



**Verified Carbon
Standard**

DARICA-1 99 MW HYDRO POWER PLANT MONITORING REPORT: 4TH VERIFICATION

Document Prepared by

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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 (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 fourth monitoring period covers the 5 years from 01-January-2013 to 31-December-2017 (both days included). Net electricity generation was achieved as 1,132,269.60 MWh, and actual emission reduction was realized as 724,399 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)	% by year
01- January -2013	31-December-2013	126,560	209,722	-40%
01- January -2014	31-December-2014	79,782	209,722	-62%
01- January -2015	31-December-2015	170,047	209,722	-19%
01- January -2016	31-December-2016	197,930	210,297	-6%
01- January -2017	31-December-2017	150,080	209,722	-28%
Total		724,399	1,049,185	-31%

¹ Electricity Generation Licence

² Electricity Generation Licence

As aforementioned above, Darıca 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 31% 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	Funda Yenici
Title	Project Representative
Address	Kuleli Sokak No.87/1 G.O.P. Çankaya/Ankara TURKEY
Telephone	+90 (0312) 446 30 23
Email	contact@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. Moreover, the project is not included in an ETS or other GHG trading mechanism. Since an ETS is not implemented in Turkey, an emission reduction cap has not been enforced for any sector.

1.11 Sustainable Development

Building a HPP contributes to a sustainable expansion path of the Turkish energy system, as it serves the steadily growing electricity demand in an environmentally suitable way. The project also

contributes to dissemination of state-of-the-art new renewable energy (REN) technology. This helps strengthening those pillars of Turkish energy supply that are based on ecologically sound and domestically sourced technology.

No significant negative ecological impacts can be expected from the proposed project activity. Darica HPP has undergone a full environmental impact assessment (**EIA**) according to Turkish law. The EIA Report has been approved on 15-March-2007 by the Turkish Ministry of Environment and Urbanization (Turkish: Türkiye Cumhuriyeti Çevre ve Şehircilik Bakanlığı, **TÇŞB** abrogated: **TÇOB**). A summary of the EIA Report is given in Section D of the registered PDD.

In fact, there are essential positive environmental effects, as highly polluting electricity generation technologies is displaced by the project. Pollution not only comprises greenhouse gases but other local air pollutants such as SO₂, NO_x, or Particulate Matter, as well.

As for social impacts, significant positive employment effects will occur especially during the construction and installation period. Management, operation and maintenance of the HPP creates permanent jobs which require high qualification, contributing to capacity building and know-how dissemination in Turkey. Moreover, since it is a renewable energy project, it contributes to achieve nationally stated sustainable development priorities which were indicated like in the law on use of renewable energy resources for electricity generation⁴. Introduction purpose of this Law; the use of renewable energy resources for electrical energy generation to spread these resources to the economy in a reliable, economical and quality manner, decreasing greenhouse gas emissions, utilizing wastes, protecting the environment and developing the manufacturing sector needed to achieve these objectives.

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.

⁴ <https://www.mevzuat.gov.tr/MevzuatMetin/1.5.5346.pdf>

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.

Stakeholder meeting was performed on 25-October-2021. Within this monitoring period as well, both of the mukhtars were interviewed about the project activities. In addition to the fact that they reported that they had no problems with the project, both of them said that they were still able to reach the project activity management via cell phone, any time they needed. Consequently, no negative comment or feedback received during the conversation with the Mukhtars.

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 EMRA⁵, 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.⁶

JP Morgan Ventures Energy Corporation was responsible for the previous verification processes of the Project⁷. For this monitoring period, carbon consultant of the Project, responsible of the project development, is Life İklim ve Enerji Ltd. Şti.

Table 1. Technical Specifications of Electricity Meters⁸

Name	Brand & Model	Serial Number	Accuracy Class
Main Meter 1	ELSTER & A1500	361509	0.2S
Back-up Meter 1	ELSTER & A1500	361510	0.2S
Main Meter 2	ELSTER & A1500	364713	0.2S
Back-up Meter 2	ELSTER & A1500	364714	0.2S

⁵ Energy Market Regulatory Authority

⁶ Electricity Generation Licence

⁷ Registered PD (Dated: 18 April 2009)

