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# Gezin SPP – Certifying Gold Standard Project Using Renewable Energies

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MSc

Todas as correções determinadas pelo júri, e só essas, foram efetuadas.

O Presidente do Júri,

Porto, ______/______/_________

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# Resumo

Este relatório tem como objetivo apresentar o estágio curricular, realizado no âmbito do Programa da União Europeia denominado Erasmus +, desenvolvido na Life İklim ve Enerji Ltd. Şti, em Ancara, na Turquia. Pertencente a esta unidade curricular do 2º ano do Mestrado em Ciências e Tecnologias Ambientais da Faculdade de Ciências da Universidade do Porto e ver este trabalho obter o grau de Mestrado em Ciências e Tecnologias Ambientais da Universidade do Porto.

Portanto, este documento aborda a temática da redução de emissões de carbono na atmosfera usando energias renováveis, neste caso específico energia solar, com vista combater as alterações climáticas. Consequentemente, foi feito um pedido de certificação de redução de emissões de carbono a uma entidade certificadora, o Gold Standard for Global Goals, usando um projeto de campo solar chamado Gezin Solar Power Plant. Este trata-se de um projecto voluntário, sendo que mostra de forma clara a preocupação dos proponentes em reduzir a sua pegada de carbono.

**Palavras Chave:** Redução de Emissões, Energias Renováveis, Energia Solar, Alterações Climáticas, Certificação, Voluntário, Pegada de Carbono

# Abstract

This report aims to present the curricular internship, carried out under the European Union Program called Erasmus +, developed at Life İklim ve Enerji Ltd. Şti in Ankara, Turkey. Belonging to this curricular unit of the 2nd year of the Master's in Environmental Sciences and Technologies of the Faculty of Sciences of the University of Porto and seeing this work obtain the Master of Environmental Sciences and Technologies degree from the University of Porto.

Therefore, this paper addresses the issue of certification of carbon emissions reduction in the atmosphere using renewable energies, in this specific case solar energy, in order to combat climate change. Consequently, a carbon reduction certification application was made to a certification body, the Gold Standard for Global Goals, using a solar field project called Gezin Solar Power Plant. This is a voluntary project and clearly shows the proponents' concern to reduce their carbon footprint.

**Keywords**: Emission Reduction, Renewable Energy, Solar Energy, Climate Change, Certification, Voluntary, Carbon Footprint

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# List of Abbreviations

**AAUs** - Assigned Amount Units

**AMS** - Applied Methodology Standard

**BM -** Build Margin

**CDM -** Clean Development Mechanism

**CE -** Carbon Emissions

**CERs -** Certified Emissions Reductions

**CM -** Combined Margin

**CSR -** corporate social responsibility

**EF -** Emission Factor

**ETS -** Emission Trading Systems

**EU -** European Union

**EU ETS -** European Union Emissions Trading System

**GHG -** Greenhouse Gases

**GS4GG -** Gold Standard for Global Goals

**HCV -** High Conservation Value

**ILO -** International Labour Organization

**JI -** Join Implementation

**LCR -** Low-Cost Resource

**LSC –** Local Stakeholder Consultation

**MRV -** Measurement Report and Verification

**ODA -** Official Development Assistance

**OM -** Operating Margin

**PDD** – Project Design Document

**PV -** Photovoltaic

**RE -** Renewable Energies

**REED -** Reducing Emissions from Deforestation and Forest Degradation

**SC -** Social Carbon

**SFR –** Stakeholder Feedback Round

**SPP -** Solar Power Plant

**TEIAS -**Turkish Electricity Transmission Corporation

**UDHR -** Universal Declaration of Human Rights

**UN -** United Nations

**UNESCO -** United Nations Educational, Scientific and Cultural Organization

**UNFCCC -** United Nations Framework Convention on Climate Change

**VER –** Verified Emission Reduction

**VCM** – Voluntary Carbon Market

**VCS -** Verified Carbon System

# Chapter 1: Introduction

On a planet increasingly affected by the constant climate changes that threaten the future of generations, day by day, it is essential to find fast, feasible solutions that meet a society in constant evolution and development. Being one of the solutions, the enforcement of laws that punish anyone, company or individual, in any way, excessively uses the resources that belong to everyone.

One of the most effective ways to fairly control and distribute the use of natural resources is the Carbon Market. Therefore, those who somehow, by their activity produces more, will, if they exceed the previously established limit, have the opportunity to simply and above all, acquire emissions that others do not use.

The Carbon Market makes it fairer for both society and the environment, and in many countries, it is a regulated and compulsory market (in the European Union, for example, exists the EU ETS (European Union Emissions Trading System). In Turkey's case companies voluntarily purchase and trade emissions in an attempt to lower their carbon footprint, mitigate climate change affects and, above all, become more environmentally friendly.

Carbon Emissions (CE) that, through emission quotas, set limits according to the strategic importance and / or size of the company. During the internship, projects were developed in several areas, focusing on this theme, using renewable energies, specifically solar energy. Such projects help sustainable development and the reduction of emissions and the production of clean energy. They also show companies' concerns and their efforts to improve the quality of life, the planet, and the environment as well as their ecological footprint.

## 1.1 Report structure

This report is divided into four chapters: Introduction, Theoretical Framework, Performed activities during the Internship and Conclusions.

In the first chapter, a brief note concerning the master's degree Course, the host country, and the program of study as well as the company is mentioned. A brief description of the main objectives, general and specific

The second chapter gives a brief theoretical framework of the theme and show it in numbers. From the state of the market, to sellers and buyers passing to the different existent mechanisms.

The third chapter presents the development of all the methodology in projects developed and works done during the Internship, the mathematical expressions of the calculation to be made for the certification of the Gezin SPP project, the study of the area, the expected results and the obtained ones.

To conclude, the fourth chapter is the one where the final considerations will be presented, namely the limitations encountered in carrying out the work, some suggestions of the way forward, and an appreciation of what could be improved.

# Chapter 2: Theoretical framework

## 2.1 Voluntary Carbon Market

According to Nordic Initiative for Cooperative Approaches (2019), Voluntary Carbon Market (VCM), also called Carbon Offsetting Market, is a carbon pricing practice. It was designed in addition to the mandatory carbon markets. Includes several mechanisms as Emission Trading, Joint Implementation (JI), and Clean Development Mechanism (CDM).

The VCM was developed under the Kyoto Protocol. This protocol signed on 11th December 1997 by 84 countries (also known as Annex B countries) has set limits on GHG emissions for countries that have ratified the agreement. Each country, according to its characteristics, received a target of emissions and correspondent allowances - also known as Assigned Amount Units (AAUs).

On average, it required countries to reduce their emissions by 5.2%, below 1990 levels between 2008 and 2012. To this end, three options were suggested to the signatories:

- Reduce their emissions;
- Negotiate emission allowances with other countries with excess benefits;
- Buying carbon credits

To enable greater flexibility and increase the cost-effectiveness of reducing emissions, the protocol then established so-called Flexible Mechanisms.

- Clean Development Mechanism (CDM);
- Join Implementation (JI)

### 2.1.1 Clean Development Mechanism (CDM)

It enables targets to be met by the most developed countries that have signed the agreement by financing carbon reduction projects in the least developed and/or developing countries.

This type of mechanism is beneficial to both parties as the "buyer" invests and clean energy in a country where labour is cheaper, has lower efficiency, and significantly lower legal requirements and provides investment in the country. Host and encourages sustainable development. CDMs thus generate emission credits called Certified Emissions Reductions (CERs). Each unit is equivalent to one ton of CO2 that can later be used, purchased and / or traded (UNFCCC, 2018c).

### 2.1.1 Joint Implementation (JI)

The way it works is similar to the CDM, but the significant difference is that the host country is not a developing country but one belonging to the Annex B countries. In this mechanism, tradable units are referred to as Emission Reduction Units (ERUs). Because they are two countries that have a general reduction target, they have a more emissions trading component rather than a credit component compared to the CDM (UNFCCC, 2018b).

The Kyoto Protocol thus tries to bring together a group of countries by making them interact and help each other. The 15 EU countries (at the date of signing the agreement) then decided to form the EU Emission Trading Scheme (EU-ETS), which started in 2005. As the most significant active cap-and-trade scheme, limiting emissions and allowances, making them trade between countries.

## 2.2 Carbon Offsets in Numbers

According to the Ecosystem Marketplace (2018), before 2018, Carbon Offset was divided into seven distinct categories: Energy Efficiency / Fuel Switching, Forestry, and Land Use, Gases, Household Devices, Methane, Renewable Energy and Others. Since 2018 it has been divided into eight categories and 44 project types. The following table shows the different project types by category.

**Table 1:** Carbon offset project categories and types after 2018

| **Project Category** | **Project Type** |
|---|---|
| Agriculture | Fertilizer – N20 |
| | Grassland/rangeland management |
| | Livestock methane |
| | No-till/low-till agriculture |
| | Rice cultivation/management |
| | Sustainable agricultural land management |
| | Other – Agriculture |
| Chemical Processes/Industrial Manufacturing | Nitric Acid |
| | Ozone-depleting substances |
| | Ozone-depleting substances (US-based) |
| | Carbon capture and storage |

| | |
|---|---|
| | Coal mine methane |
| | Other – Chemical Processes/Industrial Manufacturing |
| Energy Efficiency/Fuel Switching | Energy efficiency – community-focused (targeting individuals, communities, etc.) |
| | Energy efficiency – community-focused (targeting corporations) |
| | Fuel switching |
| | Waste heat recovery |
| | Other - Energy Efficiency/Fuel Switching |
| Forestry and Land Use | Afforestation/reforestation |
| | Agro-forestry |
| | Avoid conversion |
| | Improved forest management |
| | REDD – Avoided planned deforestation |
| | REDD – Avoided unplanned deforestation |
| | Soil carbon |
| | Urban forestry |
| | Wetland restoration/management |
| | Other - Forestry and Land Use |
| Household Devices | Clean cookstove distribution |
| | Water purification device distribution |
| | Other - Household Devices |
| Renewable Energy | Biogas |
| | Biomass/biochar |
| | Geothermal |
| | Large Hydro |
| | Run-of-river hydro |
| | Solar |
| | Wind |
| | Other - Renewable Energy |
| Transportation | Transportation – private (cars/trucks) |
| | Transportation – public (bikes/public transit) |
| | Other – Transportation |
| Waste Disposal | Landfill methane |
| | Wastewater methane |
| | Other – Waste Disposal |

Source: Voluntary Carbon Markets Insights:2018 Outlook and First-Quarter Trends (2018)

After that, according to also the study of the Ecosystem Marketplace (2018), the Number of offsets issue divided by Category (2008-2018) is giving in the table below.

**Table 2**: Number and Volume ($MtCO_2e$) of Issued Project Offsets per Project Category

| Project Category | Projects with Issued Offsets | The volume of Offsets issued in MtCO2e (2005- 2018) |
|---|---|---|
| Agriculture | 87 | 6.7 |
| Chemical Processes/Industrial Manufacturing | 72 | 63.5 |
| Energy Efficiency/Fuel Switching | 633 | 127.9 |
| Forestry and Land Use | 170 | 95.3 |
| Household Devices | 161 | 23.4 |
| Renewable Energy | 611 | 61.9 |
| Transportation | 43 | 1.1 |
| Waste Disposal | 238 | 57.5 |

Source: Voluntary Carbon Markets Insights:2018 Outlook and First-Quarter Trends (2018)

Voluntary Carbon Offsets are produced in 83 countries, and mostly they can be traded freely between sellers and buyers, indifferent or the same countries. Some countries have their domestic markets, and they encourage citizens to buy locally-produced offsets.

Since 2005, 2,008 projects have issued offsets (not all of them were used in voluntary markets, some of them may be used for compliance purposes).
The table above shows the distribution (per percentage) of them.

