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"WE JOIN FORCES FOR THE GREEN FUTURE PROJECT"

"Yeşil Bir Gelecek İçin Güçlerimizi Birleştiriyoruz Projesi"

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ÇİNE MUNICIPALITY SECAP SUSTANAIBLE ENERGY and CLIMATE ACTION PLAN 2024-2030

CONTRIBUTORS

Çine Municipality Team

Sırrı Cemal DİNÇER / Project Coordinator / Landscape Architect

Olcay DİNÇER / Deputy Project Coordinator / Parks and Gardens Manager

Osman ÖZTÜRK / Project Specialist / Zoning Plan Manager

Hüseyin AYDIN / Project Specialist / Architect

Consultant Team

Esra DEMİR / Demir Enerji / Management Engineer (MSc)

Caner DEMİR / Demir Enerji / Mechanical Engineer (MSc)

Melda KARADEMİR / Demir Enerji / Environmental Engineer (MSc)

Dilan CENGİZ / Demir Enerji / Urban Planner

İrem ORMAN / Demir Enerji / Environmental Engineer

Prepared by

DE SÜRDÜRÜLEBİLİR ENERJİ VE İNŞAAT SANAYİ TİC. LTD. ŞTİ.
Koşuyolu mahallesi, Halili sokak, No:7, 34718, Kadıköy / İSTANBUL
Telephone: +90 (216) 428 76 69
E-mail: bilgi@demirenerji.com
Web address: www.demirenerji.com

This report has been prepared with the contributions of Demir Enerji.

PREFACE

Climate change, which has increasingly made its presence felt in recent years and affects the entire world globally, has become one of our greatest challenges. Rising temperatures and the extension of seasonal periods have led to an increase in extreme weather events such as droughts, floods, tornadoes, and forest fires, resulting in major disasters in cities. Not only have these events damaged the urban infrastructure and superstructure, but they have also negatively impacted agricultural and livestock areas. Their consequences are also felt in socioeconomic terms, public health, ecological balance, and biodiversity.

In the future, the onset of water and food crises, as well as hunger, wars, and climate migrations, is an undeniable reality. Being located in one of the geographies most affected by climate change, our country will inevitably face significant challenges in the coming period related to disasters caused by climate change and the efforts to combat them.

Inspired by the motto “Global Issues are Solved Locally,” we have embarked on a journey to anticipate the adverse effects of climate change, to take appropriate measures to prevent or minimize the damage it may cause, and to seize opportunities that may arise. Our aim is to make our district a “Climate-Resilient City” and create a “Greener, Cleaner, More Livable, Low-Carbon, and Sustainable Çine.”

We are committed to transforming Çine, with its 72 neighborhoods and a population of approximately 48,585, where agriculture, livestock, and mining are prominent, into a climate-friendly and resilient city.

By joining the Global Covenant of Mayors for Climate & Energy (GCoM), which guides local governments and their stakeholders in the fight against global warming, we declare that we are also part of the global struggle against climate change.

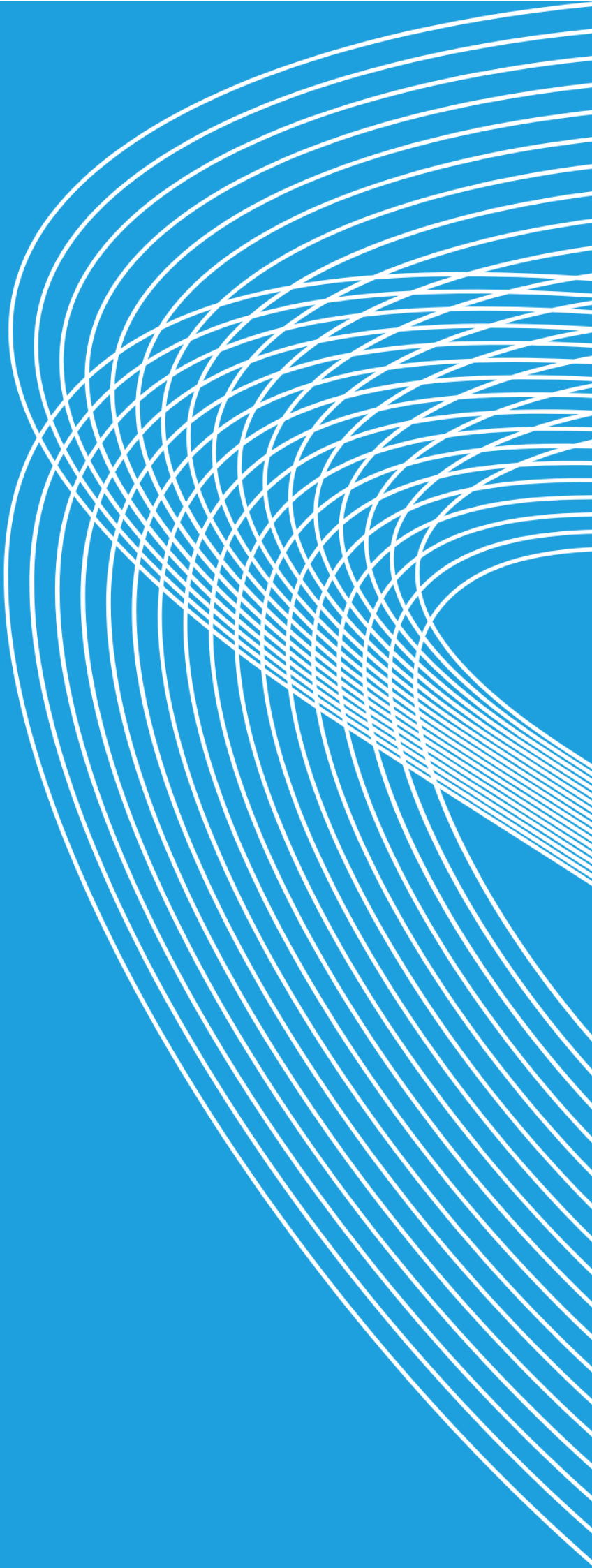
As part of the project titled “Joining Forces for a Green Future,” implemented within the framework of the EU-funded Turkey-EU Town Twinning Program II, we have prepared the Çine SECAP (Sustainable Energy and Climate Action Plan) report. We express our deepest gratitude to the EU for providing the funding for this report, to our consulting firm Demir Enerji for their long and detailed efforts in this project, to the Project Coordinator and Team of our Municipality, to all the internal and external stakeholders, and to the public institutions and representatives who contributed by participating in our workshops.

With the Sustainable Energy and Climate Action Plan (SECAP), we will continue to work resolutely and confidently to make Çine a climate-friendly and resilient city. We are fully convinced that our citizens will support us in implementing our plans and will act sensitively on this issue.

With love and respect,

MEHMET KIVRAK, MAYOR OF ÇİNE

2024 - 2030



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Abbreviations

Abbreviation	Description
AR5	Fifth Assessment Report
BAU	Business-As-Usual Scenario
BEI	Baseline Emissions Inventory
CO_2	Carbon dioxide
COP	Conference of the Parties
CoM	Covenant Of Mayors
C40	C40 Cities
ÇŞİDB	Ministry of Environment, Urbanisation and Climate Change
EPDK	Energy Market Regulatory Authority
EVEP	Energy Efficiency Action Plan
GWP	Global Warming Potential
GHG Protocol	Greenhouse Gas Protocol
ICLEI	Local Governments for Sustainability
IEAP	International Local Government Greenhouse Gas Emissions Analysis Protocol
IPCC	Intergovernmental Panel on Climate Change
İDEP	Climate Change Action Plan
MCA	Multi-Criteria Assessment
MGM	General Directorate of Meteorology
NASA	National Aeronautics and Space Administration
UNFCCC	United Nations Framework Convention on Climate Change
GHG	Greenhouse Gas
SPI	Standardized Precipitation Index
SECAP	The Sustainable Energy and Climate Action Plan
WMO	World Meteorological Organization

Executive Summary

Since the Industrial Revolution, climate change has been increasingly linked to the use of fossil fuels. According to the Intergovernmental Panel on Climate Change's (IPCC) 2021 report on the Physical Science Basis of Climate Change, global warming has accelerated at an unprecedented rate over the past 70 years. Each of the last three decades has witnessed higher temperatures than any previous decade. Human activities related to fossil fuel consumption have led to a more rapid increase in carbon dioxide emissions compared to previous periods. If this trend continues, it could result in severe climate changes, environmental damage, mass deaths, and major catastrophes for humanity.

Sustainable Energy and Climate Action Plans (SECAPs) serve as a roadmap for reducing greenhouse gas emissions in cities, which are responsible for a significant portion of carbon emissions, and for preparing cities for climate change. This report has been prepared within this scope and includes the preparation of a greenhouse gas emission inventory, an assessment of the current situation, the development of actions to reduce emissions, a risk and vulnerability assessment, the identification of climate adaptation actions for sectors affected by climate change, and strategies for addressing energy poverty.

Çine Greenhouse Gas Inventory

The greenhouse gas inventory has been prepared in accordance with the general principles and philosophy of the International Local Government Greenhouse Gas Emissions Analysis Protocol (IEAP), which was developed by the International Council for Local Environmental Initiatives (ICLEI) and is applicable to every local government following IPCC guidelines. Accordingly, for the year 2023, the energy consumption of the Çine district, including industry, agriculture, and livestock, has been calculated as 876,482 MWh, with greenhouse gas emissions totaling 528,540 tCO2e. When formulating mitigation strategies, the greenhouse gas emissions excluding industry, which the municipality is responsible for, should be taken into consideration. The energy consumption of the Çine district excluding industry has been calculated as 556,428 MWh, with greenhouse gas emissions amounting to 181,188 tCO2e. According to the calculations, 49.61% of the emissions are attributed to buildings, 46.86% to transportation, and 3.53% to waste and wastewater sources. Per capita emissions stand at 3.73 tCO2e.

Mitigation

In line with international agreements and Europe's target to reduce greenhouse gas emissions by 55% by 2030, a 55% reduction target has also been set for Çine, indicating that per capita greenhouse gas emissions should be reduced to 1.68 tCO2e. The reduction targets for Çine have been determined accordingly. The reduction actions aim to achieve the levels of energy consumption and greenhouse gas emission reductions by sector as shown in the table below.

Sector	Number of Actions	Energy Reduction (MWh)	Emission Reduction (Ton CO_2e)
Biuildings	11	143.742	47.277
Renewable Energy		28.560	10.838
Transport	6	168.813	36.416
Waste and Wastewater	2	-	3.202
Grid Decarbonization	-	-	13.702
Toplam	**19**	**341.115**	**111.436**

Adaptation to Climate Change

The Risk and Vulnerability Assessment provides an insight into how and to what extent the settlement and its inhabitants will be affected by the impacts of climate change. Identifying risks is crucial for conducting efforts aimed at mitigating and preventing adverse effects. Within the scope of the Risk and Vulnerability Assessment, quantitative data on climatic disasters and disaster risk obtained from the Çine Municipality were analyzed, along with base maps containing topographic and hydrological data related to the area. The findings of projections and studies conducted in the region were evaluated, and assessments were made based on the opinions of experts in relevant fields.

