FINAL REPORT

Niğde G4-Bor-1 Solar Power Plant Project

Environmental and Social Impact Assessment - Climate Change Risk Assessment

Submitted to:

Smart Güneş Enerjisi Teknolojileri Ar-Ge Üretim San ve Tic A.Ş.
Rüzgarlıbahçe Mah., Feragat Sk. Energy Plaza No:2, 34805 Beykoz/İstanbul

Submitted by:

WSP Danışmanlık ve Mühendislik Ltd. Şti.
Hollanda Cad. 691. Sok. Vadi Sitesi No:4, Yıldız 06550 Ankara, Türkiye

+90 312 4410031

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1.0 INTRODUCTION

Smart Güneş Enerjisi Teknolojileri Ar-Ge Üretim San ve Tic A.Ş. (hereinafter referred as "Smart") has retained WSP Danışmanlık ve Mühendislik Ltd. Şti. (hereinafter referred as "WSP Türkiye" or "WSP") to prepare the Environmental and Social Impact Assessment ("ESIA") for the Niğde G4-Bor-1 Solar Power Plant Project (hereinafter referred as "the Project'") in compliance with the national and international requirements. The Project will have a total installed capacity of 140 MWp / 100 Mwe and located in Seslikaya and Badak Villages Bor District, Niğde Province.

Climate change is a multifaceted and complex issue that can lead to serious environmental and socioeconomic consequences and even threaten the security of countries. The impacts of climate change have become one of the most important challenges for the life of future generations.

This report presents a Climate Change Risk Assessment (CCRA) for the evaluation, at present and in the future, of the potential climate-related events that could affect the Project and that may exacerbate as a consequence of the climate change.

Within this framework stands the revision and release of the Equator Principles[1] (EPs, version IV) which is a risk management framework adopted by financial institutions for determining, assessing, and managing environmental and social risks in projects and is primarily intended to provide a minimum common standard for due diligence and monitoring to support responsible risk decision-making. Currently more than 110 Equator Principles Financial Institutions (EPFIs) have officially adopted the EPs, covering the majority of international project finance debt within developed and emerging markets. The EPs categorize projects that are financed by EPFIs based on the environmental and social impacts that they generate and the risks that they may pose to financing. Category A projects have the highest risks, while category C is used for low-risk projects.

According to EPIV, a Climate Change Risk Assessment (CCRA) is required to be undertaken:

- For Category A and, as appropriate, Category B projects. For these projects, the CCRA has to include consideration of relevant climate-related 'Physical Risks' as defined by the Task Force on Climate-Related Financial Disclosure (TCFD)[2].
- For all projects, in all locations, when combined Scope 1 and Scope 2 emissions are expected to be more than 100,000 tons of CO_2 equivalent annually. For these projects, the CCRA is to include considerations of climate-related 'Transition Risks' (as defined by the TCFD). The CCRA must also include a completed alternatives analysis which evaluates lower greenhouse gas (GHG) intensive alternatives.

As per the environmental and social categorization criteria of the applicable standards, based on the discussions held with the Lenders and Lenders' Advisor, available data, the National EIA, Project area being located inside Key Biodiversity Area (KBA), the Project is categorised as "Category A". Since combined emissions of the Project are below 100,000 tons of CO_2 equivalent annually (Please see Section 2.2), only Physical Risks are included in this CCRA Report.

The TCFD Recommendations on Climate-related Financial Disclosures state that "Physical risks resulting from climate change can be event driven (acute) or longer-term shifts (chronic) in climate patterns".

[1] The Equator Principles Association, 2020 (The Equator Principles_EP4_July2020 (equator-principles.com).

[2] Task Force on Climate-Related Disclosures (TCFD), Recommendations of the Task Force on Climate-related Financial Disclosures, June 2017.

Acute physical climate risks can include increased severity and frequency of droughts, storms, floods, heat waves and wildfires. Chronic physical climate risks can include sea level rise and longer-term temperature increase. Climate-related Physical Risks may include a variety of effects:

- Direct damage to assets, as a result of extreme weather events (i.e., drought, storms) or rising sea levels.
- Changes in water availability, sourcing and quality, often with consequent social impacts.
- Disruption to operations, ability to transport goods and supplies and impacts on employee/community safety, and more.

This assessment should be considered a screening level CCRA aimed at supporting the Environmental and Social Assessment process in the frame of the Equator Principles IV provisions. This CCRA relies on the interpretation of the results of modelling of future climatic conditions which have an inherent high level of uncertainty, and on the identification of project vulnerability that are based on a feasibility level of definition. The conclusions and recommendations are meant to guide the Client in defining an appropriate Risk Management framework and should not be relied upon in the design and sizing of specific infrastructures, nor in taking financial decisions regarding the feasibility or level of exposure to future damages or losses related to climate change.

2.0 PROJECT BACKGROUND

The Project area had been declared as an area suitable for the development of a solar project: a Renewable Energy Resource Area (“YEKA”).

The Solar Power Plant (“SPP”) will consist of solar panels, an assembly structure, an inverter, a substation, an administrative building and Supervisory Control and Data Acquisition (“SCADA”) system as main components. The energy transmission line (“ETL”) will be established as an associated facility. With the establishment of the Project, it is planned to produce 100 MWe of electrical energy annually during the operation phase, and the produced energy will be transmitted to the Yaysun SPP Substation by approximately 29.5 km long 154 kV ETL that will be constructed by Turkish Electricity Transmission Corporation (“TEİAŞ”). Details of the Project components are provided in Chapter 3 of the ESIA report.

The Project pre-construction activities, namely, mobilization of temporary site facilities, site preparation, grading and levelling, material delivery and storage and certain early trenching activities for cable laying have been started in October 2023. Within the scope of the Project, construction phase is estimated around 11 months, while operation phase is estimated as 30 years.

The Project is set to be developed on a 201.3 ha of former pastureland. Designated as an "Industrial Zone" in the 1/100,000 Scale Environmental Plan, the Project site falls within the borders of the "Niğde-Bor Energy Specialized Industrial Zone."

The location of the Project is given in Figure below.

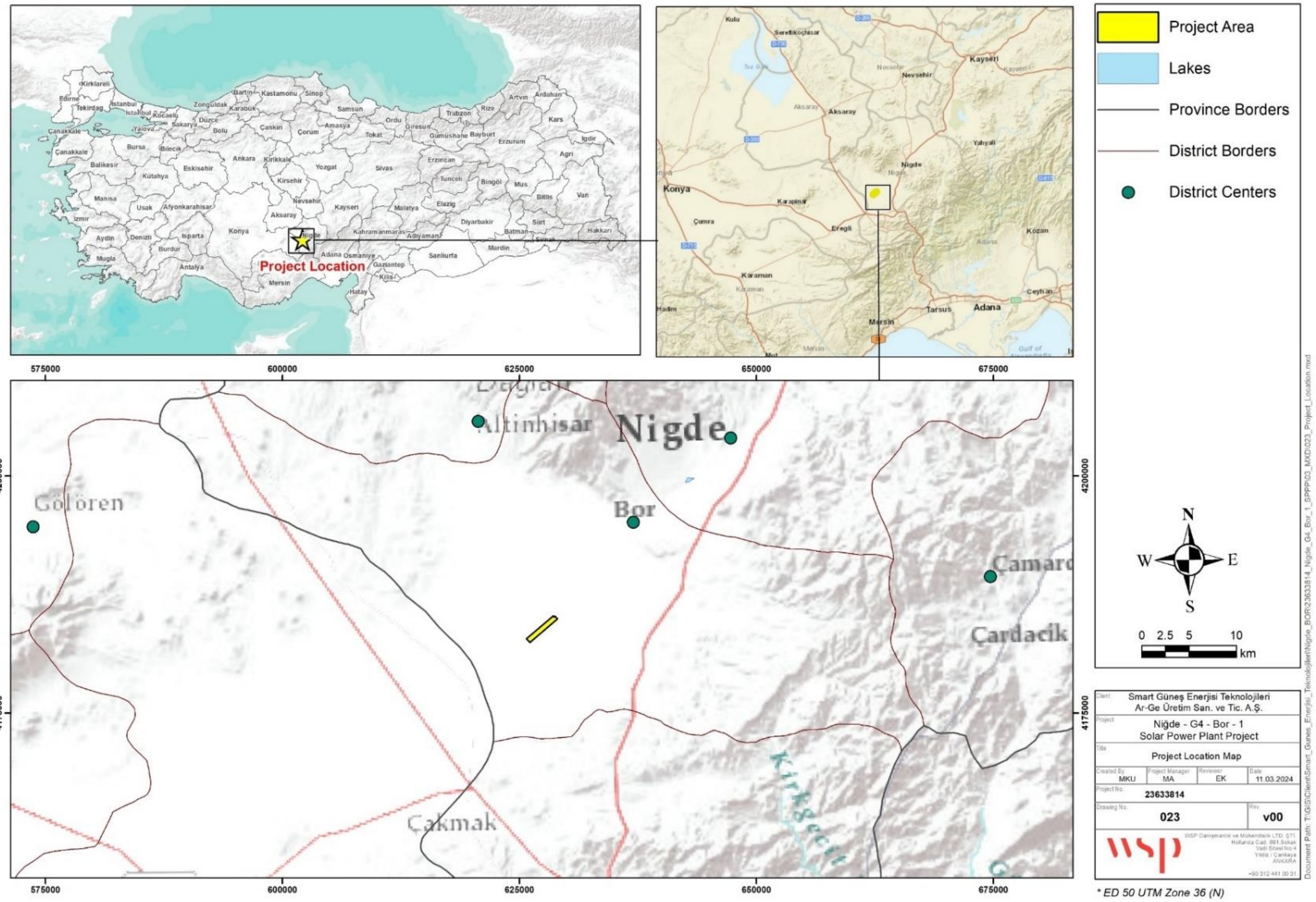

Figure 2-1: Location of the Project

2.1 Preliminary NCC/NDCs Compatibility Review

Parties to the Paris Agreement have been obliged since 2015 to submit Nationally Determined Contributions (NDCs), or national climate action plans. While not required, countries are also encouraged to submit Long-Term Strategies (LTS) for a low-carbon economy.

The primary means via which nations publicly declare their self-defined intentions for establishing long-term decarbonization targets to keep global temperature rise below 1.5 degrees Celsius and to set goals for improving climate resilience are the Nationally Determined Contributions (NDCs) filed under the Paris Agreement.

As outlined in the EPIV Guidance Note on Climate Change Risk Assessment, the purpose of the preliminary NCC compatibility review of physical risks is to assess their alignment with the host country's National Climate Contributions (NCCs) and relevant global adaptation objectives under the Paris Agreement. This includes objectives such as enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change, all with the aim of contributing to sustainable development.

According to Republic of Türkiye Updated First Nationally Determined Contribution (NDC) Report[3], Türkiye has made significant investments in many sectors to mitigate the impacts of climate change, especially in the energy sector, which greatly resulted in the reduction in GHG emissions. Like many other countries, the energy sector has the highest GHG emission share compared to others. Therefore, policies and measures to reduce GHG emissions have had a higher focus on energy policies with clear renewable energy generation targets, particularly in the power sector. Türkiye aims to raise this rate even further. The nation's energy policy has placed a high priority on making the most use of renewable energy sources while reducing reliance on imports by enhancing supply security. Türkiye's primary energy sector mitigation strategy for 2030 is to make the most use of renewable energy and energy efficiency while taking market conditions, energy security, and feasibility into account. Investments in renewable energy, particularly solar and wind power, have accelerated thanks in large part to YEKA and the Renewable Energy Sources Support Mechanism (YEKDEM).

As of September 2022, the total installed capacity is 102,281 MW. Renewable energy sources have 55,630 MW and constitute 54 percent of Türkiye's electricity generation installed power capacity. In 2023, Türkiye has become one of the 14 countries in the world with an installed power exceeding 100 thousand megawatts. Among 54% in the share of renewable energy sources, the share of hydro, wind, solar, geothermal, and biomass are 30.9%, 10.9%, 8.8%, 1.6%, and 1.8%, respectively. In the last two years, 97% of commissioned energy sources were from renewables; the rest is cogeneration, which is a good practice of efficiency. Approximately 3,000 MW of solar plus wind power was commissioned in 2021. Given these circumstances, the project aligns with national policies and commitments for climate adaptation or resilience. Project-related physical climate risks been identified and addressed in the following chapters.

The 2022 Sustainability Report[4] published by Smart states that the Company aims to be net zero in 2040. Smart has created a road map and projected all the steps it will take to achieve its net zero target. Adopting a responsible and sustainable production approach, the Company's greenhouse gas emissions from electrical energy consumption in management and factory buildings were zeroed in 2022 by obtaining I-REC certification. The International REC Standard (I-REC) is an international standard created by the International REC Standard Foundation to track the source and prove the consumption of energy produced from renewable sources in any country in the world. The I-REC Certificate, called Renewable Energy Certificate or Green Energy Certificate in Türkiye, certifies that electricity is produced from renewable energy sources by ensuring the traceability of the source and attribute of the energy produced.

[3] https://unfccc.int/sites/default/files/NDC/2023-04/T%C3%9CRK%C4%B0YE_UPDATED%201st%20NDC_EN.pdf

[4] https://smartsolar.com.tr/pdf/Surdurulebilirlik-Raporu.pdf

2.2 Calculated GHG Emissions

As it has been described in Supplementary E&S Assessment Report which is the main report of this appendix, the combined annual emissions from the construction phase of the Project are about **1,648.96 t CO_2e per annum**. This annual value is below the 25,000 t CO2e threshold defined in IFC PS3 and Equator Principles IV. Therefore, no additional monitoring will be required.

With the consideration of this assumption, annual emissions from the operation phase of the Project are about **28.80 t CO_2e per annum**. This annual value is well below the 25,000 t CO2e threshold defined in IFC PS3 and Equator Principles IV. Therefore, no additional monitoring will be required.

3.0 RISK ASSESSMENT METHODOLOGY

According to the ISO 14091 Standard "Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment[5]" Climate Risk Assessments fulfil diverse objectives depending on the information needs of a Client, and on challenges caused by climate change. These can include the following.

- Raising awareness: Risk assessments help increase awareness of the consequences of climate change.
- Identification and prioritization of risks: many factors contribute to a system's sensitivity, exposure and adaptive capacity. Climate change risk assessments provide insight into these factors and this helps the Client to prioritize the risks to be addressed.
- Identification of entry points for climate change adaptation intervention: the final results and the process of risk assessment can help identify possible adaptation responses. Risk assessments can show where early action is required.
- Tracking changes in risk and monitoring and evaluating adaptation: repeating risk assessments can help to track changes over time and generate knowledge on the effectiveness of adaptation.

This section of the CCRA chapter presents an overview of the methodology for CCRA for physical risks and applies it to the Project. The assessment will result in the identification of physical risks that may affect the Project within a certain time frame, and in a number of adaptation measures that the Client may consider and implement to mitigate these risks.

WSP developed a risk assessment methodology based on existing methodologies for the assessment of climate change risks and vulnerability as part of adaptation strategies. Guidelines and methodologies from the ISO 14091 as well as the Intergovernmental Panel on Climate Change (IPCC)[6] and the World Bank Group[7] were used as a guidance for defining factors that contribute to determine the risk. These methodologies consider a variety of risk components whose definitions are as follows:

- Climate-related Hazard: natural or human induced climate-related hazard, such as flood, wildfire, extreme heat, that can occur at the Project Site. The changes in intensity of hazard related events and of their probability over-time are influenced by climate change.
- Exposure: the possibility for a Project in a specific site to be adversely affected by a certain hazard because of the presence of certain Project services, resources, infrastructures, people and other Project's intrinsic elements that are prone to be affected. A Project, depending on its intrinsic nature and characteristics, may

[5] ISO 14091 gives guidelines for assessing the risks related to the potential impacts of climate change. It describes how to understand vulnerability and how to develop and implement a sound risk assessment in the context of climate change.

[6] The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.

[7] The World Bank Group (WBG) is a family of five international organizations that make leveraged loans to developing countries.

or may not be exposed to a certain hazard that occur at the Project Site. Exposure is therefore an indicator of if the Project "can or cannot be affected" by a certain hazard.

- Sensitivity: propensity or predisposition of elements of the Project to be affected by a certain hazard. Sensitivity is a measure of "how much" a Project exposed to a certain hazard can be affected.
- Adaptive capacity: the ability of the Project to adjust to climate hazard-related events, to mitigate potential damages, to take advantage of opportunities, or to respond to the consequences.
- Vulnerability: expresses the magnitude of potential effects and consequences of climate hazard-related events on elements of the Project. Vulnerability results from the combination of Sensitivity and Adaptive capacity.
- Risk: the result of the combination of Hazard probability or intensity at a certain time and the Vulnerability.

This methodology assesses all different climate-related hazards independently, at present and in the future, over a time consistent with the temporal scope of the assessment, and according to multiple future carbon emission scenarios. Workflow of the risk assessment for a specific hazard "h" is explained in Figure 3-1. For each specific hazard, the risk components are assigned a qualitative class ("i.e., "high", "medium", "low") and then combined using qualitative matrices (see , The result is a class of Risk ("low", "medium", "high" or "extreme") for each climate-related hazard considered in the analysis. An explanation of criteria for ratings and identification of significance are given in Table 3-1.