**Table 3**: Distribution (%) per Geographical Zone of the Carbon Offsets

| Zone | Percentage |
|---|---|
| Asia | 51 |
| North America | 18 |
| Latin America and the Caribbean | 11 |
| Europe | 11 |
| Africa | 11 |
| Oceania | 1 |

Source: Voluntary Carbon Markets Insights:2018 Outlook and First-Quarter Trends (2018)

From the 435.4 MtCO2e of offsets issued until 2018, 39% were produced in Asia, 26% in North America, Africa (13%), Latin America and the Caribbean (12%), Europe (9%) and Oceania (1%).

The Top Five project hosting countries represent almost three quarters (72%) of all voluntary carbon projects. The table 4 and figure 1 show it, in numbers.

**Table 4:** Top Five project hosting countries vs. Nº of Voluntary Carbon Projects

| Country | Nº of Voluntary Carbon Projects |
|---|---|
| India | 442 |
| China | 426 |
| United States | 351 |
| Turkey | 124 |
| Brazil | 97 |

Source: Voluntary Carbon Markets Insights:2018 Outlook and First-Quarter Trends (2018)

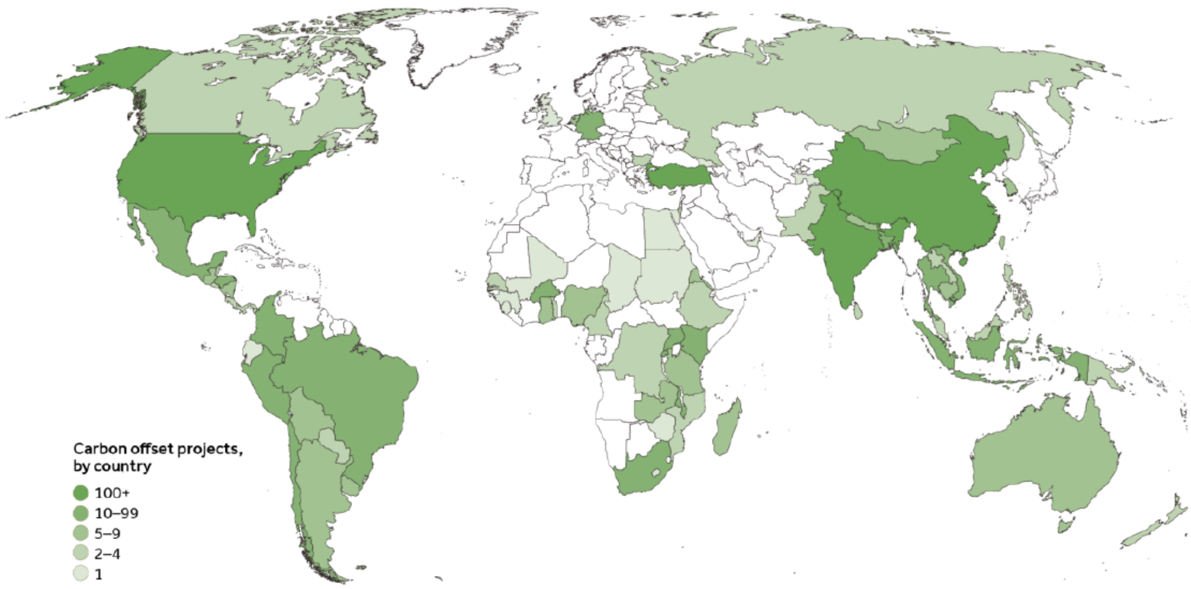



**Figure 1:** Voluntary Carbon Offset Projects Location, 2008-2018**.** Source: Voluntary Carbon Markets Insights – 2018 Outlook and First-Quarter Trends (2018)

**Note:** Map shows only projects that issued offsets through specific standards (from 2008 to Q1 2018: American Carbon Registry, Climate Action Reserve, Gold Standard, Plan Vivo, and Verified Carbon Standard).

## 2.2 Status of Voluntary Carbon Market

If we compare the demand for mandatory with voluntary carbon markets, we conclude that the second one is substantially smaller. It affects the price, that it's much lower than other emission reduction certificates, with the EU ETS, for example, with a unit price around €24 in April 2019 while VER credits with VCM between €0,30 – 0,80. Due to their free and voluntary nature, voluntary markets are subject to demand, which means that they cannot compete in the same way as mandatory and legislated markets. As long as a

The average price for a GS VER credit was less than €1/tCO2e in 2016, and it is now around €0.6/tCO2e in 2019. The following three significant parameters affect the price of VER credits:

- Project type (e.g., Hydro, WPP, SPP): VER credits with relatively less environmental and social negative impacts such as SPP and WPP projects find buyers at higher prices.
- Vintage Year: Recently issued credits find buyers at a higher price.
- Trade volume: The unit price decreases as the trade volume increases
- Type of certificate (the Standard): Gold Standard VER credits find buyers at higher prices concerning VCS VER credits.

By operating outside compliance markets, voluntary markets allow businesses, governments, individuals, and NGOs to offset their emissions. It can be done purchasing offsets through the CDM or in voluntary carbon market (Verified or Voluntary Emission Reductions - also called VERs). The demand here is only created for buyers, while in the regulated market, it is by a regulatory instrument. Because of their lower demand, and they can't be used in compliance markets, VERs are cheaper than Certified Emission Reduction (CERs) credits.

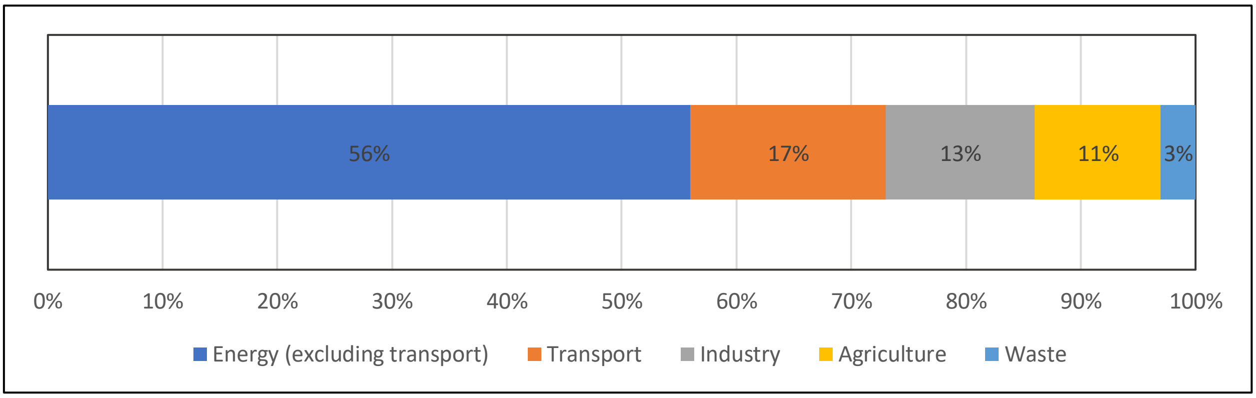
In April 2012, Turkey adopted a new regulatory framework. Monitoring started in 2015 and reporting of 2015 emissions in 2016. In the last years, the country has been developing draft legislation and improving capacity (technical and institutional) to move for a suitable carbon pricing policy (ICAP, 2019).

**Table 5**: Overall GHG emissions in Turkey by sector

| | |
|---|---|
| Overall GHG emissions by sector | Energy (excluding transport) 279.2 (56%) |
| | Transport 81.8 (17%) |
| | Industry 62.4 (13%) |
| | Agriculture 56.5 (11%) |
| | Waste 16.2 (3%) |
| Overall GHG emissions | 496.1 MtCO2e (2016) |

Source: International Carbon Action Partnership (ICAP) – Status Report (2019)

The major source of emissions in the country is the Energy sector, followed by transport and Industry. The Energy sector alone, produce more emissions than all the other sectors together as we can see in the graphic 1.




**Graphic 1:** GHG emissions by sector in Turkey in percentage in 2019. Source: International Carbon Action Partnership (ICAP) – Status Report (2019)

# Chapter 3 Performed activities in The Internship

## 3.1 The company

The **Life İklim ve Enerji Ltd. Şti.** is a privately held environmental consulting company based in Ankara, Turkey. Composed of a team of professionals with twelve years of experience in Climate Change and Carbon Market and sixteen in the Renewable Energy market. With consultancy work on emission reductions in Turkey including geothermal, solar, wind, hydropower and landfill gas projects converting these into electricity as well as energy efficiency projects since 2009, the team has developed over 100 certification projects in the Voluntary Carbon Market divided into Gold Standard, VCS and Social Carbon.

Experts in energy legislation and climate change, sectoral emissions and the MRV (Measurement, Reporting, Verification) system in the country.

Its work focuses mainly on the following issues:

- Climate change;
- MRV (Measurement, Reporting, and Verification);
- ETS (Emission Trading Systems);
- Voluntary Carbon Market;
- Development of Renewable Energy projects.

## 3.2 Internship Description

During the internship period, the main objective was to develop the skills and learning obtained during the master’s degree, being involved in all areas of the company, focusing on renewable energy projects and carbon market. In the first phase, be in contact with the working methods of the company, and a second phase, apply the knowledge practically.

Throughout the certification process, the report was developed from scratch, from clarification contacts with the certifying entity to the writing of the document and respective corrections, having the whole process followed during the stay in the company.

## 3.3 Key project information

The methodology developed has as its main objective, using the CDM calculation tools, to obtain the certification of the Gezin Solar Power Plant project (Gezin SPP) by the certification body chosen by the company, Gold Standard for Global Goals. Using a standard report, updated at the time of this work, taking into account country specificities and default values.

Table 1 gives a brief description of the project, its main objectives, and business details such as the entities involved, and methodologies applied in the report writing.

**Table 6**: General description of the project

| **Title of Project:** | **Gezin Solar Power Project (Gezin SPP)** |
|---|---|
| **Brief description of Project:** | The main purpose of this project activity is to generate electricity from a micro-scale solar power plant and supply of power generated to the Turkish national utility grid. The generated energy will be fed into Gezin Distribution Center which is connected to the grid through Hazar-1 Substation. Gezin SPP is a bundled project, involves installation and operation of 3 unlicensed (GEZİN 3, GEZİN 4, GEZİN 5) solar power projects. The total installed capacity of the project is 2.97 MW.<br>The generated power from this Project activity will be supplied to the grid. The generation of electricity from solar power is a clean technology as there is no fossil fuel-fired or no GHGs are emitted during the process. |
| **Expected Implementation Date:**<br>**Expected duration of the Project:** | 15/01/2018<br>25 years |
| **Project Developer:** | Life İklim ve Enerji Ltd. Şti. |
| **Project Representative:** | Life İklim ve Enerji Ltd. Şti. |
| **Project Participants and any communities involved:** | Lahit Elektrik Üretim A.Ş. (Bundling Agency)<br>Petrojes Elektrik Üretim A.Ş. |
| **Host Country / Location:** | Turkey |

| | |
|---|---|
| Certification Pathway (Project Certification/Impact Statements & Products | Project Certification |
| Methodologies applied: | AMS I.D. Version 18.0 |
| Regular/Retroactive: | Retroactive |
| SDG Impacts: | 1 – SDG7 Affordable and Clean Energy<br>2 – SDG8 Decent Work and Economic Growth<br>3 – SDG13 Climate Action |
| The estimated amount of SDG Impact Certified | 3,062 tCO2e |

## 3.4 Description of the project

Lahit Elektrik Üretim A.Ş. (hereafter referred to as "Lahit") and Petrojes Elektrik Üretim A.Ş. invested into a new Solar Power Project called Gezin Solar Power Project (hereafter referred to as the "Project" or "Gezin SPP"). Gezin SPP involves the installation and operation of 3 unlicensed (GEZİN 3, GEZİN 4, GEZİN 5) solar power projects. "Lahit" is the bundling agency in this project. The total installed capacity of the project is 2.97 MW. The generated energy will be fed into Gezin Distribution Center, which is connected to the grid through Hazar-1 Substation. In the same project field, there is the second and third unlicensed solar plant.