Given the geographical and physical characteristics of the Çine district, the primary climatic hazards for the city have been identified as:

- **Temperature Increase/Heatwaves**
- **Drought**
- **Forest Fires**

Accordingly, considering the dominant economic sectors in Çine and their exposure and vulnerability to these primary climatic hazards, the sectors most at risk have been identified as Agriculture, Water Resources, Public Health, and Biodiversity. To prepare Çine for climate-related hazards, 32 actions have been identified under 7 goals, with a primary ***focus on water management, agriculture, and disaster management.***

Energy Poverty

The measurement and threshold values of energy poverty vary depending on local characteristics. Energy poverty can be assessed through different definitions and observations by examining local features such as geographical location, climate, housing structures, existing heating/cooling systems, energy prices, and other factors affecting these elements. In this context, socioeconomic factors considered at the household and individual levels, such as age, health, and economic conditions, are important variables in determining energy poverty. Accordingly, to combat energy poverty in Çine, actions have been identified under three main headings: ***buildings, households, and social assistance policies.***

1. INTRODUCTION

1.1. Purpose

The purpose of this report is to minimize the impacts of global climate change on cities by inventorying greenhouse gas emissions from buildings, transportation, energy, waste, wastewater, agriculture, and livestock, and reducing these emissions by at least 55%. Additionally, it aims to support adaptation by minimizing the impacts of climate change-induced disasters on individuals, the built environment, and the natural environment in urban areas. To achieve these goals, the Çine Municipality Sustainable Energy and Climate Action Plan has been prepared.

1.2. Scope

The Sustainable Energy and Climate Action Plan (SECAP) is a tool that provides local governments with a comprehensive action plan for reducing greenhouse gas emissions and transitioning to a low-carbon economy. SECAP outlines and designs the steps municipalities should take to reduce emissions in areas such as energy efficiency, renewable energy, and climate-friendly transportation. It also provides guidance on how to develop and implement sustainable energy and climate action plans, as well as how to monitor and report on progress.

SECAP should clearly define the emission reduction target by specifying the Base Year for the Greenhouse Gas Emission Inventory (BEI) and the type of reduction target (absolute reduction or per capita reduction), aiming for 2030 (and potentially beyond). Additionally, SECAP must include a set of adaptation goals aligned with identified vulnerabilities, risks, and hazards. It may also incorporate objectives aimed at addressing energy poverty to increase and promote the use of clean energy in cities. SECAP should outline the established or assigned organizational structures, the capacity of the local government, stakeholder participation, the budget allocated for implementation, and the monitoring process.

To mitigate the impacts of climate change, actions and measures such as increasing energy efficiency and transitioning to renewable energy sources are prioritized. Energy efficiency can be enhanced through methods like improved building design, energy-efficient appliances, and effective insulation, while renewable energy sources such as solar, wind, and geothermal provide clean and sustainable energy.

Cities may be exposed to various extreme weather conditions such as floods, droughts, heatwaves, and storms. Understanding the needs of local governments is essential to anticipate and prepare for these events. Climate change can have a significant impact on local authorities or regions through various effects, such as changes in temperature, precipitation, and sea levels. Identifying assets and individuals at risk from these effects and developing climate change adaptation strategies to mitigate them is crucial.

For adaptation actions to be effective, they must align with the results of the city's Risk and Vulnerability Assessment (RVA). RVA should provide a broad understanding of the risks and vulnerabilities within the city and adapt the adaptation actions and measures accordingly. Additionally, adaptation actions and measures should be tailored to the city's unique context to ensure they are most effective and appropriate.

The preparation of Sustainable Energy and Climate Action Plans is a complex and challenging process. This process requires significant resources such as personnel, data, and various technological tools, and must encompass energy efficiency and renewable energy applications. Furthermore, the plans should be tailored to the characteristics and needs of the city, include clear and measurable targets, and develop appropriate strategies to secure funding for implementation. In this regard, the Sustainable Energy and Climate Action Plan prepared for Çine Municipality consists of 6 main stages. The scope of these stages is as follows;

Preparation of Greenhouse Gas Inventory: Collection of consumption data for greenhouse gas sources for the base year determined for Çine, identification of the city's major sources of greenhouse gas emissions, and presentation of detailed inventory results.

Development of Greenhouse Gas Reduction Actions: Creation of actions related to buildings and energy, transportation, waste, wastewater, agriculture, and livestock in line with the greenhouse gas reduction targets set in the Sustainable Energy and Climate Action Plan prepared for Çine district.

Climate Risk and Vulnerability Assessment: Evaluation of climate risks and their impacts, such as heavy rainfall, flooding, hail, storms, and drought, for the Çine district.

Development of Climate Change Adaptation Actions: Identification and prioritization of climate adaptation actions based on the risk and vulnerability assessment.

Creation of Actions to Reduce Energy Poverty: Development of relevant actions based on the district's energy poverty profile.

Creation of a Monitoring Plan: Development of indicators for the actions related to mitigation, adaptation, and energy poverty under the Sustainable Energy and Climate Action Plan.

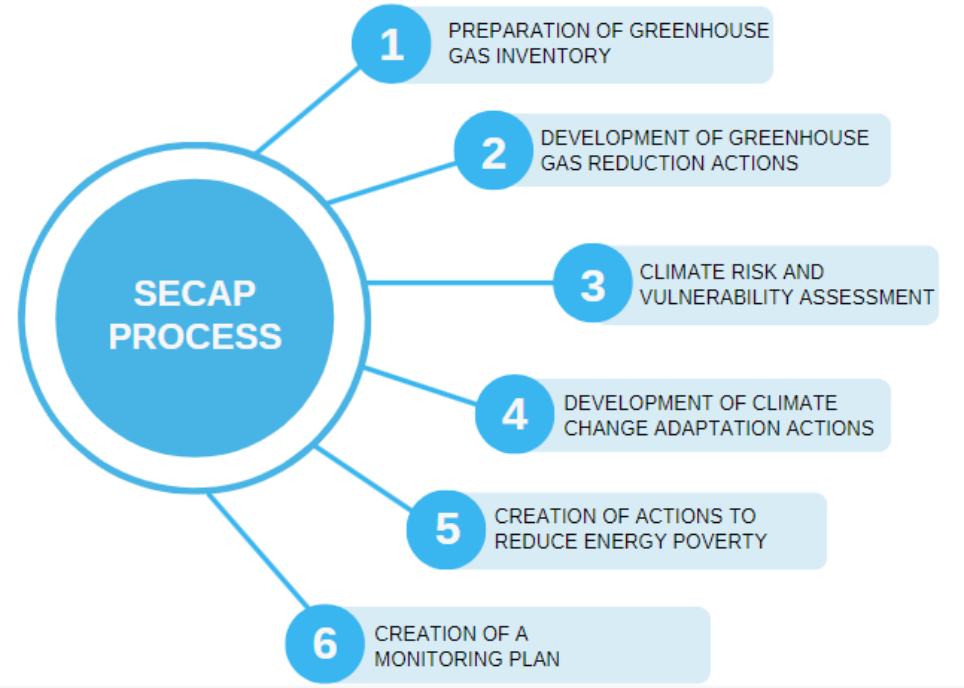


Figure 1. Sustainable Energy and Climate Action Plan process

2. CLIMATE CHANGE AND ITS IMPACTS

2.1. Climate Change

Climate change is defined by the IPCC's 6th Assessment Report as long-term changes observed in the climate system, largely driven by human activities. These activities include the burning of fossil fuels, deforestation, and industrial processes. The increase in greenhouse gas concentrations in the atmosphere manifests through rising land and ocean surface temperatures, rising sea levels, and more frequent and intense extreme weather events.

The report indicates that greenhouse gas emissions, particularly gases such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), are the primary causes of climate change. These gases absorb energy from the Sun and reflect it back to the Earth's surface, creating a greenhouse effect that raises the Earth's surface temperature. Human activities such as energy production, transportation, industry, and agriculture are the main sources of these emissions. The report warns that if emissions continue at their current rate, global temperature increases will persist, leading to irreversible changes.

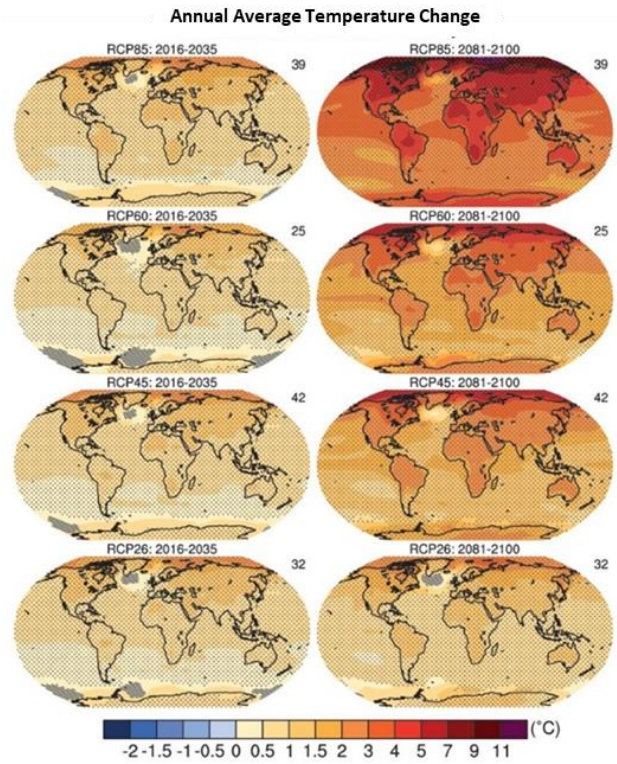


Figure 2. Annual mean temperature anomalies projections

Furthermore, the effects of climate change are felt globally and pose serious threats to ecosystems, water resources, food security, health, and the economy. Rising temperatures, glacier melt, sea level rise, and ocean acidification are resulting in increased occurrences and intensity of extreme weather events such as droughts, floods, and hurricanes. The IPCC emphasizes the need for urgent, comprehensive, and decisive measures, global cooperation, and effective policies to address climate change. The increasing urban population and consumption patterns driven by modern lifestyles are exacerbating the impacts of climate change.[1]

The IPCC's special report on 'Global Warming of 1.5°C' details the potential impacts of temperature increases of 1.5°C and 2°C, and explains why the 1.5°C target is considered safer with scientific evidence. The report indicates that to achieve the 1.5°C target, greenhouse gas emissions must be reduced by approximately 55% by 2030 and reach net zero by 2050. Consequently, the 1.5°C target is central to climate policies and requires countries to make more ambitious commitments. [2]

[1] *IPCC, Synthesıs Report of the Ipcc Sıxth Assessment Report (AR6), 2022*
[2] *IPCC, Global Warmıng of 1.5 °C an IPCC Special Report On The İmpacts Of Global Warming, 2018*

2.2. International and National Developments

International Developments

Paris Agreement

The Paris Agreement was accepted on December 12, 2015, at COP 21 in Paris and entered into force in November 2016. The primary goal of the Agreement is to limit global temperature rise to 2°C, and preferably to below 1.5°C. The Agreement includes provisions for countries to take action to reduce greenhouse gas emissions and to adapt to climate change.

