DENİZLİ WIND POWER PROJECT, TURKEY

Document Prepared By Life Enerji

Project Title	Denizli Wind Power Project, Turkey
Version	01
Date of Issue	06/07/2018
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1

PROJECT DETAILS

1.1 Summary Description of the Project

Korda Enerji Üretim Pazarlama İthalat ve İhracat A.Ş. (hereafter referred to as "Korda") invested into a new Wind Power project called Denizli Wind Power Project, Turkey (hereafter referred to as the "Project" or "Denizli WPP"), which involves installation and operation of 3 MWp wind turbines. The project is involved of 22 wind turbines. The generated energy will be fed to the grid Çan Havza TM.

An estimated electricity net generation of 186,100 MWh per year by the efficient utilization of the available wind 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 105,524 tonnes of CO2e/year. The total emission reduction by the project activity is estimated to be 633,144 tonnes of CO2e for the first crediting period, which is 01/01/2019 to 31/12/2028. Moreover, project activity will contribute further dissemination of wind energy and extension of national power generation.

The project will help Turkey to stimulate and commercialize the use of grid connected renewable energy technologies and markets. Furthermore, the project will demonstrate the viability of grid connected solar farms which can support improved energy security, improved air quality, alternative sustainable energy futures, improved local livelihoods and sustainable renewable energy industry development. The specific goals of the project are to:

- 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 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.

1.2 Sectoral Scope and Project Type

Title: Grid Connected Electricity Generation from Renewable Sources
Reference: ACM 0002 (Version 18.1) [1]

For the determination of the baseline, the official methodology ACM0002 version 18.1, "Large-scale Consolidated baseline methodology for grid-connected electricity generation from renewable sources"[2], is applied, using conservative options and data as presented in the following section. This methodology refers to five Tools, which are:

1. Tool to calculate the emission factor for an electricity system (Version 6.0.0)[3];
2. Tool for the demonstration and assessment of additionality (Version 07.0.0)[4];
3. Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0.0)[5];
4. Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 03.0.0)[6].
5. Tool to determine the remaining lifetime of the equipment (Version 01.0.0.)[7]

[1] Please see ACM0002 Version 18.1: https://cdm.unfccc.int/methodologies/DB/5725LCHYPYM4I1V8OD9SFYVAMFFWNP

[2] Please see ACM0002 Version 18.1: https://cdm.unfccc.int/methodologies/DB/5725LCHYPYM4I1V8OD9SFYVAMFFWNP

[3] Please see https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v6.pdf

[4] Please see https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

[5] Please see https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf

[6] Please see https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf

The first tool is used for baseline calculation and second tool is used for additionality assessment. As third tool is the combination of the first and second tool, it is not used. Since no project emission or leakage calculation is required for wind power project, fourth tool is not used, and finally to determine the remaining lifetime of the equipment, fifth tool is used.

Since the project activity is a wind power plant, the respective sectoral scope is scope 1: "Energy Industry – Renewable/Non-renewable Sources". Project participant hereby confirms that this is not a grouped project.

1.3 Project Proponent

Organization name	Korda Enerji Üretim Pazarlama İthalat ve İhracat A.Ş.
Contact person	Uğur İlhan
Title	Electrical Works Specialist
Address	Akfen Yenilenebilir Enerji A.Ş. Turan Güneş Bulvarı Galip Erdem Cad. No: 3 Çankaya/ANKARA
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1.4 Other Entities Involved in the Project

Organization name	Life İklim ve Enerji Ltd Sti
Role in the project	Project consultant
Contact person	Kaan Bolat
Title	Assistant expert
Address	Oğuzlar Mah 1377 Sk No:19/9 Balgt/Çankaya-Ankara TURKEY
Telephone	+90 312 481 21 42
Email	kaan.bolat@lifeenerji.com

1.5 Project Start Date

Project start date is expected to be 01/09/2019.

1.6 Project Crediting Period

Start date of the crediting period is expected to be 01/01/2019, and it shall be a crediting period of 10 years. The lifetime of the project is 25 years.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

[7] Please see http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf

Project Scale	
Project	
Large project	x

Year	Estimated GHG emission reductions or removals (tCO_2e)
01/01/2019	105,524
2020	105,524
2021	105,524
2022	105,524
2023	105,524
2024	105,524
2025	105,524
2026	105,524
2027	105,524
31/12/2028	105,524
Total estimated ERs	1,055,240
Total number of crediting years	10
Average annual ERs	105,524

1.8 Description of the Project Activity

The technology being employed, converts wind energy into electrical energy. The technology is an environment friendly technology since there are no GHG emissions associated with the electricity generation.

The proposed project will use wind turbines. Since the project activity is a Greenfield installation there was no electricity generation at the project site prior to its implementation. Technical specifications of typical modules will be as follows:
Table 1: Technical specification of the module and the inverter

Table 1: Technical specifications of Siemens SWT-3.4-108 Curtailed to 3MW[8]

[8] See; Yield Assessment Report page 40

Specifications	Siemens SWT-3.4-108 Curtailed to 3 MW
Rated Power (kW)	3000
Rotor Diameter (m)	108
Blade Length (m)	62
Num. of Blades	3
Swept Area (m²)	12469
Cut-out wind speed (m/s)	22.5

Technical life time of Denizli is determined by using the 'Tool to determine the remaining lifetime of equipment '' (v. 1)[9]. In the tool it is stated that;

Project participants may use one of the following options to determine the remaining lifetime of the equipment:

(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 warranty[10].

1.9 Project Location

The project is located in Denizli Province, Babadağ District, Demirli Village Location of the project is given in Figure 1 . The project is in the territory of Demirli Village[3]. And also the coordinates of the project activitiy are given under Table 2.

