



Verified Carbon Standard

DARICA-1 99 MW HYDRO POWER PLANT PROJECT, TURKEY MONITORING REPORT: 5TH VERIFICATION

Document Prepared by

Bilgin Güç Santralleri Enerji Üretim A.Ş. (as Project Owner)

Life İklim ve Enerji Ltd. Şti. (as Carbon Consultant)

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Prepared By	Bilgin Güç Santralleri Enerji Üretim A.Ş. & Life İklim ve Enerji Ltd. Şti.
Contact	Adress: Kuleli Sokak No.87/1 G.O.P. Çankaya/Ankara TURKEY Telephone: +90 (0312) 446 30 23 e-mail: contact@bilgin.com.tr Website: www.bilgin.com.tr

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

DARICA-1 99 MW Hydro Power Plant Project, Turkey (in short **Darica HPP**) has 112.42 MW of total installed capacity and is located in Mesudiye district, Ordu province, Turkey (subsequently the “Host Country”). Bilgin Güç Santralleri Enerji Üretim A.Ş. (translation: Bilgin Power Plants Energy Generation Company Incorporated) is the project owner and developer (subsequently referred to as the “Project Developer”).

The generation capacity of the project was initially designed as 99 MW, however during the operation phase the capacity of the project was increased to 112.42 MW (2 x 56.21 MW turbines) and the generator capacity was increased to 110.32 MWe (2 x 55.16 MW)¹. Accordingly, the expected annual electricity generation was also increased to 410,000 MWh². This is accomplished with the manufacturer’s assistance, by adjusting the turbines to their maximum limits. To accommodate this increase, the electricity generation license was renewed, and the EIA was updated with an additional report submitted to Ordu Provincial Directorate of Environment and Forestry. The EIA exemption certificate was granted to the project, and the capacity increase completed.

Project construction commenced in April 2007, and the first turbine began operating on 10-October-2009. On 23-December-2009, the second turbine began operating, and the Project has been operational since.

This fifth monitoring period covers the 1 year 10 months from 01-January-2018 to 09-October-2019 (both days included). Net electricity generation was achieved as 498,373.10 MWh, and actual emission reduction was realized as 318,925 tonnes of CO₂e for this period. A comparison table which indicates the difference between estimated and achieved amounts is provided below.

Vintage		Actual ERY (tCO ₂ e)	Estimated ERY (tCO ₂ e)
01-January-2018	31-December-2018	152,705	209,722
01-January-2019	09-October-2019	166,220	162,032
Total		318,925	371,754

As aforementioned above, Darica HPP is a run-of-river HPP, the electricity amount supplied to the grid depends on external physical conditions, i.e. the flow rate. That is why, actual emission

¹ Electricity Generation Licence

² Electricity Generation Licence

reduction amounts are 14.20% lower than estimated amount since electricity generated is also lower than the estimated amount of electricity.

1.2 Sectoral Scope and Project Type

According to guidance from VCS, Darıca HPP falls under sectoral scope no. 1 "Energy Industries (renewable/non-renewable)".¹ The project type is Renewable Energy (REN). More specifically, it is a run-of-river HPP project. Darıca HPP is not a grouped project if referring to the relevant VCS rules. Referring to CDM rules it is also neither a project bundle nor a debundled component of a large-scale project activity.

1.3 Project Proponent

Organization name	Bilgin Güç Santralleri Enerji Üretim A.Ş.
Contact person	Kadir Coşar
Title	Project Representative
Address	Kuleli Sokak No.87/1 G.O.P. Çankaya/Ankara TURKEY
Telephone	+90535 357 1718
Email	kadir.cosar@bilgin.com.tr

1.4 Other Entities Involved in the Project

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

1.5 Project Start Date

The Project was commissioned and started to feed energy to the grid on 10-October-2009.³ This is the date on which the project started to produce emission reductions.

1.6 Project Crediting Period

The start date of the crediting period is 10-October-2009. Project started operating on 10-October-2009, therefore starting date of first crediting and monitoring period were taken as 10-October-2009.

In accordance with VCS rules, the project crediting period is 10 years; 10-October-2009 to 09-October-2019 (both days included).

1.7 Project Location

The Power Plant is located on the Melet River in the Mesudiye District of Ordu Province (12 km Northeast of Topçam) in the Northern Black Sea region of Turkey.

The Turbine House has latitude 40° 43' 51 N and longitude 37° 51' 30 E.



Figure 1. Location of Ordu District in Turkey

³ Provisional Acceptance Protocol



Figure 2. Location of the Project Activity

1.8 Title and Reference of Methodology

“Consolidated baseline methodology for grid connected electricity generation from renewable sources” (ACM0002 version 7)

The above methodology is hereafter referred to as the “Baseline Methodology”. The Baseline Methodology is used in conjunction with the approved monitoring methodology ACM0002 version 7 (subsequently referred to as “Monitoring Methodology”).

The monitoring report also draws upon the:

- “Tool for assessment and demonstration of additionality”, Version 5.2
- “Tool to calculate the emission factor for an electricity system”, Version 01

1.9 Participation under other GHG Programs

Darica HPP does not participate in any GHG program other than the VCS.

1.10 Other Forms of Credit

No GHG related environmental credits are applied to the Turkish power sector.