On September 21, 2021, Turkey announced its accession to the Paris Agreement and its commitment to achieving net zero emissions by 2053 during the United Nations General Assembly. The Law on the Approval of the Paris Agreement was unanimously passed by the Turkish Grand National Assembly on October 6, 2021. The Presidential Decree No. 85, published in the Official Gazette No. 31643 on October 29, 2021, renamed Turkey's Ministry of Environment and Urbanization to the Ministry of Environment, Urbanization, and Climate Change.[3]

The Paris Agreement, which frames the climate change regime post-2020, is distinguished from the UNFCCC by its system based on contributions from all countries. In the context of combating climate change, the Agreement has established a framework for implementation procedures concerning national contributions, mitigation, adaptation, loss and damage, finance, technology development and transfer, capacity building, transparency, and status assessment.

The Agreement primarily aims for developed countries to provide financial support, technology transfer, and capacity-building opportunities to developing countries in need, especially Least Developed Countries and Small Island Developing States, in order to enhance their adaptation and resilience capabilities and to increase their greenhouse gas emission reduction capacities. In this context, Nationally Determined Contributions (NDCs), which include countries' climate change mitigation targets, form a key pillar of the Agreement. Turkey has announced that its 'Intended Nationally Determined Contribution' for 2030 will involve a reduction of up to 41%.

European Green Deal

The European Union, through the publication of the 'Fit for 55' package and the 'REPowerEU' Plan, has set more ambitious energy efficiency targets and recognized the need to revise the EU Energy Efficiency Directive established in 2012. The revised Energy Efficiency Directive, published in September 2023, aims for the EU to achieve a 11.7% reduction in energy consumption by 2030 compared to projections from the 2020 reference scenario. This Directive establishes the 'Energy Efficiency First' principle as a

[3] *https://csb.gov.tr/tarihcemiz-i-7012 Erişim tarihi: Kasım 2023*

fundamental policy of EU energy policy, emphasizing that energy efficiency must be considered in all policy regulation, planning, and significant investment decisions for both energy and non-energy sectors. Due to the public sector accounting for 5-10% of the EU's final energy consumption, a target has been set for public institutions to reduce their energy consumption by 1.9% annually.

In Turkiye, the Green Deal Action Plan, published on July 16, 2021, in the Official Gazette No. 31543, aims to support the transition to a resource-efficient economy in line with the European Green Deal and sustainable development goals. The plan includes 32 goals and 81 actions under 9 main headings, and its implementation is expected to have a significant impact on the Turkish economy. Preparations are underway by various working groups under this plan, and drafts of necessary laws and secondary regulations are being developed.

National Developments

Turkey became a party to the United Nations Framework Convention on Climate Change (UNFCCC) on May 24, 2004. It ratified the Kyoto Protocol on August 26, 2009, and joined the Paris Agreement on October 7, 2021. Recently, Turkey updated its first Nationally Determined Contribution (NDC), committing to a 41% reduction in greenhouse gas emissions by 2030. Additionally, Turkey has announced a target of net-zero emissions by 2053. Strategies related to climate change, aligned with international negotiations, have also been updated with more ambitious targets in response to recent developments, particularly following the Paris Agreement.

At the beginning of 2023, Turkey approved the 'Energy Efficiency 2030 Strategy and the II. National Energy Efficiency Action Plan,' aiming to reduce energy consumption per unit of GDP (energy intensity) by 15% compared to 2023 levels and achieve a total of 37.1 MTEP primary energy savings between 2024 and 2030. This target is expected to result in a reduction of 100 million tons of CO2 equivalent greenhouse gases.

A large part of Turkey is located in the subtropical Mediterranean climate zone, where summers are generally dry. Turkey is considered a country with moderate to high levels of risk regarding climate change and future climate risks. In this context, there is a need for efforts on climate monitoring, climate change sensitivity and risk assessments, and adaptation measures to mitigate the adverse effects of climate change. National action plans have been developed to support these decisions, forming the main basis for the Sustainable Energy and Climate Action Plan (SECAP).

3. ÇİNE OVERVIEW

General Information

Çine is located 37 km from Aydın, along the Aydın-Muğla highway. The district was established as a township in 1877 and gained district status in 1880. Covering a total area of 943 km², Çine is composed of 70% mountainous terrain and 30% plain areas. The general vegetation of the district includes pine forests, olive groves, and maquis shrubland.[4]

Geographic Location

Çine district is located in the southern part of the Büyük Menderes Basin, on the southwestern slopes of Madran Mountain, within the Çine River valley. The Çine River, which is now within the Çine Dam, is a significant water source that gives its name to the region.

Population and Demographic Structure

According to data released by the Turkish Statistical Institute as a result of the 2023 Address-Based Population Registration System studies, the population of Çine district is 48,584. Çine is the 7th most populous district of Aydın province and has experienced a declining population over the last five years. Children aged 0-14 make up 15% of the population, while 20% are elderly individuals aged 65 and above[5] The population of Çine district has been in a downward trend in recent years. (Figure 3).

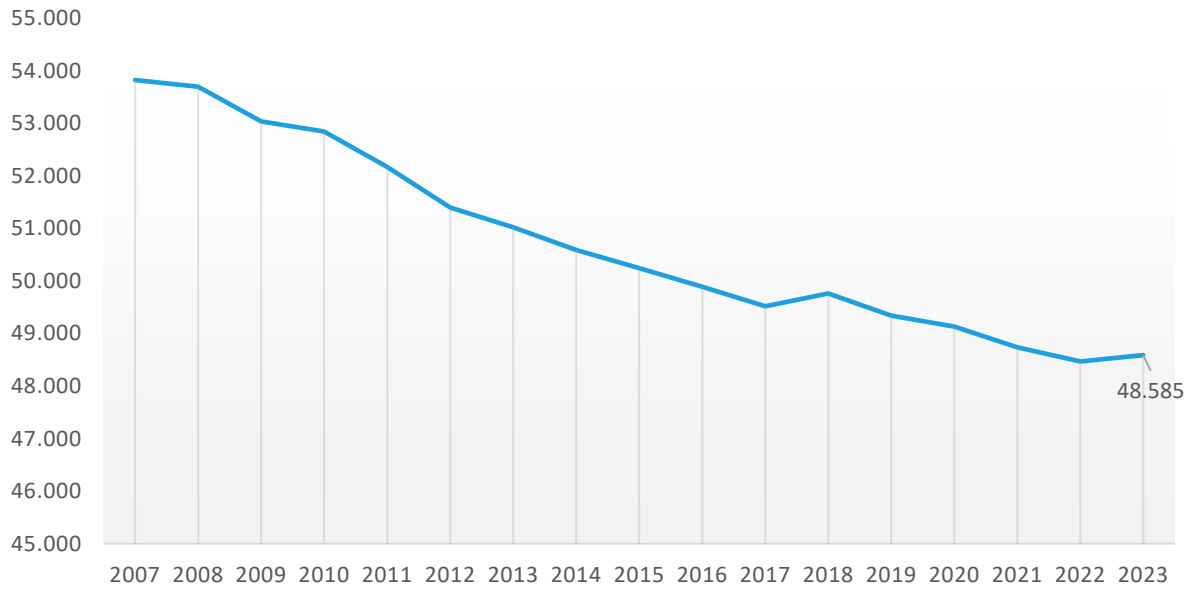


Figure 3. Population change graph between 2007-2023 in Çine

[4] www.cine.gov.tr *Access date: July 2024*
[5] *TÜİK, 2023*

Education

10% of Çine's population holds a bachelor's degree or higher, while 13% of the population has an education level below primary school.

Economy

The economy of the Çine district is primarily based on agriculture and livestock farming. Agricultural activities are particularly concentrated in the Çine and Akçaova plains. In addition to traditional crops like corn, cotton, olives, and peanuts, fruit and vegetable production, as well as greenhouse farming, have become increasingly significant in recent years. The district's industrial sector includes cotton ginning factories, olive oil factories, soap workshops, and mining operations. Notably, the mining industry stands out in the global market with the production of quartz and feldspar. Furthermore, metal processing and manufacturing facilities play an important role in the district's industrial structure. Livestock farming, especially dairy cattle and livestock breeding, is the main source of livelihood for the local population. The natural spring water produced at the Topçam bottling facilities significantly contributes to the district's economy. Additionally, one of the six Organized Industrial Zones (OSB) in Aydın province is located in Çine. Çine is the largest region in the world for feldspar reserves, used in the production of glass, ceramics, porcelain, and enamel. As of 1995, 95% of the world's feldspar production comes from the Çine and Milas areas.

Socioeconomic

According to the 2022 "District Socioeconomic Development Ranking Research (SEGE 2022)" conducted by the Turkish Ministry of Industry and Technology, Çine district ranks 6th within Aydın province and 365th out of 973 districts in Turkey. Its socioeconomic tier has been determined as level 3. The fact that Çine's economy is largely based on agriculture, which involves the production of relatively low-value-added products, is a significant factor contributing to this ranking.

Year	TR Ranking	Aydin Province Ranking	Score	Grade
2022	365	6	-0,070	3

History and Cultural Structure

Çine is home to significant ancient Carian cities such as Alabanda and Gerga. Additionally, the Ahmet Gazi Mosque and Ahi İbrahim Tomb from the Menteşeoğulları period are among the notable historical sites worth visiting in the district.[6] The Tepecik Höyük, located 3 km southwest of Çine's Karakollar neighborhood, is an important archaeological site with cultural layers indicating settlements from the Chalcolithic and Early Bronze Ages.[7]

[6] www.cine.gov.tr *Erişim tarihi: Temmuz 2024*
[7] *Kültür ve Turizm Bakanlığı, Tepecik Höyüğü – Çine, https://aydin.ktb.gov.tr/TR-266656/tepecik-hoyugu---cine.html*

Figure 4. Çine district tag

Total Area

943 km²

Population

48.584 person
(2023)

Population between the ages of 0-14

15%

Education

Education level below primary school: 13%

Number of Neighborhood

72

Number of Residences

31.009
(2023)

65+ Age Population

%20

Household Size

2,64 person

Climate

Aydın province is influenced by the Mediterranean climate, characterized by hot and dry summers and mild, rainy winters. In terms of the climate characteristics of Çine, the district has an average annual temperature of 17.8°C. The hottest months are July and August, while the coldest months are January and February. Average high temperatures during the summer can reach significant levels, with 33.4°C recorded in July and 35.9°C in August. During the winter, the lowest temperatures are observed in January and February. Çine enjoys an average of 6.5 hours of sunshine per day annually, with this duration increasing to 9.9 hours during the summer months. The district experiences an average of 80.1 rainy days per year, with January (12.89 days) and December (12.78 days) being the wettest months. In terms of precipitation, the total annual rainfall is 660.7 mm, with December (122.6 mm) and January (119.1 mm) receiving the most rainfall.