[6] See, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf

[7] Please see EPC agreement

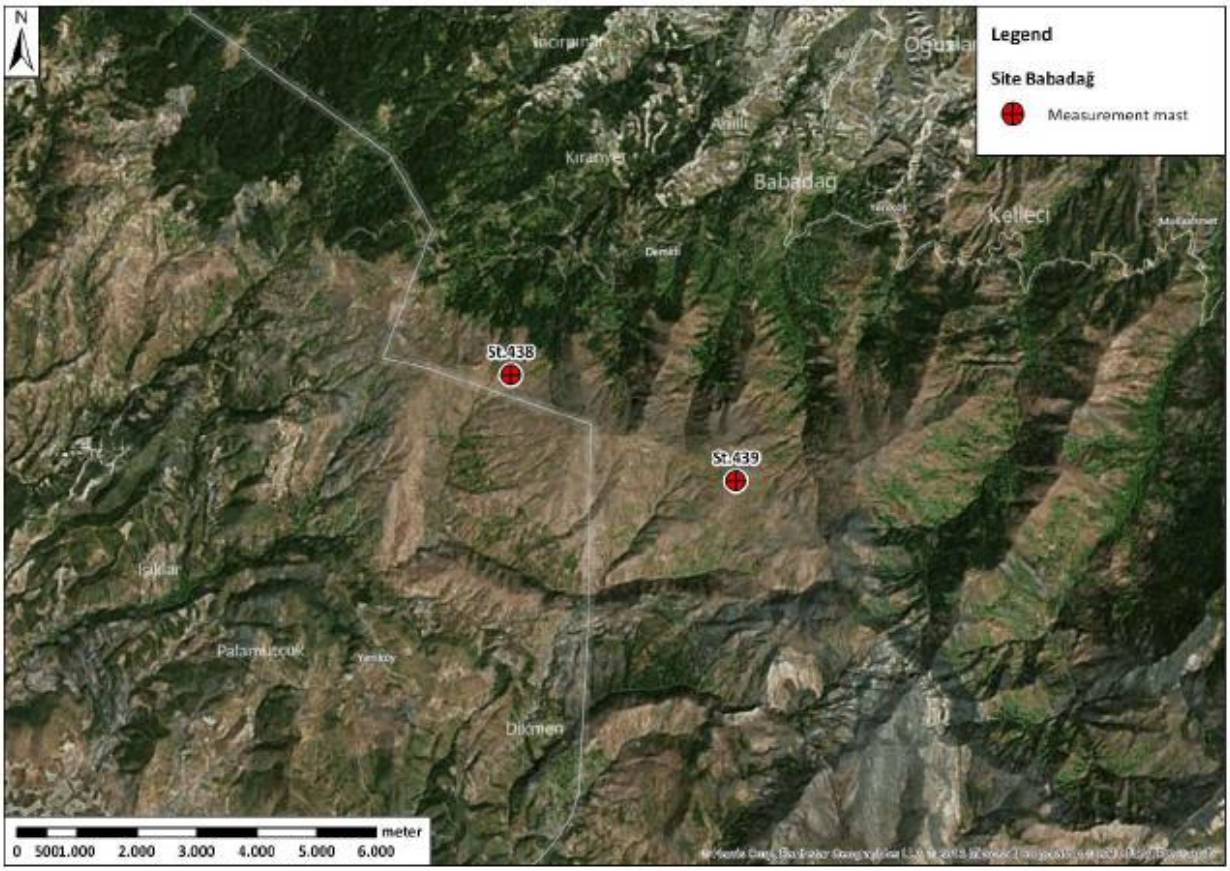

Figure 1: Location of the plant[11]

Table 2: Geographic coordinates of the project activity of Denizli WPP[12]

[11] Please see, Energy Yield Assesment Report.

[12] Please see Production License

Wind Turbine No.	I. Latitude (N)	. Longitude (E)
1	37º 47' 20.6232''	28º 46' 23.1853''
2	37º 47' 12.2208''	28º 47' 01.8137''
3	37º 47' 03.9120''	28º 47' 14.8588''
4	37º 47' 01.2264''	28º 47' 27.2621''
5	37º 47' 00.8664''	28º 47' 48.5921''
6	37º 46' 57.2304''	28º 48' 07.8802''
7	37º 46' 48.7524''	28º 48' 21.2862''
8	37º 46' 40.6128''	28º 48' 27.3013''
9	37º 46' 28.7040''	28º 48' 38.1288''
10	37º 46' 27.5160''	28º 49' 06.7112''
11	37º 46' 22.2780''	28º 49' 16.2287''
12	37º 46' 20.9208''	28º 49' 30.3374''
13	37º 46' 16.3164''	28º 49' 51.1912''
14	37º 46' 10.6140''	28º 50' 03.2709''
15	37º 46' 12.4608''	28º 50' 38.6291''
16	37º 46' 03.8532''	28º 50' 43.5239''
17	37º 45' 55.1196''	28º 50' 46.0450''
18	37º 45' 45.2808''	28º 50' 54.7502''
19	37º 45' 36.4392''	28º 51' 02.1310''
20	37º 45' 28.4112''	28º 51' 11.2480''
21	37º 45' 19.0440''	28º 51' 25.1119''
22	37º 45' 24.4980''	28º 51' 55.5690''

1.10 Conditions Prior to Project Initiation

The pre project scenario is same as baseline scenario. Please refer Section 2.4 (Baseline Scenario) for the description of baseline scenario.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

Laws as relevant to the project are (Law No. and Enactment Date):

(1) Electricity Market Law[13]

(2) Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy[14]

[13] See: http://www.epdk.gov.tr/documents/elektrik/mevzuat/kanun/Elk_Kanun_6446.doc (Enactment Date:2013)

(3) Environment Law[15]

(4) Occupational Health and Safety Regulation[16] (Nr. 6331, 30.06.2012)

1.12 Ownership and Other Programs

1.12.1 Project Ownership

The Project is owned by individual Korda Enerji Üretim Pazarlama İthalat ve İhracat A.Ş.

1.12.2 Emissions Trading Programs and Other Binding Limits

Not applicable: The project activity is neither included in an emissions trading program nor does it take place in a jurisdiction or sector in which binding limits are established on GHG emissions.

1.12.3 Other Forms of Environmental Credit

The project has not created any form of other credit. Korda Enerji Üretim Pazarlama İthalat ve İhracat A.Ş. does not obtain any public funding.

1.12.4 Participation under Other GHG Programs

The project does not participate/has not participated under any other GHG program.

1.12.5 Projects Rejected by Other GHG Programs

Denizli Wind Power Project has not applied for crediting under any other GHG program nor has it been rejected from any other GHG program.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

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

This is not a grouped project activity

Leakage Management

Not applicable.

Commercially Sensitive Information

Any commercially sensitive information that has been excluded from the public version of the VCS PD that will be displayed on the VCS Project Database shall be listed by the project proponent.

Sustainable Development

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[14] See: http://www.epdk.org.tr/documents/elektrik/mevzuat/kanun/Elk_Kanun_Yek_Kanun.doc (Enactment Date: 2005)

[15] See: http://www2.cevreorman.gov.tr/yasa/k/2872.doc (Enactment Date: 1983)

[16] See: http://www.resmigazete.gov.tr/eskiler/2012/06/20120630-1.htm

As the project developer, **Korda** believes that efficient utilization of all kinds of natural resources with a harmony coupled with responsible environmental considerations is vital for 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 significant reduction in greenhouse gas (GHG) emissions, the project has been carried out to provide 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:

Environmental
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 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, majority of which are based on fossil fuels. Thus, the project is replacing the greenhouse gas emissions (CO_2, CH_4) and other pollutants (SO_X, NO_X, particulate matters) occurring from extraction, processing, transportation and burning of fossil-fuels for power generation connected to the national grid.

Economical
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 sector will be encouraged to invest in solar power generations. It will also assist to reduce 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.

Social
Local employment will be enhanced by all project activities during 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 contribution of the project to welfare of the region, the quality of the electricity consumed in the region will be increased by local electricity production, which also contributes decreasing of distribution losses.

Technological

Implementation of the proposed project will contribute to wider deployment of solar power technology in 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 pillars of Turkish electricity supply based on ecologically sound technology.