⁸ Test Protocols of Meters

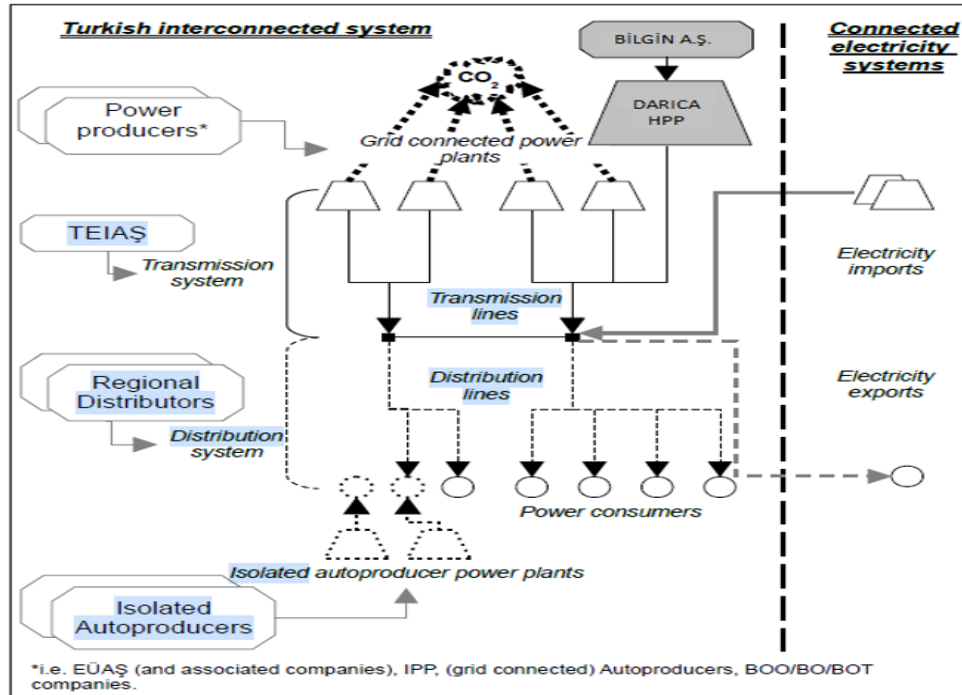


Figure 3. Single Line Diagram of Darica HPP

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 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).

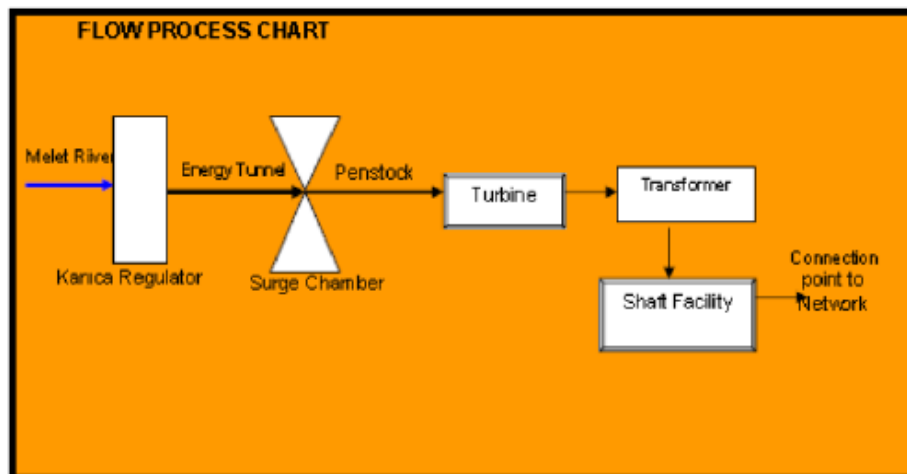


Figure 4. Process Flow Chart

3.2 Deviations

3.2.1 Methodology Deviations

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

3.2.2 Project Description Deviations

For the parameter E_{Gy} (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.

There is no project description deviation impacts 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.