1.11 Sustainable Development Contributions

Darica HPP is located in Mesudiye district, Ordu province, Turkey. Electricity generated by the project is fed into the national electricity grid, displacing energy that would otherwise be generated

by fossil fuels. The project facilitated 498,373.10 MWh renewable electricity generation, 318,925 tCO₂e during its fifth monitoring period⁴.

Considering regional development efforts, the project owner has employed 23 workers⁵. Furthermore, project has socially and economically supported the local region through several public reliefs and financial aids.

⁴ Project's fifth monitoring period is in between 01-January-2018 to 09-October-2019.

⁵ 10 out of 23 were locally performed.

Table 1. Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	13.2	13.2.2 Total greenhouse gas emissions per year	Implemented activities to decrease	318,925 tCO ₂ emission reduction during this MP	318,925 tCO ₂ emission reduction over the project lifetime
2)	7.2	7.2.1 Renewable energy share in the total final energy consumption	Implemented activities to increase	498,373.10 MWh during this MP	498,373.10 MWh over the project lifetime
3)	8.5	Number of individuals hired in long-term, full-time positions	Implemented activities to increase	There are 23 employees have been working at the Plant during this MP	There are 23 employees have been working at the Plant over the project lifetime

2 SAFEGUARDS

2.1 No Net Harm

No negative environmental and socio-economic impacts have been observed/recorded for this project. Detailed information of Darica Hydro Power Plant Project's social and environmental performance can be gained via Sustainable Development chapter.

2.2 Local Stakeholder Consultation

The local stakeholder meeting has been conducted on 19-October-2006 at Derinçay Village. The Stakeholder Meeting was announced through newspaper advertisements and notices displayed in the headman's offices in each village in the location. The meeting was held in the context of Environmental Impact Assessment procedures implemented in the country. In addition to notices and advertisements, officers from related local government institutions and ministries and NGOs have been invited to the meeting. 34 people in total attended the stakeholder meeting. All the comments and questions held during the meeting were noted and the attendance register collected.

According to the notes in the PDD, no significant issue has been raised since there is no house or economical activity affected by the Project Activity.

For stakeholder interactions, there is a logbook sent to the coffeehouse to comment if needed. There are all necessary information including phone number and email address of the project owner. On-site photos showing that the logbook was sent has been provided to VVB. All stakeholders can add their comments in the logbook, and they can communicate with the project owner directly if required. During this monitoring period, there is no negative comment or feedback located in the logbook. Moreover, a supporting document stating that the contact information is available for the stakeholders, and there is no negative feedback during this monitoring period, has been signed by the Mukhtar and Pinarli Youth Association President. All supporting documents have been provided to VVB.

2.3 AFOLU-Specific Safeguards

It is not a AFOLU project. So, not applicable.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The Darica-1 HEPP started to generate and provide electricity to the Turkish National Grid on 10-October-2009 when the first turbine (49.5 MW power capacity) became operational. The second 49.5 MW turbine came into operation on 23-December-2009, and the HEPP has remained operational since.

On 17-June-2010 following the approval of EMRA⁶, the power plant capacity was increased to 112.42 MW (2 x 56.21 MW turbines) and the generator capacity was increased to 110.32 MW (2 x 55.16 MW). On 26-July-2011 the capacity increase was accepted by the Ministry of Energy and Natural Resources.

Yapısan Elektrik Üretim A.Ş. has been changed as Bilgin Güç Santralleri Enerji Üretim A.Ş. Yapısan Elektrik Üretim A.Ş. has transferred its rights to Bilgin Güç Santralleri Enerji Üretim A.Ş. Thus, the project proponent is Bilgin Güç Santralleri Enerji Üretim A.Ş.⁷

Revision and maintenance works were carried out during this Monitoring Period. In this context, there is no generation in Group 1 between 24/11/2018-10/01/2019. And there is no generation in Group 2 between 29/08/2018-16/11/2018. Also, the letter of conformity taken from TEIAS, which is the authorized transmission company in Turkey, for the revision and maintenance works has been provided to VVB. The amount of electricity that was monitored (on the days that the maintenance works were conducted), were part of the overall monitored electricity generated for the GHG ER. Since there is no generation in these periods, the electricity generation and therefore the emission reduction amount is taken as “0” for the non-operating unit on these days. For the plants in group 1, generated electricity was taken as ‘0’ for 12th month in 2018. However, the electricity was generated on days, when revision and maintenance works were not carried out, in November 2018 and January 2019. In the same way, generated electricity for the plants in group 2 was taken as ‘0’ for 9th and 10th months in 2018. But the electricity was generated on days, when revision and maintenance works were not carried out, in August 2018 and November 2018. Meter Index documents, showing daily and hourly electricity generation for these dates, have been provided to VVB. According to these documents, it can be checked that the amount of electricity is taken as ‘0’ on the days of revision and maintenance works. As a result, all these circumstances have been considered for calculating GHG ER during this MP.