An estimated electricity net generation of 5,400 MWh (1800 MWh/y for each unlicensed SPP) per year by the efficient utilization of the available solar energy by project activity will replace the grid electricity, which is constituted of different fuel sources, mainly fossil fuels. The electricity produced by project activity will result in a total emission reduction of 3,062 tonnes of $CO_2$e/year. The total emission reduction by the project activity is estimated to be 15,310 tonnes of $CO_2$e for the first crediting period, which is 15/01/2018 to 14/01/2023. Moreover, project activity will contribute to further dissemination of solar energy and the extension of national power generation. The acceptance of a 2.97 MW unlicensed plant took place on 15/01/2018, and the generation started on 15/01/2018. Thus, the first crediting period started on 15/01/2018.

Reduce greenhouse gas emissions in Turkey compared to the business-as-usual scenario,

- Help to stimulate the growth of the solar power industry in Turkey,
- Create local employment during the construction and the operation phase of the solar plant,
- Reduce other pollutants resulting from the power generation industry in Turkey, compared to a business-as-usual scenario,
- Help to reduce Turkeys increasing energy deficit,
- and differentiate the electricity generation mix and reduce import dependency.

As the project developer, Lahit believes that the efficient utilization of all kinds of natural resources with harmony coupled with responsible environmental considerations is vital for the sustainable development of Turkey and the World. This has been a guiding factor for the shareholders towards the concept of designation and installation of a solar power project. Other than the objective of climate change mitigation through a significant reduction in greenhouse gas (GHG) emissions, the project has been carried out to provide a social and economic contribution to the region in a sustainable way. The benefits that will be gained by the realization of the project compared to the business-as-usual scenario can be summarized under four main indicators:

### 3.4.1 Environmental benefit

The project activities will replace the grid electricity, which is constituted of different fuel sources causing greenhouse gas emissions. By replacing in the consumption of these fuels, it contributes to the conservation of water, soil, flora and faunas and transfers these natural resources and also the additional supply of these primary energy sources to the future generations. In the absence of the project activity, an equivalent amount of electricity would have been generated from the power plants connected to the grid, the majority of which are based on fossil fuels. Thus, the project is replacing the greenhouse gas emissions (CO2, CH4) and other pollutants (SOX, NOX, particulate matters) occurring from extraction, processing, transportation, and burning of fossil fuels for power generation connected to the national grid.

### 3.4.2 Economic benefit

Firstly, the project will help to accelerate the growth of the solar power industry and stimulate the designation and production of renewable energy technologies in Turkey. Then, other entrepreneurs, irrespective of the sector will be encouraged to invest in solar power generations. It will also assist in reducing Turkey's increasing energy deficit and diversify the electricity generation mix while reducing import dependency, especially natural gas. Importantly, rural development will be maintained in the areas around the project site by providing infrastructural investments to these remote villages.

### 3.4.3 Social benefit

All project activities will enhance local employment during the construction and operation of the solar plant. As a result, local poverty and unemployment will be partially eliminated by increased job opportunities and project business activities. Construction materials for the foundations, cables, and other auxiliary equipment will preferentially be sourced locally. Moreover, as the contribution of the project to the welfare of the region, the quality of the electricity consumed in the region will be increased by local electricity production, which also contributes decreasing in distribution losses.

### 3.4.4 Technological benefit

Implementation of the proposed project will contribute to the wider deployment of solar power technology at the local and national level. It will demonstrate the viability of larger grid-connected solar power plants, which will support improved energy security, alternative sustainable energy, and also renewable energy industry development. This will also strengthen the pillars of the Turkish electricity supply based on ecologically sound technology.

## 3.5 Eligibility of the project under Gold Standard

"Gezin Solar Power Project" is classified in the Renewable Energy Source category as electricity from non-fossil and non-depletable energy sources, in this case from solar, is fed into the Turkish electricity grid.

This is not a grouped project activity. The project activity is a bundle of 2 project participants.

The project activity meets the eligibility criteria as per section 3.1.1 of GS4GG Principles & Requirements document as described below:

- The project applies methodology AMS I.D., which is an approved methodology under the Gold Standard.

- The project is micro-scale and the type is solar, which is an eligible project type as it is in following 1.1.1 a) and 1.1.1 b) of the Eligible Project Types & Scope under Renewable Energy Activity Requirements.

- The project activity results in the displacement of electricity from solar power stations while contributing to the sustainable development of Turkey. Hence, the project contributes to the Gold Standard Vision and Mission.

- This project activity is not associated with geoengineering or energy generated from fossil fuel or nuclear, fossil fuel switch, nor does it enhance or prolongs such energy generation

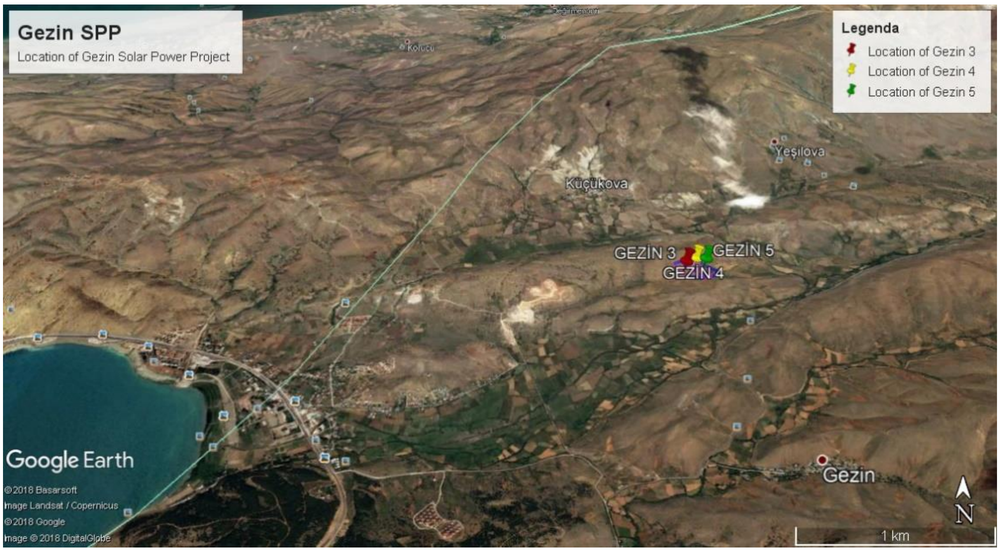
## 3.6 Project site

The project is located close to the Maden district of Elazığ. The project area is in Elazığ province, Küçükova village in the Maden district, Republic of Turkey.

### 3.6.1 Physical/Geographical location

The project site is given below in Map 1.

The project site is located in Maden district of Küçükova village, in Elazığ province of Turkey. The closest village is Küçükova village. The closest settlement is 1,130 m away from the top view. The geographical coordinates of the project site are given in Table 2.




**Map 1**: Location of Gezin Solar Power Project

**Table 7**: Geographical coordinates of the project activity

| Project | Latitude (N) | Longitude (E) |
|---|---|---|
| GEZİN 3 | 38º 31’ 55.7’’ | 39º 33’ 04.6’’ |
| GEZİN 4 | 38º 31’ 56.05’’ | 39º 33’ 06.00’’ |
| GEZİN 5 | 38º 31’ 56.05’’ | 39º 33’ 07.13’’ |

**Table 8**: Technical specifications

| Technical detail of the equipment of 0.999 $MW_e$ unlicensed plant | Remark | | |
|---|---|---|---|
| The Project | Gezin 3 | Gezin 4 | Gezin 5 |
| Type of system | Grid-connected photovoltaic (PV) Power Plant | | |
| Type of PV modules | CSUN270-60P Polycrystalline PV Modules | | |
| Number of modules | 4334 | 4312 | 4312 |
| Capacity of each module | 1170,18 kWp | 1164,24 kWp | 1164,24 kWp |
| Module supplier | CSUN | | |
| Inverter capacity | 50kW but one invertor is set to 35 kW* | | |
| Number of inverters | 20 | | |
| Inverter type | KACO blueplanet 50.0 TL3 M1 | | |
| Module guarantee | Ten years of physical resistance<br>Twenty-five years of performance guarantee | | |
| Inverter guarantee | At least five years product guarantee | | |

* To not exceed the installed capacity, an invertor in each power plant was set to 35 KW.

## 3.7 Technologies and/or measurements

The technology being employed converts solar energy into electrical energy. The technology is environmentally friendly since there are no GHG emissions associated with electricity generation.

The proposed PV project will use crystalline silicon-based solar PV modules. Since the project activity is a Greenfield installation, there was no electricity generation at the project site before its implementation. Technical specifications of typical modules will be as follows:

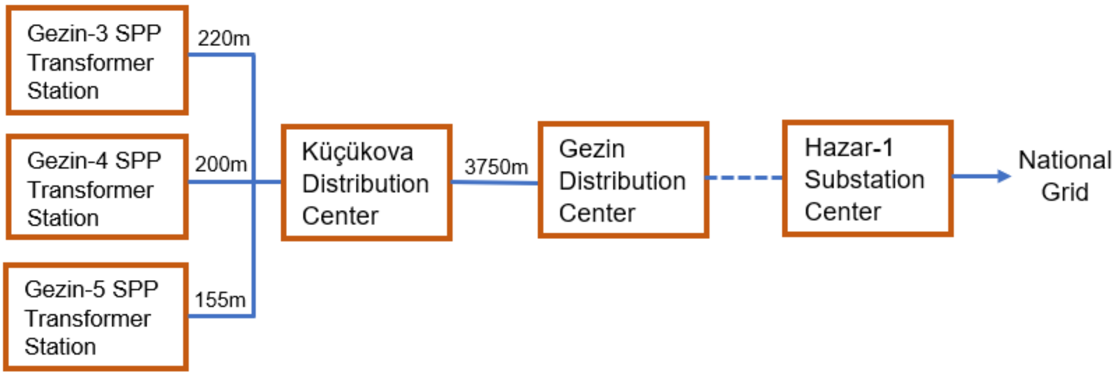



**Figure 2**: Electrical single-line diagram

The technical lifetime of Lahit is determined by using the 'Tool to determine the remaining lifetime of equipment'' (v. 1) .

In the tool it is stated that project participants may use one of the following options:

(a) Use manufacturer's information on the technical lifetime of equipment and compare to the date of first commissioning;

(b) Obtain an expert evaluation;

(c) Use default values.

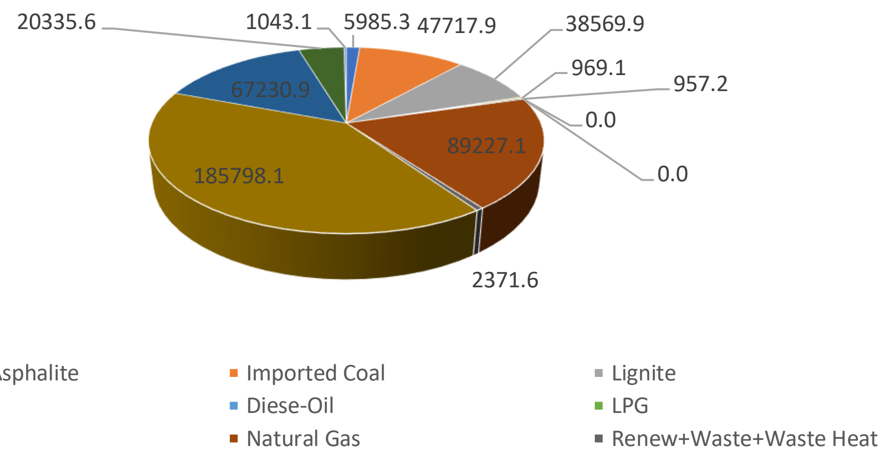
For the project, **option (a)** is used. According to the equipment agreement, the system has 25 years of 80.7% performance warranty.