Further Information

Not applicable.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

For the determination of the baseline, the official methodology ACM0002 version 16.0.0, "Large-scale Consolidated baseline methodology for grid-connected electricity generation from renewable sources"[17], is applied, using conservative options and data as presented in the following section. This methodology refers to five Tools, which are:

1. Tool to calculate the emission factor for an electricity system (Version 04.0.0)[18];
2. Tool for the demonstration and assessment of additionality (Version 07.0.0)[19];
3. Combined tool to identify the baseline scenario and demonstrate additionality (Version 05.0.0)[20];
4. Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 02.0.0)[21].
5. Tool to determine the remaining lifetime of the equipment[22]

For baseline calculation the first tool, for additionality assessment the second tool is used. As third tool is the combination of the first and second tool, it is not used. Since no project emission or leakage calculation is required for wind power project fourth tool is not used, and finally to determine the remaining lifetime of the equipment fifth tool is used.

2.2 Applicability of Methodology

Since the project is below 99 MW installed capacity, large scale methodology ACM 0002 version 18 is used. The applicability criteria are described as follows;

Applicability Conditions in the ACM0002/Version18.0	Applicability to this project activity
This methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Install a Greenfield power plant; (b) Involve a capacity addition to (an) existing plant(s); (c) Involve a retrofit of (an) existing operating plants/units; (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s).	The project activity consists of installation of Greenfield power plant at a site where no renewable power plant was operated prior to the implementation of the project activity. Thus, it meets the said applicability condition.
The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with	The project activity is the installation of 22 numbers of wind turbine generators (WTVCS). Hence, meets this criterion.

[17] ACM0002 Version 18: https://cdm.unfccc.int/methodologies/DB/5725LCHYPYM4I1V8OD9SFYVAMFFWNP

[18]See; http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf

[19] See; http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

[20] See; http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v5.0.0.pdf

[21] See; http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

[22] See; http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf

or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	
In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	The project activity does not involve capacity additions, retrofits, rehabilitations or replacements. Hence this criterion is not applicable to the project activity.
In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: a. Lower than or equal to 15 MW; and	The project activity is not a hydro power plant. Hence this applicability criterion is not relevant to the project activity.

b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	
In the case of integrated hydro power projects, project proponent shall: (a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	The project activity is not a hydro power plant. Hence this applicability criterion is not relevant to the project activity.
The methodology is not applicable to: (a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (b) Biomass fired power plants/units	Project activity does not involve: • Switching from fossil fuels to renewable energy sources at the site of the project activity. • Biomass fired plants. Hence this criterion is not applicable.
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance”.	The project is not a retrofit, rehabilitations, replacements or capacity addition; hence this applicability criterion is not relevant.
In addition, the applicability conditions included in the tools referred to above apply.	Applicability conditions of the applied tool are justified

2.3 Project Boundary

The project Denizli uses wind energy to produce electricity. Kinetic power of the wind is converted to electrical energy, which then will be transferred to the grid. Back-up power generators in the wind farm will only be used when the wind farm is out of service and power cannot be supplied from grid. Hence, emissions due to usage of back-up power generation are expected to be very low and are taken to be zero complying with the ”Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion “(v.2)

Project boundary diagram is depicted in the diagram below:

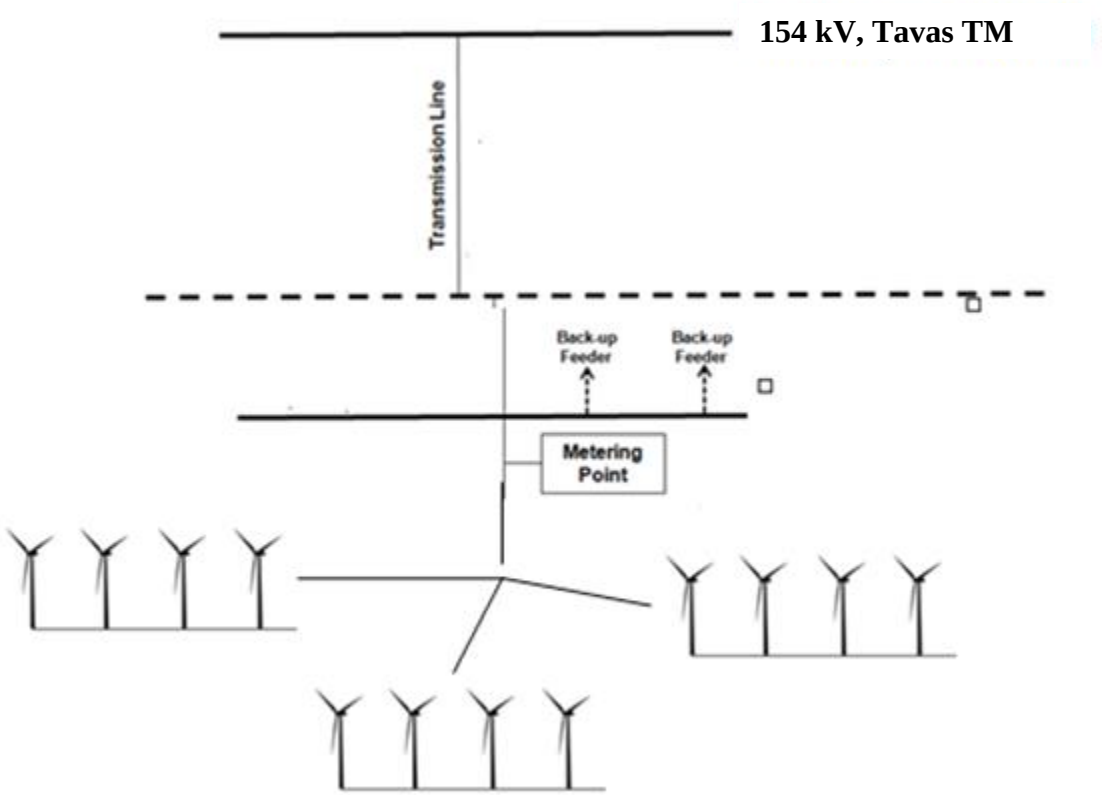


***Figure 2**: Project boundary diagram*

Source		GHVCS	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 to 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

2.4 Baseline Scenario

According to the guidelines of the applicable large scale approved methodology ACM 0002 (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, 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 3 and Figure 3 are examined, electricity demand is expected to exceed 340 billion kWh in 2026 with an average increase of 2.6%[23] 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.[24]

***Table 3**: 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

[23] Please see: https://www.teias.gov.tr/sites/default/files/2017-06/10Y%C4%B1ll%C4%B1kTalepTahminleriRaporu2016%282%29.pdf

[24] Please see: https://www.teias.gov.tr/sites/default/files/2017-06/10Y%C4%B1ll%C4%B1kTalepTahminleriRaporu2016%282%29.pdf