⁶ Energy Market Regulatory Authority

⁷ Electricity Generation Licence

Table 2. Technical Specifications of Electricity Meters⁸

Name	Brand & Model	Serial Number	Accuracy Class
Old Main Meter 1	ELSTER & A1500	361509	0.2S
New Main Meter 1	EMH-LZQJ-XC	7019969	0.2S
Old Back-up Meter 1	ELSTER & A1500	361510	0.2S
New Back-up Meter 1	EMH-LZQJ-XC	7019970	0.2S
Old Main Meter 2	ELSTER & A1500	364713	0.2S
New Main Meter 2	EMH-LZQJ-XC	7019971	0.2S
Old Back-up Meter 2	ELSTER & A1500	287913	0.2S
New Back-up Meter 2	EMH-LZQJ-XC	7019972	0.2S

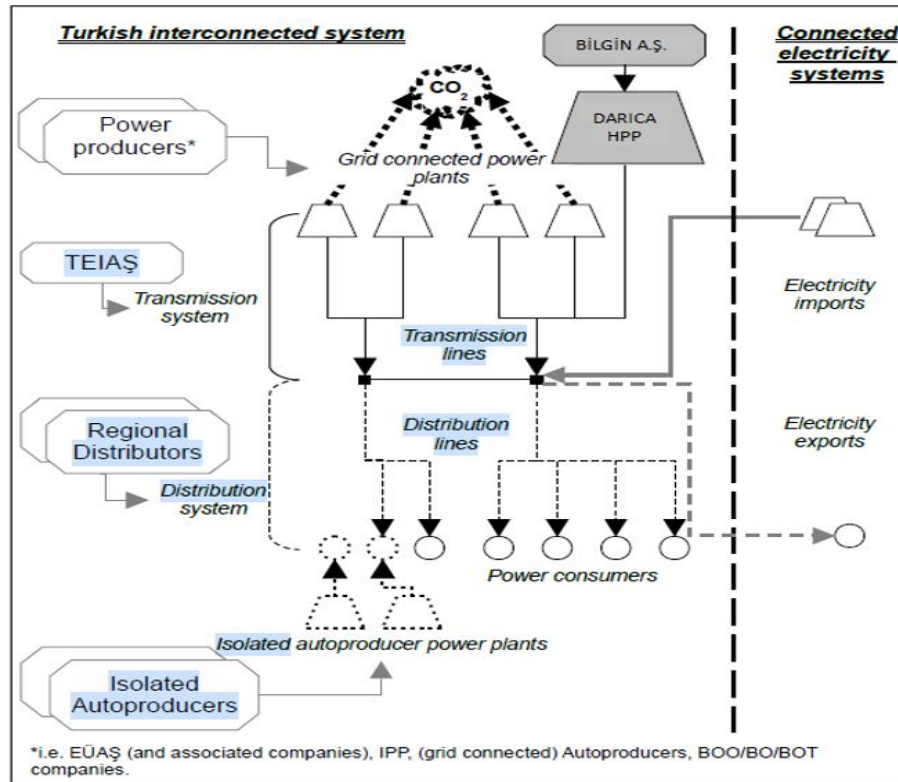


Figure 3. Single Line Diagram of Darica HPP

Darica HPP is fed by the Karıca Diversion Regulator which diverts the water used by the state owned Topçam HEPP upstream to Darica HPP. The water is conveyed from the Karıca Regulator to the plant site by means of the transmission tunnel and penstock. The power generated is transmitted to

⁸ Test Protocols of Meters

the switchgear area (approximately 1.3 km upstream) by transformers and then is fed to the national grid. The process flow chart may be referred to in Figure 4 (below).

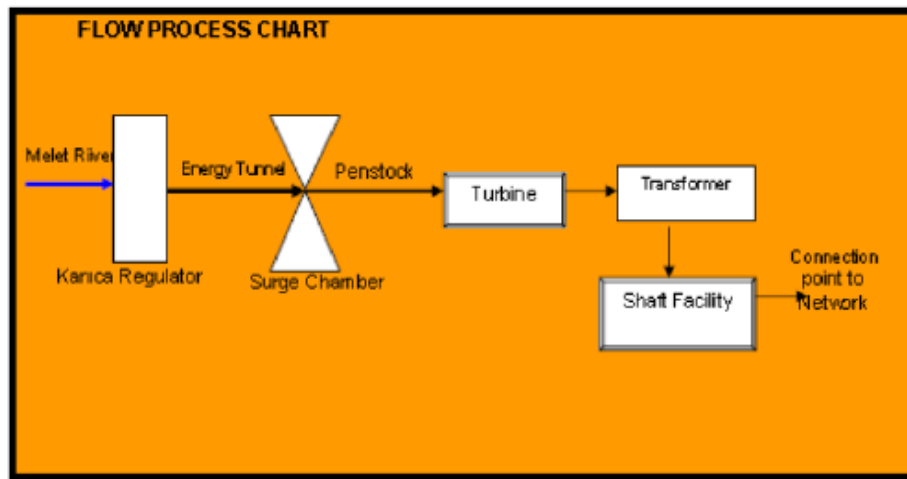


Figure 4. Process Flow Chart

3.2 Deviations

2.1.1 Methodology Deviations

There has been not any methodology deviation during this monitoring period.

