DAGBASI HYDROELECTRIC POWER PLANT MONITORING REPORT

Document Prepared by Kilittasi Engineering Consulting and Construction Co. Ltd.

Project Title	Dagbasi Hydroelectric Power Plant
Version	1.5
Report ID	VCS_DagbasiHEPP_MR
Date of Issue	21 November 2022
Project ID	VCS 1333
Monitoring Period	11 April 2014 to 10 April 2020
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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)
TNGS	Turkish National Grid System

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Dagbasi Hydroelectric Power Plant (hereafter Project and/or Dagbasi HEPP) is a run-of river type power plant with an installed capacity of 10.756 MW (10.433 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 is located on the Sugozu stream between elevations of 510 m and 383.5 m, located in province of Mersin, Anamur district in the Mediterranean Region. Project was commenced on 11 April 2014, and since then producing renewable electricity to the TNGS.[1] Generated energy is being transmitted to the Otluca HEPP via a 4 km transmission line which is the connection point of Dagbasi HEPP to the TNGS.

Dagbasi HEPP project has a weir on the Sugozu stream on 510 m elevation that diverts water to conveyance channel. Dimensions of the weir are 7.0 m height and 25 m length, which does not reserve/store water. There will be a settling basin at the end of the conveyance channel. Water flows to settling basin through conveyance channel. From the settling basin, water flows to Head Pond, regulating water before being taken into the Energy Tunnel. Water flowing through Energy Tunnel is taken into the Power House where water is turbined by identical three units of turbines.

Each turbine has an installed capacity of 3.58533 MW (3.47766 MWe). Turbines are Francis type and horizontal axis with the model number of each WWS-FSP 707 manufactured by the Wasserkraft GmbH from Austria. Each unit has a generator with a capacity of 4000 kVA (750 U/min).

Following table provides a summary of the technical specifications of the project facilities.

Table 1: Technical Characteristics of Dagbasi HEPP

Project Main Characteristics			Powerhouse	
Type	Run-of-river		Type	Above Ground
Gross Head	126.10 m		Width	17.7 m
Design Discharge	9.50 m3/s		Length	35.6 m
Total Installed Power	10.756 MW		Height	10.3 m

[1] For more information, “Verra VCS Dagbasi HEPP Project Description Report”, 23 June 2014, Section 1.1 and Section 1.8. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as PROJ_DESC_1333_24JUN2014.pdf. Access date 21 April 2022.

Power Generation	38.446 GWh/year		Tailwater Elevation	383.5 m
Weir, Water Intake Structure			**Generator**	
Type	Concrete Body		Number of Generators	3
Elevation at Crest	510.0 m		Nominal Voltage	6.3 kV (+- 5%)
Thailweg Elevation	502.0 m		Frequency	50 hz
Height from River Bed	8.0 m		Synchronic Rotation Freq.	750 rpm
Length of Weir	10.0 m			
Water Intake	Left Side			
Water Intake Dimension	3x2.5 m			
Channel			**Turbine**	
Type	Box		Type	Horizontal Axis Francis
Gradient	0.0006		Installed Power	3 x 3.585 MW
Bottom Width	3.0 m		Rotation Frequency	750 rpm
Length	328.8 m			
Headpond and Settling Basin			**Transmission Line**	
Length	30.3 m		Voltage	36 kV
Width	5.0 m		Connection Point	Otluca HEPP
Number of Span	2		Length	6.0 km
Headpond Width	10.0 m			
Headpond Length	32.0 m			
Headpond Height	13.5 m			
Headpond Elevation	509.60 m			
Energy Tunnel			**Powerhouse Access Tunnel**	
Type	Horse Shoe		Type	Modified Horse Shoe
Length	1306.8 m		Length	258.5 m
Diameter	3.3 m		Dimensions	4.6 (h) x 4.0 m
Slope	0.095			
Penstock			**Weir Access Tunnel**	
Type	Inside Tunnel		Type	Modified Horse Shoe
Diameter	2.4 m		Length	971.5 m
Length	80.0 m		Dimensions	4.2 (h) x 4.0 m
Branch	3			
Branch Diameter	1.2 m			

Table 2 Dagbasi HEPP Project Timeline[2]

Project Implementation Stages	Date
"Environmental Impact Assessment (EIA)" Exemption Letter by the "Ministry of Environment, Urbanization and Climate Change"	12 Jan 2011
Water Use and Operation Agreement[3]	17 Mar 2011
Acquirement of Electricity Generation License[4]	12 May 2011
Board of directors Decision regarding to the carbon revenue	16 Aug 2011
Construction Contract	13 Sep 2011
Start of Construction Date	28 Sep 2011
Commissioning Date of the Project/Start Date of the First Crediting Period	11 Apr 2014

As a renewable type of energy generation project, Dagbasi HEPP has been contributing to global CO^2 emission reductions efforts. Accordingly, project generated 109,226.83 MWh electricity and 57,843 tCO_2e amount of emission reduction during the first monitoring period, 11 April 2014 - 10 April 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, Dagbasi 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.