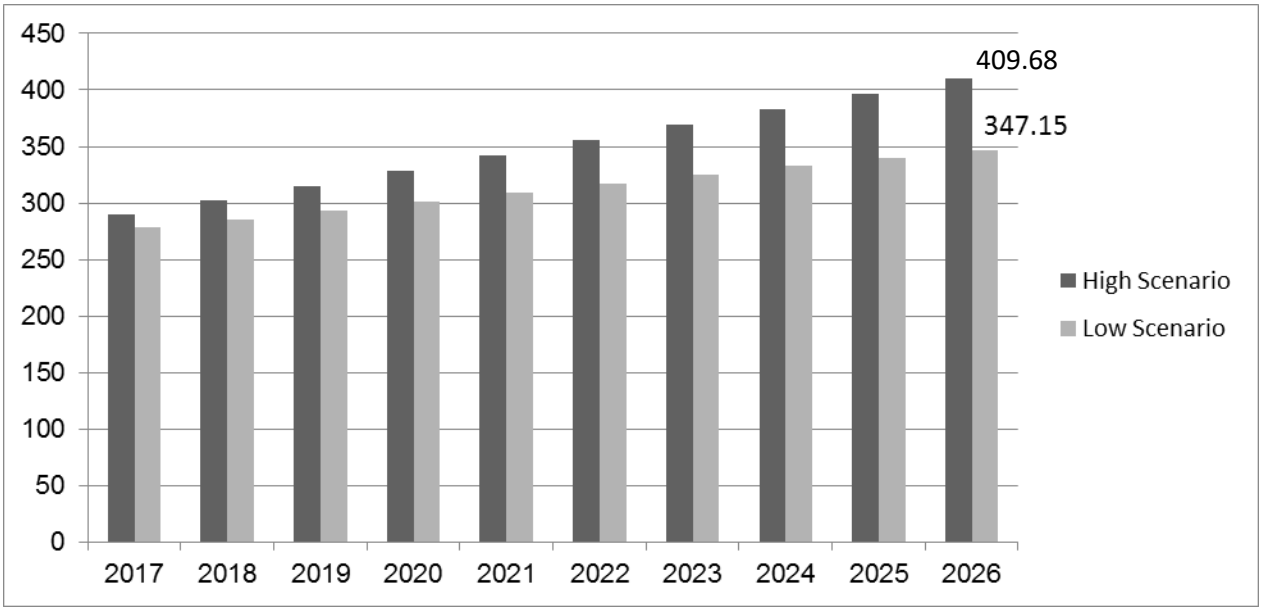


***Figure 3**: Electricity Demand Projections for Ten Years*

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 4**: Projection of Total Generation Capacity by Fuel Types (TWh)*[25]

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

[25] Please see: https://www.teias.gov.tr/sites/default/files/2017-12/KapasiteProjeksiyonu2017a%C4%9Fustos.pdf

TOTAL	**429.416**	**481.415**	**497.051**	**504.472**	**529.440**	**560.729**	***100.0%***

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 Turkish electricity sector, which is given in **Figure 4**.

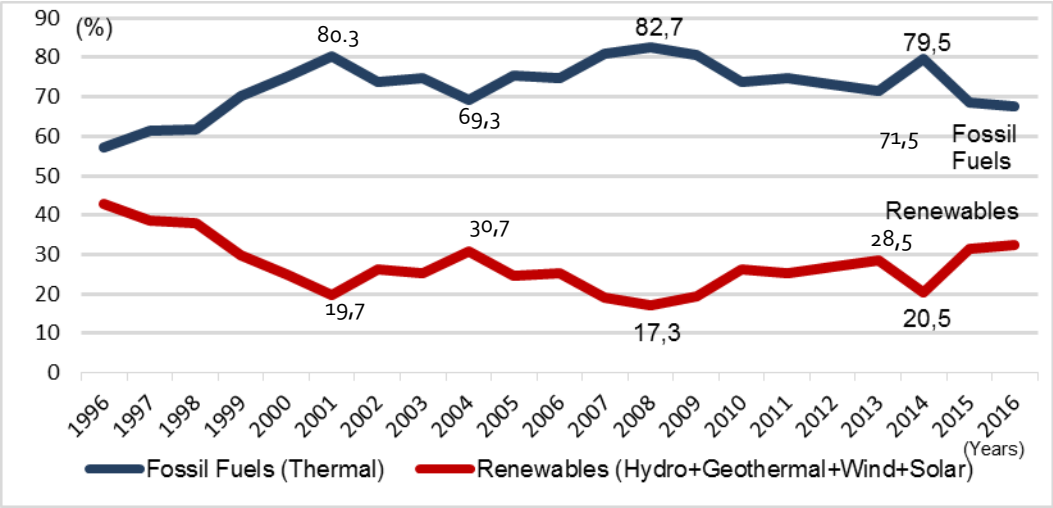


***Figure 4**: Fossil Fuels and Renewable in Turkish Electricity Mix (1996-2016)*[26]

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

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

• Conclusion-2: Even all operational plants, construction phase plants and licensed ones are taken into account lack of supply is projected after five operational years.[27] So, there is 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 coming years.

• Conclusion-3: Fossil fuels will hold the dominance in generation mix till the end of 2021 with 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 total share by the end of that period. This also shows that most of new capacity additions will be fossil fuel fired power plants. *The combination of aforementioned trends indicates that if Denizli WPP would not be built, power from a new grid-connected thermal plant would be the most likely scenario*.

2.5 Additionality

For the explanation of how and why the project activity leads to emission reductions that are additional to what would have occurred in the absence of the project activity, the Baseline Methodology refers to the consolidated "Tool for the demonstration and assessment of additionality"[28] version 7.0.0 (Tool), which defines a step-wise approach to be applied to the proposed project.

[26] Please see: http://www.teias.gov.tr/sites/default/files/2017-10/46.xls

[27] https://www.teias.gov.tr/sites/default/files/2017-12/KapasiteProjeksiyonu2017a%C4%9Fustos.pdf

[28] Version 7, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf (Page7)

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations.

Sub-step 1a. Define Alternatives to the project activity

To identify the realistic and credible alternative scenario(s) for project participants, scenarios in the Tool are assessed:

a) The proposed project activity undertaken without being registered as a VCS VER project activity

This alternative is realistic and credible as Denizli WPP may undertake project activity if it sees no risk for project and/or if the project turns out to be financially attractive without VCS VER credit income. However, investments analyze shows that the project is not economically feasible without VCS VER credit income. Detail information is given in Step-3.

b) Other realistic and credible alternative scenario(s) to the proposed VCS VER project activity scenario that deliver electricity with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology;

The project activity is power generation activity without any greenhouse gas emission harnessing the energy of the wind. Being a private entity, Denizli doesn't have to invest power investments even proposed project activity. Also, since Denizli has a license only for wind power investment and since in the proposed project area there is no hydro or other sources for electricity generation, other project activities delivering same electricity in the same project area is *not* realistic for project participant.

c) Continuation of the current situation, i.e. Denizli WPP is not built

The decision in favor or against a project investment depends on the expected revenues and risks, like for every other private investment. Investment decisions other than Denizli WPP are independent from the question whether Denizli WPP is built or not. This alternative is also realistic and credible.

According to baseline scenario, which is described in B.4, there is a need for energy investment to satisfy increasing demand and if the Denizli WPP is not built, the same amount of energy will be supplied by other private investors to the grid. Forecasts shows that electricity supplied in the absence of Denizli WPP will be mainly based on fossil fuels as the projections for the year of 2017 forecasts 73.85% share for fossil fuels in the energy mix.

In the absence of the project the power will be produced by new and existing power plants in accordance with the baseline in ACM0002 version 18.

Outcome of Step 1.a: Therefore, two realistic and credible alternative scenarios are identified for the project activity:

a) The proposed project activity undertaken without being registered as a VCS VER project activity.

b) Continuation of the current situation, i.e. Denizli WPP is not built.