Table 1. Seasonal Norms for Aydın

Extreme Maximum, Minimum and Average Temperatures Measured in Long Period (°C)												
AYDIN	January	February	March	April	May	June	July	August	September	October	November	December
Maximum Temp.	23.2	27.4	32.4	35.4	42.6	44.4	44.8	45.1	43.3	39.5	31.1	25.9
Minimum Temp.	-11.0	-5.4	-5.0	-0.8	4.6	8.4	13.4	11.8	7.6	1.6	-4.7	-5.3
Average Temp.(1981-2010)	8,2	9,5	12,3	16,1	21,2	26,2	28,7	28,3	24,0	19,1	13,5	9,5
Average Max. Temp. (1981-2010)	13,5	15,2	18,7	23,2	28,9	34,2	37,0	36,6	32,6	27,0	20,3	14,7
Average Min. Temp. (1981-2010)	4,4	5,3	7,2	10,5	14,9	19,1	21,5	21,4	17,6	13,6	9,0	5,9

Measured in Long Period								
Max. Precipitation	04.01.2009	**93.8** kg/m2	**Max. Wind**	19.04.1969	**106.2** km/hour	**Max. Snow Height**	03.01.1942	**8** cm

Landuse

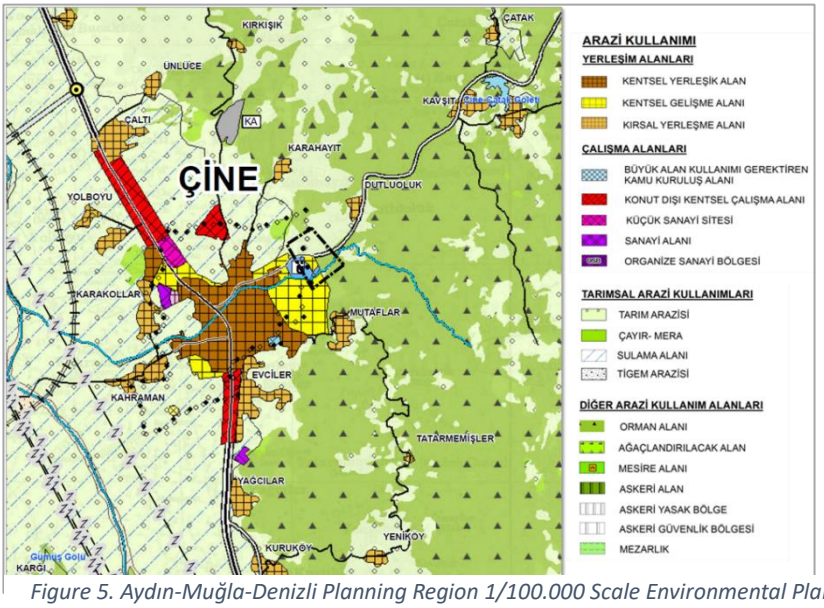


Figure 5. Aydın-Muğla-Denizli Planning Region 1/100.000 Scale Environmental Plan

When examining land use in Çine, it can be seen that there are extensive agricultural areas to the west of the city center and forested areas to the east. While urban residential areas are located in the city center, new urban development areas are to the east of the city center. Non-residential urban working areas are positioned in the north-south direction of the city. [8]

[8] https://mpgm.csb.gov.tr/aydin---mugla---denizli-planlama-bolgesi-i-82184

4. CITIZEN AWARENESS SURVEY ÇİNE

This section presents the results of a survey conducted to measure perceptions related to climate change. The primary goal of the survey is to evaluate the levels of knowledge, concerns, perceptions of personal and societal impacts, and proposed solutions regarding climate change across different demographic groups.

The survey is structured to comprehensively examine awareness, attitudes, and behaviors related to climate change. The questions aim to assess participants' knowledge levels about climate change, their concerns about the issue, individual measures they have taken to combat climate change, and the actions they expect from governments and other institutions.

The collected data will be used to enhance public awareness, develop education and communication strategies, and shape climate policies. In this context, the findings of the report aim to contribute to strategic planning processes designed to increase awareness about climate change.

A total of 146 individuals participated in the survey. Approximately 29% of the participants are women, while the remainder are men. Regarding age distribution, a significant portion of the participants (46%) falls within the 35-49 age range, and 31% are in the 50-64 age group. Additionally, 82% of the respondents have a high school education or higher.

4.1. Survey Results

96% of the survey participants indicated that they feel the effects of climate change in Çine. Additionally, 93% of respondents believe that climate change plays a role in the increased frequency of extreme weather events in Çine, such as floods, storms, forest fires, extreme heat, and droughts in recent years. Only 18% of participants reported receiving information from any public institution on this issue, while 34% are aware of ongoing efforts related to these studies. When asked about the most significant climate hazards affecting Çine, extreme heat stands out as the top concern by a significant margin. Among participants who had the option to select multiple hazards, extreme heat was followed by drought and forest fires as the most critical threats to Çine. (

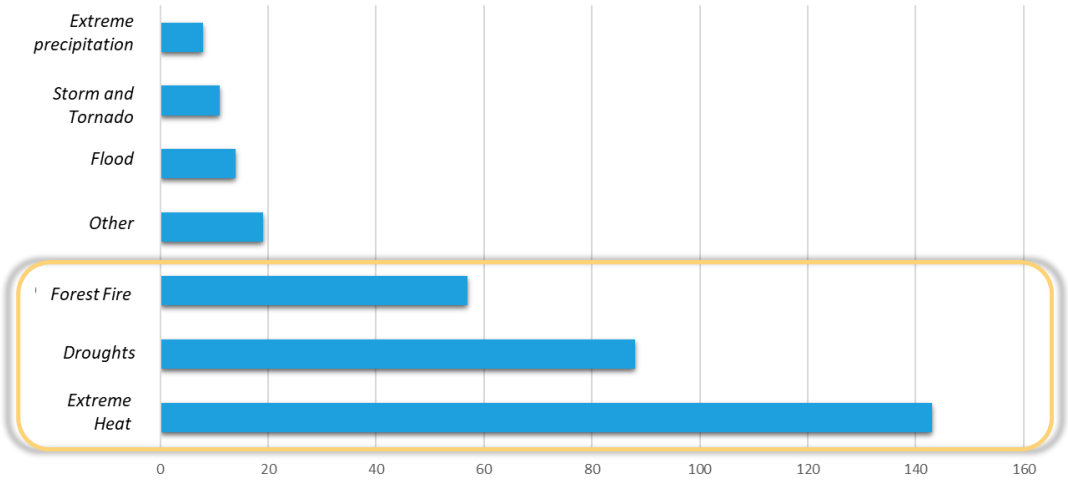


Figure 6).

Figure 6. Opinions on which climate hazards Çine is most affected by

Another important question in the survey focused on identifying which groups are most affected by climate change. Participants could select multiple options. According to the results, farmers (22%), individuals with chronic illnesses (20%), and those aged 65 and over (19%) emerged as the highest risk groups. Following these groups are young children (13%) and low-income households (11%). Additionally, all participants expect to see an increase in health problems among particularly vulnerable populations due to climate change.

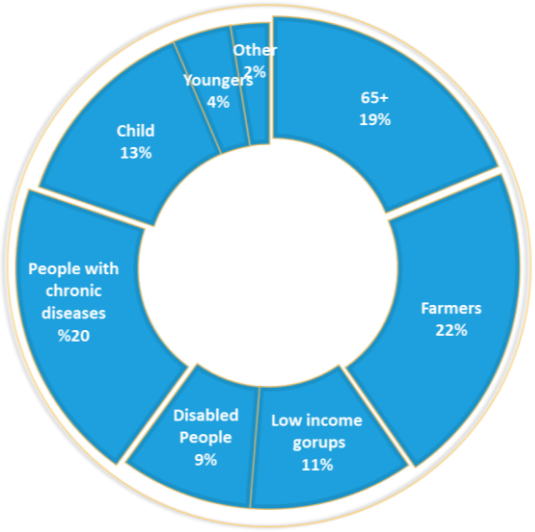
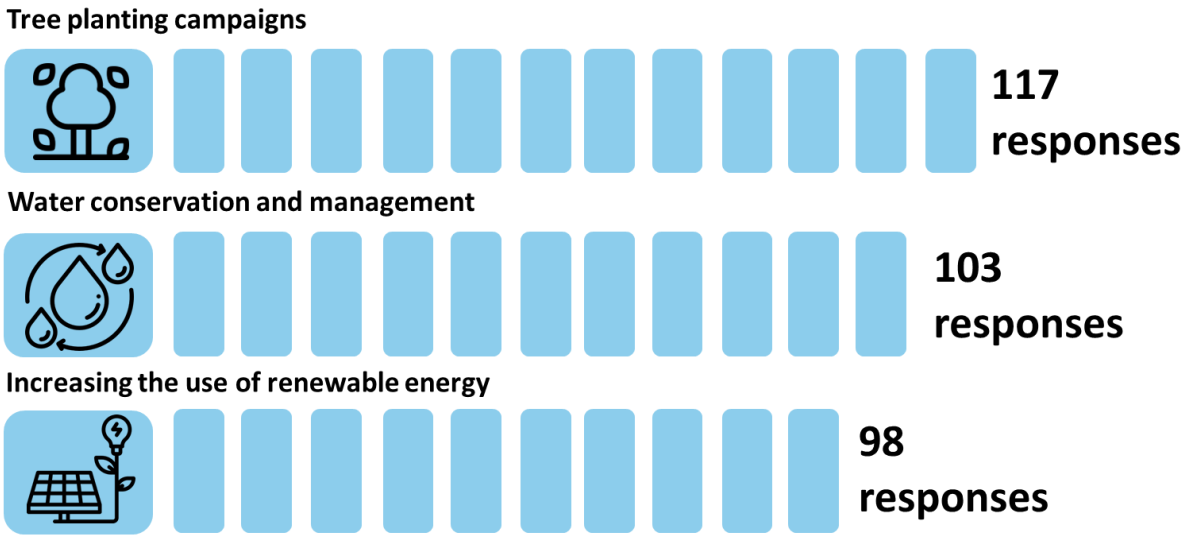


Figure 7. Distribution of vulnerable groups that may be affected by climate change

Finally, the survey asked participants what areas they expect the local government to focus on in addressing climate change. The most common responses were tree planting campaigns (117 responses), water conservation and management (103 responses), and increasing the use of renewable energy (98 responses).


Tree planting campaigns
117 responses
Water conservation and management
103 responses
Increasing the use of renewable energy
98 responses


CO2

5. ÇİNE DISTRICT GHG GAS INVENTORY

5.1. Methodology

In calculating greenhouse gas emissions, various internationally accepted methodologies are available. In these calculations, the IPCC guidelines are particularly influential. Additionally, content has been prepared in accordance with the GHG Protocol, the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) 1.1, and the International Emissions Analysis Protocol (IEAP).

The Covenant of Mayors, established by the European Commission and signed by local governments since 2008, provides a framework for cities to present action plans to achieve their climate and energy goals. Globally, 13,491 local governments have signed this covenant. Member local governments are required to quantify greenhouse gas emissions from both their own activities and those of the entire population within their geographical boundaries. To this end, the International Council for Local Environmental Initiatives (ICLEI) has developed the International Emissions Analysis Protocol (IEAP), which includes common rules and standard approaches for local governments to concretely identify and compare their greenhouse gas emissions and reductions. The IEAP facilitates the auditing processes of greenhouse gases, bringing together and reporting the gains from different communities, and ensuring the creation of a reliable database. ICLEI assists local governments in their efforts to reduce greenhouse gases that contribute to climate change and deteriorating air quality. Today, it provides analytical tools and methods for local governments to measure their emissions, set reduction targets, and achieve those targets.

The diverse areas of activity under local government jurisdiction require tailored greenhouse gas management programs. Local government greenhouse gas inventories can be divided into two categories: emissions from the local government's own activities and emissions from the community activities within the administrative area. The most commonly used international protocol for creating a corporate greenhouse gas inventory is the GHG Protocol. For preparing district-scale greenhouse gas inventories, the 2014 IPCC Guidelines for National Greenhouse Gas Inventories developed by the Intergovernmental Panel on Climate Change (IPCC) Working Group on National Greenhouse Gas Inventories are used as the basis.

