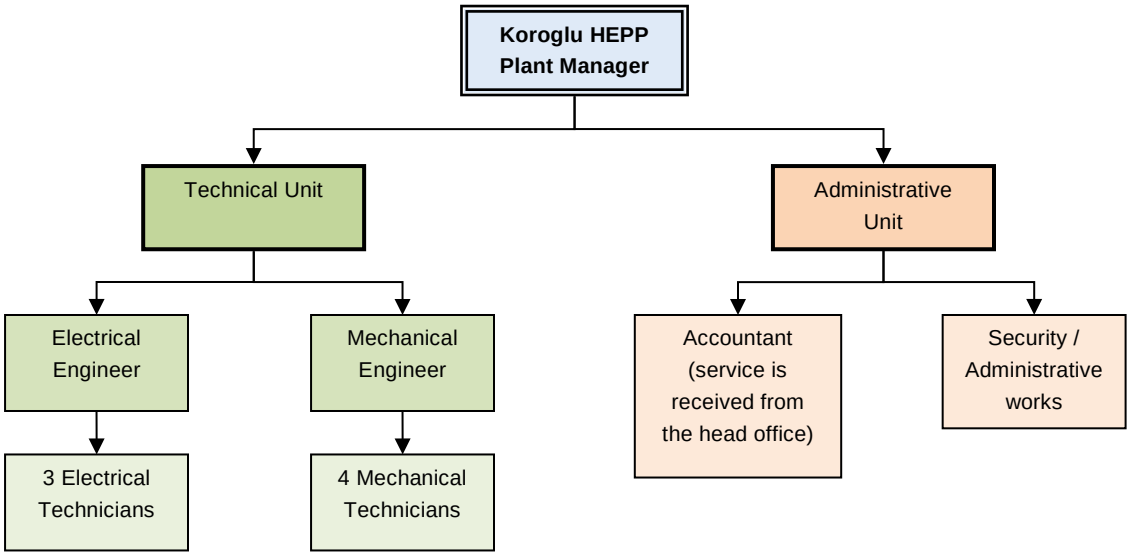
Other parameters, CAPpj which is the project's installed capacity, and APpj, which is the project reservoir area, are not changing. Although they are listed as monitoring parameters in Section 4.2 of this report, these parameters are fixed and not changing in the project.

Data recording procedure

TEIAŞ makes remote reading to the power meters located at the Koroglu DM. TEIAŞ then records the measured data to the PMUM- EPIAŞ platform. This is the data recording procedure of the project activity. Project owner keeps the data during the project activity plus five years.

Organizational Structure

Koroglu HEPP Plant Manager has been responsible for the implementation of the monitoring plan. All relevant data is recorded and kept by the facility manager and will be presented to the DOE during verification. Data will be kept for more five years following the completion of the crediting period.



Plant manager is fully responsible for operation of the Koroglu HEPP project. He is also responsible for maintaining relations with stakeholders and government agencies.

Electrical engineer and electrical technicians are responsible for technical maintenance of electrical parts of the project activity. And these engineering services are outsourced.

Mechanical engineer and mechanical technicians are responsible for technical maintenance of the mechanical elements of the project activity.

Security is responsible for the security of the project site.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

AMS-I.D. methodology defines the baseline scenario as the electricity delivered to the grid by the project activity that would have otherwise been generated by the operation of grid-connected power plants and addition of new generation sources into the grid.

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

where;

BE_y Baseline Emissions in year y (t CO_2)

$EG_{BL,y}$ Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{CO2,grid,y}$ CO_2 emission factor of the grid in year y (t CO_2/MWh)

In line with the requirements of the applied tool, the Simple Operating Margin Emission Factor ($EF_{grid,OM}$ simple,y) has been calculated ex-ante, using TEIAŞ data for 2008-2010 period which is actual data during the investment decision date. The operating margin is calculated as 0,6555 tCO2 / MWh.

For BM Calculation the set of power capacity additions in the electricity system that comprise 20% of the system generation and that have been built recently. The most recent data TEIAŞ 2010 values are used. For the determination of the emission factor for the build margin calculation, the lower limit of the IPCC-Intergovernmental Panel on Climate Change EF values are used. The build margin emission factor is the generation-weighted average emission factor (tCO2/MWh) of all power units. The build margin is calculated as 0,4043 tCO2 / MWh.