Sub-step 1b. Consistency with mandatory laws and regulations

Both alternatives are (building or not building the project activity) in compliance with the following identified applicable mandatory laws and regulations:

(1) Electricity Market Law[29]
(2) Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy[30]
(3) Environment Law[31]

Table 5: Project Implementation Schedule

Date (DD/MM/YYYY)	Activity
15/07/2011	"EIA is not required" certificate
18/08/2011	Issuance of the License
20/10/2014	Site Related Wind Potential Analysis and Energy Yield Assessment Report at the Babadağ Site
19/03/2018	Agreement with Equipment provider

According to Turkish regulations, to get necessary permits for further project implementation, license issued by EMRA is required. Hence, issuance of license cannot be considered as 'Investment Decision Taken Date' but a prerequisite to proceed for further project development activities. Notice to proceed date of electromechanical equipment contract is set to be Investment Decision Taken Date (19.03.2018). From above Implementation Schedule it can be seen that Denizli WPP after having license started to analysis of VER and decided to get consultancy for VER development, much before planned construction starting date.

Aforementioned project implementation schedule shows us that Denizli WPP started to consideration of VER from the beginning of the project implementation and VER Revenue has decisive impact on decision of proceeding to the project.

In the following, the investment analysis is applied to clearly demonstrate that the project activity is unlikely to be financially/economically attractive without the revenue from the sale of VERs.

Outcome of Step 1.b: Denizli consisted with mandatory laws and regulations. Project implementation schedule shows us that Denizli started to consideration of VER from the beginning of the project implementation and VER Revenue has decisive impact on decision of proceeding to the project.

Step 2. Investment analysis

"Guidelines on the assessment of investment analysis[32]" version 5 is taken into account when applying this step.

Applied tool: **"Tool for the demonstration and assessment of additionality version 7.0.0"**

Sub-step 2a: Determine Appropriate Analysis Method

Three options can be applied for the investment analysis: the simple cost analysis, the investment comparison analysis and the benchmark analysis.

- Option I: Simple cost analysis

[29] See, http://www.emra.org.tr/EN/Document/6654

[30] See, http://www.emra.org.tr/EN/Document/6659

[31] See, http://www2.cevreorman.gov.tr/yasa/k/2872.doc (Enactment Date: 1983)

[32] See, http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

- Option II: Investment comparison analysis
- Option III: Benchmark analysis

The simple cost analysis is not applicable for the proposed project because the project activity will have revenue (from electricity sales) other than CDM related income. The investment comparison analysis is also not applicable for the proposed project because the baseline scenario, providing the same annual electricity output by the Turkish National Grid, is not an investment project.

To conclude, the benchmark analysis will be used to identify whether the financial indicators (Equity IRR in this case) of the proposed project is better than relevant benchmark value.

Sub-step 2b: Option III: Benchmark analysis

While applying the Benchmark Analysis, Option III, the Equity IRR is selected as the financial indicator for the demonstration of the additionality of the project as permitted in the additionality tool.

Benchmark rate is calculated in line with "Tool for the demonstration and assessment of additionality" (v.7) which suggests using the government bond rates, increased by a suitable risk premium. The government bonds are used for determining the Benchmark because there is no pre-determined value for IRR or any other financial indicator for wind power projects in Turkey at the investment decision date of the project.

According to the Tool, benchmark can be derived from 'Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds'.
Ministry of Development publishes "Main Economic Indicators" on a monthly basis. Since the project is a mid-term investment (exceeding one yerar), lending rate for medium term investment has been selected as the benchmark. The lending rate for the medium term investment as estimated by the Turkish Development Bank is 13,8% for the March 2018[33]. This 13,8% is taken as the benchmark value. Assessment of likelihood conditions for each parameter to reach benchmark IRR is provided below:

Electricity Price
In order to reach 13,8% equity IRR benchmark, electricity price 61.4 EUR/MWh which is 10.7% higher than assumed price (55.5 EUR/MWh). This feed-in-tariff price is already very high compared to general market price and not likely to increase. Thus, this 10.7% increase of the feed-in-tariff is not likely to happen.

Investment Cost
In order to reach benchmark IRR, investment costs shall be decreased more than 10,6%. Since the equipment contract which has the higher share of the total costs is fixed, 10,6% decrease in the investment cost is unlikely. Thus it is not likely for project activity to have threshold investment cost and reach to benchmark IRR.

Energy Yield
To have benchmark IRR, annual energy yield amount shall increase 10,7% more than base case electricity generation amount used in financial analysis. Although most of the wind power project uses p90 electricity generation amount from energy yield reports, to be conservative in financial investment analysis of the project activity p75 is used (139,862 MWh/yr). Even p50 figure of the project activity

[33] Republic of Turkey, Ministry of Development Website. Main Economic Indicators.Section 7, 13th Excel Sheet. Table 7.13- Lending and Deposit Interest Rates. Published for the second quarter of 2016, but the rate has been taken for the investment decision taken date, which is 15/03/2013

http://www.kalkinma.gov.tr/Pages/TemelEkonomikGostergeler.aspx

(154,919,882kWh/yr[34]) is almost equal to the threshold energy yield amount. These figures are annual electricity generation to be sold. Using electricity generation amount in financial analysis, which have less than 10,7% probability of occurrence is not rational. Thus it is not likely for project activity to generate threshold energy yield to reach benchmark IRR.

Operation Cost
In order to reach benchmark IRR, annual operation decrease more than 38%. Such huge decrease in annual operation cost is not likely.

Sub-step 2c: Calculation and comparison of the IRR

In the paragraph 12 of the 'Guidance on the Assessment of Investment Analysis'[35] version 5, it is stated that:
'Required/expected returns on equity are appropriate benchmarks for equity IRR'. Since, benchmark identified in the Sub-step 2b *is required/expected returns on equity*, equity IRR (after tax) of the project activity shall be calculated for comparison.

Table 6: IRR inputs

Item	Value	Units	Source	Date of The Source Document
Installed Power	66/45	MWm/ MWe	License of The project	22/12/2011
Technical lifetime of the project	25	years	Tool to determine the remaining lifetime of equipment (v.1) [36]	16/10/2009
Gross Generation	186,100	MWh	Denizli Wind Data Analysis and Energy Production Generation Assessment Report	03/02/2012
Electricity tariff	55.5	EUR Per MWh	Feed-in-tariff[37]	18/05/2005

Technical life time of the Denizli WPP is determined by using the 'Tool to determine the remaining lifetime of equipment'' (v.1). In the tool it is said that default lifetime for the on-shore wind turbines is 25 years.

The equity IRR (after tax) of Denizli WPP is calculated on the basis of expected cash flows (investment, operating costs and revenues from electricity sale), as used in the financial analysis for the feasibility assessment of the project.

[34] See; Power Production Assesment

[35] See, http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf (Page 3)

[36] See; http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf

[37] For feed-in-tariff (5.5 Eur/kWh) see, http://www.epdk.org.tr/TR/Dokuman/1859 (page 2-footnote 1)the Law stating the electricity selling price is revised and the new law is : http://www.epdk

.org.tr/TR/Dokuman/6777 However, the price has not been changed in the Law, so the 5.5 €/kWh, which is stated in the former Law is still valid. This explanation is also given with the footnotes in the IRR Excel and PDD.