2.1.2 Project Description Deviations

For the parameter EGy (Net Electricity generated and delivered to the grid by the power plant in year y), the monitoring plan in the validated PDD implies the use of “Metering devices measuring the electricity generated at the exit of the plant and cross checked with invoices prepared for billing the transmission company”. However due to a regulatory change the invoices no longer contain data regarding the quantity of electricity produced. Therefore in lieu of the invoices, the data output of the official Market Financial Reconciliation Center (MFRC/PMUM) is utilised. The MFRC/PMUM is a unit within TEİAŞ that is responsible for the financial settlement system (on this and other grid-connected privately held power facilities in Turkey) by calculating amounts payable/receivable for market participants via a complex mechanism. The electricity generated is metered by TEİAŞ by two meters placed on the switchgear station, where the plant is connected to national grid. Those meters provide official data which is read and recorded monthly by TEİAŞ officers for invoicing (as of January 2012, this data recording is done automatically and processed by MFRC/PMUM (Market Finance Reconciliation Centre). Till December 2011, an authorized person from TEİAŞ was coming to the project site to read the main meters and back up meters at the end of each month; and accordingly create a protocol which clearly stated the net electricity generation and plant’s energy consumption

values. Starting from January 2012, the meter data is recorded electronically. This new system is called OSOS (Automatic Meter Reading System). In this system, TEİAŞ is not coming to the site to read the meters but has a remote connection to the main meter which is still sealed at the project site. However, every month (till July 2012) project owner's representative went to TEİAŞ at the end of the month to take the originally signed hard copy of the meter protocol.

However, starting from August 2012, TEİAŞ no longer provide any originally signed hard copy but provides access to OSOS database from where the monthly generation details can be located. Thus, duly signed hard copies of the monthly meter protocols till the end of July 2012 and the screenshots of OSOS (Automatic Meter Reading System) which shows the monthly meter records from August 2012 are used to substantiate the electricity generation by the project activity.

The generation capacity of the project was initially designed as 99 MW, however during the operation phase the capacity of the project was increased to 112.42 MW (2 x 56.21 MW turbines) and the generator capacity was increased to 110.32 MWe (2 x 55.16 MW)⁹. Accordingly, the expected annual electricity generation was also increased to 410,000 MWh¹⁰. This is accomplished with the manufacturer's assistance, by adjusting the turbines to their maximum limits. To accommodate this increase, the electricity generation license was renewed, and the EIA was updated with an additional report submitted to Ordu Provincial Directorate of Environment and Forestry. The EIA exemption certificate was granted to the project, and the capacity increase completed.

As per the project description the start date of the project was 28th February 2007, and the project crediting period was 10 years fixed starting from 1 July 2009 but due to delay in commissioning of the project the crediting period start date has been revised as 10-October-2009 since the commissioning date of the project activity is 10-October-2009¹¹. Considering 10 years fixed crediting period which is specified in the PD, project crediting period has been determined as 10-October-2009 to 9-October 2019.

There is no project description deviation impact the applicability of the methodology, additionality, or the appropriateness of the baseline scenario for this monitoring period.

3.3 Grouped Projects

Darica Hydro Power Plant Project is a single project not a grouped project activity.

⁹ Electricity Generation License

¹⁰ Electricity Generation License

¹¹ Provisional Acceptance Document

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$FC_{i,y}$
Data unit	m ³ or tonnes
Description	Amount of fossil fuel type I consumed by the Project electricity system
Source of data	TEİAŞ web page (www.teias.gov.tr)
Value applied	See baseline calculation
Justification of choice of data or description of measurement methods and procedures applied	Data is published by the transmission company (TEİAŞ) annually. It will be used once for the crediting period.
Purpose of Data	Calculation of baseline emissions.
Comments	No additional comments

Data / Parameter	$NCV_{i,y}$
Data unit	TJ/kt
Description	Net calorific value (energy content) of fossil fuel type i in year y
Source of data	Calculated for Turkish grid using TEİAŞ data (www.teias.gov.tr)
Value applied	Depends on fossil fuel type. Please refer to PDD (e.g. hard coal, imported coal, lignite, fuel oil, diesel oil, LPG, naptha or natural gas)
Justification of choice of data or description of measurement methods and procedures applied	Applied in the calculation of the simple OM, where fuel consumption data is available for all power plants.
Purpose of Data	Calculation of baseline emissions.
Comments	No additional comments

Data / Parameter	EFCO_{2 i,y}
Data unit	tCO ₂ /GJ
Description	CO ₂ emission factor of fossil fuel type i in year y
Source of data	2006 IPCC Guidelines for National Greenhouse Inventories
Value applied	Between 0.0543 and 0.0946 depending on type of fuel – defined in PDD
Justification of choice of data or description of measurement methods and procedures applied	Applied in the calculation of the simple OM, where fuel consumption data is available for all power plants.
Purpose of Data	Calculation of baseline emissions.
Comments	No additional comments

Data / Parameter	EFCO_{2 y}
Data unit	tCO ₂ /TJ
Description	CO ₂ emission factor of fossil fuel type i in year y
Source of data	2006 IPCC Guidelines for National Greenhouse Inventories
Value applied	74.8
Justification of choice of data or description of measurement methods and procedures applied	Fossil fuel used in Standby generator
Purpose of Data	Calculation of baseline emissions.
Comments	No additional comments

4.2 Data and Parameters Monitored

Data / Parameter	EG_y
Data unit	MWh
Description	Net Electricity generated and delivered to the grid by the power plant in year y
Source of data	TEİAŞ installed electricity meters
Description of measurement	Measured and recorded with the Monitoring Equipment detailed herein

methods and procedures to be applied					
Frequency of monitoring/recording	Continuous				
Value monitored	498,373.10 MWh				
Monitoring equipment					
	Name	Serial Number	Brand&Model	Accuracy Class	Calibration Dates
	Old Main Meter 1	361509	ELSTER – A1500	0.2S	13/12/2017
	New Main Meter 1	7019969	EMH – LZQJ-XC	0.2S	08/06/2018 24/11/2020
	Old Back-up Meter 1	361510	ELSTER – A1500	0.2S	13/12/2017
	New Back-up Meter 1	7019970	EMH – LZQJ-XC	0.2S	08/06/2018 24/11/2020
	Old Main Meter 2	364713	ELSTER – A1500	0.2S	13/12/2017
	New Main Meter 2	7019971	EMH – LZQJ-XC	0.2S	08/06/2018 24/11/2020
	Old Back-up Meter 2	287913	ELSTER – A1500	0.2S	13/12/2017