The project activity will achieve emission reductions by avoiding $CO_2$ emissions from the business-as-usual scenario electricity generation produced by mainly fossil fuel-fired power plants within the Turkish national grid (Graphic 2) Total emission reduction over the 5 year crediting period is expected to reach **15,310 $tCO_2e$** with the assumed total net electricity generation of **5,400 MWh** per year

**Table 9**: Share of Sources in Electricity Generation in Turkey 2016

| Source | Value (GWh) | Percentage (%) |
|---|---|---|
| Hard Coal+Asphalite | 5985,3 | 1,30 |
| Imported Coal | 47717,9 | 10,37 |
| Lignite | 38569,9 | 8,38 |

| | | |
|---|---|---|
| Fuel-Oil | 969,1 | 0,21 |
| Diesel-Oil | 957,2 | 0,21 |
| LPG | 0,0 | 0 |
| Napta | 0,0 | 0 |
| Natural Gas | 89227,1 | 19,39 |
| Renew+Waste+Waste Heat | 2371,6 | 0,52 |
| Thermal | 185798,1 | 40,37 |
| Hydro | 67230,9 | 14,61 |
| Geothermal+Wind | 20335,6 | 4,42 |
| Solar | 1043,1 | 0,23 |
| **Total** | **460205,8** | **100** |



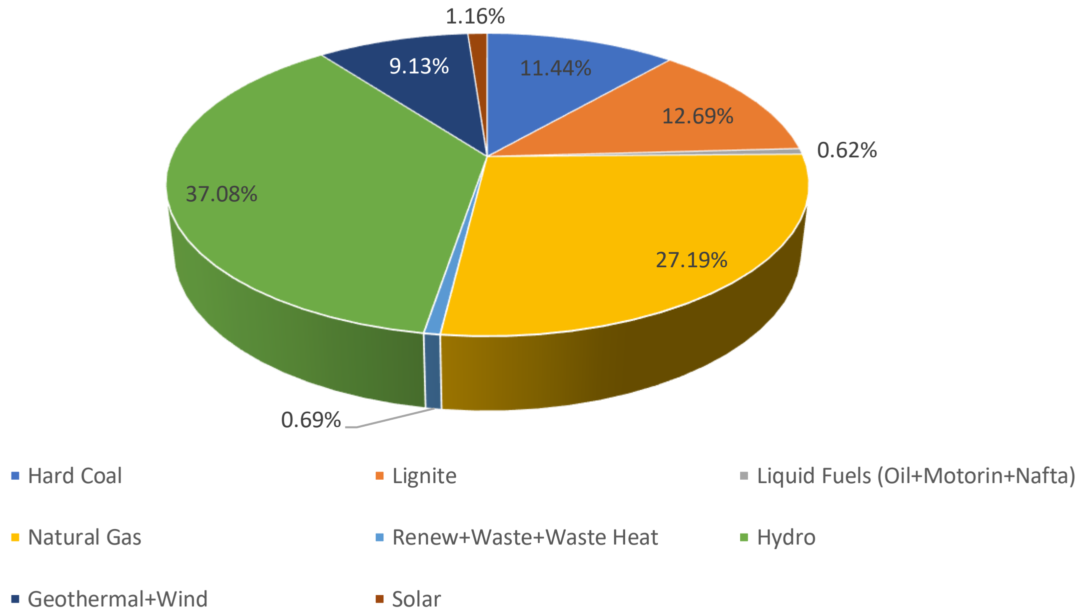

**Graphic 2:** Percentage of Share of Sources in Installed Capacity 2016 (MW). Source: Annual Development of Turkey's Installed Capacity by Primary Energy Resources, TEIAS 2016

**Table 10**: Share of Sources in Electricity Installed Capacity in Turkey 2016

| **Source** | **Value (MW)** | **Percentage (%)** |
|---|---|---|
| Hard Coal | 8228,9 | 11,44 |
| Lignite | 9126,5 | 12,69 |
| Liquid Fuels (Oil+Motorin+Nafta) | 445,3 | 0,62 |
| Natural Gas | 19563,6 | 27,19 |

| | | |
|---|---|---|
| Renewables+Waste+Waste Heat | 496,4 | 0,69 |
| Hydro | 26681,1 | 37,08 |
| Geothermal+Wind | 6572,2 | 9,13 |
| Solar | 832,5 | 1,16 |
| **Total** | **71946,5** | **100** |

Source: Annual Development of Turkey's Installed Capacity by Primary Energy Resources, TEIAS 2016




**Graphic 3**: Share of Sources in Electricity Generation 2016 (GWh). Source: Annual Development of Turkey's Installed Capacity by Primary Energy Resources, TEIAS 2019

The emission reductions would not occur in the absence of the proposed project activity because of various real and perceived risks that impede the provision of financing. Gezin SPP, as a small-scale solar power plant project, will serve as a perfect project to demonstrate the long-term potential of solar energy as a means to efficiently reducing GHG emissions as well as to diversifying and increasing the security of the local energy supply and contributing to sustainable development. The Gold Standard for the Global Goals certification shall help to realize this seminal technology by providing adequate compensation for the lacking financial incentives in the Turkish renewable energy market.

Generation of emission reduction and by the way crediting period will start with the first day of documented electricity supply to the national grid. The first 5-year crediting period is from 15/01/2018 to 14/01/2023 after the completion of commissioning. Applying the approved methodology to the project (detailed in Section B), the annual average amount of 3,062 $tCO_2e$ emission reductions is estimated to be achieved by producing 5,400 MWh/year electricity. In each year, the amount of VERs generated by the project will vary depending on the metered net electricity supplied to the grid, but a total of 15,310 $tCO_2e$ emission reductions is expected over the period of five years and distribution of minimum quantity versus years are listed in Table 6.

**Table 11**: Estimated annual emission reductions of the project over the crediting period

| Year | Estimation of project activity emissions (tonnes of $CO_2e$) | Estimation of baseline emissions (tonnes of CO2e) | Estimation of leakage (tonnes of CO2e) | Estimation of overall emission reductions (tonnes of $CO_2e$) |
|---|---|---|---|---|
| 15/01/2018 31/12/2018 | 0 | 2,945 | 0 | 2,945 |
| 2019 | 0 | 3,062 | 0 | 3,062 |
| 2020 | 0 | 3,062 | 0 | 3,062 |
| 2021 | 0 | 3,062 | 0 | 3,062 |
| 2022 | 0 | 3,062 | 0 | 3,062 |
| 01/01/2023 14/01/2023 | 0 | 117 | 0 | 117 |
| **Total (tonnes of CO2e)** | **0** | **15,310** | **0** | **15,310** |

## 3.8 Scale and Funding sources of the project

The project is a micro-scale project and the activity does not have any public funding or Official Development Assistance (ODA) funding.

## 3.9 Assessment that project complies with 'gender-sensitive' requirements

The questionary above was developed for Gold Standard with the contributions of several organizations and individuals and aims to ensure that the projects comply with that. The main objective is to give responsiveness to the gender equality issue and create links between environmental sustainability, natural resources management, and gender equality topic.

All the project developers are invited to reply, how his project can help and ensure these requirements are taking into consideration from the beginning and across all the process.

*Question 1: Does the project reflect the key issues and requirements of Gender Sensitive design and implementation as outlined in the Gender Policy? Explain how.*

Answer: As per Gold Standard Gender Policy, p. 10 "Foundational gender-sensitive requirement - This strengthens Gold Standard's 'do no harm' approach and addresses safeguards to prevent or mitigate adverse impacts on women or men. Such action is mandatory for all projects seeking Gold Standard certification and includes compliance with the gender 'do no harm' safeguards, gender gap analysis, and gender-sensitive stakeholder consultations." The project is a renewable energy project that is not gender-sensitive project. The project does not adversely impact women or men.

*Question 2: Does the project align with existing country policies, strategies, and best practices? Explain how.*

Answer: Turkey is a party to "Convention on the Elimination of All Forms of Discrimination against Women  and the project is aligned its labor policies that do not discriminate on gender. (

*Question 3: Does the project address the questions raised in the Gold Standard Safeguarding Principles & Requirements document? Explain how.*

Answer: The Project shall complete the following gender assessment questions below:

1. *Is there a possibility that the Project might reduce or put at risk women's access to or control of resources, entitlements, and benefits?*
   Answer: No, the Project being a solar project does not reduce access to or control of resources for women.

2. *Is there a possibility that the Project can adversely affect men and women in marginalized or vulnerable communities (e.g., potential increased burden on women or social isolation of men)?*
   Answer: No, the Project beneficiaries in terms of employment and social upliftment of the area are common for both the gender. Further the project has carried out various CSR activities leading to the welfare of the community at large. However, due to the lack of interest of women to these kinds of jobs stemming from norms of society, the impact of the project to this indicator is expected to be neutral.

3. *Is there a possibility that the Project might not take into account gender roles and the abilities of women or men to participate in the decisions/designs of the project's activities (such as lack of time, childcare duties, low literacy or educational levels, or societal discrimination)?*
   Answer: No, the CSR activities carried out by the project proponent are discussed with the community consisting of both the genders.

4. *Does the Project take into account gender roles and the abilities of women or men to benefit from the Project's activities (e.g., Does the project criteria ensure that it includes minority groups or landless peoples)?*
   Answer: Yes, the project takes into account the gender roles and abilities of women/men. The job profile is allocated based on the type of work to be carried out.

5. *Does the Project design contribute to an increase in women's workload that adds to their care responsibilities or that prevents them from engaging in other activities?*
   Answer: No, on the contrary, the project leads to increased availability of electricity in the regional grid thereby uplifting the living standards.

6. *Would the Project potentially reproduce or further deepen discrimination against women based on gender, for instance, regarding their full participation in design and implementation or access to opportunities and benefits?*
   Answer*:* No, since the project is a renewable electricity generation project, thus it will not have discriminated against women.

7. *Would the Project potentially limit women's ability to use, develop and protect natural resources, taking into account different roles and priorities of women and men in accessing and managing environmental goods and services?*
   Answer: No, in fact, the project leads to improved electricity in the regional grid thereby leading to less usage of fuel for lighting.

8. *Is there a likelihood that the proposed Project would expose women and girls to further risks or hazards?*
   Answer: No, in fact, due to improved electricity availability the usage of fuel for lighting would be reduced as well as indoor air quality would be improved.

*Question 4: Does the project apply the Gold Standard Stakeholder Consultation & Engagement Procedure Requirements? Explain how.*

Answer: The project is currently a CDM project applying for retroactive GS registration. The project is retroactive; thus, the Local Stakeholder Consultation (LSC) meeting is not required. However, the Stakeholder engagement procedure will be followed, and the Stakeholder Feedback Round (SFR) will be implemented.

## 3.10 Application of selected approved Gold Standard methodology

**Title:** Grid Connected Renewable Electricity Generation

**Reference:** AMS I.D. (Version 18)

It has been referred from the list of approved methodologies for CDM project activities on the United Nations Framework Convention on Climate Change (UNFCCC) website. The approved methodology also refers to the latest approved versions of "Tool to calculate the emission factor for an electricity system, version 4.0." for the determination of the baseline scenario of the proposed project activity.