The parameters and values used for the IRR calculation are available to DOE during validation and also can be seen from the chart below.

FINANCIALS	
Equity Amount	Confidential
Loan Amount	Confidential
Interest Rate	6,00%
Repayment Period	5
Grace Period (years)	2
Construction Start Date	21.10.2013
Power Plant Operation Start Date	20.08.2014
Investment Decision Date	15.03.2013
USD/TL	1,8085
EUR/USD	1,3054
EUR/TL	2,3608
Corporate Tax Rate	20%

The resulting IRR for 25 years is stated in below table.

Table 71: Equity IRR value for project activity (after tax)

Period	**IRR**
25 years	10,2070%

The Benchmark is 15%, it does clearly exceed the resulting equity IRRs, thus rendering the project activity economically unattractive.

PLF= Annual Gen. / Installed Cap. * (working hours)
=186,100/45*8760
=0.364

Sub-step 2d: Sensitivity analysis

While the main parameter determining the income of the project is the electricity sales revenue, investment cost and operation cost, a variation of the accordant values shall demonstrate the reliability of the IRR calculation. Key parameters are varied with +/-10%. The worst, base and best-case results for each parameter variation are given below, in **Table 82**8.

The sensitivity analysis confirms that the proposed project activity is unlikely to be economically attractive without the revenues from VERs as even the maximum IRR result for the best case scenario (12,8284%) is below the benchmark, which is 13%

Table 82: Equity IRR results according to different parameters

Parameter	**Electricity Price**			**Investment Cost**			**Energy Yield**			**Operating Cost**		
Variance	-10%	0%	10%	-10%	0%	10%	-10%	0%	10%	-10%	0%	10%
IRR	7,60%	10,21	12,83	12,81	10,21	8,37%	7,60%	10,21	12,83%	11,71	10,21%	8,55%

		%	%	%	%			%		%		

Step 3. Barrier analysis

The investment analysis has fully demonstrated and explained the additionality of the project, so step 3 is skipped.

Step 4: Common Practice Analysis

The section below provides the analysis as per step 4 of the *"Tool for the demonstration and assessment of additionality"*, version 7.0.0 and according to the Guidelines on Common Practice version 02.0

Step 1. Calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity: The proposed project has a capacity of 45 MWe. Per the guideline of +/-50%, the applicable output range for the project is **22.5 MW to 67.5 MW**.

Step 2: Identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:

(a) The projects are located in the applicable geographical area; (Turkey)
(b) The projects apply the same measure as the proposed project activity; (Renewable Energy Projects)
(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity; (Wind Power Plants)
(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant; (N.A.)
(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1; (33 MW-99 MW)
(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity; (N.A.)

Table 39: WPP's with the same output range

Reference***		NAME OF THE PLANT	Installed Power MW	Project Production Capacity GWh	Fuel Type
Page 97	9	AKDENİZ ELEK. MERSİN RES	33	100	Wind
Page 97	10	AKRES (AKHİSAR RÜZGAR)	43,8	165	Wind
Page 97	17	BELEN HATAY	36	114	Wind
Page 97	18	BERGAMA RES (ALİAĞA RES)	90	355	Wind
Page 97	19	BORASKO BANDIRMA	60	240	Wind
Page 97	26	MARE MANASTIR	39,2	129	Wind
Page 97	28	KİLLİK RES (PEM EN.)	40	86	Wind
Page 97	34	ERTÜRK ELEKT. (ÇATALCA)	60	210	Wind
Page 97	35	İNNORES ELEK. YUNTDAĞ	52,5	213	Wind
Page 97	38	SAYALAR RÜZGAR (DOĞAL ENERJİ)	34,2	108	Wind

Page 97	42	SOMA RES (BİLGİN ELEK.)	90	307	Wind
Page 97	43	SUSURLUK (ALANTEK EN.)	45	112	Wind
Page 97	44	ŞAH RES (GALATA WIND)	93	400	Wind
Page 97	47	ZİYARET RES	57,5	210	Wind

Step 3: Within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.

N_{all} = 0

Step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}.

N_{diff}= 0

Step 5: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

$F = 1-N_{diff}/N_{all}$
$= 1 – (0/0)$
Factor F is therefore **unidentified**.

2.6 Methodology Deviations

There is no methodology deviation.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

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 8,395 MWh of clean energy per annum.

SDG 8 Decent Work and Economic Growth
The project leads to employment opportunities which 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 mitigation of 105,524 tCO2 per annum.

Baseline scenario is identified and described in B.4. Emission reductions due to project activity will be calculated according to “Tool to calculate the emission factor for an electricity system”(v6) (Tool)[38] as indicated in ACM 0002.

[38] Please see: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf (version 05)

Stepwise approach of „*Tool to calculate the emission factor for an electricity system*" version 06.0.0 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*[39]".

As it can be understood from this phrase, only one transmission system, which is national transmission system is defined and only TEİAŞ is in the charge of all transmission system related activities. Moreover, a communication with representative of TEIAS, which indicates that: "*There are not significant transmission constraints in the national grid system which is preventing dispatch of already connected power plants*" is submitted to the DOE. Therefore, the national grid is used as 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.[40]Because of that, for BM calculation transmission capacity is not considered.

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

[39] Please see, www.enermet.com.tr/upload/mce/.../1._electricity_market_licensing_regulation.doc (Page 21)

[40] Please see, http://www.epdk.org.tr/TR/Dokumanlar/Elektrik/YayinlarRaporlar/UretimKapasiteProjeksiyonlari

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 must run resources. 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 10: *Share of Low Cost Resource (LCR) Production 2012-2016 (Production in GWh)*[41]

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 last five years	27.33%				

As 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 Simple OM method**, with the most recent data for the baseline calculation stemming from the years 2012 to 2016.

<u>Step 4.</u> 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 are considered as low-cost power sources and 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:

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

[41] Please see: https://www.teias.gov.tr/sites/default/files/2017-10/59%282000-2016%29.xls

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 sources 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 excel table that shows 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 11**.

***Table 11**: 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 12:** Gross electricity production by fossil energy sources 2014-2016 (GWh)*[42]

Gross Electricity Production by Energy Source 2014-2016 [GWh]			
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

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 on the basis of overall gross and net production numbers.

***Table 13**: Net/gross electricity production 2014-2016 (GWh)*[43]

Relation Net/Gross Electricity Production 2014-2016

[42] Please see: https://www.teias.gov.tr/sites/default/files/2017-10/59%282000-2016%29.xls

[43] Please see: https://www.teias.gov.tr/sites/default/files/2017-10/56%2893-2016%29.xls

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%

Multiplying these overall gross/net relation percentages with the fossil fuels generation amount does in fact 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 14 shows the resulting net data for fossil fuel generation and adds electricity imports.

Table 14: *Electricity supplied to the grid, relevant for OM (GWh)*

Net El. Production by fossil fuels and Import 2014-2016 [GWh]			
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

Electricity import is added to the domestic supply in order 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.