Figure 3-1: Workflow of the risk assessment for a specific hazard "h" the Project is exposed to, showing how different risk factors are combined across the analysis

Table 3-1: Criteria of Ratings

Rating	Sensitivity Criteria (Degree of impact)	Adaptive Capacity Criteria (Ability to respond)
Highest	Extremely vulnerable; severe operational, financial, or environmental consequences.	No adaptation measures; lack of financial, technological, or institutional capacity to respond.
High	High sensitivity; significant performance, safety, or economic impacts.	Limited adaptation capacity; measures exist but are insufficient or poorly implemented.
Medium	Moderate sensitivity; some disruptions or costs are expected but manageable.	Moderate adaptation capacity; some measures in place but requiring improvements.
Low	Low sensitivity; minor or negligible impacts on operation and performance.	Good adaptation capacity; proactive strategies in place, but some risks remain.
Lowest	Resilient; not significantly affected by climate hazards.	Fully resilient with comprehensive adaptation strategies in place.

Table 3-2: Criteria of Hazard Classes

Rating	Hazard Class Criteria
High	The climate-related hazard is highly likely to occur and/or has the potential to cause significant disruption to operations, infrastructure, or surrounding communities.
Medium	The hazard has a moderate likelihood and/or impact. Some disruption may occur, but existing mitigation measures can partially address the risk.
Low	The hazard has low likelihood and minimal potential impact. Disruptions, if any, are expected to be negligible and easily managed with existing systems and infrastructure.

4.0 CLIMATE CHANGE PHYSICAL RISK ASSESSMENT

The CCRA that follows is referred to Niğde G4-Bor-1 Solar Power Plant Project located in Bor District of Niğde Province of Turkey (see Figure 4-1).

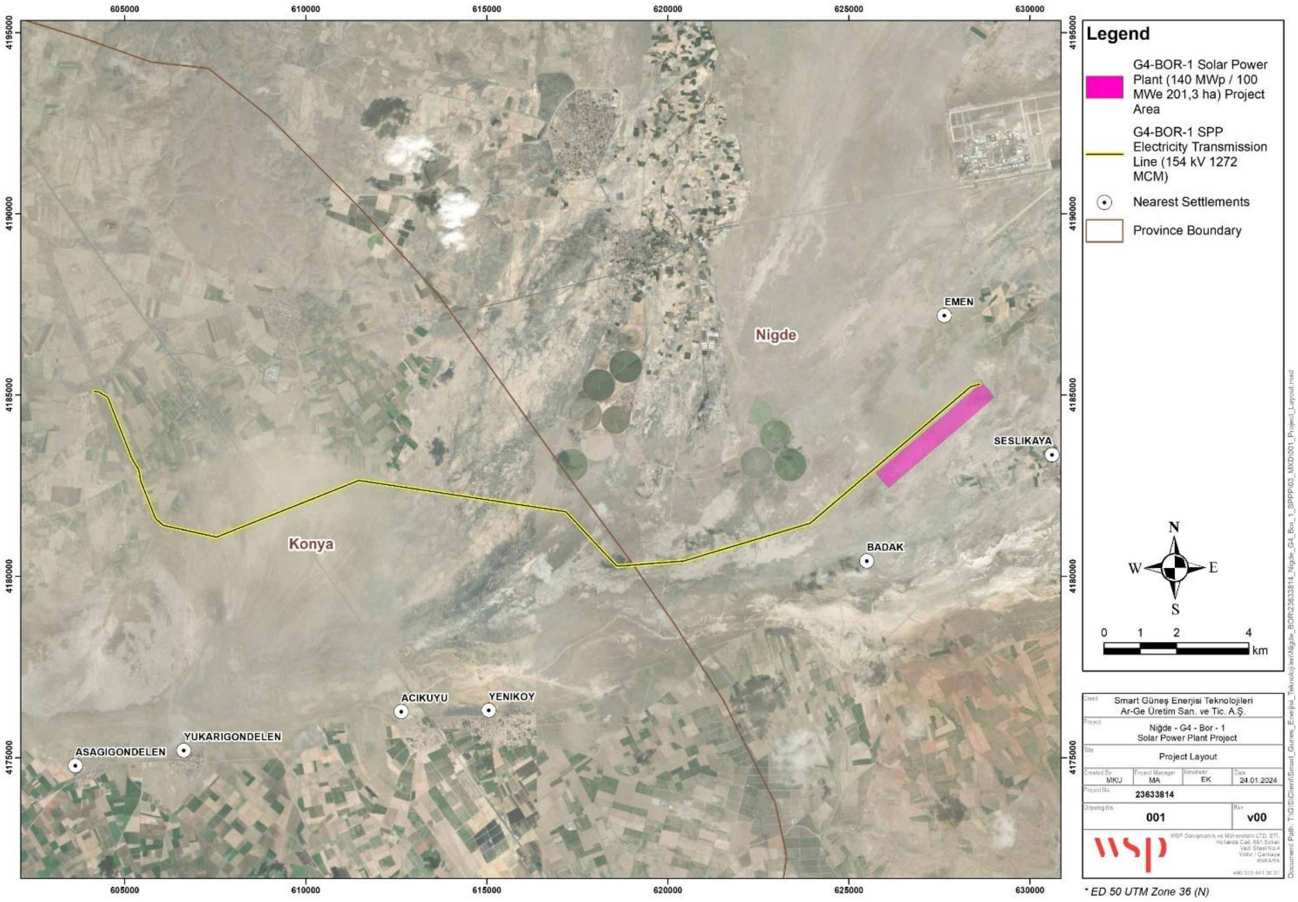

Figure 4-1: Project Layout with Energy Transmission Line

The CCRA focuses on following Project components that could potentially be affected by climate-related hazards.

- PV Solar panels, which Integrates semiconductor PV cells on the panel to ensure the generation of direct current electricity from the sunlight,
- Inverter, which converts the direct current electricity generated by PV panels into grid electricity for daily use,
- Pannel support system, which refers to the support structure systems and mounting apparatus where photovoltaic PV panels are installed,
- Balance of System (BOS), which encompasses elements beyond the fundamental materials mentioned above. In the context of Solar Energy Plants, the part outside the Module, Inverter, and construction is defined as BOS. It includes infrastructure activities and materials necessary for the sustainability and protection of the system, such as infrastructure, AC-DC cables, connectors, paralleling panels, switchgear equipment, low-voltage panels, transformer substations, medium/high-voltage panels, construction works, wire fences, lighting, camera systems,
- Energy transmission line with 29.5 km length and 154 kV, and

- Project personnel.

4.1 Assessment of Hazards

4.1.1 Climate Overview – Country Level

Türkiye is located between the subtropical and temperate zones, giving rise to a variety of climate zones observed in the country. These climate zones include the Mediterranean Climate, characterized by hot and dry summers and mild, rainy winters. The Black Sea Climate features cool summers and warm winters along the coastal areas, while the higher regions experience cold, snowy winters. The Terrestrial Climate exhibits significant temperature differences between seasons and day and night. Additionally, the Marmara Climate acts as a transition zone, combining characteristics of the Terrestrial, Black Sea, and Mediterranean climates. In terms of precipitation, Türkiye receives the majority of its rainfall during winter and spring. During the summer months, precipitation decreases, while temperatures and evaporation rates increase. The annual long-term mean precipitation is recorded at 574 mm. However, there has been an observable increase in the number of meteorological extreme events, particularly since 2000 (covering the period from 1981 to 2017). These events include phenomena such as severe storms, floods, and heatwaves, reflecting a trend towards more extreme weather occurrences in recent years.

The Project is located in Niğde Province in Türkiye. Information collected from the World Bank Group – Climate Change Knowledge Portal[8] was used for an overview of the current climate and the mean climate projections. Meteorological data were obtained from Meteorological Stations located around the Project area. The most comprehensive data representing the Project area was obtained from Niğde Meteorological Station of Turkish State Meteorological General Directorate (see Figure 4-2), which is also the closest meteorological station to the project area This data is used to establish a general view on basic conditions for meteorology and climatology.

[8] The Climate Change Knowledge Portal (CCKP) provides global data on historical and future climate, vulnerabilities, and impacts.

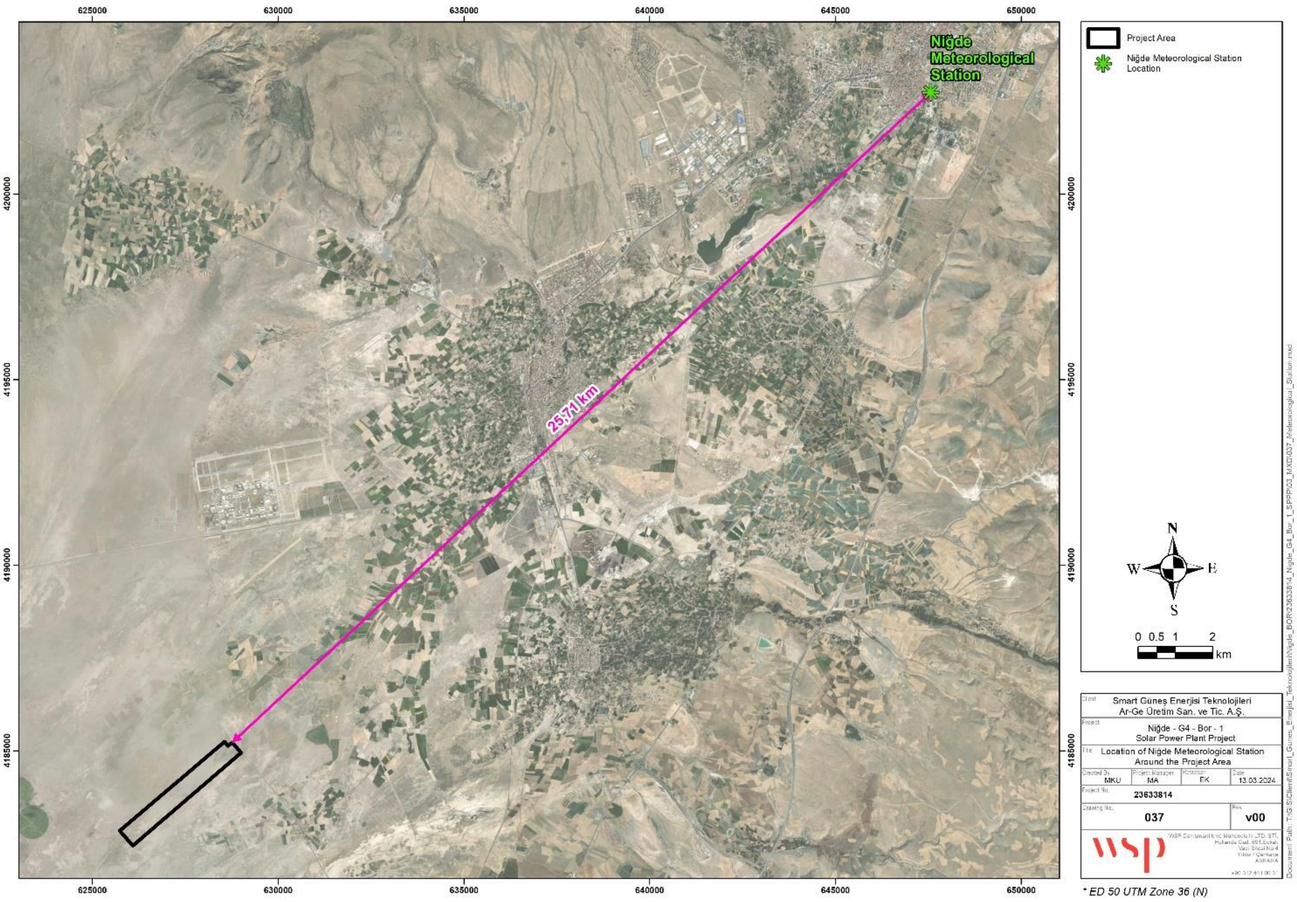

Figure 4-2: Niğde Meteorological Station

4.1.2 Climate Overview – Local Level

4.1.2.1 Historical Data

Niğde is located in the Central Anatolia region of Türkiye. The continental climate is prevailing in the Niğde province and winters are cold and snowy, and summers are hot and dry with transitional periods of mild weather in spring and autumn.

Air Temperature

According to the observation records of Niğde Meteorology Station between 1960 and 2021, the highest air temperature was recorded in July and August with 38.5°C, and the lowest air temperature was measured in February with -24.2°C. Annual average air temperature is 11.2°C (see Table 4-1 and Figure 4-3).

Table 4-1: Niğde Meteorological Station – Air Temperature Measurements (°C) (1960 - 2021)

Months	Average Air Temperature	Maximum Air Temperature	Minimum Air Temperature
January	-0.3	19.9	-21.7
February	1.2	20.5	-24.2
March	5.4	26.3	-23.9
April	10.6	30.8	-6.9
May	15.0	32.1	-2.6
June	19.0	34.8	3.5

Months	Average Air Temperature	Maximum Air Temperature	Minimum Air Temperature
July	22.4	38.5	7.1
August	22.1	38.5	6.7
September	18.0	37.3	1.0
October	12.5	30.6	-5.2
November	6.4	24.6	-14.7
December	1.9	20.9	-20.6
Annual	**11.2**	**38.5**	**-24.2**

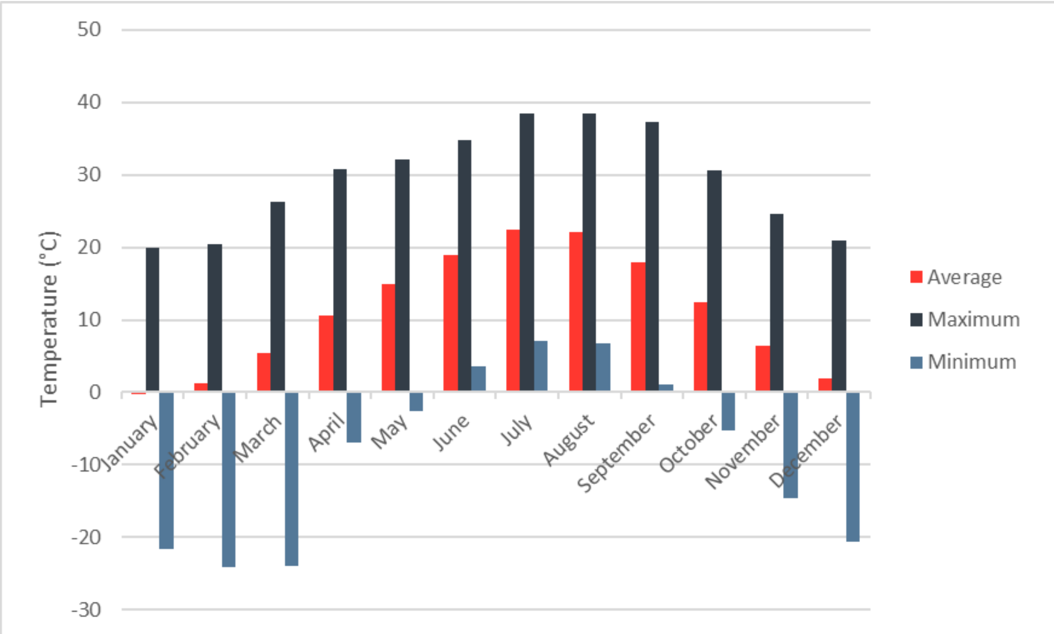

Figure 4-3: Niğde Meteorological Station – Air Temperature Measurements (°C) (1960 - 2021)

Precipitation

According to the observation records of Niğde Meteorology Station between 1960 and 2021, maximum amount of precipitation per day was measured in December with 54.5 mm. Annual average total precipitation is 336.9 mm (see Table 4-2 and Figure 4-4).

Table 4-2: Niğde Meteorological Station - Precipitation Measurements (mm) (1960 - 2021)

Months	Average Total Precipitation	Maximum Daily Precipitation
January	32.9	40.6
February	31.4	30.1
March	36.3	32.6
April	42.8	42.9
May	46.7	43.1
June	27.1	39.2

Months	Average Total Precipitation	Maximum Daily Precipitation
July	5.1	22.5
August	5.4	20.6
September	10.1	27.8
October	26.4	34.4
November	31.4	43.7
December	41.3	54.5
Annual	**336.9**	**54.5**

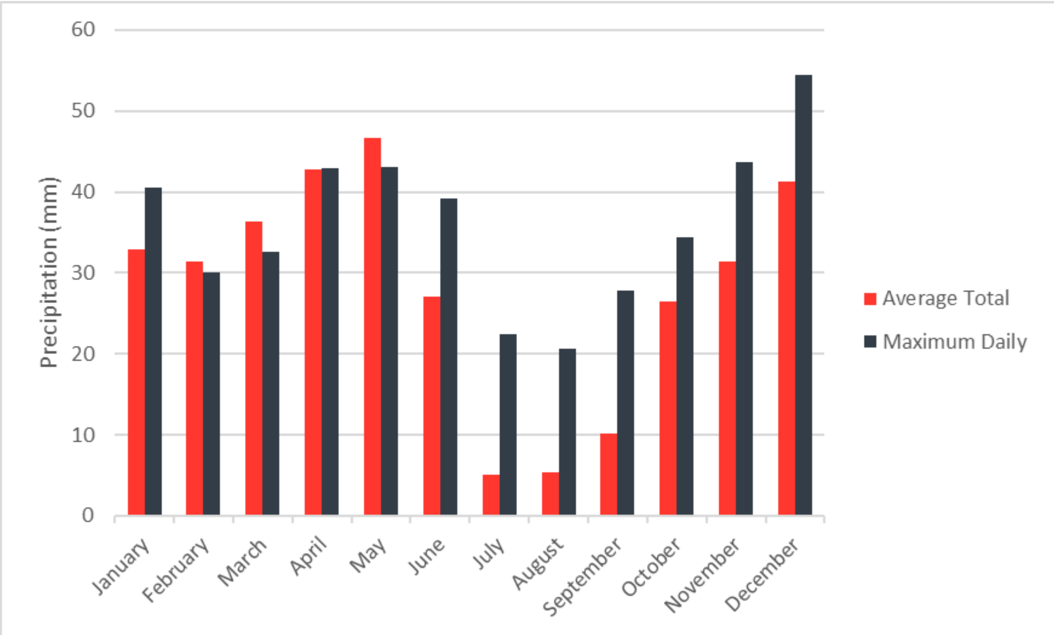

Figure 4-4: Niğde Meteorological Station - Precipitation Measurements (mm) (1960 - 2021)

Atmospheric Pressure

According to the long term (1960-2021) observation records of Niğde Meteorology Station, maximum atmospheric pressure is observed as 899.9 hPa, and minimum atmospheric pressure is 852.9 hPa. Average atmospheric pressure is 879.6 hPa per year (see Table 4-3 and Figure 4-5).