In accordance with the methodology of the "Tool to calculate the emission factor for an electricity system" v.04.0, the Combined Margin Emission Factor is calculated as

$EF_{grid,CM,y} = 0.6555 * 0.5 + 0.4043 * 0.5$

Koroglu HEPP $EF_{grid,CM,y}$	**0.5299 tCO_2/MWh**

All the steps that are used in calculation of the Combined Margin Emission Factor (Koroglu HEPP $EF_{grid,CM,y}$) is provided in detail in the VCS validated "Koroglu Project Description Report".[28]

[28] "Verra VCS Koroglu HEPP Project Description Report", 7 April 2017, Section 3.1. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456, as PROJ_DESC_1456_07APR2015.pdf. Access date 21 April 2022.

5.2 Project Emissions

AMS-I.D Version 17.0 methodology refers to the ACM0002[29] for calculating project emissions. As per the ACM0002 Ver. 15.0, project emission is calculated as given in the following formula.

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

Where

$PE_{FF,y}$: Project emissions from fossil fuel consumption in year y (t CO2/yr)

$PE_{GP,y}$: Project emissions from the operation of dry, flash steam or binary geothermal power plants in year y (t CO2e/yr).

$PE_{HP,y}$: Project emissions from water reservoirs of hydro power plants in year y (t CO2e/yr)

Regarding the project emission from fossil fuel combustion ($PE_{FF,y}$), ACM0002 Ver 15.0 states that emissions due to the use of fossil fuels for the backup generator can be neglected. At Koroglu HEPP project, the only source of fossil fuel consumption is backup generator. Therefore, this value is neglected in project emission calculations.

Since Koroglu HEPP is a hydropower plant, $PE_{GP,y}$ is not taken into account in calculation.[30]

Hence $PE_{FF,y}$ and $PE_{GP,y}$ are excluded from PEy emission calculations.

$PE_{HP,y}$ is calculated by using the following formula as stated by the ACM0002 methodology 15.0.[31]

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

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

[29] Most up to date version of ACM0002 was Version 15.0 at the time of Koroglu HEPP validation process in 2014.
[30] UNFCC CDM ACM0002: Grid-connected electricity generation from renewable sources, Ver. 5., p.13.
[31] UNFCC CDM ACM0002: Grid-connected electricity generation from renewable sources, Ver. 5., p.12.

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.

Reservoir area of the project activity is "1450 m^2" and total installed capacity is 9.06 $x10^6$ W, resulting with a power density of 6248 W/m^2.

$$PD = \frac{9.06\ x10^6\ W - 0\ W}{1450\ m^2 - 0\ m^2} = 6248\ W/m2$$

ACM0002 Version 15 states that if the power density of the project activity is greater than 10 W/m2, $PE_{HP,y}$ value is accepted as zero.

So, based on the above calculations project emission value of Koroglu HEPP (PE_y) is taken/accepted as zero.

5.3 Leakage

Leakage emissions are neglected as per the methodology.

5.4 Net GHG Emission Reductions and Removals

As per the AMD-I.D., emission reductions by the project is calculated as follows:

$ER_y = BE_y - PE_y - LE_y$

Where:

ER_y = Emission reductions in year y (tCO_2)

BE_y = Baseline Emissions in year y (tCO_2)

PE_y = Project emissions in year y (tCO_2)

LE_y = Leakage emissions in year y (tCO_2)

Table 6 Koroglu HEPP CO2 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)
2014 (20/06-31/12)	1,738	0	0	1,738
2015	10,730	0	0	10,730
2016	8,700	0	0	8,700
2017	9,706	0	0	9,706
2018	12,538	0	0	12,538
2019	14,479	0	0	14,479
2020 (01/01-19/06)	11,543	0	0	11,543
Total	69,434	0	0	69,434

APPENDIX I: KOROGLU HEPP MONTHLY NET ELECTRICITY GENERATION

Table 7 Koroglu HEPP Monthly Net Electricity Generation (kWh)[32]