¹² Meter Change Protocols have also been provided to VVB.

	a) Subtracting self-consumption value from gross generation value for each month to find the net electricity supplied to the grid. b) Adding up all monthly net electricity values to calculate the total net electricity supplied to the grid during the monitoring period. Multiplying the total net electricity value with the CM emission factor¹³.
Comments	-

Data / Parameter	Fossil Fuel Use
Data unit	tonnes
Description	Diesel used in standby generator
Source of data	Auxiliary diesel generator consumption is recorded, and the annual volume of fuel consumed is summed and (conservatively) rounded up to the nearest whole liter For conservativeness, the higher value between (a) and (b) above is employed in the Project emissions calculations. Mass is calculated based on the following formula: • $M = Dv$ where: • $M = \text{Mass [kg]}$ • $d = \text{average density of diesel fuel (0.845 kg/L)}^{14}$ • $V = \text{Volume [Liters, L]}$ The Mass [kg] is converted to tonnes (dividing by 1,000)
Description of measurement methods and procedures to be applied	As per source of data above
Frequency of monitoring/recording	When generator is used

¹³ Please see registered PD for the calculation of CM emission factor.

¹⁴ Please see:

https://tprstaticfilessa.blob.core.windows.net/assets/uploads/urunler/TPR.%C3%9CPM.%C3%9CSP.0403_DE_17%20%20%20%C3%9CR%C3%9CN%20SPES%C4%B0F%C4%B0KASYONU%20MOTOR%C4%B0N.pdf

Value monitored	12,504 L of diesel usage 12,504 L x 0.845 kg/L = 10,565 kg = 10.57 tonnes Diesel Fuel
Monitoring equipment	Onsite logs and measurements
QA/QC procedures to be applied	Calculated amount is cross-checked against Project on-site log books and the fuel invoice.
Purpose of the data	Calculation of project emissions
Calculation method	As per the “Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion”
Comments	-

4.3 Monitoring Plan

The Monitoring methodology applied to the Project is ACM0002 version 7, “Approved consolidated baseline and monitoring methodology for grid connected electricity generation from renewable resources” The amount of net electricity generated by the plants is monitored in order to demonstrate the emission reductions. In addition, fuel consumption by the auxiliary equipment (i.e. diesel generator) is also considered in the calculations. Monthly generation data is measured and recorded by both TEİAŞ and the Project Manager. Data is recorded in an Excel workbook and kept in electronic and paper form, both at the project site and at the Project Developer’s Head Office in Ankara.

The annual Project emission reductions are calculated by multiplying the net electricity generated and combined margin emission factor. The process of verification of the Project will be followed up by JP Morgan Ventures Energy Corporation.

The Plant Manager is responsible for maintenance of credible, transparent, and adequate data estimation, measurement, collection, and tracking systems of the net electricity generation of the plant. Such records are provided to the selected DOE to verify project performance, as part of the verification process.

Emission reductions by the project activity are calculated using electricity generated by Darica HPP. This electricity displaces the power generated by other plants in the grid. An Excel spreadsheet is used to calculate emission reductions from the renewable electricity generated.

Gross electricity production is measured, recorded monthly through two high precision measuring devices sealed and controlled by TEİAŞ, and recorded in the Excel workbook. TEİAŞ is the electricity distribution company and electricity buyer. The preceding is per TEİAŞ regulations.

The electrical engineer or the plant manager accompany the TEİAŞ officer during the monthly measurements since this data also forms the basis for monthly invoicing to TEİAŞ.

In accordance with Article 9 (b) of the “Inspection of Measurement and Measuring Equipments Regulation” which was published in Turkish Official Gazette dated 15-January-2019 and No. 30647, the maintenance and calibration of meters should be undertaken every 10 years.

In the event that the accuracy of metering devices is less than 0.2%, a test is carried by TEİAŞ officers, and if required, the calibration and maintenance of the meters is carried out by TEİAŞ. If the accuracy passes the 0.2% range the meters are re-calibrated. Other than this, under normal conditions the calibration is repeated every 10 years. The calibration, type of the meters allowed to be used in power plants, and their accuracy class (which is 0.2S) are determined by the communiqué on the Electricity Meters declared by EMRA (Electricity Market Regulatory Agency). According to this communiqué the electricity meters have to be in compliance with the IEC-EN 60687 Standard.

Electricity produced is sold to EPIAŞ, a system that offers market participants an environment where they can make energy purchase and sale requests. EPIAŞ reconciles demand and supply, and buys electricity from the producers. At the end of the month the electricity sold from each power plant of Bilgin Güç Santralleri Enerji Üretim A.Ş. is summed up under one monthly invoice after generation data is controlled by measuring and recording by both TEİAŞ and the Project Manager. Therefore, the TEİAŞ data do not exhibit the monthly electricity production by the Darica HPP alone. Monthly EPIAŞ data can also be used to cross-check electricity production data.