The last step is to calculate $EF_{grid,OMsimple,y}$:

Table 15: Calculation of Weighted $EF_{grid,OMsimple,y}$ ($ktCO_2$/GWh)

	2014	2015	2016
CO2-Emmissions (ktCO2)	122,715	113,727	123,437
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)**

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 chose 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 the 2013 which is the latest year for official statistics published for plants put in operation. VER plants are excluded from 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 (AEVCSET->20%) GWh. Total electricity generation of last five power plants in operation is 369 GWh (AEVCSET-5-units) which is lower than 20% total generation in 2016. Since AEVCSET->20% is bigger than AEVCSET-5-units , SET->20% is chosen as SETsample. Also in the sample group there is no power plant started supply electricity to grid more than 10 years ago, steps d, e and f are ignored.

Sample group for BM emission factor is given below table. The derivation of the values presented in **Table 16** is contained in a separate excel file which is available for validation.

Table 16: *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 of only fuel types and electricity generation data are available for the sample group, *Option B2* of Simple OM method is used to calculate emission factor. The formulation of 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)
$\eta_{m,y}$	=	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 is 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 sources and references are given in Excel Table 11: EGm,y [GWh] Sample Group for BM.

Table 17: *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 (%)

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

= 0.5670 tCO2/MWh

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

➔ $EF_{grid,CM,y}$=0.5670 tCO_2/MWh

3.2 Project Emissions

The proposed project activity involves the generation of electricity by 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.

3.3 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: $ER_y = BE_y$

3.4 Net GHG Emission Reductions and Removals

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plant by renewable electricity. The emission reduction ERy by the project activity during a given year y is the difference between Baseline emission and Project emission & Leakage emission.

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).

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
01/01/2019	0	105,524	0	105,524
2020	0	105,524	0	105,524
2021	0	105,524	0	105,524
2022	0	105,524	0	105,524
2023	0	105,524	0	105,524
2024	0	105,524	0	105,524
2025	0	105,524	0	105,524
2026	0	105,524	0	105,524
2027	0	105,524	0	105,524
31/12/2028	0	105,524	0	105,524
Total	**0**	**1,055,240**	**0**	**1,055,240**

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{elec\ i,j,y}$
Data unit	tCO_2/MWh
Description	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”
Source of data	As per “Tool to calculate the emission factor for an electricity system”

Value applied:	0.5670 tCO_2/MWh
Justification of choice of data or description of measurement methods and procedures applied	As per "Tool to calculate the emission factor for an electricity system" Calculated from data provided by the TEIAS for Turkish Power Sector; Operating Margin = 0.6483 tCO2e/MWh Build Margin = 0.3234 tCO2e/MWh Combined Margin = 0.5670 tCO2/MWh Calculated as weighted sum of OM and BM emission factor
Purpose of Data	
Comments	Emission Factor is fixed at ex-ante calculation.

4.2 Data and Parameters Monitored

Data / Parameter	**EG**
Data unit	MWh
Description	Net electricity delivered to the grid
Source of data	On site measurement from the meters.
Description of measurement methods and procedures to be applied	**186,100 MWh/year**
Frequency of monitoring/recording	Yearly
Value applied	
Monitoring equipment	Two electricity meters will be placed (one main and one reserve) at the substation. These meters are sealed by TEIAS and intervention by project proponent is not possible. The fact that two meters are installed in a redundant manner 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 relation between the plant operator and the electricity buyers. PMUM (Piyasa Mali Uzlaştırma Merkezi) readinVCS will be used as a base The above described measurement method follows Article 81 of the official regulation "Electricity Market Balancing And Settlement Regulation"[44]
QA/QC procedures to be applied	According to the Article 2 of the Communiqué of Meters in Electricity Sector[45]: '*The meters to be used in the electricity market shall be compliant with the standards of Turkish Standards*

[44] See, http://www.epdk.gov.tr/documents/elektrik/mevzuat/yonetmelik/elektrik/dengeleme_uzlastirma/DUYson.doc(page 55)

[45]See, www.**epdk**.org.tr/TR/Dokuman/3156

	*Institute or IEC and have obtained **"Type and System Approval" certificate from the Ministry of Trade and Industry.'*** Therefore, Ministry of Trade and Industry (Ministry) is responsible from control and calibration of the meters. Also according to Article 11 of this Communiqué, meters shall be in class of 0.5s, which means error interval for measuring is in +-0.5% range which is well acceptable according to rules. Paragraph b) of the Article 9 of the 'Regulation of Metering and Testing of Metering Systems'[46] (Regulation) of Ministry states that: ' *b) Periodic tests of meters of electricity, water, coal gas, natural gas and current and voltage transformers are done **every 10 years**.'* Therefore periodic calibration of the meters will be done every 10 years according to the regulation. However, meters on the plant will be calibrated by the supplier firm on an annual basis. Also according to Article 67 (page 20) of this regulation, the calibration shall be done in calibration stations which have been tested and approved by Ministry of Trade and Industry. Article 10 d) of Communiqué requires the meters shall be three phase four wire and Article 64 of Regulation clearly states how calibration shall be performed for this kind of meters. As above mentioned, the data acquisition and management and quality assurance procedures that are anyway in place, no additional procedures have to be established for the monitoring plan.
Purpose of data	• Calculation of Baseline and Project Emission
Calculation method	-
Comments	Plant manager will be responsible for measuring the data

4.3 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 Denizli WPP. 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.

Under data handling process, the meter is read remotely at the end of every month and published through website of TEİAŞ which can be accessed by project owner to check the correctness of the data. Besides, project owner carries monthly protocol to cross-check the data. By this way a cross check is done. Once the meter data is correct then the amount is also published in PMUM website which is also accessible by project owner. When all data is correct, an invoice (receipt of sale) is prepared by Korda Enerji Üretim

[46] See, http://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.6381&MevzuatIliski=0&sourceXmlSearch=

Pazarlama İthalat ve İhracat A.Ş. and delivered to TEIAŞ. The electricity generation amount, the collected data, are kept in both hardcopy and softcopy in daily and monthly basis indefinitely. Moreover, these data are submitted to several authorized people. Thus, several additional copies of these data are stored at different computers. The collected data during the monitoring period will be kept by the project owner at least two years after the last issuance of VERs.Denizli Personnel at the plant keep records for electricity generation amount and reports to operation manager on a monthly basis. Records are kept in electronic format for 2-years basis. The data is monitored via electricity meters. Meter is read by Denizli WPP staff 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 second year after the end of crediting period. These records can be used for monitoring in case of any problem will arise in meters. Technical specifications of the meters are given below. Calibration of the meters will be conducted on a 2-year basis.

The collected data will be kept by Denizli during the crediting period and until two years after the last issuance of VERs for the Denizli WPP 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 taken into account.