Table 4-3: Niğde Meteorological Station - Atmospheric Pressure Measurements (hPa) (1960 - 2021)

Months	Average Atmospheric Pressure	Maximum Atmospheric Pressure	Minimum Atmospheric Pressure
January	880.2	899.9	852.9
February	879.0	895.5	856.3
March	878.1	892.8	854.7
April	877.7	890.3	860.1
May	878.8	888.5	865.0
June	878.5	886.9	866.7

Months	Average Atmospheric Pressure	Maximum Atmospheric Pressure	Minimum Atmospheric Pressure
July	877.3	885.3	869.1
August	878.2	885.1	870.3
September	880.6	889.2	868.4
October	882.7	891.9	865.6
November	882.8	893.3	865.0
December	881.4	896.4	852.9
Annual	**879.6**	**899.9**	**852.9**

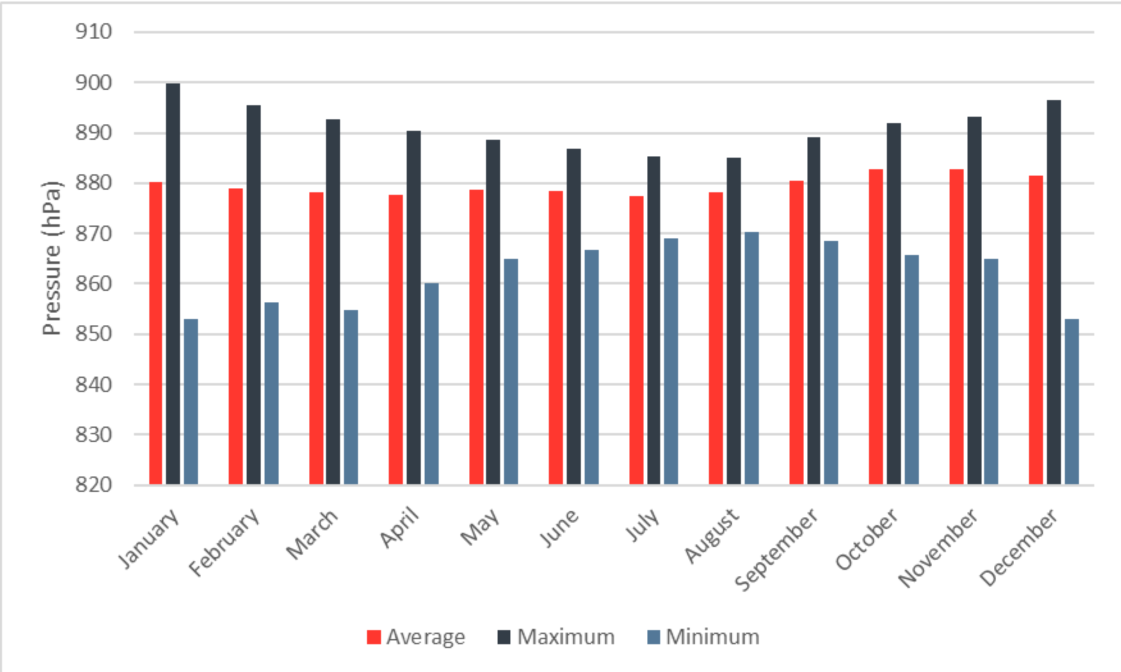

Figure 4-5: Niğde Meteorological Station - Pressure Measurements (1960 - 2021)

Relative Humidity

According to the observation records of Niğde Meteorology Station between 1960 and 2021, the annual average relative humidity is 58.5%. Relative humidity values for 1960-2021 are presented in Table 4-4 and Figure 4-6.

Table 4-4: Niğde Meteorological Station - Relative Humidity Measurements (%) (1960 - 2021)

Months	Average Relative Humidity (%)
January	72.8
February	69.9
March	63.1
April	57.7
May	55.9

Months	Average Relative Humidity (%)
June	50.4
July	43.5
August	43.6
September	47.8
October	58.0
November	66.4
December	72.9
Annual	58.5

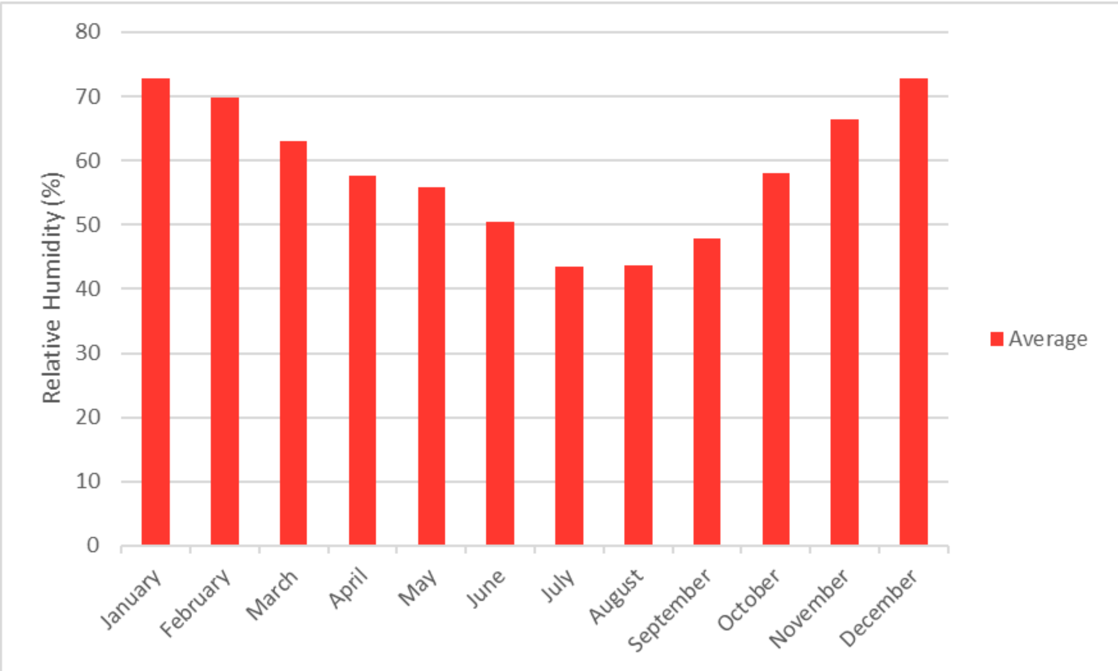

Figure 4-6: Niğde Meteorological Station - Relative Humidity Measurements (%) (1960 - 2021)

Evaporation

According to the observation records of Niğde Meteorology Station between 1960 and 2021, the average total evaporation was 1272.6 mm, and the daily maximum evaporation was 17 mm in June and July. Evaporation Values for 1960-2021 are presented in Table 4-5 and Figure 4-7.

Table 4-5: Niğde Meteorological Station - Evaporation Measurements (mm) (1960 - 2021)

Months	Average Evaporation (mm)	Daily Maximum Evaporation (mm)
January	0	-
February	0	-
March	0	-
April	58.3	12.1

Months	Average Evaporation (mm)	Daily Maximum Evaporation (mm)
May	168.2	15.0
June	214.3	17.0
July	273.0	17.0
August	257.9	13.0
September	185.3	11.0
October	100.4	10.0
November	15.2	5.4
December	0	-
Annual	1272.6	17

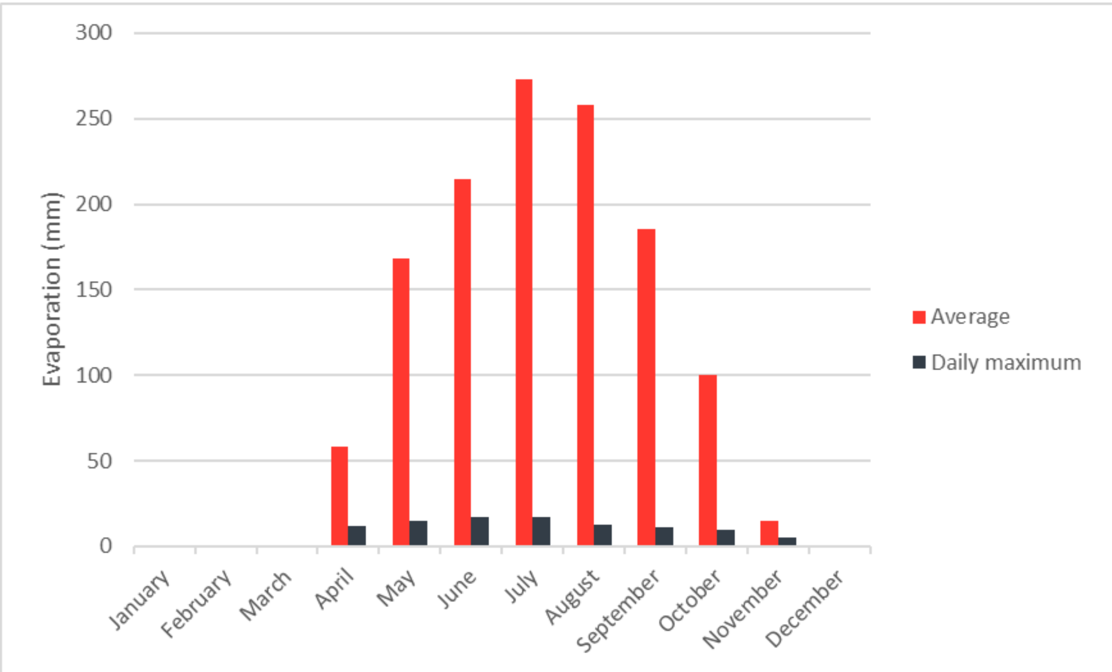

Figure 4-7: Niğde Meteorological Station - Evaporation Measurements (mm) (1960 - 2021)

Wind Distribution

Number of Winds

The total number of the wind blowing measured at Niğde Meteorological Station between 1960 and 2021 is given in Table 4-6 and Figure 4-8. As can be seen from the Table 4-6 and Figure 4-8, dominant wind direction is blowing from north-northeast (NNE) direction, second degree dominant wind direction is blowing from northeast (NE) direction.

Table 4-6: Niğde Meteorological Station - Wind Direction Measurements (mm) (1960 - 2021) (blowing from)

Direction	Annual Total Wind
N	13822
NNE	130642
NE	111696
ENE	41862
E	8542
ESE	5559
SE	5233
SSE	19996
S	16914
SSW	60972
SW	36470
WSW	46016
W	12218
WNW	8210
NW	2896
NNW	8911

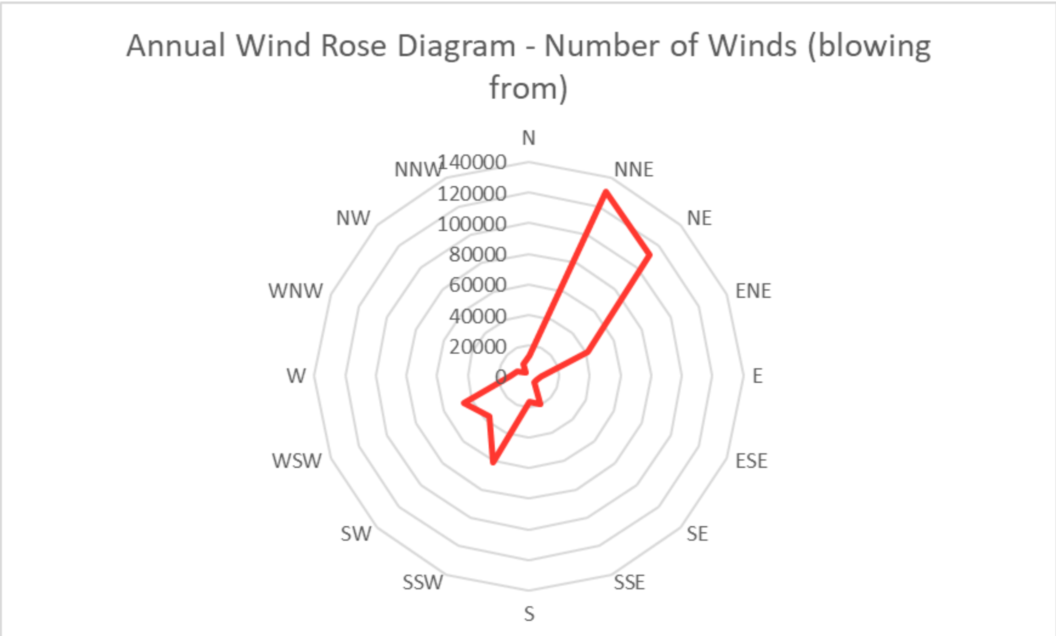

Figure 4-8: Niğde Meteorological Station - Wind Direction Measurements (mm) (1960 - 2021) (blowing from)

Wind Speed

According to data from Niğde Meteorology Station between 1960 and 2021, the annual average wind speed is 3.0 m/s. Maximum monthly wind speed is measured as 38.3 m/sec blowing from south-southeast (SSE) direction (see Table 4-7)

Table 4-7: Niğde Meteorological Station - Wind Speed (m/ sec) (1960 - 2021)

	Average Monthly Wind Speed (m/sec)	Maximum Monthly Wind speed (m/sec) and Direction
I	3	SSE 32.0
II	3.3	SSE 30.4
III	3.4	SE 31.0
IV	3.3	SSE 38.3
V	2.8	SE 28.3
VI	2.8	SE 26.2
VII	3.1	S 20.9
VIII	3	W 24.3
IX	2.7	S 25.3
X	2.5	S 21.7
XI	2.7	WSW 35.9
XII	2.9	SSE 27.8
Annual	3	SSE 38.3

Other parameters

According to the observation records of Niğde Meteorology Station between 1960 and 2021:

- The maximum snow thickness was measured as 39 cm in December 2002,
- The average annual number of snow days is 22.35,
- The number of snow-covered days is 32.92,
- The number of foggy days is 4.72,
- The number of hail days is 2.88,
- The number of frosty days was 24.11,
- The number of thunderstorm days was 4.98,
- The number of strong windy days is 51.99 days per year, and
- The number of stormy days is 9.68 days per year.

4.1.2.2 Future Projection

World Bank Climate Change Knowledge Portal[9] was used for the climate projections which uses climate projection data refers to modeled data generated by the Coupled Model Inter-comparison Projects (CMIPs) of

[9] World Bank Climate Change Knowledge Portal , 2025, https://climateknowledgeportal.worldbank.org/download-data

the World Climate Research Program. The specific data presented here is from CMIP6, which is the Sixth phase of the CMIPs. These CMIPs serve as the fundamental data source for the Intergovernmental Panel on Climate Change (IPCC) Assessment Reports. CMIP6, in particular, supports the IPCC's Sixth Assessment Report.

In analyzing and interpreting climate change projections from multi-model ensembles, outputs are presented as a range, which represents model spread. CCKP identifies the range of 10th and 90th percentiles, as and median (or 50th percentile). The 10th percentile indicates that just 10% of simulation outputs fall below this result. The 90th percentile means that 90% of all simulation outputs fall below this result.

The projection data is provided at a resolution of 1.0º x 1.0º (100 km x 100 km), offering a spatial representation of climate information. The data used are those referring to the Multi model ensemble for the following scenarios:

- SSP1 – 2.6: optimistic scenario in which global CO_2 emissions are drastically reduced reaching net zero after 2050 due to an evolution of societies towards environmental and social sustainability and temperatures stabilize around 1.8°C more by the end of the century;
- SSP2 – 4.5: Intermediate scenario in which CO_2 emissions hover around current levels before starting to decline mid-century but fail to reach net zero by 2100. Socio-economic factors follow their historical trends without significant changes. Progress towards sustainability is slow, with development and income growing unevenly. In this scenario, temperatures rise by 2.7°C by the end of the century;
- SSP5 – 8.5: Scenario where current CO_2 emission levels roughly double by 2050. The global economy is growing rapidly, but this growth is fuelled by fossil fuel exploitation and high-intensive lifestyles energy. By 2100, the global average temperature will be as much as 4.4°C higher.

The construction period of the Project is estimated to be 8 months and the total operation period will be 30 years, therefore the period between 2020-2100 were taken into consideration within the scope of the CCRA to cover all construction and operation phase of the Project.

Average Mean Surface Air Temperatures

Average mean surface air temperature is expected to increase in all considered scenarios as can be seen from Figure 4-9.