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

⁹ Electricity Generation Licence

¹⁰ Electricity Generation Licence

Description	Net calorific value (energy content) of fossil fuel type i in year y
Source of data	Calculated for Turkish grid using TEİAS 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 /t
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	3,239 tonnes CO ₂ per tonne fuel
Justification of choice of data or description of measurement	Fossil fuel used in Standby generator

methods and procedures applied	
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 methods and procedures to be applied	Measured and recorded with the Monitoring Equipment detailed herein
Frequency of monitoring/recording	Continuous
Value monitored	1,132,270 MWh
Monitoring equipment	• TR-1: Main Electricity Meter 1 Make & model: Elster A1500-W043 Serial #: 361509 Official code: 11047 Last calibrated: 06/02/2008 Valid till: 05/02/2018 • Back-up Electricity Meter Make & model: Elster A1500-W043 Serial #: 361510 Last calibrated: 06/02/2008 Valid till: 05/02/2018 • TR-2: Main Electricity Meter 2 Make & model: Elster A1500-W043

	Serial #: 364713 Official code: 11048 Last calibrated: 02/04/2008 Valid till: 01/04/2018 • Back-up Electricity Meter Make & model: Elster A1500-W043 Serial #: 364714 Last calibrated: 02/04/2008 Valid till: 01/04/2018
QA/QC procedures to be applied	Two main electricity meters are backed up by two auxiliary meters. The maintenance and calibration of the meters has also been undertaken by TEİAŞ who ensure the accuracy and quality of the measurements. In accordance with Article 9 (b) of the “Inspection of Measurement and Measuring Equipments Regulation”¹¹, published in Turkish Official Gazette dated 15-January-2019 and No. 30647, the maintenance and calibration of meters should be undertaken every 10 years. If the difference between the readings of the main meter(s) and auxiliary meter(s) exceeds 0.2%, maintenance and calibration will be undertaken before waiting for the calibration period to end. Meter Reading Protocols based on the TEİAŞ data is used as a main source. Cross-check is done by using the EPIAŞ data.
Purpose of the data	Calculation of baseline emissions
Calculation method	The net electricity is calculated by: Subtracting self-consumption value from gross generation value for each month to find the net electricity supplied to the grid.

¹¹ <https://www.resmigazete.gov.tr/eskiler/2019/12/20191215.pdf>

	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 factor¹².
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 for average density of diesel fuel between (a) 820 kg/m³ and (b) 845 kg/m³, above is employed in the Project emissions calculations. Mass is calculated based on the following formula: • $M = Dv$ where: • $M = \text{Mass [kg]}$ • $d = \text{average density of diesel fuel (0.845 kg/L)}^{13}$ • $V = \text{Volume [Liters, L]}$ 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
Value monitored	90,996 L of diesel usage

¹² Please see registered PD for the calculation of CM emission factor.

¹³ 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

	90,996 L x 0.845 kg/L = 76,892 kg = 76.89 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 TEİAŞ using a system called EPIAŞ. Under this system, TEİAŞ 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. Therefore, the invoices do not exhibiting the monthly electricity production data by the Darica HPP alone. However, monthly EPIAŞ data can 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.

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 2.