[2] "Verra VCS Dagbasi Hydroelectric Power Plant Validation Report", 2 July 2014, p.8-9. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1456,VALID_REP_1333_02JUL2014.pdf. Access date 21 April 2022.
[3] Agreement with the General Directorate of State Hydraulics Works of the Government of Turkey (Devlet Su İşleri- in Turkish)
[4] License received from the Energy Market Regulatory Authority of the Government of Turkey (Enerji Piyasaları Denetleme Kurulu-EPDK)

1.3 Project Proponent

Organization name	ALPEREN Elektrik Üretim A.Ş.
Contact person	Ahmet Balsuyu[5]
Title	Company manager/authorized signatory
Address	Egemenlik Mahallesi Doğu Çevre Yolu Blv. Shell Petrol Ofisi No. 9/A Dulkadiroğlu / Kahramanmaraş/ Turkey
Telephone	+90 5332170046
Email	abalsuyu@gmail.com; ahmet@balsuyu.com

1.4 Other Entities Involved in the Project

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

Organization name	Kilittasi Engineering Consulting and Construction Co. Ltd.
Role in the Project	Consultant on the development of Dagbasi HEPP carbon assets.
Contact person	İncigul Polat Erdogan
Title	Environmental Engineer, MSc.
Address	Ceyhun Atuf Kansu Cad. No:176/15 06520 Balgat Ankara/TURKEY
Telephone	+90 538 3275657
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1.5 Project Start Date

Project start date is 11 April 2014. This is also the provisional acceptance date as well as the starting date of the first crediting period.

1.6 Project Crediting Period

Project crediting period is 10 years 0 month, renewable twice.

First crediting period starts on 11 April 2014 and ends on 10 April 2024.

[5] In Project Description Report Uğur Pabuçcu was given as the contact person. Now Ahmet Balsuyu is provided as contact person who is the authorized signatory and at the same time owner of the Alperen Elektrik Üretim A.Ş.

1.7 Project Location

Project activity is located in the province of Mersin, Anamur district in the Mediterranean Region in Turkey. The geographical coordinates of the project components are given in Table 2.

Closest residential area to the project site is the Dibek Mahallesi, which is about 5 km away by road at the downstream.

Table 3 Geographical Coordinates of the Project Components[6]

Project Facilities	Latitude (6° UTM)	Longitude (6° UTM)
Dagbasi Weir	40 17 850 N	48 00 00 E
Powerhouse	40 16 200 N	48 00 80 E

Figure 1 Project Location in Turkey

[6] Coordinates were validated by the DOE. "Verra VCS Dagbasi Hydroelectric Power Plant Validation Report", 02 July 2014, p.4. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as VALID_REP_1333_02JUL2014.pdf. Access date 21 April 2022.

Figure 2 Project Location in Province of Mersin

1.8 Title and Reference of Methodology

Methodology:

AMS-I.D.: "Grid Connected Renewable Electricity Generation", Version 17.0.[7]

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

CDM Tool 07: "Tool to Calculate the Emission Factor for an Electricity System", Version 3.0.0.[8]

CDM Tool 01: "Tool for the Demonstration and Assessment of Additionality" Version 7.0.0.[9]

ACM0002: "Grid-connected electricity generation from renewable sources" Version 15.0.[10]

1.9 Participation under other GHG Programs

Dagbasi HEPP hasn't been registered and not seeking registration under any other Greenhouse Gas (GHG) programs.

[7] UNFCC, CDM, "AMS-I.D.: Grid connected renewable electricity generation --- Version 17". Available at https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK, Accessed on 12 April 2022.
[8] Available at https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf. Accessed on 12 April 2022.
[9] Available at https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf. Accessed on 12 April 2022.
[10] 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 Dagbasi 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, Dagbasi 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 will lead 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.

Project, during the first monitoring period from 11 April 2014 to 10 April 2020, generated 109,226.83 MWh renewable electricity to the TNGS.