Base Year

The baseline year is the reference year against which the emission reduction targets of the proposed actions will be compared. When selecting this year, it is essential to choose a year with the most reliable data available and one that is free from extraordinary events (such as pandemics). In this context, the baseline year for the Çine district has been selected as 2023.

Scope

The selected sectors within the boundaries of Çine Municipality include buildings, energy, transportation, waste, and wastewater, with greenhouse gas emissions from the industrial, agriculture, and livestock sectors also being calculated. However, Çine Municipality does not have any

enforcement authority over the industrial sector, which is largely defined as the private sector. Additionally, because the decision-making process for the agriculture and livestock sectors is under central government control, greenhouse gas reduction targets have excluded emissions from industrial, agricultural, and livestock sources.

Scope

In preparing the current greenhouse gas inventory, the most commonly used sector-based approach employed by cities has been applied. In this approach, all CO_2e (or greenhouse gas) emissions resulting from direct (fuel combustion) or indirect (electricity consumption) energy use in Çine are included. While a significant portion of greenhouse gas emissions is from CO_2, CH_4 and N_2O emissions are of secondary importance concerning combustion processes in the residential and transportation sectors. All CO_2, CH_4, and N_2O emissions are calculated using IPCC emission factors from the Fifth Assessment Report (AR5), along with their global warming potentials (GWP) for all fuel types.

- ***Scope 1 – direct greenhouse gas emissions:*** These are emissions from all stationary and mobile greenhouse gas sources that are owned or directly controlled by the organization. This includes assets that are owned, leased, or acquired through financial leasing. The scope boundary encompasses all emission sources that can be controlled. Refrigerant gases used in climate control systems for activities should also be included in this scope.
- ***Scope 2 – energy indirect greenhouse gas emissions:*** These are greenhouse gas emissions resulting from the energy purchased for the organization's activities. This includes grid electricity or other types of energy used for heating or cooling purposes.
- ***Scope 3 – other indirect greenhouse gas emissions:*** These are greenhouse gas emissions caused by the organization's activities that are not under its direct control and fall outside of other indirect emissions. These emissions may result from activities before or after the organization's core operations, from employee travel, or from the activities of organizations not under the authority of the Çine Municipality but still related to services for residents of Çine. (Figure 8).

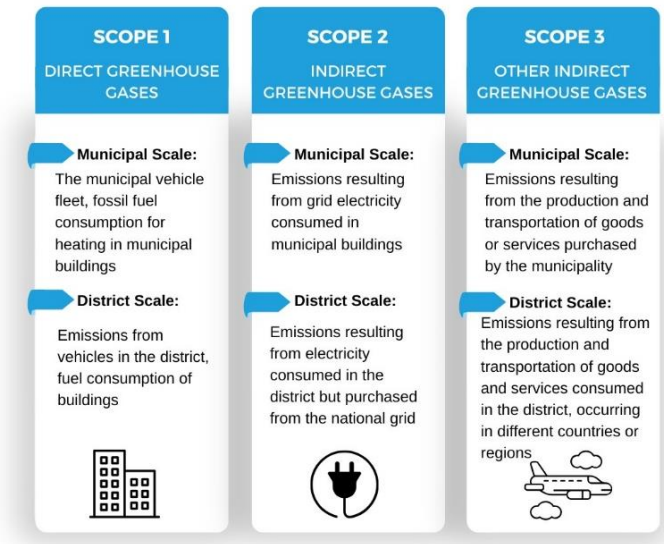


Figure 8. Greenhouse Gases by scope

- The greenhouse gases and their global warming potentials specified in the Kyoto Protocol, which must be included in greenhouse gas inventories, have been used. These are:
- ***GWP (Global Warming Potential):*** A factor that describes the radiative forcing effect of a specific greenhouse gas in terms of equivalent mass of carbon dioxide over a given time period.
- ***CO_2e (Carbon Dioxide Equivalent):*** A unit used to compare the radiative forcing of a greenhouse gas to that of carbon dioxide.

Table 2. Greenhouse gases and GWP values according to IPCC and Kyoto Protocol

Greenhouse Gases	Chemical Formula	Residence time in the atmosphere (Year)	Global Warming Effect * (CO_2e) [9]
Carbon dioxide	CO_2	5-200	1
Methane	CH_4	12	28
Diazot monoxide	N_2O	114	265
Perfluorocarbons	PFCs	50.000**	6.630-9.200
Hydro fluorocarbons	HFCs	226**	148-12.400
Sulphur hexafluoride	SF_6	3.200	23.500
Nitrogen trifluoride	NF_3	740	16.100
*: Time dependent. **: The highest values are shown for this group of greenhouse gases.			

The direct and indirect greenhouse gas emissions of each energy carrier have been calculated by multiplying the final energy consumption by the corresponding emission factor. Additionally, emissions from waste and wastewater treatment, including CH_4 and N_2O, have been calculated and converted to CO_2e.

Data Collection: To create this inventory, an effective division of labor has been established among the administrative units of local government at the institutional level, and with other organizations at the district level that could impact or provide information on both institutional and urban activities (such as other public institutions, organized industrial zones, various associations and chambers, energy suppliers, etc.).

Calculation: For greenhouse gas calculations within the boundaries of Çine Municipality, the formulas and variables listed below were used for Scope 1, Scope 2, and Scope 3 greenhouse gas sources based on their types.

[9] https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values %20%28Feb %2016%202016%29_1.pdf

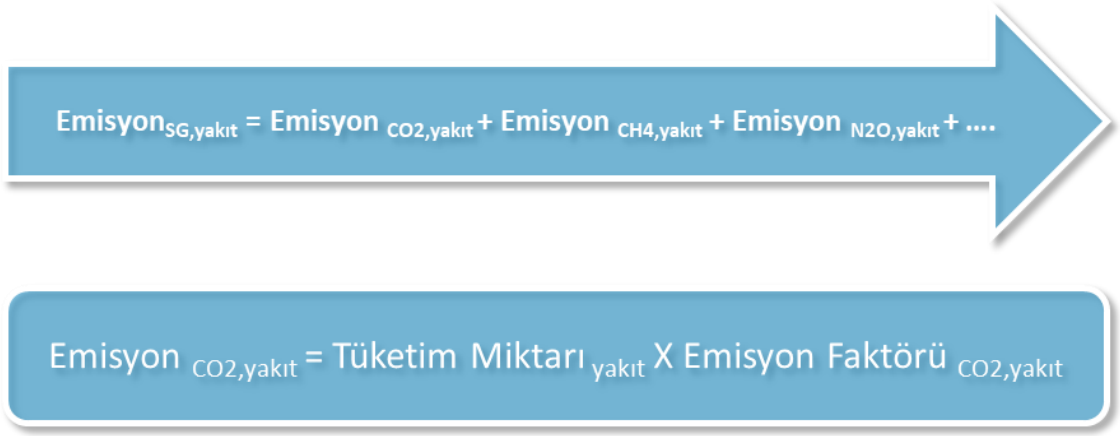


Figure 9. Greenhouse Gas calculation formulas

5.2. Greenhouse Gas Inventory

With data obtained from Çine Municipality and external stakeholders (such as electricity and gas distribution companies, EPDK, etc.), the greenhouse gas inventory for Çine District for the year 2023 has been created. The inventory includes buildings, energy, transportation, waste and wastewater, agriculture, and livestock sectors within the boundaries of Çine Municipality. Since Çine Municipality does not have enforcement authority in the industrial sector, two separate inventories have been prepared: one including and one excluding the industrial sector.According to Table 3, for the year 2023, the total energy consumption in Çine District, including industry, agriculture, and livestock, is 876,482 MWh, with greenhouse gas emissions amounting to 528,540 tCO_2e. Emissions from fuel and electricity consumption in buildings account for 20.53% of the total emissions. Transportation-related greenhouse gas emissions constitute 16.06%, while other greenhouse gas emissions from solid waste, wastewater treatment, fugitive emissions, agriculture, livestock, and agricultural irrigation account for 53.26% of the total emissions.

Table 3. Çine district greenhouse gas inventory (including industry, agriculture and livestock), 2023

Çine Greenhouse Gas Inventory (Including Industry)2023	Energy Consumption	Greenhouse Gas Emissions	Share in the Inventory
	MWh	Ton CO_2e	%
Buildings	**284,001**	**108,523**	**20.53%**
Municipality Buildings and Facilities	1,027	472	0.09%
Tertiary (non-municipal) buildings, equipment/facilities	40,432	18,186	3.44%
Residential buildings	185,647	68,719	13.00%
Public lighting	5,342	2,509	0.47%
Industry	51,552	18,637	3.53%
Transportation	**323,979**	**84,897**	**16.06%**
Municipal Fleet	3,480	941	0.18%
Public Transport	2,427	658	0.12%
Private and commercial transport	315,629	82,636	15.63%
Transit - Bus Terminal	2,443	662	0.13%

Çine Greenhouse Gas Inventory (Including Industry)2023	Energy Consumption	Greenhouse Gas Emissions	Share in the Inventory
	MWh	Ton CO_2e	%
Other Emissions	**4,483**	**281,524**	**53.26%**
Solid Waste Disposal	-	2.915	0.55%
Waste Water Treatment	**-**	**3,490**	**0.66%**
Waste Water Treatment Process CH_4	-	3,151	0.60%
Waste Water Treatment Process CO_2	-	183	0.03%
Wastewater Treatment Process Nitrification /Denitrification N_2O	-	46	0.01%
Waste Water Treatment Discharge N_2O	-	109	0.02%
Agriculture, Livestock and Land Use	-	273,013	51.65%
Agricultural Irrigation	4,483	2,105	0.40%
Energy Production	**264,019**	**53,596**	**10.14%**
Fuel Consumption for Electricity Production	264,019	53,596	10.14%
Overall Total	**876,482**	**528,540**	**100.00**

In the table below, the energy consumption of Çine district, excluding greenhouse gas emissions from industrial, agricultural, and livestock activities, is reported as **556,428 MWh**, and the amount of greenhouse gas emissions is **181,188 tCO_2e**.

Table 4. Çine district greenhouse gas inventory (excluding industry), 2023

Çine Greenhouse Gas Inventory (Excluding Industry)2023	Energy Consumption	Greenhouse Gas Emissions	Share in the Inventory
	MWh	Ton CO_2e	%
Buildings	**232,449**	**89,886**	**49.61%**
Municipality Buildings and Facilities	1,027	472	0.26%
Tertiary (non-municipal) buildings, equipment/facilities	40,432	18,186	10.04%
Residential buildings	185,647	68,719	37.93%
Public lighting	5,342	2,509	1.38%
Transportation	**323,979**	**84,897**	**46.86%**
Municipal Fleet	3,480	941	0.52%
Public Transport	2,427	658	0.36%
Private and commercial transport	315,629	82,636	45.61%
Transit - Bus Terminal	2,443	662	0.37%
Other Emissions	**-**	**6,405**	**3.53%**
Solid Waste Disposal	-	2,915	1.61%
Waste Water Treatment	**-**	**3,490**	**1.93%**
Waste Water Treatment Process CH_4	-	3,151	1.74%
Waste Water Treatment Process CO_2	-	183	0.10%
Wastewater Treatment Process Nitrification /Denitrification N_2O	-	46	0.03%
Waste Water Treatment Discharge N_2O	-	109	0.06%
Overall Total	**556,428**	**181,188**	**100.00**

As indicated in Figure 10, within the total greenhouse gas inventory for Çine District, excluding industry, agriculture, and livestock, the share of emissions from buildings is 49.61%, transportation accounts for 46.86%, and emissions from waste and wastewater sources constitute 3.53% (Figure 10).