### 3.10.1 Applicability of methodology

Since the project is below 15 MW installed capacity, small scale methodology AMS I.D. version 18 is used. The applicability criteria are described as follows:

**Table 12**: Applicability Criteria to the Project

| **Applicability Criteria** | **Applicability to the project** |
|---|---|
| 1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass a) supplying electricity to a national or a regional grid; or b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. | The project is a renewable energy generation through the installation of solar photovoltaic modules. The project will supply electricity to the national grid, sale to the grid as well as third party. Thus, the project activity complies with this criterion. |
| 2. Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F, and AMS-I.A2) applies is included in Table 2[1] | The 1st and 3rd option of Table 2 of AMS I.D. Version 18 is applicable (please refer footnote 5) |
| 3. This methodology is applicable to project activities that (a) Install a Greenfield plant; b) Involve a capacity addition in (an) existing plant(s); (c) Involve a retrofit of (an) existing plant(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s). | This methodology applies to the project activity as it's a Greenfield project where Option (a) i.e. install a new power plant at a site where there was no renewable energy power plant operating before the implementation of the project activity (Greenfield plant).<br>Hence the project activity fulfills the applicable criterion. |
| 4. Hydropower plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:<br>-The project activity is implemented in an existing reservoir with no change in the volume of the reservoir; | The Project activity is not a Hydro Power Project; therefore, this eligibility criterion does not apply to the proposed project activity. |

| | |
|---|---|
| -The project activity is implemented in an existing reservoir, where the volume of the reservoir is increased, and the power density of the project activity, as per definitions are given in the Project Emissions section, is greater than 4 W/m2;<br>-The project activity results in new reservoirs, and the power density of the power plant, as per definitions are given in the Project Emissions section, is greater than 4 W/m2. | |
| 5. If the new unit has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW | The project activity has only a renewable component, i.e., solar PV generated power with 2.97 MW capacity, which meets the eligibility of 15 MW for a small scale CDM project activity. The capacity of the project shall remain the same for the entire crediting period. Further, the project does not involve any use of fossil fuel. Thus, this criterion does not apply to the project activity. |
| 6. Combined heat and power (co-generation) systems are not eligible under this category. | The project activity generates only power and hence is not a cogeneration system. Thus, this criterion does not apply to the project activity. |
| 7. In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units. | The project activity is the new installation of a small-scale solar PV generated power project and doesn't involve the addition of a new unit to any of the existing renewable power generation facilities: therefore, the given criterion does not apply to the project activity. |
| 8. In the case of a retrofit, rehabilitation or replacement, to qualify as a small-scale project, the total output of the retrofitted, rehabilitated, or replacement power plant/unit shall not exceed the limit of 15 MW. | Not applicable, project activity is neither retrofit nor modification of an existing facility. The installed capacity of the project will be 2.97 MW, which is not exceeding the limit for small scale projects. The entire project is a Greenfield project activity and not the enhancement or up-gradation project. |

| | |
|---|---|
| 9. In the case of landfill gas, waste gas, wastewater treatment, and agro-industries projects recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid, then the baseline for the electricity component shall be by the procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration, other applicable Type-I methodologies such as “AMS-I.C.: Thermal energy production with or without electricity” shall be explored. | Not applicable as the project activity is neither a landfill gas, waste gas, wastewater treatment, and agro-industries projects, nor a recovered methane emissions project. |
| 10. In case biomass is sourced from dedicated plantations, the applicability criteria in the tool “Project emissions from cultivation of biomass” shall apply. | Not applicable as the project is not a biomass project. |
| 1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass a) supplying electricity to a national or a regional grid; or b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. | The project is a renewable energy generation through the installation of solar photovoltaic modules. The project will supply electricity to the national grid, sale to the grid as well as third party. Thus, the project activity complies with this criterion. |

### 3.10.2 Project boundary

The project's spatial extent of Gezin SPP is the project power plant and all power plants connected physically to the electricity system which is discussed and applied with a calculation of combined margin by "Tool to calculate the emission factor for the electricity system".

Project boundary diagram is depicted in the diagram below:

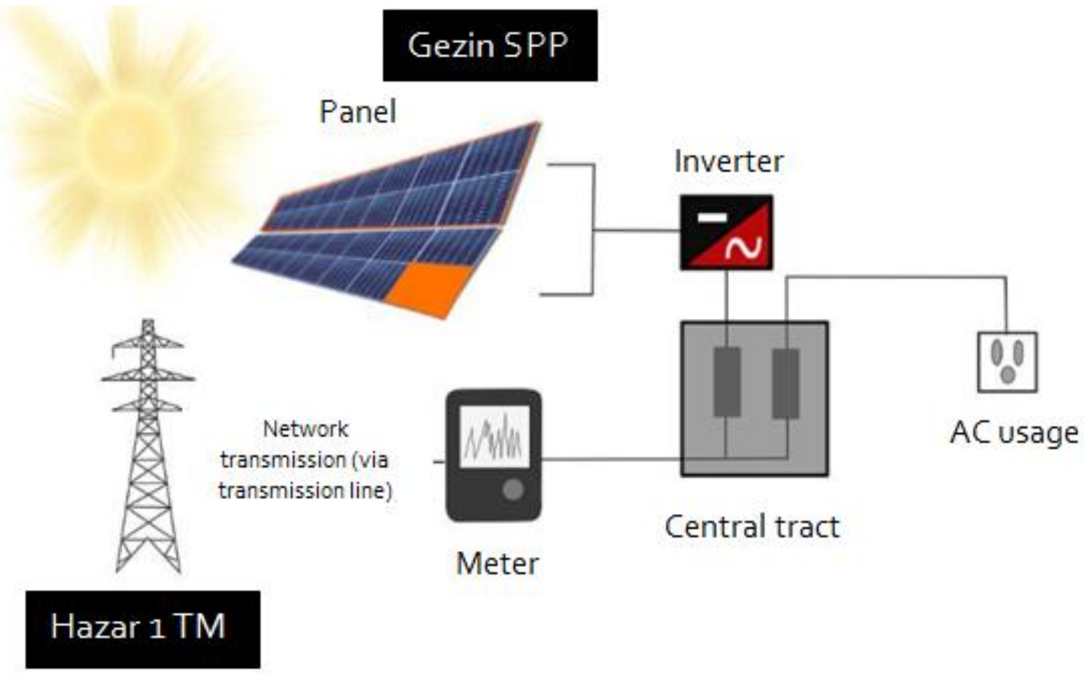



**Figure 3.** Project boundary diagram

For GHG mitigation/sequestration following table shall be completed.

**Table 13**: Emissions sources included in or excluded from the project boundary

| Source | | GHGs | Included? | Justification/Explanation |
|---|---|---|---|---|
| **Baseline scenario** | Grid | $CO_2$ | Yes | *Main emission source*: Fossil fuels fired for electricity generation cause $CO_2$ emissions. It is included in the baseline calculation to find the displaced amount by the project activity. |
| | | $CH_4$ | No | Excluded for simplification. This is conservative |
| | | $N_2O$ | No | Excluded for simplification. This is conservative |
| **Project scenario** | No Emissions | $CO_2$ | No | Minor emission source |
| | | $CH_4$ | No | Minor emission source |
| | | $N_2O$ | No | Minor emission source |

### 3.10.3 Establishment and description of the baseline scenario

According to the guidelines of the applicable small scale approved methodology AMS.I.D (Version 18), “The baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.” Thus, the proposed project activity will evacuate power to the National Grid complying with the stated guideline.

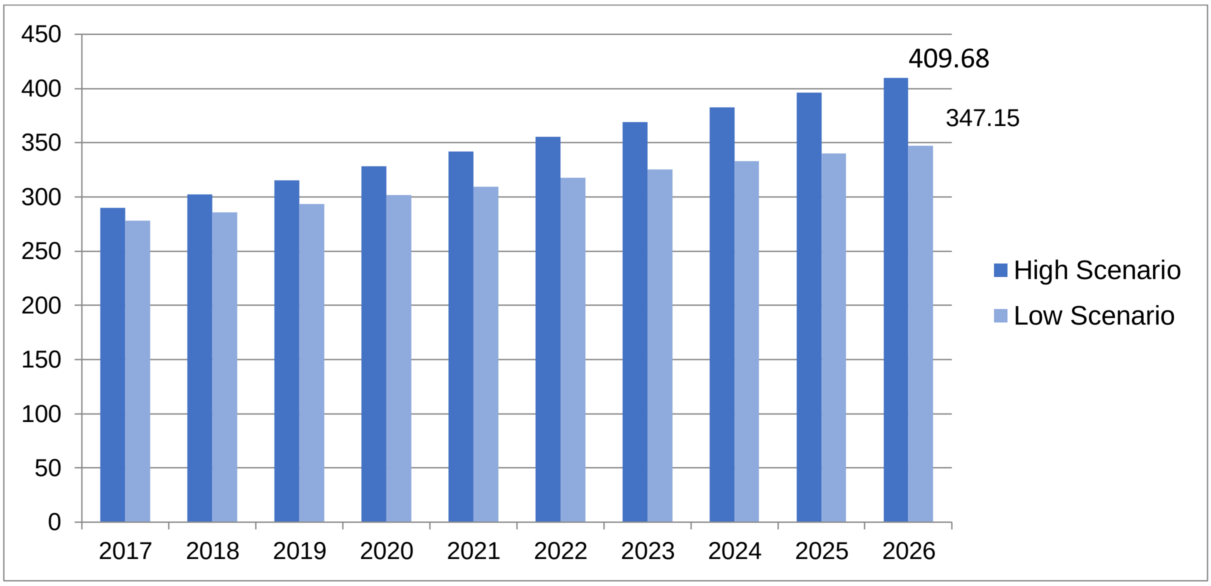
To describe the baseline and its development for the project activity, long-term electricity demand, and supply projections for Turkey are assessed.

When Table 9 and Graphic 3 are examined, electricity demand is expected to exceed 340 billion kWh in 2026 with an average increase of 2.6% for the low scenario, for the baseline scenario, electricity demand is expected to increase by 3.2% on average to exceed 370 billion kWh; it is expected that electricity demand will exceed 400 billion kWh with an average increase of 3.8% for the high scenario. (Teias, 2016)

**Table 14**: Low and High Demand Projection Scenarios for Ten Years Period (TWh)

| Scenarios | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|---|---|---|---|---|
| High Scenario | 289.93 | 302.26 | 315.28 | 328.31 | 341.72 | 355.63 | 368.88 | 382.56 | 396.08 | 409.68 |
| Low Scenario | 278.06 | 285.63 | 293.75 | 301.67 | 309.68 | 317.64 | 325.45 | 333.04 | 340.18 | 347.15 |

Source: 10 Yıllık Talep Tahminleri Raporu (2017-2026), Teias 2016




**Graphic 4**: Electricity Demand Projections for Ten Years. Source: Source: 10 Yıllık Talep Tahminleri Raporu (2017-2026), Teias 2016

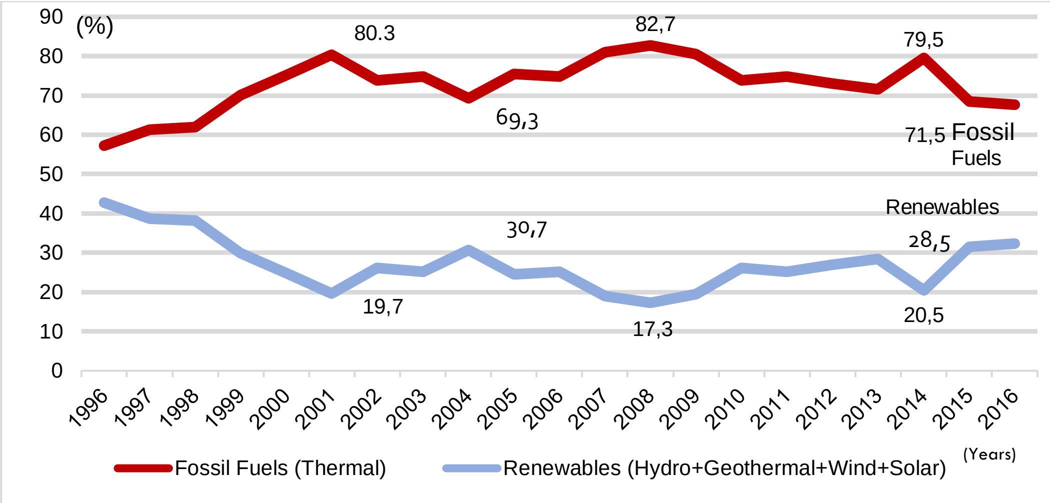
In this projection, electricity supplies are also forecasted taking into account all power plants, which are in operation, under construction, solar production facilities within the scope of Public and pre-licensed/licensing phase/licensed/YEKA project, unlicensed biomass, wind, cogeneration production facilities and private sector power plants with licenses, which are expected to be commissioned on the prescribed dates. Generation projection based on project generation is given in:

**Table 15:** Projection of Total Generation Capacity by Fuel Types (TWh)

| **Years** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **Share in 2021 (%)** |
|---|---|---|---|---|---|---|---|
| Lignite | 62.367 | 64.467 | 70.091 | 70.091 | 71.088 | 69.267 | 12.4 |
| Hardcoal & asphaltit | 5.214 | 5.214 | 5.214 | 5.214 | 5.214 | 5.214 | 0.9 |
| Import. Coal | 49.569 | 59.570 | 59.617 | 59.155 | 69.679 | 89.492 | 16.0 |
| Natural gas | 187.446 | 214.234 | 213.124 | 211.094 | 210.568 | 217.817 | 38.8 |
| Geothermal | 6.314 | 7.828 | 7.967 | 8.096 | 8.096 | 8.096 | 1.4 |
| Fuel oil | 2.613 | 2.693 | 2.693 | 5,297 | 5,297 | 5,297 | 0.5 |
| Diesel | 7 | 7 | 7 | 7 | 7 | 7 | 0.0 |
| Nucleer | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Other | 520 | 948 | 1.198 | 1.241 | 1.241 | 1.241 | 0.2 |
| Biogas+waste | 3.261 | 3.511 | 3.743 | 3.796 | 3.796 | 3.796 | 0.7 |
| Hydro | 91.548 | 95.219 | 96.538 | 101.262 | 107.542 | 108.751 | 19.4 |
| Wind | 18.476 | 21.422 | 25.007 | 28.448 | 32.593 | 33.697 | 6.0 |
| Solar | 2.081 | 6.300 | 11.850 | 13.375 | 16.921 | 20.657 | 3.7 |
| **Total** | **429.416** | **481.415** | **497.051** | **504.472** | **529.440** | **560.729** | **100.0%** |

Source: Türkiye Elektrik Enerjisi 5 Yıllık Üretim Kapasite Projeksiyonu (2017-2021), Teias 2016

According to the 5-year projection, it is clear that fossil fuels will remain the main sources for electricity generation (68.8 % in 2021). Natural gas will continue to dominate the market. Hydro will account for 19.4% of the mix, whereas all non-hydro renewable combined (geothermal/biogas/waste/wind/solar) will only account for 11.8% of all electricity generation. This projection is consistent with continuing fossil fuel-dependent characteristics of the Turkish electricity sector, which is given in Graphic 4.




**Graphic 5**: Fossil Fuels and Renewable in Turkish Electricity Mix (1996-2016)

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

• <u>Conclusion 1</u>: Energy demand in Turkey has been increasing with significant rates for ten years, and it is expected to continue at least for the next ten years.

• <u>Conclusion 2</u>: Even all operational plants, construction phase plants and licensed ones are taken into account the lack of supply is projected after five operational years(Teias, 2016). So, there is a significant need for electricity generation investments to satisfy demand, which means electricity to be generated by the project activity would otherwise be generated by new power plants to avoid power shortage in the coming years.

• <u>Conclusion 3</u>: Fossil fuels will hold the dominance in generation mix till the end of 2021 with a 68.8% share. Hydro included renewable will remain low with 31.2% share and non-hydro energy contribution will stay with only 11.8% of the total share by the end of that period. This also shows that most of the new capacity additions will be fossil fuel-fired power plants.

The combination of the trends mentioned above indicates that if Gezin SPP were not built, power from a new grid-connected thermal plant would be the most likely scenario.

### 3.10.4 Demonstration of additionality

The project is a micro-scale project. Therefore, there is no additionality.

Milestones indicating the project implementation schedule are given below:

**Table 16**: Milestones of project implementation

| **Date** | **Activity (Gezin3 & Gezin 4 & Gezin 5)** |
|---|---|
| 15.04.2016 | Call Letter for Connection Agreement |
| 02.05.2017 | Connection Agreement Date |
| 28.07.2017 | EPC Agreement with Girişim Elektrik |
| 01.08.2017 | Construction Start Date |
| 15.01.2018 | System Connection Agreement date (Commercial Start Date) Crediting Period Start Date |

## 3.11 Sustainable development goals (SDG) outcomes

- **SDG7 Affordable and Clean Energy**: The project is expected to generate 5,400 MWh clean energy per annum.
- **SDG8 Decent Work and Economic Growth:** The project provides local employment during the construction and activity phases.
- **SDG13 Climate Action**: The project would lead to a reduction of approx.3,062 tCO2 per annum.

### 3.11.1 Explanation of methodological choices/approaches for estimating the SDG outcome

SDG 7: Affordable and Clean Energy

The baseline for the project is no project, thus leading to generation in the relevant grid, which is dominated by fossil fuel. The clean energy generated by the project is calculated based on the amount of electricity generated by the project per annum. The project is expected to generate 5,400 MWh of clean energy per annum.

SDG 8: Decent Work and Economic Growth

The project leads to employment opportunities that would not have been possible in the baseline scenario. The project provides local employment during the construction and activity phases. All employees have social security and they were trained.

SDG13: Climate Action

The project leads to a mitigation of 3,062 $tCO_2$ per annum.

The baseline scenario is identified and described in 3.2.4. Emission reductions due to project activity will be calculated according to "Tool to calculate the emission factor for an electricity system" (v5) (Tool) as indicated in AMS I.D.

A stepwise approach of „*Tool to calculate the emission factor for an electricity system*" version 05.0.0 is used to find this combined margin (emission coefficient) as described below:

***Step 1:*** *Identify the relevant electric systems*

There are 21 regional distribution regions in Turkey, but no regional transmission system is defined. In Article 20 of License Regulation, it is stated that:

> *"TEIAS shall be in charge of all transmission activities to be performed over the existing transmission facilities and those to be constructed as well as the activities pertaining to the operation of* ***national transmission system*** *via the National Load Dispatch Center and the regional load dispatch centers connected to this center and the operation of Market Financial Reconciliation Center". (p.21)*

As can be understood from this phrase, only one transmission system, which is a national transmission system, is defined and only TEİAŞ is in charge of all transmission system related activities. Moreover, communication with representatives of TEIAS, which indicates that: "*There are no significant transmission constraints in the national grid system which is preventing the dispatch of already connected power plants*" is submitted to the DOE. Therefore, the national grid is used as an electric power system for project activity.

The national grid of Turkey is connected to the electricity systems of neighboring countries. Complying with the rules of the tool, the emission factor for imports from neighboring countries is considered 0 (zero) $tCO_2/MWh$ for determining the OM. There is no information about interconnected transmission capacity investments, as TEİAŞ, who operates the grid, also didn't take into account imports-exports for electricity capacity projections. Because of that, for BM calculation transmission capacity is not considered. (*EPDK 2016)*

***Step 2:*** *Choose whether to include off-grid power plants in the Project electricity system (optional)*

According to Tool project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

**Option I:** Only grid power plants are included in the calculation.
**Option II:** Both grid power plants and off-grid power plants are included

For this project, **Option I** is chosen.

***Step 3:*** *Select a method to determine the operating margin (OM);*

The calculation of the operating margin emission factor ($EF_{grid,\ OM,y}$) is based on one of the following methods:

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

The Simple Operating Margin (OM) emission factor ($EF_{grid,\ OM,\ y}$) is calculated as the generation weighted average $CO_2$ emissions per unit net electricity generation ($tCO_2/MWh$) of all the generating plants serving the system, excluding low-cost/must-run power plants. As electricity generation from solar and low-cost biomass facilities is insignificant, and there are no nuclear plants in Turkey, the only low cost /must run plants considered are hydroelectric, wind and geothermal facilities. The Turkish electricity mix does not comprise nuclear energy. Also, there is no obvious indication that coal is used as a must-run resource.

Therefore, the only low-cost resources in Turkey, which are considered as must-run, are Hydro, Renewables and Waste, Geothermal and Wind (according to statistics of TEIAS).

**Table 17:** Share of Low-Cost Resource (LCR) Production 2012-2016 (Production in GWh)

| Share of Low-Cost Resource (LCR) Production 2012-2016 (Production in GWH) | | | | | |
|---|---|---|---|---|---|
| | **2012** | **2013** | **2014** | **2015** | **2016** |
| Gross production | 239,496.8 | 240,153.95 | 251,962.82 | 261,783.3 | 274,407.7 |
| Total LCR Production | 65,345.8 | 69,512.7 | 52,961.4 | 83,981.00 | 89,938.1 |
| Hydro | 57,865.0 | 59,420.47 | 40,644.70 | 67,145.8 | 67,230.9 |
| Renewables and Waste | 720.7 | 1,171.20 | 1,432.59 | 1,758.2 | 2,371.6 |
| Geothermal and Wind | 6,760.1 | 8,921.04 | 10,884.12 | 15,077.0 | 20,335.6 |
| Share of LCRs | 27.28% | 28.95% | 21.02% | 32.08% | 32,08% |
| Average of the last five years | 27.33% | | | | |

Source: Annual Development of Turkey's Electricity Generation by Primary Energy Resources (Teias, 2016)

As an average share of low-cost resources for the last five years is far below 50% (26,94%), the simple OM method is applicable to calculate the operating margin emission factor ($EF_{grid,OM,y}$).

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

- **Ex-ante option:** A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, or
- **Ex post option:** The year, in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

The **ex-ante option is selected for the Simple OM method**, with the most recent data for the baseline calculation stemming from the years 2011 to 2015.

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

The simple OM emission factor is calculated as the generation-weighted average $CO_2$ emissions per unit net electricity generation ($tCO_2/MWh$) of all generating power plants serving the system, not including low-cost/must-run power plants. The calculation of the simple OM emission factor can be based on:

- **Option A:** data on net electricity generation a $CO_2$ emission factor of each power unit, or
- **Option B:** data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

**Option B** is chosen to calculate the Simple OM, as there is no power plant-specific data available, renewable power generation is considered as low-cost power sources and the amount of electricity supplied to the grid by these sources is known.

Where Option B is used, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} x NCV_{i,y} x EF_{CO2,i,y}}{EG_y} \quad \textbf{(1)}$$

Where:

| | | |
|---|---|---|
| **$EF_{grid,OMsimple,y}$** | = | Simple operating margin $CO_2$ emission factor in year y ($tCO_2$/MWh) |
| **$FC_{i,y}$** | = | Amount of fossil fuel type I consumed in the project electricity system in year y (mass or volume unit) |
| **$NCV_{i,y}$** | = | Net calorific value (of fossil fuel type i in year y (GJ / mass or volume unit) |
| **$EF_{CO2,i,y}$** | = | $CO_2$ emission factor of fossil fuel type i in year y ($tCO_2$/GJ) |
| **$EG_y$** | = | Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants/units, in year y (MWh) |
| **i** | = | All fossil fuel types combusted in power sources in the project electricity system in year y |
| **y** | = | three most recent years for which data is available at the time of submission of the PDD to the DOE for validation |

For the calculation of the OM the consumption amount and heating values of the fuels for each source used for the years 2014, 2015 and 2016, is taken from the TEİAŞ annual statistics, which holds data on annual fuel consumption by fuel types as well as electricity generation amounts by sources and electricity imports. All the data needed for the calculation, including the emission factors and net calorific values (NCVs), are provided in an excel table that shows the OM emission factor, Excel Table 8 Fossil Fuel Consumption Amounts and Excel Table 9 Net Calorific Values. Total $CO_2$ emission due to electricity generation in Turkey for the years of 2014, 2015 and 2016 are given in Table 13

**Table 18**: $CO_2$ emissions from electricity production 2014-2016 ($ktCO_2$)

| | 2014 | 2015 | 2016 |
|---|---|---|---|
| **CO2-Emmissions** | 122,715 | 113,727 | 123,437 |

Table 12 presents the gross electricity production data by all the relevant energy sources. Low-cost/must run resources like hydro, wind, geothermic, and biomass do not emit fossil $CO_2$ and thus are not taken into account in calculations.