Self defined indicator-Creating job opportunities (The number of people employed): During the construction and operation period, project directly and indirectly has generated job opportunities, helping to improve local employment and reduce local poverty.

Contributing to global GHG emission reduction efforts (SDG 13.0): 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: Dagbasi 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 (11 April 2014 - 10 April 2020) project net generated 109.06 GWh clean energy to the TNGS and increased the renewable energy share in total energy consumption from %29.938 to %29.944.[11]	Over the project lifetime since its operation start date (11 April 2014), project activity increased the renewable energy share in total energy consumption from %29.938 to %29.944.

[11] Data sources: https://webim.teias.gov.tr/file/41727cdb-944c-4df9-aac6-51cee9bfb19b?download energy consumption and renewable energy generation data before 2018. https://webim.teias.gov.tr/file/2a5a8ae4-f634-4abe-9e55-4d6e335622bd?download is for data for 2020. https://webim.teias.gov.tr/file/60184352-6d60-4bba-80c1-ad466d475436?download is for data for 2019.

Energy consumption: 2014 (since April):192,915.1 GWh; 2015 265,724.4 GWh; 2016 279,286.4 GWh; 2017 296,702.1 GWh; 2018 304,166.4 GWh; 2019 303,320.4 GWh; 2020 (Untill April) 76,527.3 GWh (TOTAL=1,718,642.5 GWh).

Renewable energy generation: 2014 (since April): 36,886.7 GWh; 2015 78,992.4 GWh; 2016 83,791.1 GWh; 2017 79,011.6 GWh; 2018 87,687.4 GWh; 2019 119,803.3 GWh; 2020 (Untill April) 28,468.2 GWh (Total=514,640.7 GWh).

With Dagbasi HEPP contribution: 514,640.7/1,718,642.5=29.938%; without Dagbasi HEPP contribution: 514,531.7/1,718,642.5=29.944%.

2)	-	The number of people employed	Implemented activities to increase	Project has been contributing to local economy by employing local people. There are 7 people in total working at Dagbasi HEPP, and all 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.	Over the project lifetime since its operation start date (11 April 2014), project activity annually employed 7 people.
3)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	During the monitoring period (11 April 2014 – 10 April 2020) project generated 57,843 tCO_2 emission reductions.	Over the project lifetime since its operation start date (11 April 2014), project activity generated 57,843 tCO_2 emission reductions.

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 12 January 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 Anamur Municipality once or twice a year. Solid wastes are categorized, and appropriates ones are recycled. Solid wastes are also disposed by the Anamur Municipality.

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

2.2 Local Stakeholder Consultation

A stakeholder consultation meeting (LSC) was organized on October 14, 2011.[12] Meeting was held at the Sugozu Primary School located at the Sugozu village.[13] Majority of the meeting participants were from Sugozu village. There were also participants from neighbor villages. Other participants include Mayor of the Anamur Municipality, a representative from the DSI-State Hydraulics Works and the president of the Irrigation Union.

[12] Photos from the meeting can be seen in the "Verra VCS Dagbasi HEPP Project Description Report", 23 June 2014, pp. 57-60.
[13] It is located at the upstream of the project site, and through bird fly it is 4.5 km but by road it is 20 km distant from the project site. After starting operating the project, it is recognized that Dibek village is the one that can be affected by the project activity due to that Dibek village is at the downstream of the project site.

At the meeting, there was no negative feedback from the meeting participants; the project was welcomed by the residents living in the project region. They believe that project has created a momentum for local economy and sustainable development. Only request from the villagers was to improve the school garden by laying gravel. Project owner quickly did that, and plus painted the school.

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 Dagbasi 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, mostly villagers from Dibek village makes request from the Plant Manager such as pipes, construction materials, various equipment etc. Plant Manager has always been responsive to the villagers' needs and helpful to them. There is one villager is working at the Dagbasi HEPP who is a minority. This is an important social contribution of the project to local life. The other social contribution of the project is to help the villagers finding their lost cattle in the valley where the project is located. Plant manager and the personnel, when they notice lost livestock in the valley, call the villagers. Hence villagers, with the help of Plant Manager and its personnel, find and get their livestock animals. Sometimes wild animals, such as wild goats, are injured, Plant Manager inform the Wild Life government agency to heal them.

Currently, stakeholders have still 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.[14]

Since the commencing of the project, which is the start date of the project first crediting period 11 April 2014, there has been no change in the technical characteristics of the project. In addition, since then Dagbasi HEPP has been operating smoothly in full capacity. There has been no emergencies of abnormal situations occurred that could negatively affect the production of electricity, so the reduction of GHG emissions.