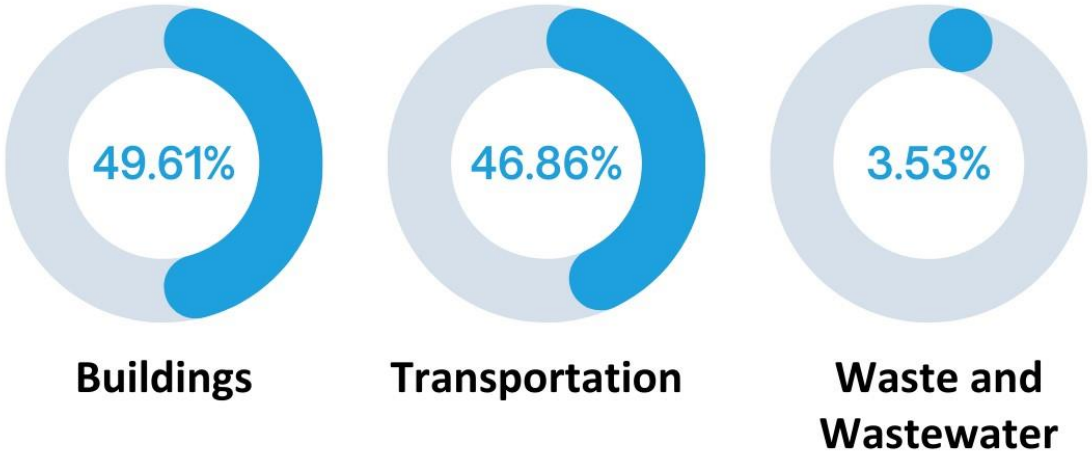


Figure 10. GHG distribution by sectors (excluding industry), 2023

5.2.1. Buildings and Renewable Energy

Buildings and renewable energy sectors play a critical role in achieving sustainability goals. While buildings account for a significant portion of energy consumption in Çine District, they also have a substantial impact on greenhouse gas emissions and natural resource use. These emissions can be reduced through energy efficiency solutions that can be integrated into buildings.

In Çine, coal is predominantly used for heating buildings and residences, though precise figures are not available. While data may be obtained from coal sales points, the issue of illegal coal usage should not be overlooked. The district has approximately 12,000 potential natural gas subscribers and 4,987 existing natural gas subscribers. Additionally, due to the high number of forest villagers, wood consumption is also widespread. In the greenhouse gas inventory for Çine District, excluding industry, the building sector has the largest share at 49.74% (Figure 10). Given that buildings account for a substantial portion of total emissions, addressing this sector is critical for achieving reduction targets. Analysis of building subcategories by usage reveals that residential buildings hold the largest share, representing 76.45% of emissions. This is followed by tertiary buildings at 20.23%, public lighting at 2.79%, and municipality buildings and facilities at 0.52% (

Figure 11).

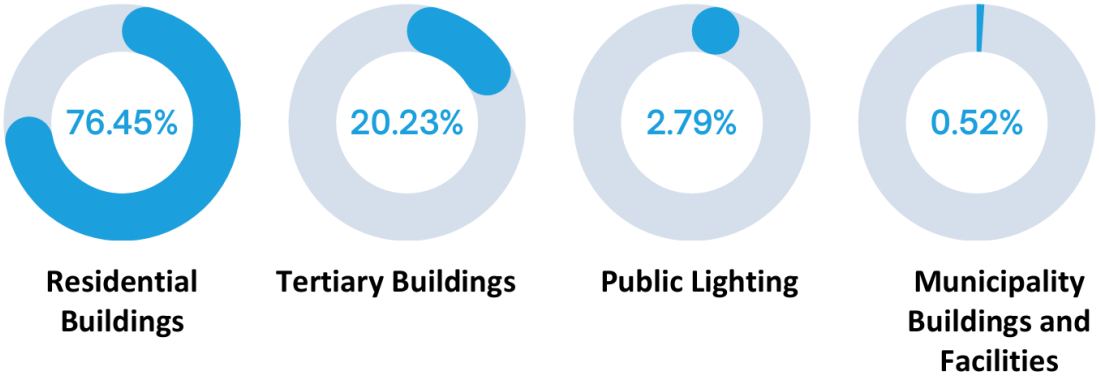


Figure 11. GHG distribution of buildings, 2023

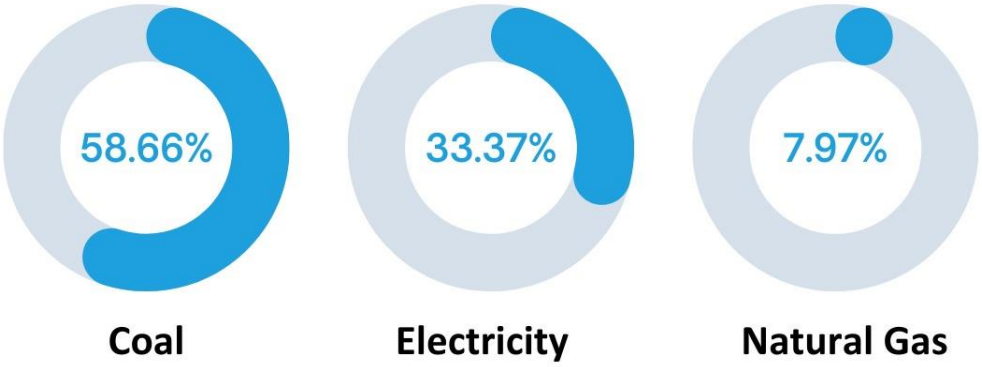


Figure 12. Breakdown of GHG emissions from residental buildings, 2023

When examining energy consumption in residental buildings, it is observed that 58.66% of greenhouse gas emissions come from coal, 33.37% from electricity, and 7.97% from natural gas. Excluding the industrial sector, the building sector in Çine District accounts for 49.74% of total emissions. Buildings represent the largest emission source in the overall greenhouse gas inventory. Therefore, interventions in buildings are crucial for achieving emission reduction targets. Although emissions from municipal buildings are relatively low, the efforts undertaken by the municipality serve as a model for residents of the district.

5.2.2. Transportation

The transportation sector is fundamental to community mobility, trade vitality, and industrial processes. However, due to its high energy demand and reliance on fossil fuels, it represents a significant area requiring effective management of its environmental impacts. In densely populated cities, there is a growing emphasis on transitioning to sustainable and environmentally friendly transportation systems to mitigate these environmental effects. In Turkey, the rapid increase in electric vehicle sales is being supported by incentives for electric vehicles. However, to sustain this growth, it is essential to expand and support the network of charging stations. Within the transportation sector, emissions from urban vehicles account for a significant proportion, with a rate of 96.77%. This underscores the importance of promoting the widespread adoption of electric vehicles. The project

route, which originates from the southwest of Umurlu District, passes through the southeastern part of Aydın city and south of Çıldır Airport. It crosses the Büyük Menderes River and the Aydın-Muğla highway near the Dalama junction, extending south to Çine. From Çine, the route continues southwest, following the Çine Creek Valley parallel to the highway, and eventually connects to Yatağan district in Muğla, and further west to Güllük Port (Aydın İRAP, 2022). Although emissions from the municipal vehicle fleet account for a low proportion of 0.18%, they serve as a guiding example for the residents of the district. Figure 13 illustrates the distribution of greenhouse gas emissions from fuel consumption in the transportation sector.

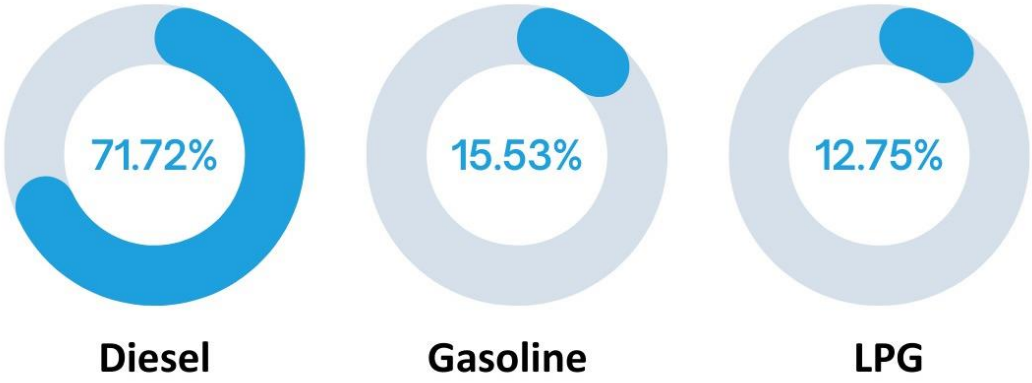


Figure 13. Distribution of GHG emissions from fuel consumption in the transportation sector, 2023

In the 2023 greenhouse gas inventory for Çine District, the transportation sector is the second-largest source of emissions, accounting for 46.86% of total emissions (excluding industry). Within transportation-related greenhouse gas emissions, diesel consumption represents the largest share at 71.72%. This is followed by emissions from gasoline consumption at 15.53%, and LPG consumption at 12.75%.

5.2.3. Waste and Wastewater

With population growth, industrialization, and changing consumption patterns, the amount of waste is continuously increasing. Today, it is crucial not only to reduce waste production but also to reintegrate generated waste into the economy. This approach plays a key role in achieving net-zero greenhouse gas emission targets both in Turkey and globally. Local governments in Turkey are required to report data on collected waste to the Turkish Statistical Institute (TÜİK). This waste typically includes similar types of waste generated from residential buildings, tertiary buildings, offices, public institutions, and schools. These data serve as a crucial reference point in the development of waste management strategies and the setting of sustainability goals. In Çine District, within the scope of solid waste management, waste is sorted at the source for recycling purposes, and packaging waste is collected separately. The remaining solid waste is regularly sent to Aydın Metropolitan Municipality's Solid Waste Landfill Site.

Wastewater generated in Çine is sent to the Çine Wastewater Treatment Plant. Although wastewater management falls under the responsibility of the Metropolitan Municipality, district municipalities also have responsibilities in raising awareness at the local level. In the 2023 greenhouse gas inventory for

Çine District, the waste and wastewater sector (excluding industry) accounts for 3.53% of total emissions. Of these emissions, 1.93% comes from wastewater, with wastewater emissions comprising 54.49% of total waste emissions. Solid waste-related emissions account for 1.61% of the total inventory, representing 45.51% of total waste emissions.

When analyzing greenhouse gas emissions from solid waste disposal and wastewater treatment, the largest share is held by CH_4 emissions from the wastewater treatment process, at 49.20%. This is followed by emissions from solid waste disposal at 45.51%, and CO_2 emissions from the wastewater treatment process at 2.86%. N_2O emissions from wastewater discharge account for 1.70%, while N_2O emissions from the nitrification/denitrification process in wastewater treatment make up 0.72%. (Figure 14).