The Project stand-by generator’s fuel consumption is monitored by volume of fuel consumed which is recorded in the Project on-site log books with the fuel invoice. The amount utilised in tonnes is calculated by multiplying the litres used and density of the fuel declared by the TUPRAŞ refinery (the sole distributor of standard diesel fuel in Turkey). This data is compared with the sampled plant daily electricity consumption values and shows that the estimate is conservative. Emissions from the generator are calculated by multiplying the annual fuel consumption with the NCV and EF values for diesel. This is used to calculate the project emissions, which do not include CH₄ emissions from the reservoir, since the Project’s power density is a hundred times larger than 10. Hence CH₄ emissions from the reservoir are negligible (as per p. 9 of the validated PDD).

The Plant Manager is responsible for electricity generation in the plant and is assisted by mechanical and electrical engineers as seen in Figure 5 (below). All relevant data is recorded by the Plant Manager on a monthly basis. Data (in electronic and paper form) is kept by the Project owner, both at the project site and at the Head Office in Ankara for two years following the completion of the crediting period.

4.3.1 Operational and Management Structure

As described before, there are two main factors important for the calculation of emission reductions. The relevant data that have to be monitored is not only net electricity generation ($EG_{\text{facility},y}$) per year but also $FC_{j,y}$ because of the project emission. The generation data are subject to the strict internal quality control systems of both parties. The monthly meter reading documents are stored by Darica HPP and TEİAŞ. The settlement notification, which is issued by TEİAŞ and includes the meter reading data, is stored on a TEİAŞ file server and accessible for Darica via a secured website. The meters themselves can always be read as plausibility check for verification. The other important parameter is the emission factor. It is approved according to strict quality control parameters from an independent external party. With this, no additional structures or processes have to be implemented to insure the availability and high quality of the necessary data for monitoring.

At the end of each monitoring period, from the monthly meter reading records the net electricity generation amounts as calculated by electricity supplied to the grid minus withdrawn from the system is added up to the yearly net electricity generation and total project emissions is subtracted from this amount and result data is multiplied with the combined margin emission factor with the help of an excel spread sheet that also contains the combined margin calculation. Thus, the complete baseline approach is always transparent and traceable.

There are 23 employees within Darica HPP covering this monitoring period. 11 of them are responsible for conducting maintenance and operations tasks. Brief information about the roles and responsibilities of each personnel involved in the monitoring process is given in the figure below. The list of employees and their departments are provided by Table 3.

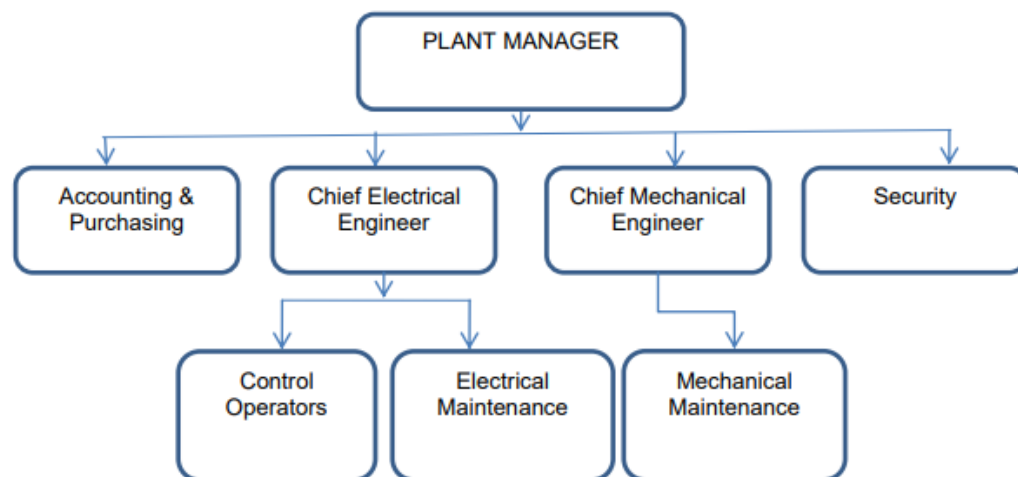


Figure 5. The Operational Flow of Darica HPP

Table 3. List of Employees

Number	Employee	Roles
1	Osman Fırat ALKAN	Manager
2	Mahir BİLGİN	Administrative Chief
3	Sedat YILMAZ	Technician Chief
4	Adem ADIYAMAN	Maintenance & Operation
5	Selami ASMA	Maintenance & Operation
6	Mümtaz BİRLİKBAŞ	Maintenance & Operation
7	Mustafa GÜLER	Maintenance & Operation
8	Semih İHTİYAROĞLU	Maintenance & Operation
9	Muhammed BİÇER	Maintenance & Operation
10	Burak YAVUZ	Maintenance & Operation
11	Alican TAŞPINAR	Maintenance & Operation
12	Raci BİLGİN	Maintenance & Operation
13	Nurettin ERDEM	Maintenance & Operation
14	Berkay ÇUVALCI	Maintenance & Operation
15	Cihan SARICA	Security
16	Aydın YILDIRIM	Security
17	Tarık TAŞDÖĞEN	Security
18	Hacı Ahmet ÇİMENER	Security
19	Hüseyin GÖRÜNDÜ	Security
20	Murat ÖZPOLAT	Security
21	Selim ÇUVALCI	Driver
22	Şenol ATABAY	Cleaning Staff
23	Temel BİÇER	Cleaning Staff

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline scenario is identified according to the “Baseline Methodology Procedure” of ACM0002 Version 7¹⁵. Baseline emissions include only CO₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated via the following formula:

$$BE_y = (EG_y - EG_{\text{baseline}}) \cdot EF_{\text{grid,CM},y}$$

Where:

BE_y = Baseline emissions in year y (t CO₂/yr)

EG_y = Electricity supplied by the project activity to the grid (MWh)

EG_{baseline} = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.