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.

There is no update or any change to the project design after the registration of the project.

3.2 Deviations

3.2.1 Methodology Deviations

Project is constructed as described in the VCS validated Dagbasi HEPP Project Description Report. Since the commencing date, there has been no deviations happened that could relate to the methodology.

3.2.2 Project Description Deviations

Regarding the monitoring procedure, there is one minor change in the Project Description. Project Net Electricity Generation, which is the main monitoring parameter, was going to be defined by the TEIAŞ monthly invoices as stated in the VCS validated Dagbasi 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.) to provide a platform where sellers and buyers can trade electricity. EPIAS, on behalf of Turkish government, took over the job from TEIAŞ and started to buy electricity from all the power plant operators. Hence, "Dagbasi HEPP electricity generation data ($EG_{Facility,y}$)" is now determined by the EPIAŞ screenshots, which shows both electricity generation and consumption.

[14] For more technical information, "Verra VCS Dagbasi HEPP Project Description Report", 23 June 2014, Section 1.1 and Section 1.8. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as PROJ_DESC_1333_24JUN2014.pdf. Access date 21 April 2022.

3.3 Grouped Projects

N/A. 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 "Dagbasi HEPP Project Description Report", Annex II, Table 21.[15]
Justification of choice of data or description of measurement methods and procedures applied	TEIAS 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	-

[15] "Verra VCS Dagbasi HEPP Project Description Report", 23 June 2014, p.67-68. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as PROJ_DESC_1333_27JUNE2014.pdf. Access date 21 April 2022.

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 "Dagbasi HEPP Project Description Report", Annex II, Table 21.[16]
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.

[16] "Verra VCS Dagbasi HEPP Project Description Report", 23 June 2014, p.67-68. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as PROJ_DESC_1333_27JUNE2014.pdf. Access date 21 April 2022.

	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 "Dagbasi HEPP Project Description Report", Annex II, Table 22.[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	$FC_{i,y}$
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 "Dagbasi HEPP Project Description Report", Annex II, Table 14.[18]
Justification of choice of data or description of measurement methods	TEIAŞ is the only government organization in Turkey which makes the electricity generation and transmission statistics available to

[17] "Verra VCS Dagbasi HEPP Project Description Report", 23 June 2014, p.68. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as PROJ_DESC_1333_27JUNE2014.pdf. Access date 21 April 2022.
[18] "Verra VCS Dagbasi HEPP Project Description Report", 23 June 2014, p.65. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as PROJ_DESC_1333_27JUNE2014.pdf. Access date 21 April 2022.

and procedures applied	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)* Available at : http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2011/istatistik%202011.htm
Value applied	VCS approved "Dagbasi HEPP Project Description Report", Annex II, Table 15 and Table 16.[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/
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 $FC_{i,y}$)

[19] "Verra VCS Dagbasi HEPP Project Description Report", 23 June 2014, p.65-66. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as PROJ_DESC_1333_27JUNE2014.pdf. Access date 21 April 2022.

	are provided by the TEIAS. $NCV = \frac{HV_{i,y}}{FC_{i,y}}$
Value applied	VCS approved "Dagbasi HEPP Project Description Report", Annex II, Table 17.[20]
"	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	**Electricity Capacity Additions**
Data unit	-
Description	Capacity addition to the national grid between 2009-2010, which comprises the 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 "Dagbasi HEPP Project Description Report", Annex III, Table 26 and Table 27.[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	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).

[20] "Verra VCS Dagbasi HEPP Project Description Report", 23 June 2014, p.66. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as PROJ_DESC_1333_27JUNE2014.pdf. Access date 21 April 2022.
[21] "Verra VCS Dagbasi HEPP Project Description Report", 23 June 2014, p.70-75. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as PROJ_DESC_1333_27JUNE2014.pdf. Access date 21 April 2022.

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 "Dagbasi HEPP Project Description Report", Section 3.1., p.41.[22]
Value applied	0.5299 tCO2/MWh
Justification of choice of data or description of measurement methods and procedures applied	UNFCC CDM Tool 07: "Tool to calculate the emission factor for an electricity system", Version 04.0.
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 will be the basis of the amount of emission reduction achieved by the project.