**Table 19:** Gross electricity production by fossil energy sources 2014-2016 (GWh)

| **Gross Electricity Production by Energy Source 2014-2016 [GWh]** | | | |
|---|---|---|---|
| | 2014 | 2015 | 2016 |
| Natural Gas | 120,576.0 | 99,218.70 | 89,227.10 |
| Lignite | 36,615.4 | 31,335.70 | 38,569.90 |
| Coal | 39,647.3 | 44,829.90 | 53,703.20 |
| Fuel Oil | 1,662.9 | 980.4 | 969.1 |
| Motor Oil | 482.4 | 1,243.60 | 957.20 |
| Naphtha | 0.0 | 0.0 | 0 |
| LPG | 0.0 | 0.0 | 0 |
| Total fossil fuels | 198,984.0 | 177,608.3 | 183,426.5 |

Source: Annual Development of Turkey's Installed Capacity by Primary Energy Resources, (TEIAS 2019)

The above table shows gross data, but $EG_y$ in the above-described formula means electricity delivered to the grid, i.e. net generation, the following table shall help to derive net data by calculating the net/gross proportion based on overall gross and net production numbers.

**Table 20**: Net/gross electricity production 2014-2016 (GWh)

| **Relation Net/Gross Electricity Production 2014-2016** | | | |
|---|---|---|---|
| | 2014 | 2015 | 2016 |
| Gross Production [GWh] | 251,962.82 | 261,783.30 | 274,407.70 |
| Net Production [GWh] | 239,448.83 | 249,889.50 | 261,936.80 |
| Relation | 95.03% | 95.46% | 95.46% |

Source: Annual Development of Electricity Generation – Consumption and Losses in Turkey

Multiplying these overall gross/net relation percentages with the fossil fuel generation amount does, mean an approximation. However, this is a conservative approximation as the consumption of plant auxiliaries of fossil power plants is higher than for the plants that are not included in the baseline calculation. In the end, this would lead to a lower net electricity generation and, therefore to a higher OM emission factor and higher emission reductions.

Table 16 shows the resulting net data for fossil fuel generation and adds electricity imports.

**Table 21:** Electricity supplied to the grid, relevant for OM (GWh)

| **Net El. Production by fossil fuels and Import 2014-2016 [GWh]** | | | |
|---|---|---|---|
| | 2014 | 2015 | 2016 |
| Net El. Prod. by fossil fuels | 189,101.2 | 169,538.9 | 175,090.4 |
| Electricity Import | 7,953.5 | 7,135.50 | 6,330.30 |
| Electricity supplied to grid by relevant sources | 197,054.7 | 176,674.4 | 181,420.7 |

Source: Annual Development of Electricity Generation – Consumption and Losses in Turkey (TEIAS, 2019)

Electricity import is added to the domestic supply to fulfill the Baseline Methodology requirements. Imports from connected electricity systems located in other countries are weighted with an emission factor of 0 (zero) $tCO_2/MWh$.

**Step 5:** Calculate the build margin (BM) emission factor

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

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

Again, the project proponents can choose between two options according to the calculation tool: calculate the BM ex-ante based on the latest available data or update the BM each year ex-post. Option 1, the ex-ante approach, is again chosen.

The sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above. The last plant of the sample group is built in 2010 and until the end of 2013 which is the latest year for official statistics published for plants put in operation. VER plants are excluded from the sample group. While identifying the sample group dismantled, revised, retrofits are not included.

Only new capacity additions (power plants/units) are taken into account. All power plants in operation by 2013 are given in Excel Table 12 Sample Group for BM Factor Calculation (Latest Power Plants put in Operation in Turkey). Total electricity generation in 2016 is 261,783.304 GWh and 20% of this generation is 52,387.4 (AEGSET->20%) GWh. Total electricity generation of the last five power plants in operation is 369 GWh (AEGSET-5-units), which is lower than 20% total generation in 2016. Since AEGSET->20% is bigger than AEGSET-5-units, SET->20% is chosen as $SET_{sample}$.

Also, in the sample group, no power plant started to supply electricity to the grid more than ten years ago, steps d, e, and f are ignored.

The sample group for the BM emission factor is given below table.

**Table 22:** Sample group generation for BM emission factor calculation (GWh)

| Energy Source | 2010 | 2011 | 2012 | Sample Group Total Generation (GWh) |
|---|---|---|---|---|
| Natural Gas | 8,702.3 | 11,815.1 | 10,540.0 | 31,057.4 |
| Lignite | 0.0 | 0.0 | 40.0 | 40.0 |
| Coal | 8,012.0 | 4,320.0 | 201.0 | 12,533.0 |
| Fuel Oil | 0.0 | 701.2 | 0.0 | 701.2 |
| Hydro | 3,336.8 | 3,730.4 | 5,354.0 | 12,421.2 |
| Renewable | 2.4 | 150.0 | 677.0 | 829.4 |
| **TOTAL** | **20,053.5** | **20,716.7** | **16,812.0** | **57,582.17** |

The build margin emissions factor is the generation-weighted average emission factor ($tCO_2/MWh$) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} x EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(2)}$$

Where:

**$EF_{grid,BM,y}$** = Build margin $CO_2$ emission factor in year y ($tCO_2/MWh$)

**$EG_{m,y}$** = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

**$EF_{EL,m,y}$** = $CO_2$ emission factor of power unit m in year y ($tCO_2/MWh$)

**m** = Power units included in the build margin

**y** = Most recent historical year for which power generation data is available

Because only fuel types and electricity generation data are available for the sample group, *Option B2* of Simple OM method is used to calculate the emission factor. The formulation of the emission factor is given below:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} x 3.6}{\eta_{m,y}} \quad \textbf{(3)}$$

Where:

| | | |
|---|---|---|
| **$EF_{EL,m,y}$** | = | $CO_2$ emission factor of power unit m in year y ($tCO_2/MWh$) |
| **$EF_{CO2,m,i,y}$** | = | Average $CO_2$ emission factor of fuel type i used in power unit m in year y ($tCO_2/GJ$) |
| **$\eta_{m,y}$** | = | The Average net energy conversion efficiency of power unit m in year y (%) |
| **y** | = | Three most recent years for which data is available at the time of submission of the PDD to the DOE for validation |

BM emission factor calculation and resulted BM factor are given in **Table 17**. For BM factor calculation, since no official emission factors for different fuel types are available, lower confidence default values of IPCC Guidelines are applied. Explanation of emission factor selection for each energy source and references are given in Excel Table 11: EGm, y [GWh] Sample Group for BM.

**Table 23:** BM emission factor calculation using equation (2) and (3)

| **Energy Source** | **Sample Group Total Generation (GWh)** | **Effective $CO_2$ emission factor ($tCO_2/TJ$)** | **Average Efficiency ($\eta_{m,y}$)** | **$CO_2$ Emission ($ktCO_2$)** |
|---|---|---|---|---|
| Natural Gas | 31,057.4 | 54.3 | 60.00% | 10,118.5 |
| Lignite | 40.0 | 90.9 | 50.00% | 26.2 |
| Coal | 12,533.0 | 89.5 | 50.00% | 8,076.3 |
| Fuel Oil | 701.2 | 72.6 | 46.00% | 398.4 |
| Hydro | 12,421.2 | 0.0 | 0.00% | 0.0 |
| Renewables | 829.4 | 0.0 | 0.00% | 0.0 |
| **Total** | **57,582.17** | | | **18,619.3** |
| **$EF_{grid,BM,y}$ ($tCO_2/MWh$)** | **0.3234** | | | |

$$EF_{grid,BM,y}=0.3234\ tCO_2/MWh$$

***Step 6:*** *Calculate the combined margin emission factor*

The calculation of the combined margin (CM) emission factor (*EFgrid, CM,y*) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

The combined margin emission factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM} \quad \textbf{(4)}$$

Where:

| | | |
|---|---|---|
| **$EF_{grid,BM,y}$** | = | Build margin $CO_2$ emission factor in year y ($tCO_2/MWh$) |
| **$EF_{grid,OMy}$** | = | Operating margin $CO_2$ emission factor in year y ($tCO_2/MWh$) |
| **$w_{OM}$** | = | Weighting of operating margin emissions factor (%) |
| **$w_{BM}$** | = | Weighting of build margin emissions factor (%) |

According to the Tool for solar power generation project activities: $w_{OM} = 0.75$ and $w_{BM} = 0.25$.

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(5)}$$

Where:

***$ER_y$*** = Emission reductions in year *y* (t $CO_2$/yr).
***$BE_y$*** = Baseline emissions in year *y* (t $CO_2$/yr).
***$PE_y$*** = Project emissions in year *y* (t $CO_2$/yr).
***$LE_y$*** = Leakage emissions in year *y* (t $CO_2$/yr).

**Project emissions**

The proposed project activity involves the generation of electricity through the development of a solar plant. The generation of electricity does not result in greenhouse gas emissions and therefore is taken as 0 $tCO_2$/year.

**Leakage**

No Leakage emissions are considered. The main emission potentially giving rise to leakage in the context of electrical sector projects is emission arising due to activities arising such as power plant construction and upstream emission from fossil fuel use (e.g. extraction, processing, and transport). These emission sources are neglected.

Then: $ER_y = BE_y$

**Baseline emissions**

Baseline emissions include only $CO_2$ emissions from electricity generation in fossil fuel-fired power plants that are displaced due to the project activity, calculated as follows:

$$BE_y = (EG_y - EG_{baseline}) \times EF_{grid,CM,y} \quad \textbf{(6)}$$

Where:

$BE_y$ = Baseline emissions in year *y* ($tCO_2$/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.

$EF_{grid,CM,y}$ = Combined margin $CO_2$ 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”.

The project activity is the installation of a new grid-connected renewable power plant so, $EG_{baseline} = 0$

### 3.11.2 Data and parameters fixed ex-ante for monitoring contribution to each of the three SDGs

- SDG7 Affordable and Clean Energy: The project is expected to generate 5,400 MWh clean energy per annum.
- SDG8 Decent Work and Economic Growth: The project provides local employment during the construction and activity phases.
- SDG13 Climate Action: The project would lead to a reduction of approx.3,062 tCO2 per annum.