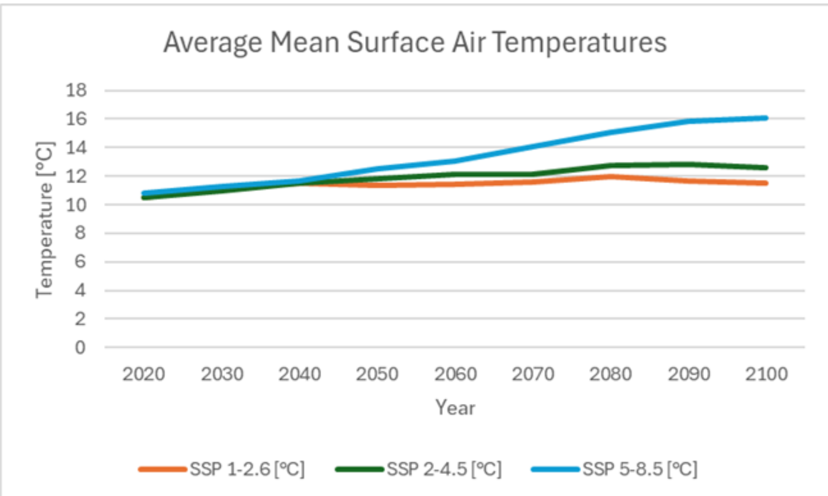

Figure 4-9: Average Mean Surface Air Temperature in climate models (CMIP6) for the historical period (1950-2020) and the Future Projections (2020-2100) in the three SSPs considered (World Bank Climate Change Knowledge Portal,2025)

The provided table below (see Table 4-8).shows the average temperature changes from 2020 to 2100 under different climate scenarios (SSP 1-2.6, SSP 2-4.5, and SSP 5-8.5). Compared to 2020, an increase in average temperature is expected across all three scenarios by 2100. The SSP 1-2.6 scenario shows the lowest temperature rise, with an increase of approximately 0.96°C from 2020 to 2100. In the SSP 2-4.5 scenario, the temperature rise reaches 2.16°C, and the highest temperature increase is observed in the SSP 5-8.5 scenario, with a rise of 5.24°C by 2100. From 2040 onwards, the temperature increases accelerate in all three scenarios, becoming more pronounced by 2080.

Table 4-8: Average Mean Surface Air Temperature in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	SSP 1-2.6 [°C]	SSP 2-4.5 [°C]	SSP 5-8.5 [°C]
2020	10.54	10.47	10.82
2030	11.18	10.95	11.28
2040	11.53	11.54	11.67
2050	11.39	11.81	12.49
2060	11.44	12.11	13.04
2070	11.61	12.12	14.09
2080	11.99	12.75	15.08
2090	11.67	12.79	15.82
2100	11.5	12.63	16.06

Seasonal variations of average mean surface air temperature in CMIP6 (2020-2100) are given in Table 4-9. Seasonal temperature projections show an overall warming trend across all seasons and emission scenarios throughout the 21st century. Winter temperatures, initially below or near 0°C in 2020 under all scenarios, are projected to increase steadily, with the most significant rise under SSP5-8.5, reaching approximately 4.4°C by 2100. Spring temperatures show relatively modest increases under SSP1-2.6 and SSP2-4.5, but a marked rise under SSP5-8.5, particularly after 2060, reaching over 14°C by 2100. Summer temperatures, already high in 2020 (around 21°C), exhibit a strong upward trend, especially under the high-emission SSP5-8.5 scenario, where they reach over 28°C by the end of the century. Autumn follows a similar pattern, with gradual increases under SSP1-2.6 and SSP2-4.5, and a sharp rise under SSP5-8.5, exceeding 18°C by 2100. These trends highlight the seasonal asymmetry of climate change impacts, with the most pronounced warming expected in winter and summer months, particularly under high-emission pathways.

Table 4-9: Seasonal Variations of Average Mean Surface Air Temperature in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	Winter			Spring			Summer			Autumn		
	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5
2020	-0.37	0.11	0.25	8.65	9.03	9.35	21.23	20.92	21.19	12.68	12.6	12.47
2030	0.39	1.1	0.4	9.43	8.53	9.51	21.83	21.51	21.73	12.97	13.3	13.18
2040	0.41	0.93	0.81	9.91	9.46	10.12	22.09	22.09	22.54	13.47	13.33	13.81
2050	1.05	0.88	1.51	9.44	9.9	10.31	21.84	22.36	23.5	13.15	13.71	14.41
2060	0.31	0.28	2.33	10.13	10.44	11.02	22.26	22.66	24.32	13.06	13.95	15.28
2070	0.7	1.66	2.73	9.72	9.67	11.63	22.04	23.55	25.37	13.67	14.32	16.32
2080	0.38	1.47	2.82	9.38	10.54	12.99	22.31	23.78	26.2	13.75	14.63	17.11
2090	0.6	2.2	3.68	9.73	10.58	12.59	21.93	24.18	26.93	13.51	14.5	17.66
2100	1.12	1.71	4.39	9.58	10.47	14.28	22.22	23.73	28.3	13.37	14.57	18.36

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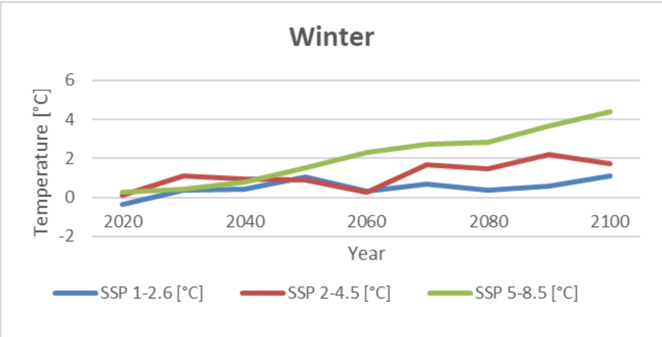

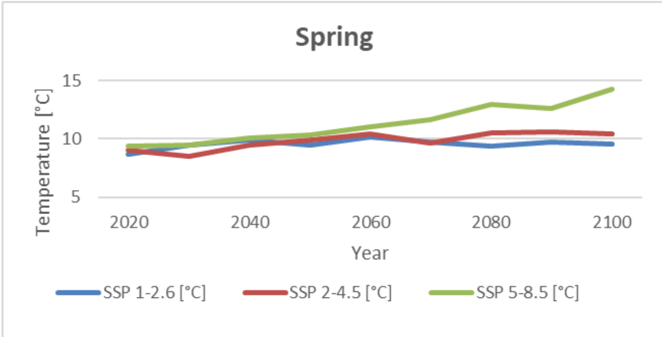

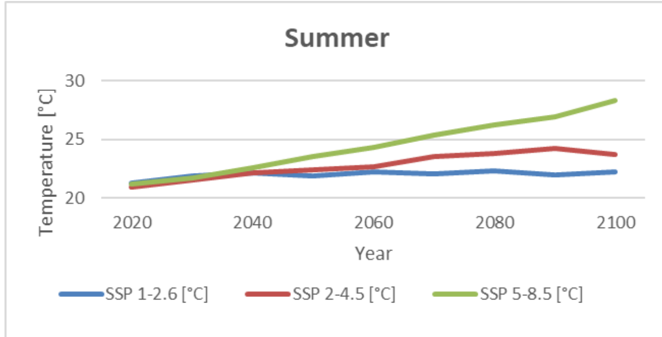

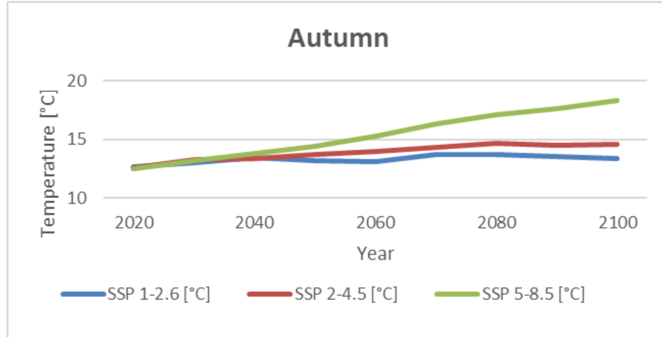

Average Maximum Surface Air Temperatures

Average maximum surface air temperature is expected to increase in all considered scenarios as can be seen from Figure 4-10.

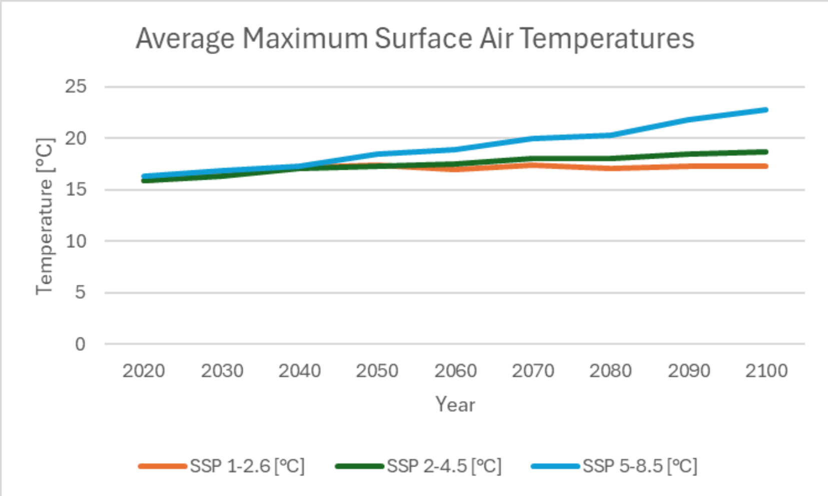

Figure 4-10: Average Maximum Surface Air Temperature in climate models (CMIP6) for the historical period (1950-2020) and the Future Projections (2020-2100) in the three SSPs considered (World Bank Climate Change Knowledge Portal,2025)

Table 4-10 displays the maximum temperature changes from 2020 to 2100 under different climate scenarios (SSP 1-2.6, SSP 2-4.5, and SSP 5-8.5). From the data, it is clear that all three scenarios predict a rise in maximum temperatures by 2100. The SSP 1-2.6 scenario shows a relatively moderate increase, with a rise of 1.35°C from 2020 to 2100. The SSP 2-4.5 scenario experiences a larger increase of 2.79°C, while the SSP 5-8.5 scenario shows the most significant rise of 6.42°C. In the SSP 5-8.5 scenario, the maximum temperature exceeds 22°C by 2100, the highest among all scenarios.

Table 4-10: Average Maximum Surface Air Temperature of Daily Maximum in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	SSP 1-2.6 [°C]	SSP 2-4.5 [°C]	SSP 5-8.5 [°C]
2020	15.93	15.9	16.36
2030	16.66	16.27	16.9
2040	17.23	17.09	17.3
2050	17.4	17.25	18.44
2060	17.01	17.49	18.85
2070	17.41	18.09	19.98
2080	17.08	18.08	20.34
2090	17.24	18.46	21.77
2100	17.28	18.69	22.78

Seasonal variations of average maximum surface air temperature in CMIP6 (2020-2100) are given in Table 4-9. Seasonal temperature projections indicate a consistent warming trend across all emission scenarios (SSP1-2.6, SSP2-4.5, SSP5-8.5), with the most significant increases observed under the high-emission pathway (SSP5-8.5). Winter temperatures, starting between 3.7°C and 4.5°C in 2020, are projected to rise steadily, reaching up to 8.8°C by 2100 under SSP5-8.5. Spring temperatures follow a similar trend, with modest increases under low and intermediate scenarios, while under SSP5-8.5, spring temperatures could exceed 20°C by the end of the century. Summer temperatures, which are already high at baseline (around 27.5°C), are projected to increase gradually, with the most dramatic rise again under SSP5-8.5, reaching nearly 35°C by 2100. Autumn shows a comparable pattern, with temperatures increasing by 1–6°C depending on the scenario, culminating in nearly 25°C under SSP5-8.5. Overall, all seasons show clear warming, but summer and autumn are projected to experience the greatest increases, especially under high-emission scenarios.

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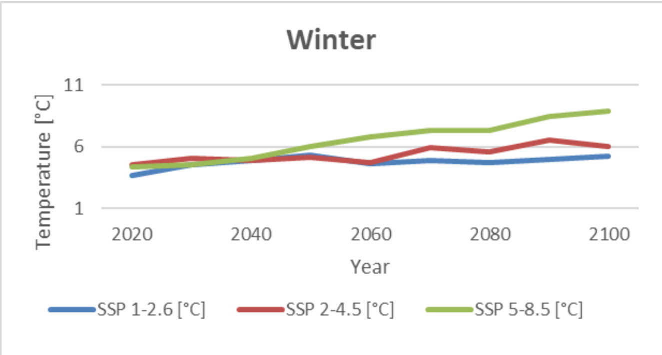
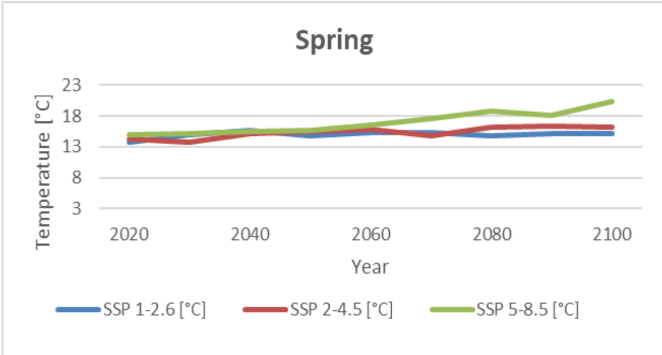
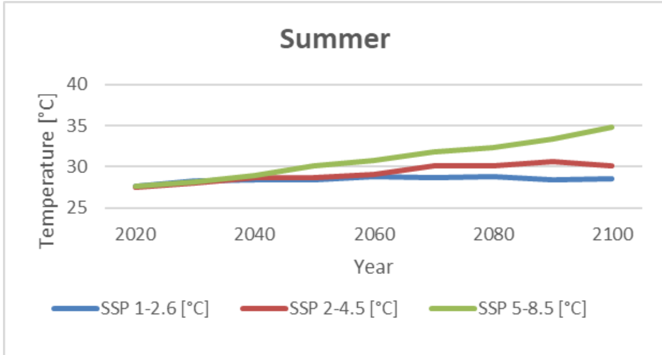
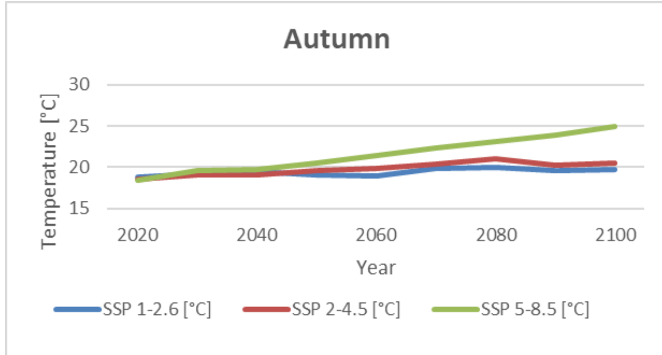
Table 4-11: Seasonal Variations of Average Maximum Surface Air Temperature in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	Winter			Spring			Summer			Autumn		
	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5
2020	3.7	4.54	4.38	13.82	14.21	14.90	27.58	27.49	27.63	18.79	18.49	18.38
2030	4.55	5.01	4.50	14.89	13.72	15.13	28.26	27.98	28.19	19.22	19.09	19.57
2040	4.92	4.85	5.02	15.59	15.09	15.48	28.46	28.66	28.92	19.41	19.04	19.69
2050	5.33	5.17	5.97	14.83	15.48	15.64	28.37	28.73	30.19	19.03	19.65	20.54
2060	4.60	4.68	6.76	15.40	15.89	16.54	28.82	29.12	30.83	18.95	19.85	21.40
2070	4.88	5.88	7.28	15.36	14.88	17.54	28.70	30.11	31.86	19.82	20.37	22.35
2080	4.67	5.54	7.34	14.84	16.11	18.72	28.80	30.11	32.40	19.94	21.05	23.09
2090	4.98	6.53	8.47	15.21	16.45	18.17	28.37	30.70	33.37	19.65	20.21	23.93
2100	5.25	6.00	8.84	15.14	16.17	20.45	28.60	30.17	34.88	19.77	20.44	24.94
Graphics												

Average Minimum Surface Air Temperatures

Average minimum surface air temperature is expected to increase in all considered scenarios as can be seen from Figure 4-11.

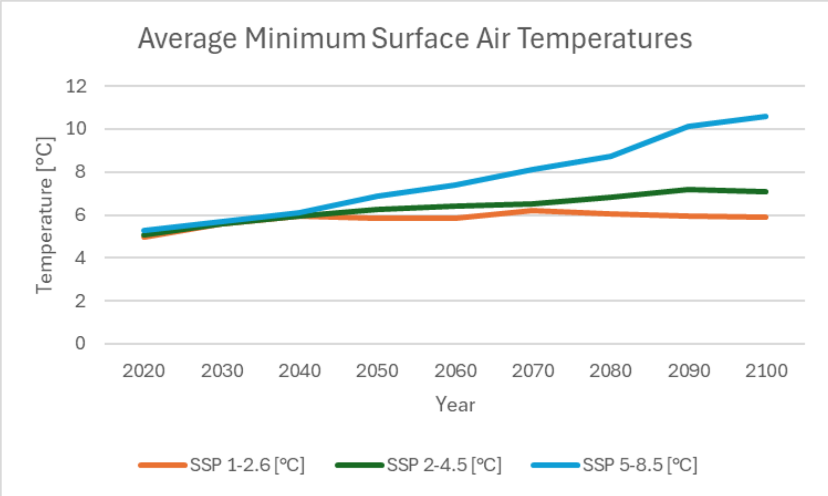


Figure 4-11: Average Minimum Surface Air Temperature in climate models (CMIP6) for the historical period (1950-2020) and the future projections (2020-2100) in the three SSPs considered (World Bank Climate Change Knowledge Portal,2025)

Table 4-12 presents the minimum temperature changes from 2020 to 2100 under different climate scenarios (SSP 1-2.6, SSP 2-4.5, and SSP 5-8.5). In all three scenarios, a clear upward trend in minimum temperatures is observed. The SSP 1-2.6 scenario shows a moderate increase of 0.91°C by 2100, with the minimum temperature reaching 5.89°C. The SSP 2-4.5 scenario experiences a larger increase of 2.01°C, reaching a minimum temperature of 7.09°C by 2100. The SSP 5-8.5 scenario sees the most substantial rise, with a temperature increase of 5.3°C, leading to a minimum temperature of 10.6°C by 2100. Notably, the minimum temperatures in the SSP 5-8.5 scenario exceed 10°C, highlighting the significant warming expected under high emission scenarios.