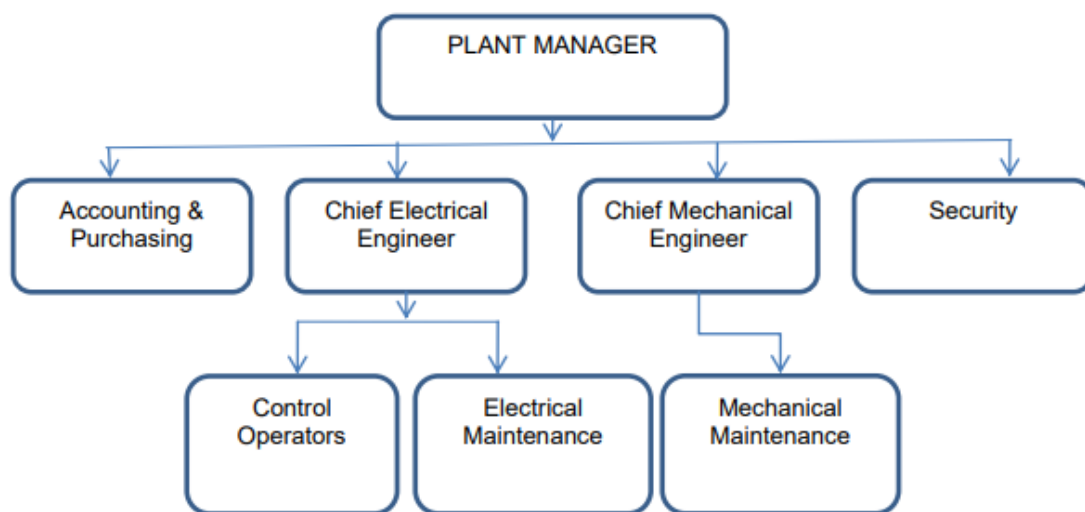


Figure 5. The Operational Flow of Darica HPP

Table 2. List of Employees

Employee	Roles
Osman Fırat ALKAN	Manager
Mahir BİLGİN	Administrative Chief
Sedat YILMAZ	Technician Chief
Adem ADIYAMAN	Maintenance & Operation
Selami ASMA	Maintenance & Operation
Mümtaz BİRLİKBAŞ	Maintenance & Operation
Mustafa GÜLER	Maintenance & Operation
Semih İHTİYAROĞLU	Maintenance & Operation
Muhammed BİÇER	Maintenance & Operation
Burak YAVUZ	Maintenance & Operation
Alican TAŞPINAR	Maintenance & Operation
Raci BİLGİN	Maintenance & Operation
Nurettin ERDEM	Maintenance & Operation
Berkay ÇUVALCI	Maintenance & Operation
Cihan SARICA	Security
Aydın YILDIRIM	Security
Tarık TAŞDÖĞEN	Security
Hacı Ahmet ÇİMENER	Security
Hüseyin GÖRÜNDÜ	Security
Murat ÖZPOLAT	Security
Selim ÇUVALCI	Driver
Şenol ATABAY	Cleaning Staff
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 7¹⁴. 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

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:

¹⁴ Please visit the methodology.

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

Where:

- $PE_{FC,j}$ 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: The CO₂ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO₂ emission factor of the fuel type i¹⁵, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

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

¹⁵ “i” is Diesel Fuel in this case

Project Emissions are therefore:

Table 3. Calculation of Project Emissions

Parameter	Value	Unit	Explanation
Total Diesel Consumption	90,996	L	The amount of diesel consumption which is recorded in the Project on-site logbooks.
Density of Diesel	0.845	kg/L	Per technical specifications of the diesel fuel provided to the market by the refineries of Turkey owned by a single company TUPRAŞ ¹⁶
M = dV	76,892	kg	Mass of Diesel used
FC_{i, j, y}	76.89	Ton	-
NCV_{i, y}	43.3	TJ/kt	-
EF_{CO2, i, y}	74.8	kgCO ₂ /TJ	-
COEF_{i, y}	3.24	tCO ₂ /tonne	-
PE	251.00	tCO ₂	-

The power density (PD) for the Darica HPP is calculated according to the directions given in the methodology¹⁷:

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

Reservoir area at maximum operating level= 104,000 m² ¹⁸

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

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.

¹⁶ 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

¹⁷ Please visit the methodology (paragraph 37, pages 12-13).

¹⁸ Darica General Site Plan

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)

$$BE_y = EG_{facility,y} * EF_{grid,CM,y}$$

$$EF_{grid,OMsimple,y} = 0.655 \text{ tCO}_2/\text{MWh}^{19}$$

$$EF_{grid,BM,y} = 0.624 \text{ tCO}_2/\text{MWh}^{20}$$

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

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;

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

¹⁹ Registered PD (Dated: 18 April 2009)

²⁰ Registered PD (Dated: 18 April 2009)

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/MWh²¹, net GHG emission reductions/removals are:

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)
2013	126,627	67	0	126,560
2014	79,833	51	0	79,782
2015	170,097	50	0	170,047
2016	197,986	56	0	197,930
2017	150,107	27	0	150,080
Total	724,650	251	0	724,399

²¹ Registered PD (Dated: 18 April 2009)

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.13	11.080,70	11.344,64	38,59	33,88	22.352,87
Feb.13	7.785,90	7.707,60	37,40	34,20	15.421,90
Mar.13	9.710,50	10.097,20	37,40	35,10	19.735,20
Apr.13	14.385,16	14.834,06	26,19	26,53	29.166,50
May.13	10.821,72	11.189,20	31,82	29,82	21.949,28
Jun.13	16.143,38	16.717,03	24,24	24,65	32.811,52
Jul.13	5.380,70	5.643,70	37,50	40,10	10.946,80
Aug.13	8.302,33	8.489,84	31,90	34,77	16.725,51
Sep.13	7.722,70	8.996,10	24,70	26,20	16.667,90
Oct.13	4.171,80	4.344,15	39,30	41,47	8.435,19
Nov.13	729,90	1.097,80	41,50	40,30	1.745,90
Dec.13	951,54	1.040,31	51,58	44,40	1.895,86
Sum 2013	97.186,34	101.501,62	421,87	411,29	197.854,80
Jan.14	1.168,53	1.378,73	50,13	47,87	2.449,27
Feb.14	563,00	596,50	44,80	42,70	1.072,00