**Table 24:** Information for $EG_y$ fixed ex-ante for monitoring

| | |
|---|---|
| **Relevant SDG Indicator** | SDG13 Climate Action |
| **Data/parameter** | $EG_y$ |
| **Unit** | MWh |
| **Description** | Net electricity generated by power plant/unit m, k or n (or in the project electricity system in case of EGy) in year y or hour h |
| **Purpose of data** | Data used for emission reduction calculation |

**Table 25:** Information for HVi,y fixed ex-ante for monitoring

| | |
|---|---|
| **Relevant SDG Indicator** | SDG13 Climate Action |
| **Data/parameter** | HVi,y |
| **Unit** | Mass or volume unit |
| **Description** | Heating Values of fuels consumed for electricity generation in the years of 2014, 2015 and 2016 |
| **Purpose of data** | Data used for emission reduction calculation |

**Table 26:** Information for FCi,y fixed ex-ante for monitoring

| | |
|---|---|
| **Relevant SDG Indicator** | SDG13 Climate Action |
| **Data/parameter** | FCi,y |
| **Unit** | Mass or volume unit |
| **Description** | Amount of fuel type i consumed in the project electricity system in year y |
| **Purpose of data** | Data used for emission reduction calculation |

**Table 27:** Information for NCVi,y fixed ex-ante for monitoring

| | |
|---|---|
| **Relevant SDG Indicator** | SDG13 Climate Action |
| **Data/parameter** | NCVi,y |
| **Unit** | GJ/mass or volume unit |
| **Description** | Net Calorific Value of fuel types in the years of 2014, 2015 and 2016 |

**Table 28:** Information for Sample Group for BM emission factor fixed ex-ante for monitoring

| | |
|---|---|
| **Relevant SDG Indicator** | SDG13 Climate Action |
| **Data/parameter** | Sample Group for BM emission factor |
| **Unit** | Name of the plants, MW capacities, fuel types, annual electricity generations and dates of commissioning. |
| **Description** | Most recent power plants which compromise 20% of total generation |

**Table 29:** Information for $EF_{CO2, I,y}$ fixed ex-ante for monitoring

| | |
|---|---|
| **Relevant SDG Indicator** | SDG13 Climate Action |
| **Data/parameter** | $\mathbf{EF_{CO2,i,y}}$ |
| **Unit** | $\mathbf{tCO_2/GJ}$ |
| **Description** | The $CO_2$ emission factor of fuel type I in year y |

**Table 30**: Information for $\eta_{m,y}$ fixed ex-ante for monitoring

| | |
|---|---|
| **Relevant SDG Indicator** | SDG13 Climate Action |
| **Data/parameter** | $\boldsymbol{\eta_{m,y}}$ |
| **Unit** | **-** |
| **Description** | The average energy conversion efficiency of power unit m in year y |

### 3.11.3 Ex-ante estimation of outcomes linked to each of the three SDGs

Baseline emissions

As per AMS I.D, the baseline emissions are calculated as the net electricity generated by the project activity, multiplied with the baseline emission factor for the project grid. Baseline emissions calculated as explained in section B.6.1 above are summarized below.

BEy = (EGy - EGbaseline) x EFgrid, CM, y , $EG_{baseline} = 0$

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

Where,

**EGy** = the net electricity exported to the grid system during the year y (5,400 MWh/annum)

**EFy** = the emission factor of the grid to which the project exports electricity (0.5670 $tCO_2$/MWh)

**$EF_{grid,BM,y}$** = Build margin $CO_2$ emission factor in year y ($tCO_2$/MWh)

**$EF_{grid,OMy}$** = Operating margin $CO_2$ emission factor in year y ($tCO_2$/MWh)

**$w_{OM}$** = Weighting of operating margin emissions factor (%)

**$w_{BM}$** = Weighting of build margin emissions factor (%)

To calculate $EF_{grid,OMsimple,y}$:

| | **2014** | **2015** | **2016** |
|---|---|---|---|
| CO2-Emmissions (ktCO2) | 122,715 | 113,727 | 123437 |
| Net Electricity Supplied to Grid by relevant sources (GWh) | 197,054.7 | 176,674.4 | 181,420.7 |
| EFgrid,OMsimple,y (ktCO2/GWh) | 0.6227 | 0.6437 | 0.6804 |
| 3-year Generation Weighted Average $EF_{grid,OMsimple,y}$ ($ktCO_2$/GWh) | 0,6483 | | |

$EF_{grid,OMsimple,y}$ = 0.6483 ($ktCO_2$ /GWh)

Hence,

$w_{OM}$ = 0.75 and $w_{BM}$ = 0.25. Then:

| |
|---|
| **$EF_{grid,CM,y}$ =** 0.6483 $tCO_2$/MWh * 0.75 + 0.3234 tCO2/MWh * 0.25 = **0.5670 tCO2/MWh** |

***$ER_y$ = $BE_y$ = $EG_y$ * $EF_{grid,CM,}$ =*** 5400 MWh/year * 0.5670 $tCO_2$/MWh = 3,062 $tCO_2$/year

Project emissions

The proposed project activity involves the generation of electricity through the development of a solar plant. The generation of electricity does not result in greenhouse gas emissions and therefore is taken as 0 $tCO_2$/year.

Leakage

No leakage emissions are applicable.

Emission reductions

ERy = $ER_y = BE_y - PE_y - LE_y$ = 3,062 – 0 – 0

ERy = 3,062 $tCO_2$ (ERy = BEy)

### 3.11.4 Summary of ex-ante estimates of each SDG outcome

SDG 13 Climate Action

**Table 31**: Summary of ex-ante estimates of each SDG 13 outcome

| Year | Estimation of project activity emissions (tonnes of $CO_2$e) | Estimation of baseline emissions (tonnes of CO2e) | Net Benefit (tonnes of $CO_2$e) |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 15/01/2018<br>31/12/2018 | 0 | 2,945 | 2,945 |
| 2019 | 0 | 3,062 | 3,062 |
| 2020 | 0 | 3,062 | 3,062 |
| 2021 | 0 | 3,062 | 3,062 |
| 2022 | 0 | 3,062 | 3,062 |
| 01/01/2023<br>14/01/2023 | 0 | 117 | 117 |
| Total (tonnes of CO2e) | 0 | 15,310 | 15,310 |
| Total Number of Crediting Years | 5 years | | |
| Annual average over the crediting period | 0 | 3,062 | 3,062 |

## SDG7 Affordable and Clean Energy

**Table 32**: Summary of ex-ante estimates of each SDG 7 outcome

| Year | Estimation of project activity emissions (MWh) | Estimation of baseline emissions (MWh) | Net Benefit (MWh) |
|---|---|---|---|
| 15/01/2018<br>31/12/2018 | 5,193 | 0 | 5,193 |
| 2019 | 5,400 | 0 | 5,400 |
| 2020 | 5,400 | 0 | 5,400 |
| 2021 | 5,400 | 0 | 5,400 |
| 2022 | 5,400 | 0 | 5,400 |
| 01/01/2023<br>14/01/2023 | 207 | 0 | 207 |
| Total (MWh) | 27,000 | 0 | 27,000 |
| Total Number of Crediting Years | 5 years | | |

| | | | |
|---|---|---|---|
| Annual average over the crediting period | 5,400 | 0 | 5,400 |

SDG 8 Climate Action Decent Work and Economic Growth

The project leads to employment opportunities that would not have been possible in the baseline scenario. The project provides local employment during the construction and activity phases. All employees have social security and they were trained.

## 3.12 Monitoring plan

### 3.12.1 Data and parameters to be monitored

**Table 33**: $EG_{facility,y}$ Monitored plan

| | |
|---|---|
| **Relevant SDG Indicator** | SDG 7: Affordable and Clean Energy<br>SDG13: Climate Action |
| **Data / Parameter** | $EG_{facility,y}$ |
| **Unit** | MWh/yr |
| **Description** | Quantity of net electricity generation supplied by the project plant to the grid in year *y* |
| **Source of data** | On-site measurement from the meters. |
| **Value(s) applied** | 5,400 MWh/year |
| **Monitoring frequency** | Continuous measurement and at least monthly recording |
| **Purpose of data** | Calculation of Baseline and Project Emission |
| **Additional comment** | Plant Manager will be responsible for monitoring data. |

**Table 34**: Number of Employment Generation Monitored plan

| | |
|---|---|
| **Relevant SDG Indicator** | SDG 8: Decent Work and Economic Growth |
| **Data / Parameter** | Number of Employment Generation |
| **Unit** | Number |
| **Description** | Number of people employed directly due to the project activity |
| **Source of data** | Plant records |
| **Value(s) applied** | 3 |
| **Monitoring frequency** | Continuous measurement and at least monthly recording |
| **Purpose of data** | Demonstration of employment amount created by project activity |

| | |
|---|---|
| **Additional comment** | Social Security registries would monitor the total number of persons working in the plant |

### 3.12.2 Other elements of the monitoring plan

As the necessary baseline emission factors are all defined ex-ante (Operating and Built Margin, see baseline description), the most important information to be monitored is the amount of electricity fed into the grid by Gezin SPP. This value will be monitored continuously by redundant metering devices, one of them being the main one in the substation, which provides the data for the monthly invoicing to TEİAŞ.

For the un-licensed plant, the main data source will be the PMUM data. TEIAŞ reciprocal agreement meter records will be used for cross-checking.

There are six meters in total: three main meters and three back-up meters for the 2.97 MW unlicensed plant. These meters are sealed by EDAŞ and intervention by project proponent is not possible. The fact that the meters are installed redundantly keeps the uncertainty level of the only parameter for baseline calculation low. High data quality of this parameter is not only in the interest of the emission reduction monitoring, but paramount for the business relationship between the plant operator and the electricity buyers.

Meter specification is as follows:

**Table 35:** Meter specifications

| | **Gezin 3** | | **Gezin 4** | | **Gezin 5** | |
|---|---|---|---|---|---|---|
| | Main Meter | Back-Up Meter | Main Meter | Back-Up Meter | Main Meter | Back-Up Meter |
| **Type** | MAKEL C510-58.51 | | | | | |
| **Production Standard and Class** | C | | | | | |
| **Serial Number** | 65002578 | 65002507 | 65002640 | 65003077 | 65002425 | 65002695 |
| **Accuracy Class** | 0.5S | | | | | |
| **Meter delivery date** | 11/01/2018 | | | | | |

Personnel at the plant keep records for electricity generation amount and reports to operation manager every month. Records are kept in electronic format for a 2-years basis. The data is monitored via electricity meters. There are 6 meters in total for the projects. Meters are remotely read by (via OSOS system) by distribution company (Fırat EDAŞ) monthly. Yearly electricity generation will be calculated by summing up monthly meter reading records. Data monitored will be kept in electronic form and hard copy until the end of the second year after the end of the crediting period. These records can be used for monitoring in case of any problem will arise in meters. The technical specifications of the meters are given below. Calibration of the meters will be conducted on a 2-year basis.

Lahit will keep the collected data during the crediting period and until two years after the last issuance of VERs for the Gezin SPP activity for that crediting period.

Given a data vintage based on ex-ante monitoring and selection of a renewable 5-year crediting period, the Combined Margin will be recalculated at any renewal of the crediting period using the valid baseline methodology.

Potential leakage emissions in the context of power sector projects are emissions arising due to activities such as power plant construction, fuel handling, and land inundation. However, according to the methodology, those emission sources do not need to be considered.

Operational and Management Structure

As described before, there are two main factors important for the calculation of emission reductions. The only relevant data that have to be monitored is only net electricity generation ($EG_{facility,y}$) per year. Since project emission is zero no additional monitoring is required. The generation data are subject to the strict internal quality control systems of both parties. The monthly meter reading documents are stored by Lahit and Fırat EDAŞ (distribution company). The settlement notification, which is issued by Fırat EDAŞ and includes the meter reading data, is stored on a Fırat EDAŞ file server and accessible for Lahit and Petrojes that can read them manually when they want.

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 ensure the availability and high quality of the necessary data for monitoring.

# Conclusions

Society has made steady strides, but so far, many find it insufficient to address the issue of climate change and its consequences. Try to find alternative urgently is essential. Technological, social, or population growth and risk production can be minimized. The renewable energy is undoubtedly the way forward, study and technological advances, making the economic and environmental point of view ever more profitable, are undoubtedly the subject of discussion in the coming years.

In this way, certification and reduction, investment in alternative and clean energy and the efforts of all will go the way.

Taking as an example the market and the voluntary action that was developed in this document, it was demonstrated that it is possible to change or execute the situation.

The main obstacles to the realization of this project highlighted above all:

• Communication difficulties and waiting time between revisions, reformulations, and acceptance of documents;

• Difficulties in complying with required legislation and requirements;

• The complexity of the certification process;

The future of this type of project is guaranteed, those executed by all are visible as parties to a more sustainable development or one that will be beneficial to all.

All the objectives of the work were achieved, only highlighting the impossibility of following the final phase of acceptance and certification of the project, the deadlines that the company expects.

As a final, important and important conclusion to this type of mobility program is the possibility of applying the knowledge of the field of study to a personal, professional level.

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