Data / Parameter	Net Electricity Generated by the Dagbasi HEPP ($EG_{Facility,y}$)
Data unit	MWh/y
Description	Net electricity supplied to the TNGS by the Dagbasi 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- PMUM platform (Piyasa Mali Uzlaştırma Platfomu) EPIAŞ screenshots
Description of measurement methods and procedures to be applied	EPIAŞ screenshots for electricity generation and electricity consumption Monthly project's net electricity generation data is provided in Appendix I: Dagbasi HEPP Monthly Net Electricity Generation
Frequency of monitoring/recording	Continuous measurement and at least monthly recording.

[22] "Verra VCS Dagbasi HEPP Project Description Report", 23 June 2014, p.41. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as PROJ_DESC_1333_27JUNE2014.pdf. Access date 21 April 2022.

Value monitored	11.04.2014-31.12.2014: 7,651.41 MWh 2015: 18,721.77 MWh 2016 : 12,104.27 MWh 2017: 17,468.20 MWh 2018: 15,777.49 MWh 2019: 26,881.74 MWh 01.01.2020-10.04.2020: 10,621.95 MWh The monthly measured data within this monitoring period is provided in Appendix 1: Dagbasi HEPP Monthly Electricity Generation Data.
Monitoring equipment	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 will be the main one, and the other one will serve 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-PMUM platform. TEIAS is responsible for the measurements. Brand of power meter is EMH, model is LZQJ-XC. Main power meter's serial number is 4241359 and backup power meter number is 4241360. Accuracy class of power meters is 0.2S.
QA/QC procedures to be applied	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.[23] Power meters are generally tested with two years period by TEIAŞ. Power meter test dates; 13.12.2015, 11.12.2016, 11.10.2018, 12.11.2020. Electricity generation data from EPIAŞ is crosschecked onsite power meters readings in the form OSF (Otomatik Sayaç Formu - Automatic Meter Form) records.
Purpose of the data	Calculation of baseline emissions

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

Calculation method	The difference between the amount of electricity supplied to the TNGS and electricity drawn from the TNGS provides the "net electricity generation".
Comments	-

Data / Parameter	CAPpj
Data unit	MWe
Description	Installed capacity of the hydropower plant after 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	10.433 MWe (10.756 MW)
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 Dagbasi HEPP Weir Layout DGB-KT-GE-04
Description of measurement methods and procedures to be	Official detailed design document of the project.

applied	
Frequency of monitoring/recording	Annually (Reservoir area does not change).
Value monitored	2800 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	Dagbasi 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 parameters is fixed, and not measured. Therefore there is no applicable calculation method.
Comments	N/A

4.3 Monitoring Plan

The purpose of Dagbasi 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 Dagbasi HEPP's annual CO2 emission reduction.

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

Brand of power meter is EMH and main power meter number is 4241359 and backup power meter number is 4241360.

Calibration and maintenance of these two power meters are performed by TEIAŞ once every 10 years as per the TEIAŞ System Usage Agreement rules Technical specifications of the power meters should comply with the Communiqué for Power Meters[24] as announced by the Energy

[24] 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.

Market Regulatory Authority of Government of Turkey (Enerji Piyasaları Denetleme Kurulu-EPDK).[25]

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 anytime. 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, EPIAŞ screenshots are.

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 will 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.

Providing a quick summary of the monitoring process, first of all main and backup power meters were installed by the project owner onsite. TEIAŞ sealed and periodically calibrated them. These meters measure the electricity, fed to the TNGS by the project, and these measured data is recorded and displaced at the PMUM platform operated by EPIAŞ. Project owner, with user and password, get access to the PMUM platform operated by EPİAŞ, and can see the monthly electricity generation and consumption. Project owner took screenshots of the EPIAŞ screen showing project's monthly electricity and consumption.

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.