Table 4-12: Average Minimum Surface Air Temperature of Daily Minimum in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	SSP 1-2.6 [°C]	SSP 2-4.5 [°C]	SSP 5-8.5 [°C]
2020	4.98	5.08	5.3
2030	5.58	5.57	5.68
2040	5.95	5.95	6.1
2050	5.87	6.27	6.89
2060	5.85	6.43	7.38
2070	6.23	6.52	8.14
2080	6.07	6.84	8.71
2090	5.95	7.21	10.11
2100	5.89	7.09	10.6

Maximum of Daily Max-Temperature

Single-day maximum temperature is expected to increase in all considered scenarios as can be seen from Figure 4-10 and Table 4-13

In the SSP1-2.6 scenario, the temperature increases by approximately 0.02°C/year, as shown in the table, with temperatures reaching around 34.78°C by 2080 (from 33.36°C in 2020). This indicates an increase of approximately 1.42°C by 2080 compared to 2020. Based on this, the temperature increase is about 4.25% by 2080.

In the SSP2-4.5 scenario, the projected increase is about 0.04°C/year, with temperatures expected to rise to 35.92°C by 2100 (from 33.20°C in 2020), as shown in the table. This represents a 2.72°C increase compared to 2020, or an approximate 8.2% increase by 2100.

In the SSP5-8.5 scenario, the temperature increases about 0.08°C/year, as shown in the table, with temperatures potentially rising to 40.18°C by 2100 (from 33.35°C in 2020). This represents an increase of 6.83°C compared to 2020, or an approximate 20.4% increase by 2100.

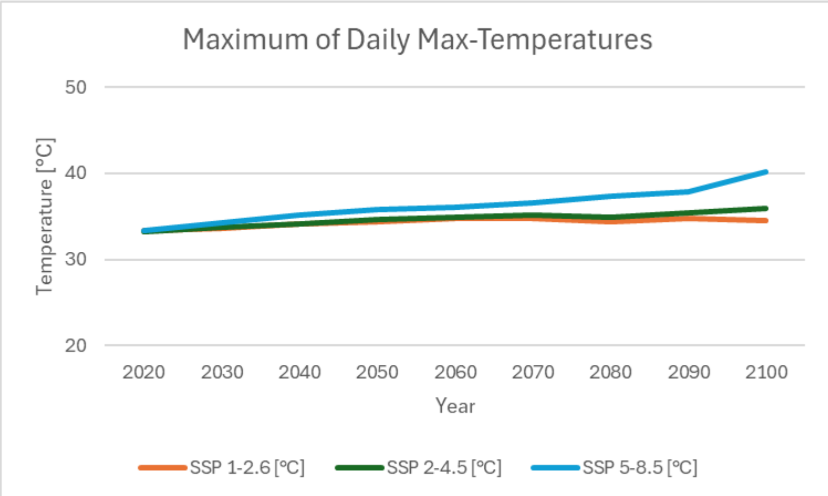


Figure 4-12: Maximum of Daily Max-Temperature in climate models (CMIP6) for the historical period (1950-2020) and the future projections (2020-2100) in the three SSPs considered (World Bank Climate Change Knowledge Portal,2025)

Table 4-13: Maximum of Daily Max-Temperature in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	SSP 1-2.6 [°C]	SSP 2-4.5 [°C]	SSP 5-8.5 [°C]
2020	33.36	33.2	33.35
2030	33.63	33.68	34.2
2040	34.17	34.11	35.15
2050	34.36	34.66	35.8
2060	34.75	34.85	36.02
2070	34.82	35.22	36.61
2080	34.38	34.85	37.32
2090	34.74	35.36	37.81
2100	34.5	35.92	40.18

Seasonal variations of daily maximum of maximum surface air temperature in CMIP6 (2020-2100) are given in Table 4-9. The comparison between the two datasets reveals a clear distinction in baseline temperature levels and projected increases. The second dataset indicates significantly higher seasonal temperatures for all years and scenarios, suggesting either a different region or a different reference baseline. For instance, in 2020, winter temperatures start around 12–13°C in the second table, while they are around 4°C in the first, indicating at least an 8°C baseline difference. Despite this, both datasets show similar trends: steady warming across all seasons, more pronounced under SSP5-8.5. In both datasets, summer temperatures show the sharpest increases, exceeding 41°C by 2100 in the second dataset under SSP5-8.5, compared to 34.9°C in the first. Autumn also exhibits strong warming, particularly under high emissions, reaching up to 36.1°C in the second dataset. The consistency in projected trends despite different baselines reinforces the robustness of warming projections, while highlighting potential regional disparities in climate impact severity.

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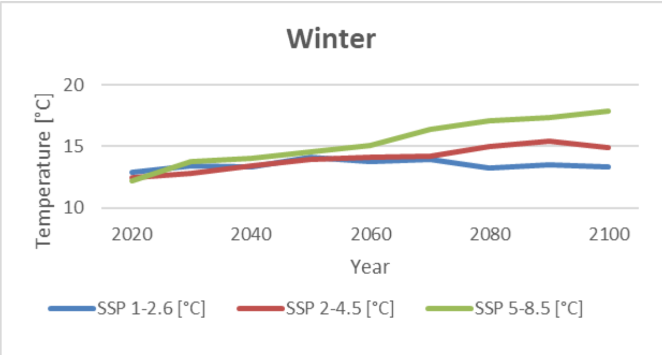
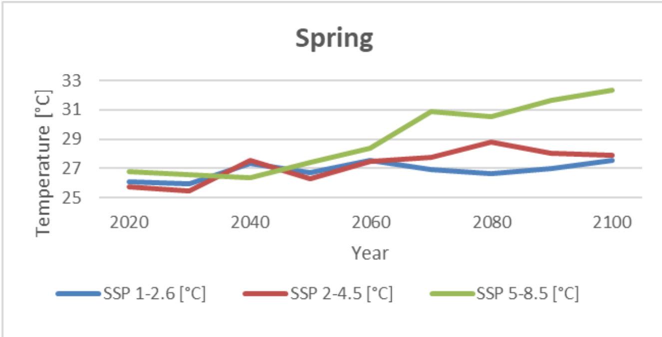
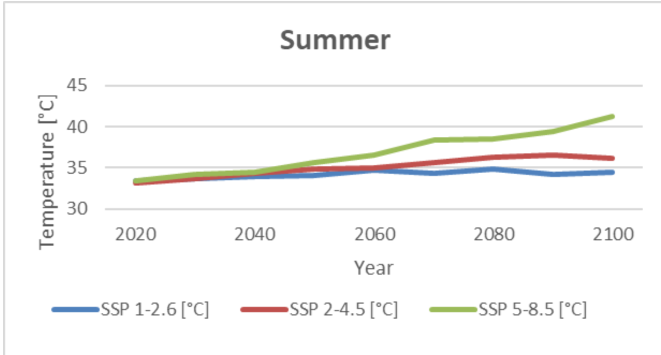
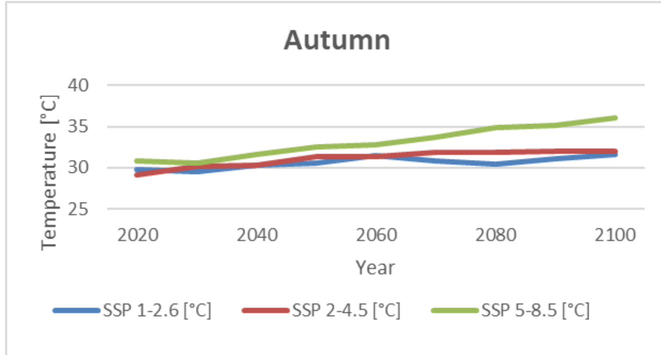
Table 4-14: Seasonal Variations of Daily Maximum of Maximum Surface Air Temperature in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	Winter			Spring			Summer			Autumn		
	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5	SSP 1-2.6	SSP 2-4.5	SSP 5-8.5
2020	12.93	12.49	12.24	26.1	25.72	26.79	33.36	33.2	33.35	29.72	29.14	30.87
2030	13.43	12.85	13.81	25.92	25.49	26.59	33.63	33.68	34.2	29.54	30.24	30.56
2040	13.33	13.44	14.01	27.36	27.53	26.33	33.87	34.36	34.49	30.37	30.37	31.57
2050	14.14	13.96	14.54	26.7	26.32	27.44	33.99	34.85	35.63	30.56	31.37	32.59
2060	13.73	14.08	15.09	27.53	27.46	28.35	34.77	34.99	36.59	31.48	31.34	32.73
2070	13.98	14.24	16.4	26.94	27.72	30.86	34.34	35.57	38.37	30.88	31.82	33.73
2080	13.22	15.03	17.07	26.61	28.79	30.52	34.83	36.22	38.52	30.46	31.88	34.83
2090	13.54	15.45	17.33	27.01	28.04	31.65	34.18	36.5	39.39	31.05	32.02	35.18
2100	13.35	14.88	17.86	27.55	27.88	32.36	34.43	36.16	41.27	31.58	32.06	36.11
Graphics												

Minimum of Daily Min-Temperature

Single-day minimum temperature is expected to increase in all considered scenarios as can be seen from Table 4-15.

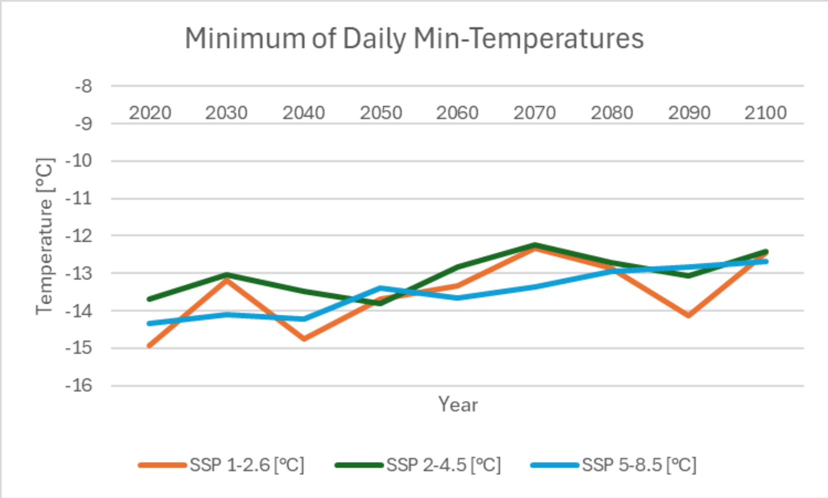


Figure 4-13: Minimum of Daily Min-Temperature in climate models (CMIP6) for the historical period (1950-2020) and the future projections (2020-2100) in the three SSPs considered (World Bank Climate Change Knowledge Portal,2025)

Table 4-15: Minimum of Daily Min-Temperature in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	SSP 1-2.6 [°C]	SSP 2-4.5 [°C]	SSP 5-8.5 [°C]
2020	-14.94	-13.68	-14.35
2030	-13.18	-13.04	-14.1
2040	-14.75	-13.47	-14.22
2050	-13.68	-13.8	-13.39
2060	-13.34	-12.84	-13.65
2070	-12.34	-12.25	-13.35
2080	-12.87	-12.72	-12.95
2090	-14.12	-13.07	-12.84
2100	-12.45	-12.43	-12.68

Hot Days (Tmax > 35 °C)

The number of hot days (Tmax > 35°C) is projected to increase under all emission scenarios throughout the 21st century, as shown in Figure 4-14 and Table 4-16.

The rate and magnitude of increase differ significantly between scenarios. Under the SSP1-2.6 scenario, the number of hot days remains relatively low, with only a slight increase from 2020 to 2100, reaching around 3 days/year by the end of the century. In the SSP2-4.5 scenario, the number of hot days shows a more noticeable upward trend, peaking at around 8–9 days/year by 2080 and then stabilizing. In contrast, the SSP5-8.5 scenario indicates a dramatic increase, with hot days rising steadily throughout the century to reach over 50 days/year by 2100. This scenario demonstrates the strongest sensitivity to continued high emissions, emphasizing the importance of mitigation efforts.

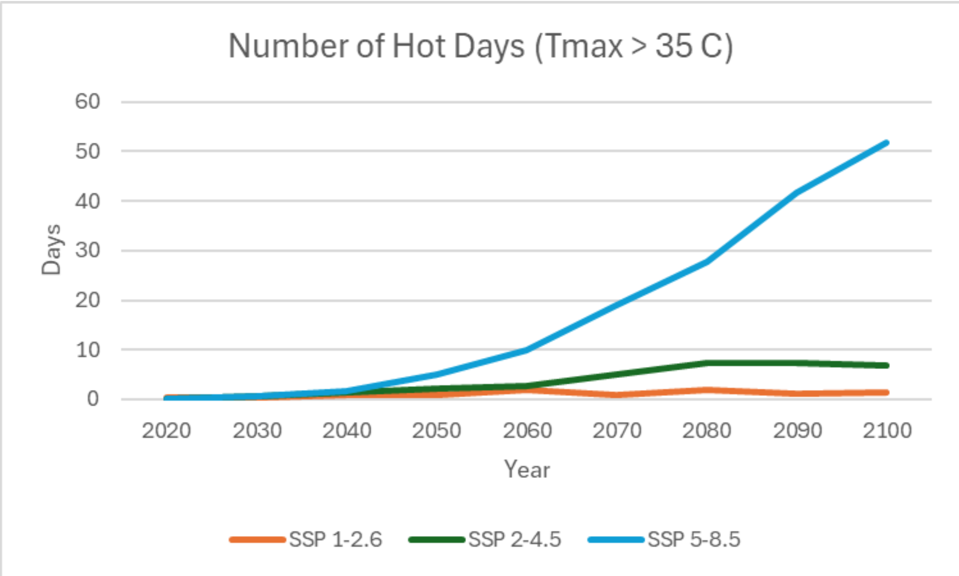


Figure 4-14: Number of Hot Days (Tmax > 35 °C) in climate models (CMIP6) for the historical period (1950-2020) and the future projections (2020-2100) in the three SSPs considered (World Bank Climate Change Knowledge Portal,2025)

Table 4-16: Number of Hot Days in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	SSP 1-2.6 [days]	SSP 2-4.5 [days]	SSP 5-8.5 [days]
2020	0.28	0.23	0.22
2030	0.35	0.51	0.73
2040	0.95	1.44	1.63
2050	0.79	2.06	5.15
2060	1.91	2.67	9.81
2070	0.91	4.94	18.88
2080	1.89	7.29	27.8
2090	1.12	7.4	41.66
2100	1.37	6.9	51.72

Frost Days (Tmin < 0 °C)

Number of frost days is projected to decrease under all considered scenarios in the first half of the century as can be seen from Figure 4-15. For the second half of the century predictions show different trend according to different emission scenarios: fluctuations with overall stability for the SSP1-2.6 scenario; fluctuations with overall decrease in the SSP2-4.5 and SSP5-8.5 scenarios.

In the SSP1-2.6 scenario, the number of frost days is expected to decrease around 0.05 days/year by 2080, then it is expected to relatively increase around 2.6 days/year by 2100. Based on that, compared to 2020, the number of frost days is expected to decrease approximately 60% by 2080. In the SSP2-4.5 scenario, the number of frost days is expected to decrease by approximately 0.07 days/year, reaching about 1.2 days/year by 2100. Based on that, compared to 2020, the number of frost days is expected to decrease approximately 75% by 2090. In the SSP5-8.5 scenario, the number of frost days is expected to decrease significantly throughout the century. (see Table 4-17).