$EF_{\text{grid,CM},y}$ = Combined margin CO₂ emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system”.

EG_{baseline} = 0

$$BE_y = EG_y \cdot EF_{\text{grid,CM},y}$$

$$EF_{\text{grid, OMsimple}, y} = 0.655 \text{ tCO}_2/\text{MWh}^{16}$$

$$EF_{\text{grid, BM}, y} = 0.624 \text{ tCO}_2/\text{MWh}^{17}$$

¹⁵ Please visit the methodology.

¹⁶ Registered PD (Dated: 18 April 2009)

¹⁷ Registered PD (Dated: 18 April 2009)

$$EF_{\text{grid, CM, } y} = w_{\text{OM}} * EF_{\text{grid, OMsimple, } y} + w_{\text{BM}} * EF_{\text{grid, BM, } y}$$

According to the registered PD, the default values of w_{OM} and w_{BM} as recommended by the selected methodology are both equal to 0.5, and these default values have been used.

Based on the formula above, baseline emission factor is calculated as;

$$EF_{\text{grid, CM, } y} = 0.5 * 0.655 + 0.5 * 0.624 = 0.640$$

$$EG_y = 498,373.10 \text{ MWh for this Monitoring Period}$$

With an actual annual project electricity generation of amounts which was given in the Appendix 1 of this report, and $EF_{\text{grid, CM, } y}$ calculated in Registered PD as 0.64 tCO₂/MWh¹⁸.

5.2 Project Emissions

An auxiliary diesel generator operates occasionally in the event of electricity cut off. Project emissions are calculated based on the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” (Version 03). Project emissions are calculated based on the following formula:

$$PE_{FC, j, y} = \sum_i FC_{i, j, y} \times COEF_{i, y}$$

Where:

$PE_{FC, j, y}$ CO₂ emissions from fossil fuel combustion in process j during year y [tCO₂ /yr]

$FC_{i, j, y}$ Quantity of fuel type i combusted in process j during year y [mass or volume unit/yr]

$COEF_{i, y}$ CO₂ emission coefficient of fuel type i in year y [tCO₂ /mass or volume unit]

i Fuel types combusted in process j during year y

The CO₂ emission coefficient $COEF_{i, y}$ is calculated based on Option B of the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion, Version 03. Since there is no available data related to Option A (chemical composition of fossil fuel type i), Option B is applied. Option B:

¹⁸ Registered PD (Dated: 18 April 2009)

The CO₂ emission coefficient COEF_{i,y} is calculated based on net calorific value and CO₂ emission factor of the fuel type i¹⁹, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO_2,i,y}$$

Where:

- COEF_{i,y} CO₂ emission coefficient of fuel type i in year y [tCO₂ /mass or volume unit]
- NCV_{i,y} Weighted average net calorific value of the fuel type i in year y [GJ/mass or volume unit]
- EF_{CO₂,i,y} Weighted average CO₂ emission factor of fuel type i in year y [tCO₂/GJ]
- i Fuel types combusted in process i during the year y

Project Emissions are therefore:

Table 4. Calculation of Project Emissions

Parameter	Value	Unit	Explanation
Total Diesel Consumption	12,503.50	L	The amount of diesel consumption which is recorded in the Project on-site logbooks.
	12.50	m ³	
Density of Diesel	845	kg/m ³	Per technical specifications of the diesel fuel provided to the market by the refineries of Turkey owned by a single company TUPRAŞ ²⁰
M = dV	10,565	kg	Mass of Diesel used
FC_{i,j,y}	10.57	Ton	-
NCV_{i,y}	43.3	TJ/kt	-
EF_{CO₂,i,y}	74.8	tCO ₂ /TJ	-
COEF_{i,y}	3.239	tCO ₂ /tonne	-
PE	33.00	tCO ₂	-

¹⁹ "i" is Diesel Fuel in this case

²⁰ Please see:

https://tprstaticfilessa.blob.core.windows.net/assets/uploads/urunler/TPR.%C3%9CPM.%C3%9CSP.0403_DE_17%20%20%20%C3%9CR%C3%9CN%20SPES%C4%B0F%C4%B0KASYONU%20MOTOR%C4%B0N.pdf

The power density (PD) for the Darica HPP is calculated according to the directions given in the methodology²¹:

$$PD(W/m^2) = \frac{\text{Installed Capacity}}{\text{Reservoir Surface Area}}$$

Reservoir area at maximum operating level= 104,000 m² ²²

$$PD \left(\frac{W}{m^2} \right) = \frac{110,320,000 W}{104,000 m^2} = 1,061 \frac{W}{m^2}$$

Since installed capacity of the project was increased from 99 MWe to 110.32 MWe, project's power density is calculated different than given in the PD.