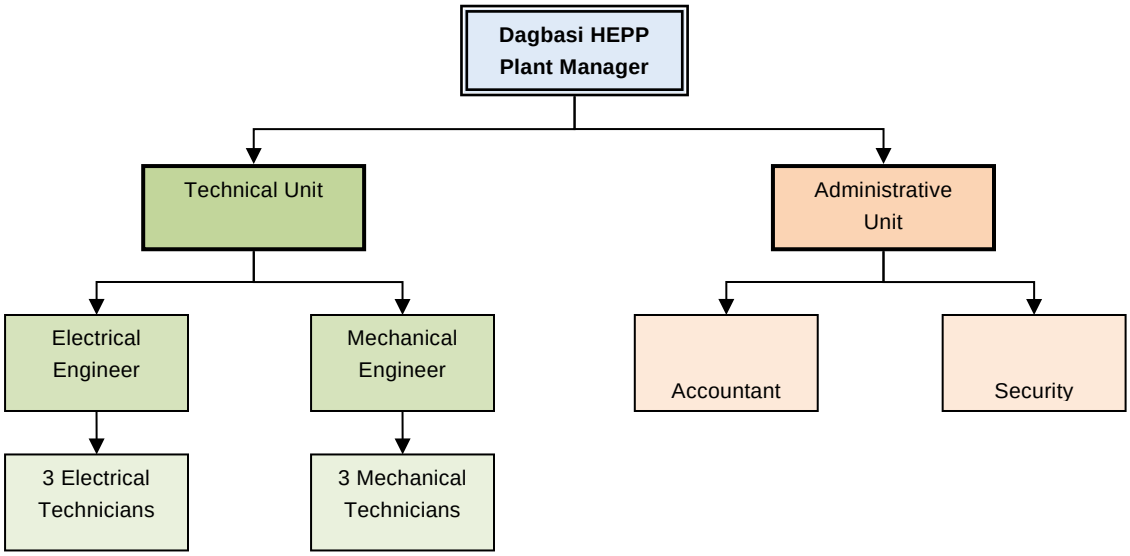
Data recording procedure

[25] TEIAS System Usage Agreement (Sistem Kullanım Antlaşması -in Turkish), Attachment 2-Section 3.3. pp.13. Available at http://mid.teias.gov.tr/SKAM/SKAornek.pdf.

TEIAŞ makes remote reading to the power meters located at the Otluca HEPP. TEIAŞ then records the measured data to the EPIAŞ platform. This is the data recording procedure of the project activity. Project owner keeps the data during the project activity plus 5 years.

Organizational Structure

Dagbasi 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 Dagbasi 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.

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 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

$EF_{grid,CM,y}$ = 0.655 * 0.5 +0.4043* 0.5

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

All the steps that are used in calculation of the Combined Margin Emission Factor (Dagbasi HEPP $EF_{grid,CM,y}$) is provided in detail in the VCS validated Dagbasi HEPP Project Description Report.[26]

5.2 Project Emissions

AMS-I.D Version 17.0 methodology refers to the ACM0002[27] 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)

Calculating project emission from fossil fuel combustion ($PE_{FF,y}$)

ACM0002 Ver 15.0[28] states that emissions due to the use of fossil fuels for the backup generator can be neglected. At Dagbasi HEPP project, the only source of fossil fuel consumption is backup generator. Therefore, this value is neglected in project emission calculations.

Calculating project emissions from the operation of dry, flash steam or binary geothermal power plants ($PE_{GP,y}$)

Since Dagbasi HEPP is a hydropower plant, $PE_{GP,y}$is not taken into account in calculation.[29]

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

$PE_{HP,y}$ is calculated by using the following formula as stated by the ACM0002 methodology 15.0.[30]

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

[26] "Verra VCS Dagbasi HEPP Project Description Report", 23 June 2014, Section 3.1. Report is available at Verra web site, https://registry.verra.org/app/projectDetail/VCS/1333, as PROJ_DESC_1333_23JUN2014.pdf. Access date 21 April 2022.
[27] The most up to date version of ACM0002 was Ver 15.0 at the time of the Dagbasi HEPP validation process in 2014.
[28] For most renewable energy project activities, PEy = 0. However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of "ACM0002: Grid-connected electricity generation from renewable sources". Ref: AMS-I.D., Version 17.0, p.12.
[29] UNFCC CDM ACM0002: Grid-connected electricity generation from renewable sources, Ver. 5., p.13.
[30] UNFCC CDM ACM0002: Grid-connected electricity generation from renewable sources, Ver. 5., p.12.

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

Reservoir area of the project activity is "2800 m²" and total installed capacity is 10.433 x10⁶ We, resulting with a power density of 3727 W/m².

that is far larger than the 4 W/m2 threshold value provided in the ACM0002.[31]

$$PD = \frac{10.433 \times 10^6 \text{ W} - 0 \text{ W}}{2800 \text{ m}^2 - 0 \text{ m}^2} = 3727 \text{ W/m}^2$$

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 Dagbasi HEPP (PE_y) is taken/accepted as zero.

5.3 Leakage

Since the Dagbasi HEPP is new a power plant and energy generators not transferred from another activity, leakage emission is neglected as per the methodology.32

5.4 Net GHG Emission Reductions and Removals

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

$$ER_y = BE_y - PE_y - LE_y$$

[31] "Verra VCS Dagbasi Hydroelectric Power Plant Validation Report", 23 October 2014, p.10. 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.
[32] UNFCC CDM AMS.I.D.: Grid Connected Renewable Electricity Generation, Ver. 17.0., p.8.