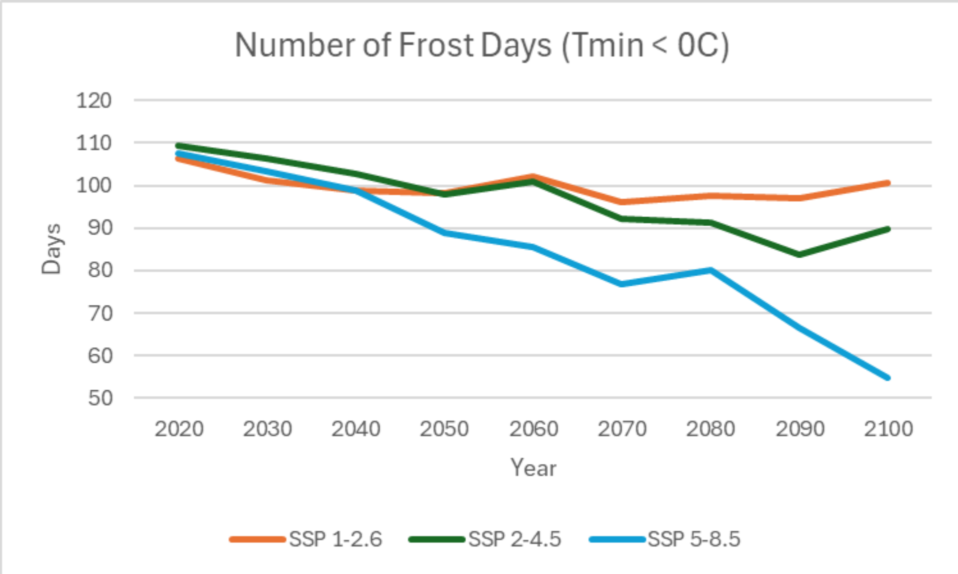


Figure 4-15: Number of Frost Days (Tmin < 0 °C) in climate models (CMIP6) for the historical period (1950-2020) and the future projections (2020-2100) in the three SSPs considered (World Bank Climate Change Knowledge Portal,2025)

Table 4-17: Number of Frost Days in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	SSP 1-2.6 [days]	SSP 2-4.5 [days]	SSP 5-8.5 [days]
2020	106.3	109.44	107.58
2030	101.14	106.27	103.27
2040	98.78	102.61	98.78
2050	98.09	97.78	88.98
2060	102.04	101.03	85.4
2070	95.96	92.16	76.74
2080	97.59	91.18	80.05
2090	97.09	83.71	66.63
2100	100.76	89.89	54.8

Precipitation

Precipitation is projected to remain stable under all considered scenarios in the first half of the century as can be seen from Figure 4-16. For the second half of the century predictions show different trend according to different emission scenarios: fluctuations with overall increase in the SSP1-2.6; fluctuations with overall stability for the SSP2-4.5; decrease for the SSP5-8.5.

In the SSP1-2.6 scenario, precipitation is expected to decrease relatively around 490 mm/year till around 2050. In the second part of the century, values tend to increase, reaching around 520 mm/year in 2100. Based on that, compared to 2020, precipitation is expected to increase approximately 7% by 2100. In the SSP2-4.5 scenario, precipitation is expected to fluctuate around 510 mm/year until 2050. In the second part of the century, values tend to decrease, reaching below 500 mm/year by 2100. In the SSP5-8.5 scenario, precipitation is expected to decrease relatively around 450 mm/year by 2100. Based on that, compared to 2020, precipitation is expected to decrease approximately 15% by 2100. (see Table 4-18).

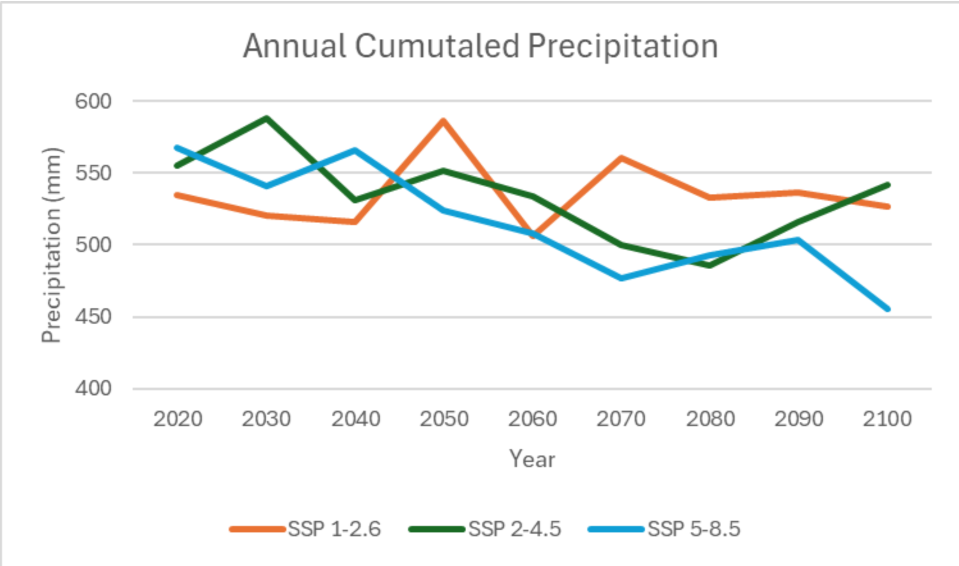


Figure 4-16: Annual Cumulated Precipitation in climate models (CMIP6) for the historical period (1950-2020) and the future projections (2020-2100) in the three SSPs considered (World Bank Climate Change Knowledge Portal,2025)

Table 4-18: Annual Cumutaled Precipitation in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	SSP 1-2.6 [mm]	SSP 2-4.5 [mm]	SSP 5-8.5 [mm]
2020	534.3	555.4	567.96
2030	520.21	588.2	540.76
2040	515.72	531.22	566.29
2050	586.87	551.86	524.05
2060	506.56	533.98	507.71
2070	560.49	499.76	476.96
2080	532.65	485.74	492.99
2090	536.51	515.76	503.32
2100	526.36	541.7	455.14

Average Largest 1-Day Precipitation

Average largest 1-day precipitation is projected to remain stable under all considered scenarios in the first half of the century as can be seen from Figure 4-17. For the second half of the century predictions show different trend according to different emission scenarios: fluctuations with overall stability for the SSP1-2.6 and SSP2-4.5; increase for the SSP5-8.5.

In the SSP1-2.6 scenario, precipitation is expected to change around 0.05 mm/year for the entire century with fluctuations of +/- 0.01 mm. In the SSP2-4.5 scenario, precipitation is expected to change around 0.07 mm/year for the entire century with fluctuations of +/- 0.01 mm. In the SSP5-8.5 scenario, precipitation is expected to change around 0.06 mm/year for the entire century with fluctuations of +/- 0.01 mm (see Table 4-19).

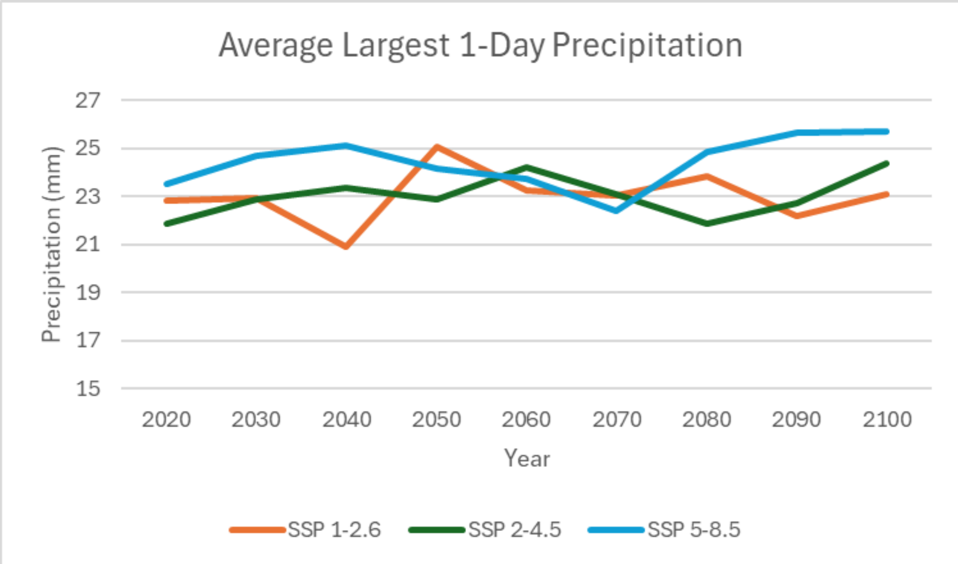


Figure 4-17: Average Largest 1-Day Precipitation in climate models (CMIP6) for the historical period (1950-2020) and the future projections (2020-2100) in the three SSPs considered (World Bank Climate Change Knowledge Portal,2025)

Table 4-19: Average Largest 1-Day Precipitation in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	SSP 1-2.6 [mm]	SSP 2-4.5 [mm]	SSP 5-8.5 [mm]
2020	22.81	21.88	23.51
2030	22.91	22.9	24.7
2040	20.9	23.36	25.11
2050	25.08	22.86	24.17
2060	23.27	24.23	23.73
2070	23.04	23.08	22.37
2080	23.82	21.86	24.84
2090	22.19	22.74	25.65
2100	23.07	24.38	25.72

Average Largest 5-Day Cumulative Precipitation

Average largest 5-day cumulative precipitation is projected to remain stable under all considered scenarios in the first half of the century as can be seen from Figure 4-18. For the second half of the century predictions show different trend according to different emission scenarios: fluctuations with overall stability for the SSP1-2.6 and SSP2-4.5; increase for the SSP5-8.5.

In the SSP1-2.6 scenario, average largest 5-day precipitation is expected to fluctuate around 50 mm/year for the entire century with variations of +/- 5 mm. In the SSP2-4.5 scenario, average largest 5-day precipitation is expected to remain relatively stable around 50 mm/year for the entire century with fluctuations of +/- 5 mm. In the SSP5-8.5 scenario, average largest 5-day precipitation is expected to remain relatively stable around 50 mm/year for the entire century with fluctuations of +/- 5 mm (see Table 4-20).

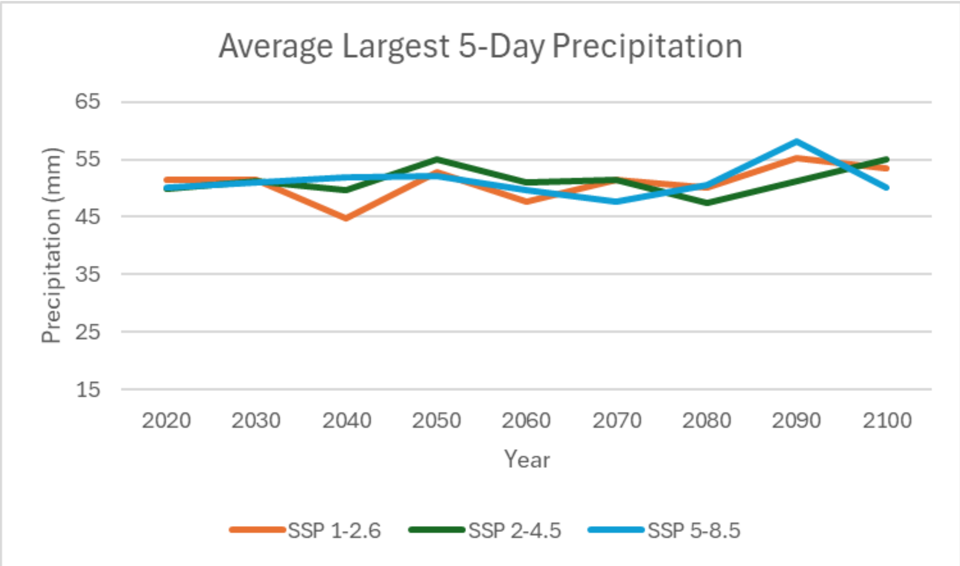


Figure 4-18: Average Largest 5-Day Cumulative Precipitation in climate models (CMIP6) for the historical period (1950-2020) and the future projections (2020-2100) in the three SSPs considered (World Bank Climate Change Knowledge Portal,2025)

Table 4-20: Average Largest 5-Day Cumulative Precipitation in CMIP6 (2020-2100) (World Bank Climate Change Knowledge Portal,2025)

Year	SSP 1-2.6 [mm]	SSP 2-4.5 [mm]	SSP 5-8.5 [mm]
2020	51.47	49.82	50.08
2030	51.53	51.18	50.89
2040	44.67	49.75	51.98
2050	52.74	55.08	52.14
2060	47.71	50.95	49.65
2070	51.54	51.34	47.57
2080	50.02	47.47	50.58
2090	55.13	51.3	58.2

Year	SSP 1-2.6 [mm]	SSP 2-4.5 [mm]	SSP 5-8.5 [mm]
2100	53.49	54.99	50.2

4.1.3 Identification and Assessment of Relevant Climate-Related Hazards

According to ISO 14091, the first step in the CCRA requires to identify the climate-related hazards that may affect the Project site and, among them, those the Project may be exposed to. Additional available literature (i.e., IPCC Report on Impacts, Adaptation and Vulnerability, UNEP Finance Initiative, World Bank National & Policy Climate and Disaster Risk Screening tool) was considered to define a framework and guide the hazard identification process.

Key questions to consider in the hazard identification process are the following:

- What are the past events and what are the main issues that affected the site and may be related to climate change?
- What is the climate-related hazards that may become relevant in the future?

Information from World Bank Group – Climate Change Knowledge Portal, Vulnerability section, were consulted to identify the most relevant hazards at the Country level. In addition to this, THINK HAZARD portal (implemented by Global Facility for Disaster Reduction and Recovery (GFDRR) in collaboration with World Bank and providing high level hazard assessment worldwide) was used to refine the investigation at the level of the city of Niğde.

Also, following physical components and their baseline conditions discussed in the ESIA report of the Project is also considered for evaluation of the hazards:

- Meteorology
- Hydrology and Hydrogeology
- Geology, Geomorphology and Geotechnics
- Soil and Subsoil

The outcomes of this processes resulted in the following list of selected hazards. They are listed together with the main justification for their inclusion and assessment (“Highest”, “High”, “Medium”, “Low” or “Lowest”) for the the risk assessment. The assessment was qualitatively characterized based on the future projections and selected according to the characteristics of the Project.

- **Flooding Hazard**

Flooding is a recurring natural hazard throughout Niğde.

The flood risk in Niğde is influenced by its geographic location in the Central Anatolia region of Türkiye. While the city is not located directly on the coast, it can still be affected by heavy rainfall from weather systems passing over the area.

During periods of intense precipitation, rivers and streams in and around Niğde can swell, potentially leading to localized flooding in low-lying areas and areas with inadequate drainage. Urbanization and changes in land use can also contribute to increased flood risk by altering natural drainage patterns.

According to the information in THINK HAZARD Portal, in Bor District, significant floods are expected at least once in the next 50 years. Factors such as intense rainfall and the district's topography contribute to this risk.

Also, according to the information acquired from the ESIA Report of the Project, there is no basins and surface water bodies in or around the Project Site to increase flooding risk.

With the consideration of the data from THINK HAZARD, precipitation condition data from the closest Meteorology Station and future projection data from World Bank Climate Change Knowledge Portal (see Section 4.1.2), this hazard has been **scoped in** for the climate change risks assessment

- **Extreme Heat Hazard**

The mean annual temperature in Niğde has increased by an average of 0.5°C per decade since 1971, adding up to a 1.5°C temperature increase since last century. Temperatures are projected to keep rising in Bor District as well. This can have significant implications for extreme heat.

Projections indicate prolonged exposure to extreme heat, resulting in heat stress, is expected to occur at least once in the next five years.

With the consideration of the data from THINK HAZARD, temperature condition data from the closest Meteorology Station and future projection data from World Bank Climate Change Knowledge Portal (see Section 4.1.2), this hazard has been **scoped in** for the climate change risks assessment

- **Extreme Cold Hazard**

In Niğde Province, in January, which is typically the coldest month of the year, average minimum temperatures moved from -6.37°C for the period 1901-1930 to -5.58° in the period 1991-2020. According to all scenarios, minimum temperatures are expected to further increase in the future.

With the consideration of the data from THINK HAZARD, temperature condition data from the closest Meteorology Station and future projection data from World Bank Climate Change Knowledge Portal (see Section 4.1.2), this hazard has been scoped in for the climate change risks assessment

- **Drought Hazard**

Droughts have large impacts on agricultural production and the population. Niğde Province has a desertification risk above medium level. It is situated at an elevation of about 1300 m above sea level.

According to a study, 110 droughts lasting six months and more occurred between 1950 and 2015. It was determined that drought magnitude increases from 1-month time scale to 36-month timescale.[10]

Additionally, if droughts intensify, they will pose serious threats to food security, people's main livelihood activity (agriculture), and water resources.

Moreover, according to the information acquired from the ESIA Report of the Project, there is no basins and surface water bodies in or around the Project Site.

With the consideration of the data from THINK HAZARD, temperature and precipitation conditions from the closest Meteorology Station and future projection data from World Bank Climate Change Knowledge Portal (see Section 4.1.2),, this hazard has been scoped in for the climate change risks assessment

[10]https://www.researchgate.net/publication/322157691_INVESTIGATION_OF_TRENDS_IN_METEOROLOGICAL_DROUGHTS_IN_NIGDE_PROVINCE

- **Severe Storms Hazard**

According to The European Severe Weather Database (ESWD)[11], severe storms including severe wind, heavy rain, large hail, damaging lightning is a recurring hazard in Niğde.

With the consideration of the data from THINK HAZARD, wind conditions from the closest Meteorology Station and future projection data from World Bank Climate Change Knowledge Portal (see Section 4.1.2), this hazard has been **scoped in** for the climate change risks assessment

- **Extreme Precipitations Hazard**

Extreme rainfall events can trigger massive mudslides in poorly constructed urban areas and along degraded and deforested slopes. Additionally, increases in the intensity of rains with climate change will have serious implications on agriculture, sedimentation rates, infrastructure, and industry.

The severity of heavy precipitation events is projected to increase, though rainfall events will likely be less frequent.