	Electricity Generation (kWh)	Electricity Consumption (kWh)	Electricity Generation (MWh)	Electricity Consumption (MWh)	Net Electricity Generation (MWh)	BE (tCO2)	PE (tCO2)	LE (tCO2)	Net GHG Emission Reductions (tCO2)
20-Jun-14 - 30-Jun-14	114,194	1,421	114.19	1.42	112.77	59	0	0	59
Jul-14	129,729	6,066	129.72	6.06	123.66	65	0	0	65
Aug-14	48,239	6,704	48.23	6.70	41.53	22	0	0	22
Sep-14	431,610	5,328	431.61	5.32	426.29	225	0	0	225
Oct-14	429,158	5,092	429.15	5.09	424.06	224	0	0	224
Nov-14	449,793	6,054	449.79	6.05	443.74	235	0	0	235
Dec-14	1,718,477	4,163	1,718.47	4.16	1,714.31	908	0	0	908
2014 Total					3,286.36	1,738	0	0	1738
Jan-15	3,692,413	1,161	3,692.41	1.16	3,691.25	1,955	0	0	1955
Feb-15	3,569,987	183	3,569.98	0.18	3,569.80	1,891	0	0	1891
Mar-15	3,986,683	211	3,986.68	0.21	3,986.47	2,112	0	0	2112
Apr-15	4,704,898	50	4,704.89	0.05	4,704.84	2,493	0	0	2493
May-15	3,096,127	1,521	3,096.12	1.52	3,094.60	1,639	0	0	1639
Jun-15	643,110	3,386	643.11	3.38	639.73	338	0	0	338
Jul-15	194,169	5,821	194.16	5.82	188.34	99	0	0	99

[32] Data source: EPİAŞ screenshots

	Electricity Generation (kWh)	Electricity Consumption (kWh)	Electricity Generation (MWh)	Electricity Consumption (MWh)	Net Electricity Generation (MWh)	BE (tCO2)	PE (tCO2)	LE (tCO2)	Net GHG Emission Reductions (tCO2)
Aug-15	72,669	7,020	72.66	7.02	65.64	34	0	0	34
Sep-15	48,389	7,387	48.38	7.38	41.00	21	0	0	21
Oct-15	96,677	7,598	96.67	7.59	89.08	47	0	0	47
Nov-15	65,699	9,649	65.69	9.64	56.05	29	0	0	29
Dec-15	149,685	13,352	149.68	13.35	136.33	72	0	0	72
2015 Total					20,263.13	10,730	0	0	10730
Jan-16	1,548,540	4,632	1,548.54	4.63	1,543.91	818	0	0	818
Feb-16	2,582,728	351	2,582.72	0.35	2,582.37	1,368	0	0	1368
Mar-16	5,411,616	180	5,411.61	0.18	5,411.43	2,867	0	0	2867
Apr-16	2,622,370	359	2,622.37	0.35	2,622.02	1,389	0	0	1389
May-16	2,620,033	859	2,620.03	0.85	2,619.18	1,387	0	0	1387
Jun-16	1,259,371	1,169	1,259.37	1.16	1,258.21	666	0	0	666
Jul-16	180,959	4,995	180.95	4.99	175.96	93	0	0	93
Aug-16	46,231	6,033	46.23	6.03	40.20	21	0	0	21
Sep-16	45,656	6,045	45.65	6.04	39.61	20	0	0	20
Oct-16	28,680	5,500	28.68	5.50	23.18	12	0	0	12
Nov-16	44,179	9,727	44.17	9.72	34.45	18	0	0	18
Dec-16	91,634	13,144	91.63	13.14	78.49	41	0	0	41
2016 Total					16,429.01	8,700	0	0	8700
Jan-17	203,257	10,179	203.25	10.17	193.08	102	0	0	102
Feb-17	331,182	7,814	331.18	7.81	323.37	171	0	0	171
Mar-17	4,342,047	768	4,342.04	0.76	4,341.28	2,300	0	0	2300
Apr-17	5,533,503	250	5,533.50	0.25	5,533.25	2,932	0	0	2932
May-17	3,659,934	1,139	3,659.93	1.13	3,658.80	1,938	0	0	1938
Jun-17	1,326,807	1,223	1,326.80	1.22	1,325.58	702	0	0	702
Jul-17	234,671	4,184	234.67	4.18	230.49	122	0	0	122