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 5 Dagbasi HEPP tCO_2 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 (11/04-31/12)	4.050	0	0	4.050
2015	9,914	0	0	9,914
2016	6,407	0	0	6,407
2017	9,251	0	0	9,251
2018	8,354	0	0	8,354
2019	14,241	0	0	14,241
2020 (01/01-10/04)	5,626	0	0	5,626
Total	57,843	0	0	57,843

APPENDIX I: DAGBASI HEPP MONTHLY ELECTRICITY GENERATION AND EMISSION REDUCTIONS

Table 6 Dagbasi HEPP Monthly Electricity Generation and Emission Reductions (tCO2e)

	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)
11-Apr-14	499,649	10,137	499.64	10.13	489.51	259	0	0	259
May-14	1,189,801	3,703	1,189.80	3.70	1,186.10	628	0	0	628
Jun-14	824,379	3,614	824.37	3.61	820.76	434	0	0	434
Jul-14	733,426	3,930	733.42	3.93	729.49	386	0	0	386
Aug-14	676,199	4,268	676.19	4.26	671.93	356	0	0	356
Sep-14	672,265	3,425	672.26	3.42	668.84	354	0	0	354
Oct-14	731,693	3,957	731.69	3.95	727.74	385	0	0	385
Nov-14	711,180	4,804	711.18	4.80	706.38	374	0	0	374
Dec-14	1,652,655	1,992	1,652.65	1.99	1,650.66	874	0	0	874
2014 Total					7,651.14	4,050	0	0	4,050
Jan-15	1,917,436	1,408	1,917.43	1.40	1,916.03	1,015	0	0	1015
Feb-15	1,629,121	1,667	1,629.12	1.66	1,627.46	862	0	0	862
Mar-15	3,014,753	562	3,014.75	0.56	3,014.19	1,597	0	0	1597
Apr-15	3,695,564	127	3,695.56	0.12	3,695.44	1,958	0	0	1958
May-15	2,594,420	81	2,594.42	0.08	2,594.34	1,374	0	0	1374
Jun-15	1,260,018	2,118	1,260.01	2.11	1,257.90	666	0	0	666
Jul-15	962,440	3,557	962.44	3.55	958.89	508	0	0	508

	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	827,592	4,836	827.59	4.83	822.76	**435**	0	0	**435**
Sep-15	744,178	4,889	744.17	4.88	739.29	**391**	0	0	**391**
Oct-15	767,074	5,016	767.07	5.01	762.06	**403**	0	0	**403**
Nov-15	679,109	5,701	679.10	5.70	673.40	**356**	0	0	**356**
Dec-15	668,149	8,132	668.14	8.13	660.01	**349**	0	0	**349**
2015 Total					**18,721.77**	**9,914**	0	0	**9914**
Jan-16	1,440,586	6,671	1,440.58	6.67	1,433.91	759	0	0	759
Feb-16	1,554,171	3,444	1,554.17	3.44	1,550.73	821	0	0	821
Mar-16	1,950,755	1,655	1,950.75	1.65	1,949.10	1,032	0	0	1032
Apr-16	1,578,513	1,795	1,578.51	1.79	1,576.72	835	0	0	835
May-16	998,760	5,180	998.76	5.18	993.58	526	0	0	526
Jun-16	749,197	5,760	749.19	5.76	743.43	393	0	0	393
Jul-16	690,358	4,591	690.35	4.59	685.76	363	0	0	363
Aug-16	631,428	4,564	631.42	4.56	626.86	332	0	0	332
Sep-16	600,782	4,457	600.78	4.45	596.33	315	0	0	315
Oct-16	602,364	5,536	602.36	5.53	596.83	316	0	0	316
Nov-16	590,924	8,267	590.92	8.26	582.66	308	0	0	308
Dec-16	780,730	12,375	780.73	12.37	768.36	407	0	0	407
2016 Total					**12,104.27**	**6,407**	0	0	**6407**
Jan-17	1,138,970	8,198	1,138.97	8.19	1,130.78	**599**	0	0	**599**
Feb-17	675,850	9,028	675.85	9.02	666.83	**353**	0	0	**353**
Mar-17	2,236,116	2,186	2,236.11	2.18	2,233.93	**1,183**	0	0	**1183**
Apr-17	4,529,017	365	4,529.01	0.36	4,528.65	**2,399**	0	0	**2399**
May-17	2,772,816	104	2,772.81	0.10	2,772.71	**1,469**	0	0	**1469**
Jun-17	961,701	2,079	961.70	2.07	959.63	**508**	0	0	**508**