With the consideration of the data from THINK HAZARD, precipitation condition data from the closest Meteorology Station and future projection data from World Bank Climate Change Knowledge Portal (see Section 4.1.2), this hazard has been **scoped in** for the climate change risks assessment

- **Wildfires Hazard**

According to Think Hazard portal, in Niğde Province the wildfire hazard is classified as high which means that there is greater than a 50% chance of encountering weather that could support a significant wildfire that is likely to result in both life and property loss in any given year. Based on data available in the Global Forest Watch, Niğde lost 79 ha overall from all loss factors between 2001 and 2022, including the loss of 23 ha of tree cover due to fires. In this time frame, the year 2021 had the greatest amount of tree cover loss due to fires, with 7 ha lost to fires accounting for 55% of all tree cover loss for that year. Fires were responsible for 23% of tree cover loss in Niğde between 2001 and 2022.

In extreme fire weather events, strong winds and winds born debris may weaken the integrity of infrastructures. Future climate projections based on models indicate that there will likely be more instances of fire weather in this area, including higher temperatures and more variable rainfall. Due to longer periods without rain during fire seasons, the length of the fire season and the number of days with weather that could assist fire spread are projected to rise in areas already subject to wildfire hazard.

With the consideration of the data from THINK HAZARD, temperature and precipitation conditions, from the closest Meteorology Station and future projection data from World Bank Climate Change Knowledge Portal (see Section 4.1.2), together with drought hazard, hazard has been **scoped in** for the climate change risks assessment although the project area is flat and has low vegetation density.

- **Water Stress**

According to the Think Hazard portal[12], Niğde Province is classified as having a high risk of water scarcity. This classification indicates that the area faces significant challenges in meeting water demand due to limited availability. Factors contributing to this risk include low annual rainfall, high evaporation rates, and increasing water consumption across agricultural, industrial, and domestic sectors.

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[11] https://eswd.eu/

[12] https://thinkhazard.org/en/

Climate change projections suggest that Niğde may experience higher temperatures and more variable precipitation patterns, potentially exacerbating water scarcity issues.

With the consideration of the data from THINK HAZARD, temperature and precipitation conditions, from the closest Meteorology Station and future projection data from World Bank Climate Change Knowledge Portal (see Section 4.1.2), together with drought hazard, hazard has been **scoped in** for the climate change risks assessment.

- **Heat Stress**

According to the Think Hazard portal, Niğde Province faces a high risk of extreme heat, with maximum summer temperatures occasionally exceeding 35°C. Climate projections indicate that these extreme heat events are likely to become more frequent and severe. According to a study analyzing temperature trends in Niğde between 1950 and 2015, there has been a significant upward trend in both annual and seasonal temperatures.[13]

Climate trends indicate a significant rise in both annual and seasonal temperatures, with projections suggesting more frequent and severe heatwaves. This poses serious health risks, as extreme heat is a leading cause of weather-related deaths and can worsen cardiovascular diseases. Given these challenges, Niğde must implement adaptive measures to mitigate the effects of rising temperatures on its population and infrastructure.

With the consideration of the data from THINK HAZARD, temperature conditions, from the closest Meteorology Station and future projection data from World Bank Climate Change Knowledge Portal (see Section 4.1.2), together with drought hazard, hazard has been **scoped in** for the climate change risks assessment.

- **Landslide**

According to the THINK HAZARD portal, landslides are a notable natural hazard in Niğde Province, Türkiye. The region's topography, characterized by mountainous and hilly terrain, combined with geological conditions and land use practices, contributes to the susceptibility to landslides. Factors such as heavy rainfall, seismic activity, and human-induced alterations like deforestation and construction can further exacerbate the risk.

Bor District, on the other hand, faces a low risk of landslides. According to the information acquired from the ESIA Report of the Project, the Project area is extremely flat and no landslide risk is foreseen for the Project. Therefore, hazard has been **scoped out** for the climate change risks assessment.

- **Soil Erosion**

As it was discussed in the ESIA, although the removal of soil will inevitably result in disturbances, rendering the soil surface more susceptible to soil erosion by wind and/or rain since there are no natural water receptors within the Project AoI, there are no natural watercourses, drainage channels, or nearby surface water bodies within or adjacent to the site. Due to the absence of sloped terrain and water flow, the risk of soil erosion is considered negligible. Furthermore, the plant involves minimal ground disturbance and no large-scale excavation or water use, further reducing the potential for erosion. Therefore, hazard has been **scoped out** for the climate change risks assessment.

4.1.4 Exposure assessment

Once hazards potentially affecting the Project site were identified, the exposure of the Project to each hazard was addressed. The key question in the exposure assessment is the following:

- In case of any of the selected climate-related hazard hitting the Project site, would the Project be impacted?

[13] https://www.researchgate.net/publication/317936510_Trends_in_Annual_and_Seasonal_Temperatures_in_Nigde_Central_Anatolia_Turkey_For_Period_1950-2015?utm_source=chatgpt.com

The evaluation considered the intrinsic characteristics and features of the Project.

Table 4-21: Exposure Assessment

HAZARD	TYPE OF HAZARD	ELEMENT EXPOSED	EXPOSURE	JUSTIFICATION
FLOODING	ACUTE	Infrastructures/People	YES	Flooding could cause damages to project components (solar panels, tacker (panel carrier) system, and PV module carrier system, DC Combiner Box, inverter stations and substation) and associated infrastructure and utilities (administrative building, Transformer Center Building), as well as disruptions to access roads and affect people.
EXTREME HEAT	ACUTE	Infrastructures/People	YES	Project components and associated facilities could be affected by extremely hot temperatures. Similarly, people would be impacted by temperatures which are already high and they are expected to increase even further.
DROUGHT	ACUTE	Infrastructures/People	YES	The plant depends on water for its functions.
SEVERE STORMS	ACUTE	Infrastructures/People	YES	Lightings, intense rain accompanied with strong wind and potentially hail would cause disruptions to project components as well as associated facilities and a thread to people. Severe storms could also cause local flooding which could represent an additional disturbance.
EXTREME PRECIPITATIONS	ACUTE	Infrastructures/People	YES	Project components, and access roads would be highly exposed in case of extreme precipitations. People as well would be impacted, in particular in case of flooding due to intense rain.
WILDFIRES	ACUTE	Infrastructures/People	YES	In case of wildfires both people and infrastructures may be affected.
WATER STRESS	CHRONIC	Infrastructures/People	YES	The plant depends on water for its functions.
HEAT STRESS	CHRONIC	Infrastructures/People	YES	Project components and associated facilities could be affected by extremely hot temperatures. Similarly, people would be impacted by temperatures which are already high and they are expected to increase even further.

The Project was considered exposed to all relevant climate-related hazards potentially affecting the Project site. Therefore, all of them were scoped in for further assessment.

4.1.5 Hazards Characterization

With the consideration of historical and future climatical conditions of the Project area, all of the identified hazards are characterized in Table 4-22. National and provincial qualitative data based on down-scaled, regional level climate change projections data from the World Bank Group Climate Change Knowledge Portal was used to identify national and provincial level projections for various climate variables (World Bank Group 2021). Further, qualitative information regarding climate projections was also gathered from the IPCC's Working Group I, on the physical science of climate change, from both AR5 and AR6 reports.

Table 4-22: Hazard Characterization of the Project

Climate Hazard	Trend	Current Climate	Future Trends	Hazard Class
TEMPERATURE				
Extreme Heat (Number of days above 35°C)	Increasing	In Niğde, there were 33.36 days with maximum temperatures greater than 35°C in 2020.	By 2100, the number of extreme heat days is expected to increase significantly under all scenarios, with the highest increase under SSP5-8.5.	High
Extreme Cold (Frost Days, Number of days below 0°C)	Decreasing	In Niğde, there were 106.3 frost days in 2020.	By 2100, the number of frost days is expected to decrease to 100.76 days under SSP1-2.6, 89.89 days under SSP2-4.5, and 54.8 days under SSP5-8.5.	Low
PRECIPITATION				
Extreme Precipitation (maximum 1-day precipitation)	Stable	The observed maximum 1-day precipitation value in Niğde was 22.81 mm in 2020.	By 2100, the average largest 1-day precipitation will be 23.07 mm under SSP1-2.6, 24.38 mm under SSP2-4.5, and 25.72 mm under SSP5-8.5.	Medium
OTHER WEATHER EVENTS				
Severe Storms[14,15]	Increasing	Niğde experiences various storm events, including thunderstorms and heavy rainfall.	By 2100, the frequency and intensity of storm events are expected to increase due to climate change, leading to more severe weather phenomena.	High

[14] Storm Events Database: https://www.ncdc.noaa.gov/stormevents/

[15] Severe Storms and Extreme Events - Data Table: https://www.climate.gov/maps-data/dataset/severe-storms-and-extreme-events-data-table

Climate Hazard	Trend	Current Climate	Future Trends	Hazard Class
Wildfires[16,17]	Increasing	Niğde is susceptible to wildfires, especially during dry periods.	By 2100, the risk of wildfires is expected to increase due to higher temperatures and prolonged drought conditions.	High
Heat Stress[18]	Increasing	Heat stress can be defined as the number of days per year with temperatures exceeding 35°C.	By 2100, the number of heat stress days is expected to increase significantly under all scenarios, with the highest increase under SSP5-8.5.	High
Flooding[19]	Increasing	Flooding can occur due to heavy rainfall, river overflow, or inadequate drainage systems.	By 2100, the risk of flooding is expected to increase due to more frequent and intense precipitation events under all scenarios.	Medium
Drought	Increasing	Niğde experiences periods of drought, originated from both lack of precipitation and extreme temperatures.	By 2100, the frequency and severity of droughts are expected to increase, leading to more significant impacts on water resources and agriculture.	High

4.2 Assessment of Sensitivity, Adaptive Capacity and Vulnerability

4.2.1 Sensitivity for Equipment and Infrastructure

For each hazard, the Sensitivity was qualitatively characterized based on a set of indicators, selected according to the characteristics of the Project potentially exposed to that hazard.

The final step was to assign a class of Sensitivity (“High”, “Medium” or “Low”), entailing all information collected through the assessment process, also considering their relative importance, reliability and completeness. A conservative approach has been adopted assigning a higher Sensitivity class whenever the assessment was uncertain due to inconsistent indicators.

The Project Sensitivity towards each hazard is presented below with the main considerations that justify the assessment.

[16] NIFC Open Data Site: https://data-nifc.opendata.arcgis.com/

[17] https://firemap.live/

[18] Heat Stress Index, compared between historical and future time periods, including historical and percent change: https://www.arcgis.com/home/item.html?id=680e87c5b1d34e0585203aa4f67d8426

[19] Floods Near Real-Time Data: https://www.earthdata.nasa.gov/topics/human-dimensions/floods/near-real-time-data

Sensitivity to Flooding: Overall Sensitivity has been assigned "LOW" with following reasons:

- Although Project components such as panels, inverters, transformers, and control systems are sensitive to water damage, the project area is located in a flat area and is not near any waterbodies:

Sensitivity to Extreme heat: overall Sensitivity has been assigned "MEDIUM". The plant would be impacted with moderate consequences due to both the nature of the hazard and the typology of the infrastructure.

- No green areas are present in the Project site that may absorb heat in case of hot temperatures.
- Project components could be susceptible to high temperatures. Solar panels can experience reduced efficiency and potential malfunctions in cases of extreme heat.
- Roads are the only gateway to the plant. Extreme heat can particularly damage roads, creating traffic disruptions.

Sensitivity to Extreme cold: overall Sensitivity has been assigned "MEDIUM". The plant would be impacted with moderate consequences due to both the nature of the hazard and the typology of the infrastructure.

- Ice formation on solar panels, cables, and other equipment can disrupt operations and increase the risk of physical damage. Icing on moving parts, such as tracking systems, may cause them to malfunction.
- Snow buildup on solar panels can block sunlight and significantly reduce energy production. The weight of accumulated snow can also strain the mounting structures, potentially causing damage.
- Roads are the only gateway to the plant. Icy and snowy roads can lead to traffic disruptions.

Sensitivity to Drought: overall Sensitivity has been assigned "LOW".

- According to the information provided by Smart, panel cleaning will be done with dry cleaning method which does not require water. Dry cleaning is the practice of using a soft brush or cloth to eliminate loose debris and dirt from solar panels' surfaces. This technique is commonly applied in areas where dust and dirt accumulation is minimal.
- Water need for dust suppression during dry periods is estimated to be 25 m^3/day and water will be supplied from Kemerhisar Municipality by water tankers.

Sensitivity to Severe storms: overall Sensitivity has been assigned "HIGH". The level is justified that all project components and other infrastructures would be highly impacted in case of strong wind, lightings and intense precipitations which typically characterize severe storms events.

- Severe storms may be accompanied with lightings that could affect the solar panels and the other components of the Project.

Sensitivity to Extreme precipitation: overall Sensitivity has been assigned "MEDIUM".

- Extreme precipitation could bring damage to the plant and the operations.
- Run-off waters may affect all Project components.
- Extreme precipitations may bring local flooding, potentially affecting the following more sensitive Project components.

Sensitivity to Wildfires: overall Sensitivity has been assigned "LOW".

- There are only a few potential fire hazards in the plant since the area is flat and has low vegetation density:
  - Solar power plants, with their extensive array of panels, are susceptible to lightning strikes. A direct lightning strike or induced surges can cause electrical and fire hazards.
  - Malfunctioning inverters can generate excess heat and pose a fire risk.
  - Electrical faults or malfunctions within the solar panel system, such as faulty wiring or overheating components, can lead to electrical fires.

Sensitivity to Water Stress: overall sensitivity has been assigned "MEDIUM." The solar power plant would be impacted with moderate consequences due to both the nature of the hazard and the typology of the infrastructure.

- The plant requires water for panel cleaning and cooling systems. Water scarcity may lead to reduced maintenance efficiency and increased operational costs.
- Dust accumulation on solar panels could intensify due to dry conditions, further decreasing energy output if water availability for cleaning is limited.

Sensitivity to Heat Stress: Overall sensitivity has been assigned "MEDIUM." The solar power plant would be impacted with moderate consequences due to both the nature of the hazard and the typology of the infrastructure.

- Solar panels could experience reduced efficiency under extreme heat conditions, as high temperatures can lower their energy output.
- Excessive heat may lead to overheating of electrical components, increasing the risk of malfunctions or system failures, potentially reducing the plant's overall reliability.
- Roads and infrastructure leading to the plant may face heat-induced damage, which could disrupt access and logistical operations.

4.2.2 Sensitivity for Project Personnel

Sensitivity to Extreme Cold: Sensitivity for Project Personnel has been assigned "HIGH" because low temperatures can pose health risks to personnel, such as hypothermia and frostbite, especially during prolonged outdoor work.

Sensitivity to Extreme Heat: Sensitivity for Project Personnel has been assigned "HIGH" because prolonged exposure can endanger worker health, reduce productivity, and increase the risk of heat-related illnesses.

Sensitivity to Water Stress: Sensitivity for Project Personnel has been assigned "HIGH" since because the project relies on a stable water supply for construction, sanitation, and dust suppression. In areas already facing limited water availability, increased demand from the project can strain local resources, affecting both operations and occupational health and safety.

Sensitivity to Heat Stress: Sensitivity for Project Personnel has been assigned "HIGH" since the plant's workers may be affected by heat stress, requiring additional cooling measures or work schedule adjustments to ensure health and safety during periods of intense heat.

4.2.3 Adaptive Capacity for Equipment and Infrastructure

Similar to Sensitivity, the Adaptive Capacity was qualitatively assessed through the information provided the Client. The final step was to assign a class of Adaptive Capacity (“High”, “Medium” or “Low”), entailing all information collected through the assessment process, also considering their relative importance, reliability and completeness. A conservative approach has been adopted assigning a lower Adaptive Capacity class whenever the assessment was uncertain due to inconsistent indicators.

The following are considerations related to considerations that apply to all hazards; their evaluation helped with an overall identification of the Adaptive Capacity versus climate change-related events in the Project region:

- In October 2021, Türkiye ratified the Paris Agreement and pledged to achieve net zero emissions by 2053. To strengthen its efforts, Türkiye is establishing new institutional arrangements, including the Ministry of Environment, Urbanization, and Climate Change (MoEUCC), and is updating its National Climate Change Action Plan, which identifies and defines a set of strategic options of mitigation and adaptation for different economic sectors.
- A Country Climate and Development Report for Türkiye was published in June 2022. The report identifies pathways to achieving climate-resilient growth. A robust analysis of the impact of climate science was undertaken, followed by an in-depth analysis of the macroeconomic and sectoral implications of climate impacts on Türkiye's future development prospects. The report was developed by the World Bank, the IFC and Multilateral Investment Guarantee Agency.
- Smart has an Environment and Climate Change Policy which was adopted and put into practice with the Board of Directors Decision dated 23/11/2022 and numbered 2022/46. The Policy is regularly reviewed and updated when deemed necessary. According to the policy Smart declares the following;
  - “While managing all our operations in compliance with relevant environmental legislation and national and international standards, we contribute to the low-carbon energy production of all our business stakeholders with our products and services.
  - We ensure that the technologies we use are environmentally sensitive, and in this context, we attach great importance to innovation and R&D activities.
  - We consider risks and opportunities related to the environment and climate change in our decision-making processes.
  - We protect natural resources, minimize waste generation with the goal of preventing and reducing pollution at its source, and ensure that resources are reused and recycled into the economy. With all these, we reflect the circular economy to our products and services.
  - We take care to develop the concept of social responsibility for the protection of the environment, climate change and raising environmental awareness, including all our stakeholders, subcontractors and suppliers, and ensure that our working environment is environmentally friendly.
  - We evaluate the impacts on biodiversity, environment and ecosystems during the project phase of all our planned investments, and we carry out activities to mitigate these impacts during construction/implementation, operation and post-operation.
  - Within the scope of preventing and combating climate change in the entire value chain, we attach importance to resource efficiency in all our processes, calculate our production-based greenhouse gas emissions in this direction, and develop targets and projects to reduce them.