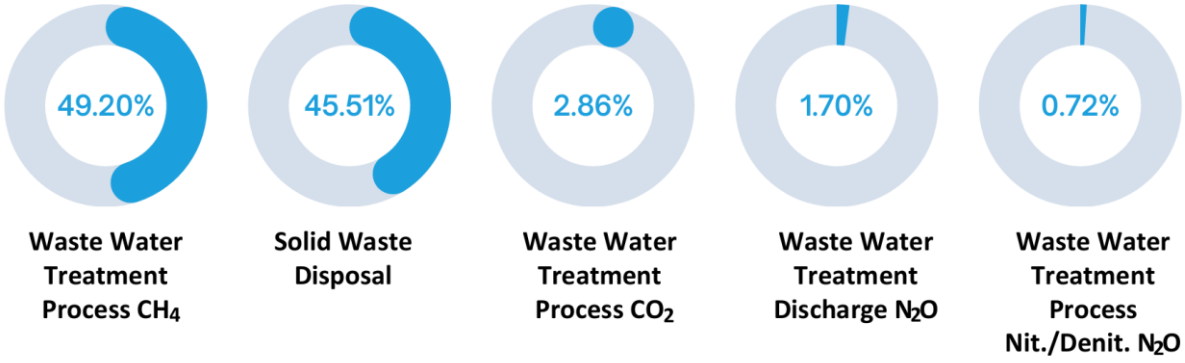


Figure 14. GHG Emissions from solid waste disposal and wastewater treatment, 2023

6. GREENHOUSE GAS MITIGATION ACTIONS

This section outlines studies regarding the projected greenhouse gas emissions inventory for 2030, based on expectations of population growth and increases in other sectors if the current situation continues, as well as the reduction amounts of greenhouse gases if mitigation measures are implemented.

6.1. Business As Usual (BAU) and Mitigation Assumptions

The most important step in determining greenhouse gas mitigation activities for the district of Çine is to create a roadmap in line with the mitigation target set for 2030. Specific mitigation targets are established for major emission sources based on the district's greenhouse gas inventory in the baseline year. Çine Municipality is planning with the goal of reducing per capita emissions by 55% by 2030, using 2023 as the baseline year.

Assumptions for greenhouse gas emissions in 2030 are made by considering factors such as population growth rate, growth rate in the building and service sectors, energy consumption trends over the past decade, and legislative changes within the jurisdiction of Çine Municipality. The assumptions regarding the district's greenhouse gas emissions growth, and the steps needed to achieve the 55% reduction target, are listed below by sector.

Table 5. BAU and mitigation assumptions

	BAU Assumptions	***Mitigation Assumptions***
Population Projection		
Population	*Due to minimal changes in the population over the years, the population has been assumed to remain constant.* *According to Çine Municipality's projection for 2030, the population is expected to be 48,585.*	
Buildings		
Residental Buildings	*Electricity consumption is projected to consist of:* *• 20% for cooling,* *• 10% for heating,* *• 40% for other electrical devices, and* *• 30% for lighting.* *A change proportional to population growth is expected.*	*A 55% reduction is projected for all existing homes, urban renewal buildings, and newly constructed residences. A 20% reduction in electricity consumption from cooling and a 10% reduction across all homes through awareness-raising activities are assumed. Additionally, a 70% reduction in lighting consumption in homes is expected, along with an 80% reduction in coal usage in existing buildings through conversion to natural gas.* *It is also projected that 29% of homes and commercial establishments will meet their energy needs from renewable sources, with a capacity of 20,000 kWp.*

Tertiary Buildings	*Natural Gas: An annual consumption increase of 3% is projected.* *Electricity: An annual increase of 4% is anticipated.* *These energy consumption increases are determined based on trends from the past five years and the development status of the service sector.*	*A 55% reduction is assumed for all commercial establishments, a 60% reduction for all street lighting, and a 10% reduction for all commercial establishments through awareness-raising activities.*
Municipality Buildings	*Natural Gas: No increase is anticipated.* *Electricity: No increase is anticipated.*	*A 55% reduction is projected for all municipal buildings.* *It is anticipated that 57% of electricity consumption in municipal buildings will be met by renewable energy sources, with a capacity of 400 kWp.*
Transportation		
Municipal Fleet	*Diesel: No increase is anticipated.* *Gasoline: No increase is anticipated.*	*A 55% reduction is projected for the entire municipal vehicle fleet, with an additional 15% reduction assumed for all municipal vehicles through eco-driving training. For waste collection vehicles, a 15% reduction is anticipated for 50% of the fleet.*
Private transport	*Diesel - private vehicles: No increase is anticipated.* *Diesel - logistics: A 2% increase is projected.* *Gasoline: No increase is anticipated.* *LPG: An annual increase of 1% is anticipated.*	*A 35% reduction is projected for all vehicles in the district, with an additional 15% reduction anticipated for logistics and all vehicles in the district through eco-driving training.*
Public transport, bicycle and pedestrian transport	*No increase is anticipated.*	*A 20% reduction is projected for all vehicles involved in public transport and rail line integration. Effective route planning for public transport is expected to lead to a 15% reduction for 50% of the vehicles.* *Additionally, a 5% reduction is anticipated for bicycle transportation and a 5% reduction for pedestrian transportation.*
Waste-wastewater		
Waste	*No increase is anticipated.* *Emissions related to waste have been projected for 2030 based on the anticipated*	*A 50% reduction is projected for the entire solid waste disposal process.*

	population growth, as they are directly linked to public activities.	
Wastewater	*No increase is anticipated.* *Emissions related to wastewater have been projected for 2030 based on the anticipated population growth, as they are directly linked to public activities.*	*A 50% reduction is projected for the entire wastewater treatment process.*

6.2. Greenhouse Gas Projection for 2030

As a result of the assumptions made, greenhouse gas emissions in the Çine district (excluding industry) are calculated to be 192,926 tCO_2e in 2030 under the Business-As-Usual (BAU) scenario. The per capita emissions, which are 3.73 tCO_2e in 2023, are expected to rise to 3.97 tCO_2e by 2030 according to the BAU scenario. However, with the implementation of action plans, this figure is planned to decrease to 1.68 tCO_2e per capita. The effects of the established targets, the current situation, the BAU scenario, and the reduction scenarios can be observed in Figure 15 below.

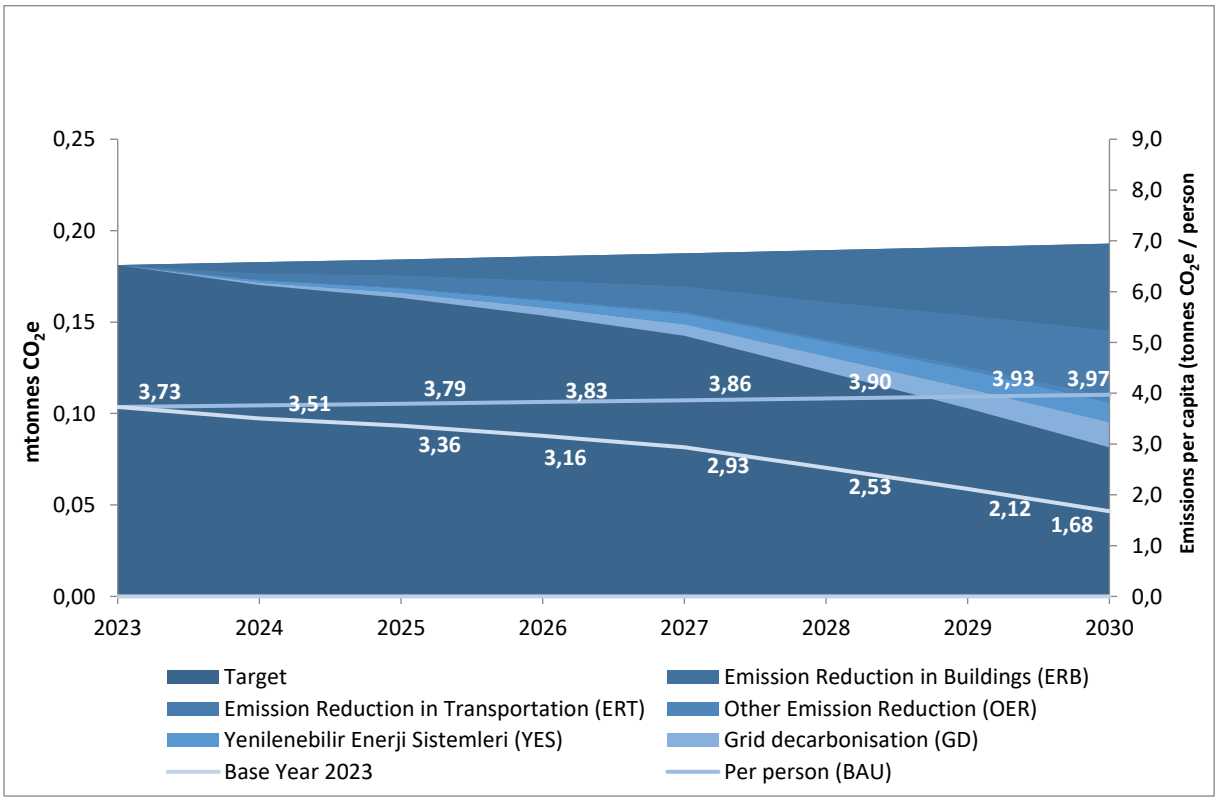


Figure 15. Mitigation Projection

When examining the greenhouse gas inventory (excluding industry), buildings hold the largest share in Çine, accounting for 49.74% of the total. With the identified mitigation actions, a total reduction of 47,277 tCO_2e is targeted in the building and energy sectors by 2030. The transportation sector holds the second-largest share, with 46.74%. Through the designated reduction actions, a reduction of 36,416 tCO_2e is aimed for the transportation sector by 2030. Additionally, mitigation actions have been proposed for waste and wastewater, which constitute the remaining 3.53% of the greenhouse gas inventory in Çine (excluding industry), with a target reduction of 3,202 tCO_2e by 2030.

In addition to all these reductions, efforts are gaining momentum to reduce emissions from the electricity grid through the integration of evolving technologies in line with Türkiye's national targets. Considering the goals of reducing coal usage in electricity generation and increasing the share of renewable energy over the years, the impact on Çine's greenhouse gas emissions has been analyzed. In this context, a reduction of 13,702 tCO_2e in emissions is projected through grid decarbonization by 2030. Table 6 summarizes the mitigation targets for all sectors.

Table 6. Mitigation amounts for Çine district, 2030

Sector	Energy Reduction (MWh)	Emission Reduction (Ton CO_2e)
Buildings	143.742	47.277
Renewable Energy	28.560	10.838
Transportation	168.813	36.416
Waste and Wastewater	-	3.202
Grid Decarbonization	-	13.702
Toplam	**341.115**	**111.436**

6.3. Mitigation Workshop

A Multi-Criteria Assessment (MCA) Analysis was conducted to identify greenhouse gas mitigation actions in collaboration with the relevant departments of Çine Municipality. In this analysis, actions were prioritized based on environmental, social, economic, and institutional criteria. During a workshop involving other internal and external stakeholders outside of Çine Municipality, the prioritized actions were discussed, and new action proposals were gathered.