Despite this change, the power density is much higher than 10 (and 4) W/m², and the project is eligible and not expected to emit significant amounts of CH₄.

5.3 Leakage

There is no leakage related to the project activity.

5.4 Net GHG Emission Reductions and Removals

According to ACM0002, emission reductions are calculated as:

$$ER_y = BE_y - PE_y - LE_y$$

where

ER_y = Emission reductions in year y (t CO₂/yr)

BE_y = Baseline emissions in year y (t CO₂/yr)

PE_y = Project emission in year y (t CO₂/yr)

LE_y = Leakage emissions in year y (t CO₂/yr)

Revision and maintenance works were carried out during this Monitoring Period. In this context, there is no generation in Group 1 between 24/11/2018-10/01/2019. And there is no generation in Group 2 between 29/08/2018-16/11/2018. Also, the letter of conformity taken from TEIAS, which is the authorized transmission company in Turkey, for the revision and maintenance works has been

²¹ Please visit the methodology (paragraph 37, pages 12-13).

²² Darica General Site Plan

provided to VVB. The amount of electricity that was monitored (on the days that the maintenance works were conducted), were part of the overall monitored electricity generated for the GHG ER. Since there is no generation in these periods, the electricity generation and therefore the emission reduction amount is taken as “0” for the non-operating unit on these days. For the plants in group 1, generated electricity was taken as ‘0’ for 12th month in 2018. However, the electricity was generated on days, when revision and maintenance works were not carried out, in November 2018 and January 2019. In the same way, generated electricity for the plants in group 2 was taken as ‘0’ for 9th and 10th months in 2018. But the electricity was generated on days, when revision and maintenance works were not carried out, in August 2018 and November 2018. Meter Index documents, showing daily and hourly electricity generation for these dates, have been provided to VVB. According to these documents, it can be checked that the amount of electricity is taken as ‘0’ on the days of revision and maintenance works. As a result, all these circumstances have been considered for calculating GHG ER during this MP.

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net emission reductions or removals (tCO ₂ e)	GHG
2018	152,724	19	0	152,705	
2019 (01/01-09/10)	166,234	14	0	166,220	
Total	318,958	33	0	318,925	

As aforementioned above, Darica HPP is a run-of-river HPP, the electricity amount supplied to the grid depends on external physical conditions, i.e. the flow rate. That is why, actual emission reduction amounts are 14.21% lower than estimated amount since electricity generated is also lower than the estimated amount of electricity. As a result, the actual emission reductions are less than the estimated emission reduction amount.

APPENDIX 1: MONTHLY ELECTRICITY GENERATION DATA

Months	METERING DEVICE Electricity supplied to the grid (MWh) (1) Group 1	METERING DEVICE Electricity supplied to the grid (MWh) (2) Group 2	METERING DEVICE Electricity consumption from the grid (MWh) (3) Group 1	METERING DEVICE Electricity consumption from the grid (MWh) (4) Group 2	METERING DEVICE Net electricity supplied to the grid[MWh] (5) =(1+2)-(3+4)
Jan.18	14,072.80	15,852.50	9.50	24.30	29,891.50
Feb.18	12,036.10	17,887.40	41.00	0.00	29,882.50
Mar.18	11,589.50	19,299.70	49.50	0.00	30,839.70
Apr.18	1,062.40	9,784.10	66.50	0.00	10,780.00
May.18	3,243.90	10,587.70	60.90	0.00	13,770.70
Jun.18	11,294.40	21,342.52	46.98	5.60	32,584.34
Jul.18	1,152.60	19,037.92	72.17	9.09	20,109.26
Aug.18	12,775.66	11,340.40	42.78	14.53	24,058.75
Sep.18	7,743.09	0.00	43.01	0.00	7,700.08
Oct.18	9,163.43	0.00	43.94	0.00	9,119.49
Nov.18	4,327.81	5,492.10	42.02	16.06	9,761.83
Dec.18	0.00	20,162.20	0.00	28.89	20,133.31
Sum 2018	88,461.69	150,786.54	518.30	98.47	238,631.46
Jan.19	17,389.35	19,535.45	5.27	37.14	36,882.39
Feb.19	13,286.86	12,602.49	15.23	39.00	25,835.12

Months	METERING DEVICE Electricity supplied to the grid (MWh) (1) Group 1	METERING DEVICE Electricity supplied to the grid (MWh) (2) Group 2	METERING DEVICE Electricity consumption from the grid (MWh) (3) Group 1	METERING DEVICE Electricity consumption from the grid (MWh) (4) Group 2	METERING DEVICE Net electricity supplied to the grid[MWh] (5) =(1+2)-(3+4)
Mar.19	15,299.82	12,950.38	12.96	43.44	28,193.80
Apr.19	22,825.16	16,686.34	7.47	36.36	39,467.67
May.19	26,753.27	25,329.36	6.14	11.39	52,065.10
Jun.19	9,338.13	18,645.19	29.15	17.08	27,937.09
Jul.19	7,391.39	7,160.78	47.76	17.94	14,486.47
Aug.19	10,759.66	11,346.10	40.26	13.31	22,052.19
Sep.19	3,495.40	7,250.62	36.07	18.90	10,691.05
Oct.19	1,053.46	1,088.62	5.55	5.76	2,130.76
Sum 2019	127,592.50	132,595.33	205.86	240.32	259,741.64
Total Sum	216,054.19	283,381.87	724.16	338.79	498,373.10