	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)
Jul-17	717,033	3,627	717.03	3.62	713.41	378	0	0	378
Aug-17	715,279	4,714	715.27	4.71	710.56	376	0	0	376
Sep-17	548,398	6,207	548.39	6.20	542.19	287	0	0	287
Oct-17	876,455	4,854	876.45	4.85	871.60	461	0	0	461
Nov-17	1,175,705	4,563	1,175.70	4.56	1,171.14	620	0	0	620
Dec-17	1,172,375	5,607	1,172.37	5.60	1,166.77	618	0	0	618
Total 2017					17,468.20	9,251	0	0	9,251
Jan-18	2,258,403	1,047	2,258.40	1.04	2,257.36	1,196	0	0	1196
Feb-18	1,585,747	778	1,585.74	0.77	1,584.97	839	0	0	839
Mar-18	2,629,601	66	2,629.60	0.06	2,629.54	1,393	0	0	1393
Apr-18	1,766,473	457	1,766.47	0.45	1,766.02	935	0	0	935
May-18	1,104,095	2,637	1,104.09	2.63	1,101.46	583	0	0	583
Jun-18	848,482	3,286	848.48	3.28	845.20	447	0	0	447
Jul-18	772,036	4,008	772.03	4.00	768.03	406	0	0	406
Aug-18	704,308	4,333	704.30	4.33	699.97	370	0	0	370
Sep-18	547,561	6,755	547.56	6.75	540.81	286	0	0	286
Oct-18	653,700	6,349	653.70	6.34	647.36	343	0	0	343
Nov-18	638,439	7,985	638.43	7.98	630.45	334	0	0	334
Dec-18	2,308,651	2,339	2,308.65	2.33	2,306.32	1,222	0	0	1222
2018 Total					15,777.49	8,354	0	0	8354
Jan-19	2,877,179	318	2,877.17	0.31	2,876.86	1,524	0	0	1524
Feb-19	2,070,639	63	2,070.63	0.06	2,070.57	1,097	0	0	1097
Mar-19	3,021,379	31	3,021.37	0.03	3,021.34	1,601	0	0	1601
Apr-19	4,979,009	46	4,979.00	0.04	4,978.96	2,638	0	0	2638
May-19	5,244,617	30	5,244.61	0.03	5,244.58	2,779	0	0	2779

	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)
Jun-19	2,074,829	129	2,074.82	0.12	2,074.70	1,099	0	0	1099
Jul-19	1,170,169	2,618	1,170.16	2.61	1,167.55	618	0	0	618
Aug-19	1,016,562	3,702	1,016.56	3.70	1,012.86	536	0	0	536
Sep-19	931,832	3,330	931.83	3.33	928.50	492	0	0	492
Oct-19	893,042	4,090	893.04	4.09	888.95	471	0	0	471
Nov-19	849,431	5,471	849.43	5.47	843.96	447	0	0	447
Dec-19	1,776,760	3,850	1,776.76	3.85	1,772.91	939	0	0	939
2019 Total					26,881.74	14,241	0	0	14241
Jan-20	2,080,631	1,646	2,080.63	1.64	2,078.99	1,101	0	0	1101
Feb-20	2,768,413	338	2,768.41	0.33	2,768.08	1,466	0	0	1466
Mar-20	4,194,848	61	4,194.84	0.06	4,194.78	2,222	0	0	2222
10-Apr-20	1,580,179	71	1,580.17	0.07	1,580.10	837	0	0	837
2020 Total					10,621.95	5,626	0	0	5626
Grand Total					109,226.83				57,843

APPENDIX II: COMPARISON OF DAGBASI HEPP TCO2 ESTIMATED AND ACHIEVED EMISSION REDUCTIONS

Year	Achieved Net GHG emission reductions or removals (tCO2e)	PDD-Estimated Net GHG emission reductions or removals (tCO2e) [33]
2014 (11/04-31/12)	4,050	14,791
2015	9,914	20,372
2016	6,407	20,428
2017	9,251	20,372
2018	8,354	20,372
2019	14,241	20,372
2020 (01/01-10/04)	5,626	5,596
Total	57,843	122,303[34]

[33] 2016 and 2020 years have 366 days,
[34] In comparison table, there is a big difference between estimated and achieved emission reductions. The reason of that during the feasibility stage of the project activity, water flow values are mistakenly overly estimated/measured.