  - We adopt the United Nations Sustainable Development Goals (SDGs) focused on combating climate change, and contribute to the fight against climate change in the national and international arena with our products and services focused on green technology and low-carbon energy production.
  - We lead the fight against climate change in Türkiye and around the world, and support projects in this field through collaborations and partnerships with national and international public institutions and organizations, private sector companies, academia and non-governmental organizations."

- The project will have an active Emergency Preparedness & Response Plan, which will be prepared by WSP. It will include also extreme weather events (flooding and lightning).

The following section presents the Adaptive Capacity specific for each hazard at the Project level; this can be achieved through design and engineering solutions or dedicated maintenance that can be introduced at Project level and do not depend on any external factor or elements.

Adaptive Capacity to Flooding: overall Adaptive Capacity has been assigned "LOW".

- There is no drainage system for rainwater and collection points. Procedures will be initiated if deemed necessary depending on the status of the project. No specific measures are in place according to available information to protect the plant.

Adaptive Capacity to Extreme Heat: overall Adaptive Capacity has been assigned "MEDIUM".

- When air conditioning systems are used, energy efficiency techniques will be considered as much as possible according to the following criteria:
  - Placing air intakes and air-conditioning units in cool, shaded locations;
- Ventilation and air conditioning system is being installed in the switchyard. There will be a self-cooling system in inverters.

Adaptive Capacity to Extreme Cold: overall Adaptive Capacity has been assigned "MEDIUM".

- PV modules that are selected for the plant can operate up to -40 degree Celsius.

Adaptive Capacity to Drought: there is few Adaptive Capacity measures in place. Overall Adaptive Capacity has been assigned "MEDIUM".

- Project will use dry cleaning for panel cleaning.

Adaptive Capacity to Severe Storms: overall Adaptive Capacity has been assigned "LOW". Little Adaptive Capacity seem to be in place to prevent or mitigate potential disruptions caused by severe storms.

- No specific measures are in place according to available information to protect the plant from infiltration due to intense precipitations, or disruption caused by strong wind and lightings which often characterize severe storms events.

Adaptive Capacity to Extreme Precipitations: overall Adaptive Capacity has been assigned "MEDIUM".

- Assessment of surface water runoff and flooding conditions after heavy rainfall events for efficiency of water conveyance systems will be implemented.
- While adaptive capacity measures stated in the adaptive capacity to flooding part above are determined, extreme precipitation cases are also taken into consideration.

Adaptive Capacity to Wildfires: overall Adaptive Capacity has been assigned "MEDIUM".

- All personnel will receive a "Training on Actions and Measures to be Taken During Emergencies" annually regarding the established emergencies. Through the competent authorities, it will be ensured that the Fire Fighting, Search, Rescue, Evacuation and First Aid teams receive the necessary training.
- Fire equipment, first aid equipment and alarm systems will be checked monthly to review their efficiencies.

Adaptive Capacity to Water Stress: Overall adaptive capacity has been assigned "MEDIUM."

- The project owner is committed to protecting natural resources and minimizing waste generation, which will help ensure efficient water use in the plant's operations.
- The use of environmentally sensitive technologies and an emphasis on innovation and R&D can potentially lead to the development of water-saving technologies, such as efficient panel cleaning systems that reduce water consumption.
- Resource efficiency, including water use, is a key consideration in the project owner's operations, and the incorporation of circular economy principles suggests that water recycling and reuse will be prioritized.
- The project's efforts to evaluate and mitigate impacts on ecosystems during the construction, operation, and post-operation phases show a proactive approach to managing water-related risks, which could include addressing water availability.
- The project also focuses on reducing pollution at its source, which can indirectly reduce the strain on water resources in the region.
- Furthermore, the project's commitment to the United Nations Sustainable Development Goals (SDGs) and partnerships with various stakeholders will strengthen the project's ability to adapt to water stress by aligning with global best practices in water management.

Adaptive Capacity to Heat Stress: Overall adaptive capacity has been assigned "MEDIUM."

- The project owner's commitment to using environmentally sensitive technologies and fostering innovation and research and development (R&D) activities can lead to the development of heat-resistant materials and cooling technologies to minimize heat stress impacts on infrastructure and operations.
- Energy efficiency techniques will be prioritized, including the placement of air intakes and air-conditioning units in cool, shaded locations to optimize cooling systems and reduce energy consumption.
- Ventilation and air conditioning systems will be installed in critical areas, such as the switchyard, to maintain optimal working conditions during extreme heat events. Inverters will also be equipped with self-cooling systems to prevent overheating.
- The project's focus on circular economy principles will help reduce waste heat and improve energy efficiency, further mitigating the impact of heat stress.
- The project's emphasis on protecting the environment and promoting climate change awareness will ensure that the risks associated with extreme heat are considered in decision-making processes, enabling adaptive responses in the future.
- Additionally, the project's alignment with the United Nations Sustainable Development Goals (SDGs) demonstrates a commitment to addressing climate change, which will include adapting to heat stress through long-term strategies and collaborations.

4.2.4 Adaptive Capacity for Project Personnel

Adaptive Capacity to Extreme Heat: overall Adaptive Capacity for Project Personnel has been assigned “MEDIUM”.

Project personnel have some ability to adapt through scheduled breaks, hydration protocols, and the use of shade or cooling stations. However, adaptation is limited by the physical nature of outdoor work, PPE requirements, and potential lack of permanent climate control infrastructure on-site.

Adaptive Capacity to Extreme Cold: overall Adaptive Capacity for Project Personnel has been assigned “MEDIUM”.

Cold weather gear, heated shelters, and flexible work shifts can help personnel cope with extreme cold. Still, the capacity is constrained during peak winter periods or in remote areas where heating and access to protective resources may be inconsistent or costly.

Adaptive Capacity to Water Stress: Overall adaptive capacity for Project Personnel has been assigned “MEDIUM.”

Personnel needs can be met through water-saving practices, efficient use of supply, and temporary storage facilities. However, dependence on local water sources and competing demand from nearby users can reduce the project’s ability to ensure uninterrupted access.

Adaptive Capacity to Heat Stress: Overall adaptive capacity for Project Personnel has been assigned “MEDIUM.”

Adaptation measures such as worker training, acclimatization programs, and modified work hours help reduce vulnerability. Yet, these measures may not fully prevent health impacts during extreme heat events or extended hot periods, especially when combined with high workloads.

4.2.5 Vulnerability

The magnitude of potential effects and consequences were assessed for each hazard, combining the Sensitivity and the Adaptive Capacity. A qualitative approach has been used, applying the matrix shown below.

VULNERABILITY			
	SENSITIVITY		
ADAPTIVE CAPACITY	Low	Medium	High
High	Lowest	Low	Medium
Medium	Low	Medium	High
Low	Low	High	Highest

Figure 4-19: Vulnerability Matrix

The Vulnerability of the Project resulted higher for Drought, Severe Storms and Extreme Precipitations. The level of Vulnerability for these hazards is “highest”, meaning that the Project could experience severe damages and consequences in case of any of these extreme events related to climate change.

The Project resulted less vulnerable to Extreme Heat and Wildfires. The level of Vulnerability for Extreme Heat is “medium”, meaning that the Project would be affected in case of such event but consequences would be less severe. Finally, the Project resulted having a “low” vulnerability to Wildfires.

Table 4-23 shows the details of Vulnerability assessment for all hazards.

Table 4-23: Vulnerability Assessment

Hazard	Sensitivity	Adaptive Capacity	Vulnerability
Flooding for Project Equipment and Infrastructure	Low	Low	**Low**
Extreme heat for Project Equipment and Infrastructure	Medium	Medium	**Medium**
Extreme heat for Project Personnel	High	Medium	**High**
Extreme cold for Project Equipment and Infrastructure	Medium	Medium	**Medium**
Extreme cold for Project Personnel	High	Medium	**High**
Drought for Project Equipment and Infrastructure	Low	Medium	**Low**
Severe storms for Project Equipment and Infrastructure	Medium	Low	**High**
Extreme precipitations for fProject Equipment and Infrastructure	Medium	Medium	**Medium**
Wildfires for Project Equipment and Infrastructure	Low	Medium	**Low**
Water stress for Project Equipment and Infrastructure	High	Medium	**High**
Water stress for Project Personnel	High	Medium	**High**
Heat stress for Project Equipment and Infrastructure	High	Medium	**High**
Heat stress for Project Personnel	High	Medium	**High**

4.3 Physical Risk Assessment

The Climate Change Risk has been assessed combining Vulnerability and Hazard levels, according to qualitative considerations based on the following matrix:

RISK					
	VULNERABILITY				
HAZARDS	Lowest	Low	Medium	High	Highest
Lowest	Lowest	Lowest	Low	Low	Medium
Low	Low	Low	Low	Medium	Medium
Medium	Low	Medium	Medium	High	High
High	Low	Medium	High	High	Highest
Highest	Medium	High	High	Highest	Highest

Figure 4-20: Risk Matrix

A summary of the outcomes is presented in Table 4-24.

Table 4-24: Risk Assessment

Hazard	Vulnerability	Hazard Class	Risk
Flooding for Project Equipment and Infrastructure	Low	Medium	**Medium**
Extreme heat for Project Equipment and Infrastructure	Medium	High	**High**
Extreme heat for Personnel	High	High	**High**
Extreme cold for Project Equipment and Infrastructure	Medium	Low	**Low**
Extreme cold for Personnel	High	Low	**Medium**
Drought for Project Equipment and Infrastructure	Low	High	**Medium**
Severe storms for Project Equipment and Infrastructure	High	High	**High**
Extreme precipitations for Project Equipment and Infrastructure	Medium	Medium	**Medium**
Wildfires for Project Equipment and Infrastructure	Low	High	**Medium**
Water stress for Project Equipment and Infrastructure	High	High	**High**
Water stress for Personnel	High	High	**High**
Heat stress for Project Equipment and Infrastructure	High	High	**High**
Heat stress for Personnel	High	High	**High**

4.4 Risk Mitigation Actions and Conclusions

The Climate Change Physical Risk Assessment helped identifying the most critical climate-related risks, at present or in the future, according to different emission scenarios and during the lifetime of the Project as a consequence of Climate Change.

Based on these results and the assessment of the Vulnerability, it was possible to identify, for each hazard, a few measures that could be put in place to prevent or to reduce the potential impacts.

The list of measures identified here has not to be considered binding nor exhaustive. However, it should be taken under consideration to try to reduce the Vulnerability of the plant towards climate-related hazards.

All Risks

- The Project Emergency Preparedness & Response Plan should include considerations, procedures and measures to deal with all hazards, such as extreme weather conditions, drought and wildfires. In addition to this, keep updating and revising the existing emergency response plans.
- Making sure all necessary equipment and training are provided along the entire Project lifespan.
- Maintain an efficient network connectivity within the Project site, making sure mobile communication and alternative communication systems would be available in case of an emergency due to climate-related extreme events.
- Collaborate with local Authorities to guarantee that roads connecting to the plant are maintained on a regular basis. This would increase the Adaptive Capacity in all hazards, particularly those related to potential flooding.

Risk of Extreme Heat and Extreme Cold for Equipment and Infrastructure

- Provide adequate and regular maintenance of cooling and heating systems verifying that the adequacy is guaranteed in the face of the expected increase and decrease in temperatures and heat waves and cold waves.
- Consider using materials for the administrative building and other infrastructures with a lower capacity to absorb heat and higher capacity to maintain their main properties in case of extremely high temperatures.
- Provide proper and regular maintenance to administrative building, infrastructures and equipment to avoid increasing their sensitivity hot and cold temperatures.

Risk of Extreme Heat and Extreme Cold for Project Personnel

- Rescheduling working hours during extremely hot and cold periods to ensure the safety and efficiency of staff working in outdoor areas.
- Providing proper clothing and PPEs in accordance with the weather conditions.

Risk of Severe Storms and Extreme Precipitations

- Flooding assessment on a regional scale has to be completed to assess the flooding conditions and the necessary changes will be incorporated into the design. A supplemental assessment of stormwater drainage risks to the environment has to be undertaken to verify the stormwater drainage designs' effectiveness in mitigating impacts on surrounding land use, surface and groundwater or sensitive ecological receptors therein.
- Implement measures to protect the plant and its main more sensitive infrastructures from infiltration due to intense precipitations, or disruption caused by strong wind and lightings which often characterize severe storms events.
- Installing lightning rods at the Project site.
- Keep manholes and drainage channels clean to avoid potential flooding in cases of heavy rain associated with intense precipitations.
- Use waterproof materials and coatings on all equipment.
- Verify that materials potentially subject to displacement in the presence of strong gusts of wind are adequate to cope with more intense and more frequent storms.
- Collaborating with the Municipality of Kemerhisar and Niğde Special Provincial Administration to better understand the contents of their plan to mitigate the effects of the rains. Trying to identify shared measures and strategies to reduce and prevent disruptions in case of extreme precipitations.
- Ensure all panels and equipment are securely fastened.

Risk of Wildfires

- Organize awareness programs and personnel availability to deal with potential fires, possibly in collaboration with the Fire Department in Niğde.
- Implement an early warning system for firefighting and make provision for a direct connection with any existing early warning systems at local or regional level to guarantee information on fire are monitored and shared.
- Verify the adequacy of the maintenance program of all prevention and fire emergency systems.

Risk of Water Stress for Equipment and Infrastructure

- Implement dry cleaning methods for solar panels to reduce water usage.
- Train staff in water conservation practices to promote efficient usage.
- Collaborate with local authorities for shared water management strategies.

Risk of Water Stress for Project Personnel

- Ensure adequate on-site water storage, use water-saving measures, and coordinate with local suppliers to secure a reliable supply to the project personnel.

Heat Stress for Equipment and Infrastructure

- Install shading structures to protect equipment and reduce heat exposure.
- Use materials that can withstand high temperatures.
- Implement cooling systems to manage heat stress on equipment

Water Stress for Project Personnel

- Adjust work hours to cooler times,
- Provide shaded rest areas and drinking water, and
- Train workers to recognize heat-related symptoms.

4.5 Implementations of Mitigation Actions and Residual Risks

The table given below outlines all identified climate-related hazards, associated risks, their initial risk ratings, proposed mitigation and adaptation measures, implementation status, and residual risk levels. As it can be seen from this table, design-related actions have already been integrated into the Project design, while operational and procedural measures are being implemented throughout the project lifecycle. Related plans for the management of these mitigation measures are addressed below.

The residual risk assessment indicates that all high and medium risks have been effectively mitigated to medium and low levels, respectively. Relevant measures have also been cross-referenced with the applicable management plans such as the Emergency Preparedness and Response Plan (EPRP) and Water Management Plan (WMP), where applicable.

Table 25: Residual Risks Table

Risk No	Hazard	Identified Risk	Gross Risk Level	Preventive / Adaptive Measure	Implementation Status	Residual Risk Level	To Be Included in Management Plan(s)?
R1	Flooding	Damage/disruption to equipment & infrastructure	Medium	Stormwater drainage, waterproof coatings, clean manholes, cooperation with local authorities	Integrated into design	Low	EPRP, WMP
R2	Extreme Heat (Equipment)	Overheating, malfunction	High	Cooling systems in inverters, reflective building materials in panels, regular maintenance	Integrated into design	Medium	EPRP
R3	Extreme Heat (Personnel)	Heat stress, health risks	High	Shift adjustments, PPE, shaded rest areas, awareness training	Ongoing implementation throughout project lifecycle	Medium	EPRP
R4	Extreme Cold (Equipment)	Equipment inefficiency	Low	Periodic inspections	Integrated into design	Low	EPRP
R5	Extreme Cold (Personnel)	Cold-related health issues	Medium	Shift scheduling, appropriate winter PPE	Ongoing implementation throughout project lifecycle	Low	EPRP
R6	Drought	Reduced water availability	Medium	Dry cleaning of panels	Integrated into design	Low	N/A
R7	Severe Storms	Physical damage, power failure	High	Lightning rods in switchyard,	Integrated into design	Medium	N/A
R8	Extreme Precipitation	Flooding, erosion, ecological impact	Medium	Drainage improvements, waterproof materials, cooperation with municipality	Integrated into design	Low	N/A
R9	Wildfires	Fire damage, emergency response	Medium	Fire awareness programs, collaboration with fire department	When necessary, throughout project lifecycle	Low	EPRP

Risk No	Hazard	Identified Risk	Gross Risk Level	Preventive / Adaptive Measure	Implementation Status	Residual Risk Level	To Be Included in Management Plan(s)?
R10	Water Stress (Equipment)	Equipment underperformance, overheating	High	Dry cleaning of panels	Integrated into design	Medium	WMP
R11	Water Stress (Personnel)	Lack of potable water	High	Adequate storage, water conservation training, reliable supply	Ongoing implementation throughout project lifecycle	Medium	EPRP, WMP
R12	Heat Stress (Equipment)	Decreased equipment lifespan	High	Shade structures, cooling systems in inverters, heat-resistant materials in panels and cables	Integrated into design	Medium	N/A
R13	Heat Stress (Personnel)	Health risks due to heat exposure	High	Shift adjustments, hydration, shaded rest, training	Ongoing implementation throughout project lifecycle	Medium	EPRP

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