Operational and Management Structure

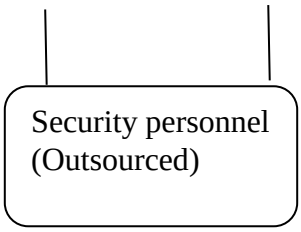
As described before, there are two main factors important for the calculation of emission reductions. The only relevant data that have to be monitored is only net electricity generation ($EG_{facility,y}$) per year. Since project emission is zero no additional monitoring is required. The generation data are subject to the strict internal quality control systems of both parties. The monthly meter reading documents are stored by Denizli 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 Denizli 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, which is planned to generally last one year, from the monthly meter reading records the net electricity generation amounts as calculated by electricity supplied to the grid minus withdrawn from the system, will be added up to the yearly net electricity generation and total project emissions will be subtracted from this amount and result data will be 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. For the elaboration and quality assurance of the monitoring report, **Life Enerji,** an expert in the project mechanisms who already supported in the project design, is assigned. However, in order to continue improving the monitoring procedures and therefore also the future monitoring reports, internal quality check shall be fulfilled by **Life Enerji**. The monitoring reports are checked and in cases of mistakes and inconsistencies in the monitoring report, revisions with improvements shall be done. Furthermore, external year verification assures that the emission reductions calculations are transparent and traceable.

Denizli will keep all the data needed for the calculation of emission reductions during the crediting period and until two years after the last issuance of VCS VERs for Denizli WPP. Organizational structure is as follows:

Operation Engineer (Akfen-Denizli)

EPC Engineer (EPC company)



Because of the data acquisition and management and quality assurance procedures that are anyway in place, no additional procedures have to be established for the monitoring plan. Dedicated emergency procedures are not provided, as there is no possibility of overstating emission reductions due to emergency cases.

Name of entity determining the baseline:
Kaan Bolat
Life İklim ve Enerji Ltd. Şti (Life Enerji) (Project consultant)
Tel : +90 312 481 21 42
Fax : +90 312 480 88 10
e-mail: kaan.bolat@lifeenerji.com
Contributor: Denizli Elektrik A.Ş.

Life Enerji is not a project participant.

5 SAFEGUARDS

5.1 No Net Harm

During the site visit, it is concluded that there are no negative impacts of the project activity to the socio-environment topics. The below mentioned parameters are also discussed:

Air condition: Electricity generated from the wind farm partially substitutes electricity generation from thermal power plants that represent a large share of the Turkish grid generation mix. Thus, besides greenhouse gases, all other air pollutants (e.g. SOx, NOx), particle and VOC emissions are avoided by the project activity.

The positive impact of solar energy on air quality will be monitored by calculating avoided NOx, CO and NMVOC emissions from electricity mix of Turkey in the year of calculation. The share of electricity generation from coal and fuel-oil will be taken from official statistics (TEIAS), as well as the total emission amounts for NOx, CO and NMVOC by electricity production (TUIK).

No	1
Indicator	Air Quality
Mitigation measure	No mitigation measures are required.
Chosen parameter	Amount of NOx, CO, NMVOC emissions
Current situation of parameter	According to latest official data, NOx, CO and NMVOC emissions

		due to electricity generation in 2012 (for NOx) and 2014 (CO and NMVOC) are: 2.627 tons/GWh, 0.296 tons/GWh and 0.063 tons/GWh respectively47.
Estimation of baseline situation of parameter		No quantitative information is available for projection of described emission rates. Continuation of current emission rates is estimated in case of baseline situation.
Future target for parameter		The described emissions shall be avoided by the solar farm and therefore the air quality will be improved in future in comparison to the baseline scenario.
Way of monitoring	How	No quantitative monitoring with respect to the different pollutants. The reporting of the amount of avoided electricity generation from the Turkish generation mix shall be sufficient to demonstrate that associated pollutants are accordingly avoided.
	When	Once at each verification.
	By who	Carbon consultant

Water: As compared to the baseline, no significant changes with regard to both ground and surface waters are expected because water will not be used for construction and operation of wind farm. As the project does not have any positive or negative impacts, that parameter is ranked as neutral.

No		2
Indicator		Water Quality and Quantity
Mitigation measure		Wastewater avoided by project activity.
Chosen parameter		Amount of avoided Wastewater discharged to the environment
Current situation of parameter		No wastewater discharge to the environment in the project area.
Estimation of baseline situation of parameter		Continuation of current situation
Future target for parameter		Continuation of current situation
Way of monitoring	How	No quantitative monitoring with respect to the different pollutants. The reporting of the amount of avoided wastewater discharge from the Turkish generation mix shall be sufficient to demonstrate that associated pollutants are accordingly avoided.
	When	One at each verification
	By who	Carbon consultant

Quantitative employment and income generation: Installation of the wind farm will provide employment to local people during construction. Besides, there are local employees from the close villages working at the project plant.

They will, as far as possible, be hired from the region. Therefore, this parameter is ranked as positive.

Number of employment during operation phase is part of the monitoring, where employment contracts shall serve as evidence for this indicator.

No		3
Indicator		Quantitative employment and income generation
Mitigation measure		No mitigation measures are required.
Chosen parameter		Employment contracts
Current situation of parameter		No change of the employment development in the region.
Estimation of baseline situation of parameter		The current employment rates are not expected to change in the baseline scenario.
Future target for parameter		Continuation of local employment
Way of monitoring	How	Employment contracts
	When	Each verification
	By who	Related personnel from Üçpınar SPP

Access to investment: The project and its role in strengthening the sustainable sector of electricity generation in Turkey tend to contribute to mitigation of import dependency. With 70 percent of total primary energy supply in the last years[48] and a growing trend this is an important issue for Turkish energy policy. Electricity generation from wind sources is completely independent from any imports and thus does not have any negative effects on the balance of payments during operation. The positive effect of this project to this indicator will be monitored by calculation of avoided natural gas and liquid fuel import amount for electricity production. Accordant data will be taken from official statistics (TEIAS). Share of natural gas fired electricity in Turkish electricity mix will be reported to show continuous positive impact of the project.

No	4
Indicator	Balance of payment and investments
Mitigation measure	No mitigation measures are required.
Chosen parameter	Avoided fossil fuels
Current situation of parameter	Fossil fuels that are used for electricity generation in Turkey lead to high import dependency.
Estimation of baseline situation of parameter	The import dependency on fossil fuels that are used for electricity generation in Turkey continues to raise as described in the PD.

48 See IEA (International Energy Agency): Energy Policies, Turkey 2005 Review, 2005, p. 28.

Future target for parameter		Every MWh of electricity generated by the project avoids the consumption of the respective share of the different fossil fuels that are part of the electricity mix in Turkey and with this contributes to mitigation of import dependency.
Way of monitoring	How	Reference to statistics on energy import shall help to demonstrate the high import dependency. No further quantitative monitoring planned.
	When	Each verification
	By who	Carbon consultant

5.2 Environmental Impact

According to the relevant Environmental Impact Assessment Regulation for Denizli Solar Power Project, an Environmental Impact Assessment is not required. The official letters from Provincial Directorate of Environment and Urbanization confirming non-applicability of this regulation is available to DOE during validation process.

5.3 Local Stakeholder Consultation

Stakeholder engagement procedure will be followed and SFR will be implemented during the registration.

5.4 Public Comments

Will be completed after SFR Project.

APPENDIX 1: CONTACT INFORMATION OF PROJECT PARTICIPANTS

Organization name	Korda Enerji Üretim Pazarlama İthalat ve İhracat A.Ş.
Registration number with relevant authority	
Street/P.O. Box	Turan Güneş Bulvarı Galip Erdem Cad. No: 3 Çankaya/ANKARA
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State/Region	
Postcode	
Country	Turkey
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E-mail	
Website	
Contact person	Uğur İlhan
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