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.14	2.033,82	726,44	45,22	48,44	2.666,60
Apr.14	839,40	907,00	44,80	42,90	1.658,70
May.14	5.566,50	5.801,30	36,30	40,20	11.291,30
Jun.14	5.497,81	6.257,21	17,89	34,53	11.702,60
Jul.14	3.681,10	3.365,00	10,70	32,10	7.003,30
Aug.14	1.125,70	1.303,70	20,50	26,30	2.382,60
Sep.14	13,40	1.156,70	31,40	38,80	1.099,90
Oct.14	8.773,10	961,05	28,85	15,92	9.689,38
Nov.14	16.687,38	9.169,11	23,63	17,43	25.815,43
Dec.14	23.473,00	24.465,70	16,00	14,20	47.908,50
Sum 2014	69.422,80	56.088,50	370,10	401,20	124.740,00
Jan.15	12.322,70	12.987,50	34,40	29,90	25.245,90
Feb.15	8.994,90	12.087,69	34,91	26,50	21.021,18
Mar.15	21.696,00	24.065,30	20,32	14,37	45.726,61
Apr.15	21.706,60	22.841,00	15,50	16,40	44.515,70
May.15	14.907,19	15.651,20	16,52	27,20	30.514,68
Jun.15	11.613,20	9.830,01	4,73	38,17	21.400,31

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)
<i>Jul.15</i>	8.818,09	8.529,79	0,00	46,08	17.301,80
<i>Aug.15</i>	1.720,80	1.254,70	4,70	46,90	2.923,90
<i>Sep.15</i>	8.414,40	8.616,92	0,02	41,73	16.989,56
<i>Oct.15</i>	11.096,50	11.291,50	0,10	43,70	22.344,20
<i>Nov.15</i>	1.760,39	4.359,87	13,21	40,27	6.066,78
<i>Dec.15</i>	5.800,70	5.976,10	41,10	9,00	11.726,70
Sum 2015	128.851,50	137.491,60	185,40	379,90	265.777,80
<i>Jan.16</i>	2.560,66	1.479,65	46,60	11,35	3.982,36
<i>Feb.16</i>	14.582,19	19.595,70	26,48	7,57	34.143,85
<i>Mar.16</i>	34.912,20	36.280,00	0,10	0,60	71.191,50
<i>Apr.16</i>	30.152,23	32.889,39	10,42	0,79	63.030,40
<i>May.16</i>	11.314,15	16.720,01	7,70	34,69	27.991,77
<i>Jun.16</i>	7.944,10	26.053,00	0,00	21,80	33.975,30
<i>Jul.16</i>	18.694,45	21.422,74	0,01	28,16	40.089,02
<i>Aug.16</i>	12.584,30	12.907,10	0,10	40,70	25.450,60
<i>Sep.16</i>	0,90	346,80	0,00	54,60	293,10
<i>Oct.16</i>	131,08	175,71	35,05	24,53	247,22

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)
Nov.16	60,50	312,50	56,20	0,30	316,50
Dec.16	4.393,22	4.307,64	59,24	0,00	8.641,54
Sum 2016	137.330,13	172.490,38	241,79	225,14	309.353,57
Jan.17	9.473,44	4.972,55	49,65	0,11	14.396,24
Feb.17	3.507,10	4.747,80	55,40	0,20	8.199,30
Mar.17	15.816,26	14.395,25	37,87	7,34	30.166,30
Apr.17	14.630,20	24.876,30	0,00	16,10	39.490,40
May.17	22.657,63	27.674,39	25,30	1,51	50.305,20
Jun.17	21.861,60	29.205,50	24,10	0,00	51.043,00
Jul.17	1.438,30	8.493,20	66,80	0,00	9.864,70
Aug.17	863,89	5.650,34	69,97	0,04	6.444,22
Sep.17	222,30	2.468,50	60,30	0,10	2.630,40
Oct.17	584,09	4.322,91	67,22	0,06	4.839,72
Nov.17	664,20	3.959,00	22,00	33,60	4.567,60
Dec.17	2.148,20	10.492,55	0,00	44,80	12.596,96
Sum 2017	93.867,34	141.258,21	478,56	103,67	234.543,32
Total Sum	526.658,10	608.830,30	1.697,60	1.521,20	1.132.269,60