	Electricity Generation (kWh)	Electricity Consumption (kWh)	Electricity Generation (MWh)	Electricity Consumption (MWh)	Net Electricity Generation (MWh)	BE (tCO2)	PE (tCO2)	LE (tCO2)	Net GHG Emission Reductions (tCO2)
Aug-17	71,999	5,361	71.99	5.36	66.63	35	0	0	35
Sep-17	35,508	5,561	35.50	5.56	29.94	15	0	0	15
Oct-17	152,431	5,808	152.43	5.80	146.63	77	0	0	77
Nov-17	621,380	4,492	621.38	4.49	616.89	326	0	0	326
Dec-17	1,864,258	2,055	1,864.25	2.05	1,862.20	986	0	0	986
Total 2017					18,328.14	9,706	0	0	9706
Jan-18	3,837,028	165	3,837.02	0.16	3,836.86	2,033	0	0	2033
Feb-18	3,486,106	20	3,486.10	0.02	3,486.08	1,847	0	0	1847
Mar-18	6,108,893	189	6,108.89	0.18	6,108.71	3,237	0	0	3237
Apr-18	3,747,116	54	3,747.11	0.05	3,747.06	1,985	0	0	1985
May-18	1,609,788	167	1,609.78	0.16	1,609.62	852	0	0	852
Jun-18	690,362	1,313	690.36	1.31	689.05	365	0	0	365
Jul-18	172,690	5,276	172.69	5.27	167.42	88	0	0	88
Aug-18	47,882	6,704	47.88	6.70	41.18	21	0	0	21
Sep-18	41,046	6,326	41.04	6.32	34.72	18	0	0	18
Oct-18	125,984	6,545	125.98	6.54	119.44	63	0	0	63
Nov-18	79,242	9,063	79.24	9.06	70.18	37	0	0	37
Dec-18	3,760,958	1,001	3,760.95	1.00	3,759.95	1,992	0	0	1992
2018 Total					23,670.27	12,538	0	0	12538
Jan-19	4,754,083	265	4,754.08	0.26	4,753.82	2,519	0	0	2519
Feb-19	4,074,685	0	4,074.68	0.00	4,074.68	2,159	0	0	2159
Mar-19	5,858,804	88	5,858.80	0.08	5,858.72	3,104	0	0	3104
Apr-19	6,264,246	111	6,264.24	0.11	6,264.13	3,319	0	0	3319
May-19	4,215,242	54	4,215.24	0.05	4,215.19	2,233	0	0	2233
Jun-19	672,523	1,134	672.52	1.13	671.39	355	0	0	355
Jul-19	312,831	4,300	312.83	4.30	308.53	163	0	0	163

	Electricity Generation (kWh)	Electricity Consumption (kWh)	Electricity Generation (MWh)	Electricity Consumption (MWh)	Net Electricity Generation (MWh)	BE (tCO2)	PE (tCO2)	LE (tCO2)	Net GHG Emission Reductions (tCO2)
Aug-19	77,978	6,806	77.97	6.80	71.17	37	0	0	37
Sep-19	52,722	6,898	52.72	6.89	45.83	24	0	0	24
Oct-19	57,319	7,421	57.31	7.42	49.89	26	0	0	26
Nov-19	63,925	8,660	63.92	8.66	55.26	29	0	0	29
Dec-19	970,486	4,966	970.48	4.96	965.52	511	0	0	511
2019 Total					27,334.13	14,479	0	0	14479
Jan-20	1,239,442	526	1,239.44	0.52	1,238.92	656	0	0	656
Feb-20	4,045,177	566	4,045.17	0.56	4,044.61	2,143	0	0	2143
Mar-20	6,540,724	129	6,540.72	0.12	6,540.60	3,465	0	0	3465
Apr-22	5,702,846	56	5,702.84	0.05	5,702.79	3,021	0	0	3021
May-22	3,870,049	79	3,870.04	0.07	3,869.97	2,050	0	0	2050
19-Jun-22	393,731	920	393.73	0.91	392.82	208	0	0	208
2020 Total					21,789.71	11,543	0	0	11543
TOTAL	131,374,587.67	273,796.60	131,374.23	273.48	131,100.75	MWh			
					131.10	GWh			