- The preparation process for the Sustainable Energy and Climate Action Plan involves a series of multi-stakeholder and interdisciplinary activities. The MCA Analysis was utilized in the greenhouse gas reduction workshop to prioritize reduction actions. During the evaluation process, the focus was on promoting the transition to sustainable energy and achieving greenhouse gas emission reduction targets, with various criteria taken into account, including environmental, economic, social, and institutional factors. These criteria in the four main categories were established in line with Çine Municipality's strategic objectives. The criteria to be used in the MCA analysis were determined through a joint preliminary assessment conducted with the relevant departments, led by the responsible unit, and actions were classified as ***"high," "medium,"*** and ***"low"*** priority. After the preliminary assessments conducted by the relevant departments of the municipality, a greenhouse gas reduction workshop was held on June 3, 2024. The workshop included participation from external stakeholders and the municipality's relevant departments. During the workshop, participants were divided into tables based on the four main topics outlined, where they were asked to provide their opinions within the framework of the table topics. The priorities of actions that would contribute to achieving the mitigation targets were discussed. The topics and table headings for the structured workshop were as follows:

• **Buildings & Energy** (Existing residential and commercial buildings, new constructions and urban renewal, public buildings; use of renewable energy in municipal buildings, vehicles, etc.)
• **Transportation** (Public transport, new technologies (electric vehicles, etc.), information-based transport services (car sharing, e-scooters, bike sharing, etc.))
• **Waste & Wastewater** (Reduction of municipal waste, technologies in facilities)
• **Agriculture and Livestock** (Organic fertilizer production, informing farmers, increasing incentive mechanisms)
These four main topics were elaborated in detail.

Figure 16. Mitigation Workshop

At each table, all actions were listed on a board. The board displayed the actions prioritized as high/medium/low during previous internal stakeholder meetings with the Çine Municipality units, categorized under the relevant topic headings. Additionally, the following questions were posed by the moderators to the participants regarding the relevant actions:

- What are the barriers to implementing these actions?
- How can we overcome these barriers?
- What are the facilitating factors?
- Who should the stakeholders be?

Participants from each group were asked to provide their insights on the topic headings within a specified time. The results of the discussions held during the workshop are as follows:

- **Buildings and Energy Table:**

The importance of reducing coal usage and transitioning to natural gas or renewable energy systems in the Çine district has been emphasized. The presence of 12,000 potential natural gas users and 4,987 natural gas subscribers in the region, along with the prevalent wood consumption among forest villagers, has also been highlighted. It was stated that heat pump systems should be promoted and implemented. Furthermore, it was noted that existing buildings should be renovated to meet zero-energy standards and that new buildings should be planned according to these standards. Additionally, raising awareness among homeowners about the possibilities and applications of renewable energy use, as well as implementing these solutions in collaboration with the municipality, has been underscored.

- **Transportation Table:**

The transformation of the vehicle fleet of Çine Municipality to prioritize electric passenger vehicles has come to the forefront, along with increasing the number of electric vehicles charging stations. Awareness-raising activities are recommended to promote pedestrian and bicycle paths by making them safer. Additionally, awareness campaigns related to eco-driving techniques should be conducted in collaboration with driving schools. Optimizing waste collection vehicles for emissions reduction is also highlighted.

It has been emphasized that addressing existing issues, such as parking problems, should be one of the priorities to reduce vehicle usage. Furthermore, the current inadequacies in public transportation (due to insufficient services between rural and urban areas) are seen as factors that increase vehicle ownership.

- **Waste & Wastewater - Agriculture and Livestock Table:**

The importance of increasing zero waste efforts in the Çine district has been emphasized, particularly focusing on the recovery of wastewater and the use of greywater to improve waste management. The promotion of composting and recycling waste are seen as critical steps for sustainable environmental policies. The significance of awareness-raising activities to enhance community knowledge about waste management and environmental consciousness has also been highlighted. Additionally, it has been noted that government support is necessary to increase the capacity of biogas facilities, and training programs should be developed for farmers to utilize agricultural waste effectively.

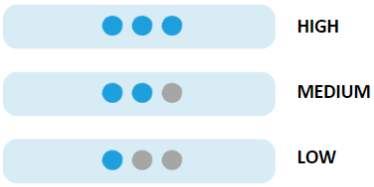
Due to the lack of authority of the district municipality over the agriculture and livestock sectors, it is deemed inappropriate to set any greenhouse gas reduction targets related to these sectors. Since decision-making for the agriculture and livestock sectors lies with central government rather than local authorities, actions related to these sectors have been excluded from the plan.

It has been stressed that national policies should support agricultural sustainability and develop incentives. The production of organic fertilizers from livestock waste has gained particular importance. Increasing the number of biomass combustion facilities and ensuring their efficient use have been suggested. There is a need to enhance awareness-raising efforts to promote environmentally friendly practices in agriculture and livestock. Promoting water-efficient landscaping practices has been

deemed important for the effective use of water resources. The establishment of early warning systems and informing farmers have been evaluated as critical for reducing risks in agriculture and increasing productivity. Conducting studies on crop patterns to select suitable plant species for the region and ensuring agricultural diversity have been highlighted. Furthermore, it has been emphasized that incentives should be increased to support small-scale livestock farming.

6.4. Actions

Mitigation actions are prepared within the framework of buildings, renewable energy, transportation, waste, and wastewater action areas. These actions are finalized after the mitigation workshop. In the action catalogs, sub-action steps are assessed under the categories of buildings, renewable energy, transportation, waste, and wastewater, along with the following headings: type of action, contribution of the municipality, responsible parties, stakeholders, timing, and the impact of the action on the targets.



The impact of the action on the targets is indicated as high, medium, and low, as shown in the figure.

Buildings

Action B1: Review and update local policies, zoning regulations, guidelines, and practices for new urban planning projects by the municipality in line with sustainability principles

Sub-Actions and Steps

- Conduct a planning process that involves local communities and stakeholders, taking into account local needs, cultural factors, and environmental priorities
- Carry out the necessary Environmental Impact Assessments (EIA) to evaluate the environmental impacts of settlement areas
- Prepare guidelines that include sustainable design principles for new settlements, and update design standards accordingly
- Establish and update standards for building energy efficiency and the integration of renewable energy.
- Identify adaptation strategies for building design to cope with climate change, and develop design standards in line with these strategies
- Explore funding sources to support the renovation of homes to meet higher and greener energy standards
- Collaborate with expert consultancy firms to develop design standards related to the location of buildings, shading, maximizing sunlight during winter, designs that make the most efficient use of daylight, or planning notes that improve building conditions
- Integrate sustainable practices such as energy-efficient lighting systems, thermal insulation, and green roofs into the design phase of new buildings to meet energy efficiency targets
- Set criteria to ensure compliance with green building certification systems (LEED, BREEAM, etc.)
- Select eco-friendly and energy-efficient materials for sustainable applications like energy-saving lighting, high-performance insulation materials, and green roofs, and create technical standards and guidelines for these applications

Action Type	Responsible	Timing
Plan/Strategy	Çine Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer	Universities, Professional Chambers	● ○ ○

Buildings

Action B2: The use of energy-efficient lighting systems in existing residential buildings

Sub-Actions and Steps

- Evaluating the energy efficiency of lighting systems used in existing residential buildings
- Identifying the energy savings potential of transitioning to LED lighting and assessing the needs of homeowners
- Organizing awareness campaigns to promote energy savings, cost reductions, and environmental benefits
- Offering affordable LED lighting solutions and support for low-income households
- Providing guidance to homeowners on replacing their current lighting systems with LED lighting systems
- Sharing successful case studies and encouraging community participation to promote the widespread adoption of LED lighting

Action Type	Responsible	Timing
Plan/Strategy	Property Owners	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Guiding and Encouraging	Çine Municipality, Universities, Professional Chambers	

Buildings

Action B3: The implementation of energy-efficient renovations in existing commercial buildings

Sub-Actions and Steps

- Identifying the energy-saving potential in buildings and analyzing priority areas for renovation (such as thermal insulation, window and door insulation, and lighting)
- Informing commercial building owners, managers, and tenants about the benefits of energy efficiency renovations
- Implementing energy-efficient renovations, such as thermal insulation and energy-saving lighting systems
- Establishing standards for renovation applications like thermal insulation and energy-efficient window and door systems
- Developing financial support programs for commercial building owners to encourage participation in renovation projects
- Promoting the use of Energy Performance Contracts (EPC) in existing public buildings

Action Type	Responsible	Timing
Plan/Strategy	Çine Municipality, Business Owners	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Guiding	Universities, Professional Chambers	

Buildings

Action B4: Transitioning to energy-efficient practices in existing municipal buildings

Sub-Actions and Steps

- Providing training to municipal employees on energy savings and raising awareness of energy efficiency
- Encouraging employees to change their daily habits to contribute to energy savings
- Promoting the widespread use of the National Green Certification System (YeS-TR) and encouraging certified new building and settlement projects
- Designing all new municipal buildings to have net-zero energy consumption
- Transitioning to energy-efficient practices (such as thermal insulation, green roofs, energy-saving LED lighting, and photovoltaics) in existing municipal buildings
- Ensuring cost savings by turning off water coolers, computers, and office lights in municipal buildings after work hours
- Monitoring, optimizing, and improving energy efficiency through smart energy management systems

Action Type	Responsible	Timing
Investment (public)	Çine Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer	Financial Institutions	● ● ●

Buildings

Action B5: Planning energy efficiency awareness campaigns for residential buildings using tools such as publications, posters, and educational programs

Sub-Actions and Steps

- Conducting various surveys and organizing focus group meetings to assess the awareness levels of residents, considering socio-economic diversity
- Holding regular informational meetings for the broader community on energy efficiency and renewable energy technologies, focusing on topics such as environmental impacts, health benefits, and the potential for reducing energy costs, in addition to technical knowledge
- Scheduling separate meetings with building material manufacturers, contractors, and financial institutions, and facilitating interactions between citizens and these stakeholders
- Organizing educational programs for children and young people to enhance their knowledge and skills regarding renewable energy sources, energy use, and environmental impacts
- Developing an effective communication model through digital platforms or various channels to explain how energy transition can lead to savings and impact household budgets with simple calculations

Action Type	Responsible	Timing
Behavioural	Çine Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Guiding and Encouraging	Property Owners, Aydın Metropolitan Municipality, Local Non-Governmental Organisations, Universities	● ○ ○

Buildings

Action B6: Planning energy efficiency awareness campaigns for commercial buildings using tools such as publications, posters, and educational programs

Sub-Actions and Steps

- Organizing meetings with energy managers of high-energy-consuming commercial buildings, such as offices, hospitals, and shopping malls, to share successful case studies
- Hosting informational and training programs on topics like heat pump systems and various energy efficiency applications, with support from experts in the field of energy efficiency

Action Type	Responsible	Timing
Behavioural	Çine Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Guiding and Encouraging	Aydın Metropolitan Municipality, Local Non-Governmental Organisations, Universities	● ○ ○

Action B7: Implementing thermal insulation in existing buildings and applying a district heating system through energy conversion

Sub-Actions and Steps

- Identifying neighborhoods with high fuel and electricity consumption in existing buildings
- Conducting feasibility studies for implementing efficient systems such as district heating in these identified neighborhoods to reduce energy consumption
- Promoting the widespread adoption of energy-efficient practices in buildings.
- Implementing thermal insulation in buildings
- Electrifying energy systems by integrating technologies like heat pumps and VRF systems.
- Renovating rooftops with white or green roofs
- Ensuring the municipality monitors the implementation of energy efficiency measures in buildings

Action Type	Responsible	Timing
Investment (public and private)	Property Owners	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Encouraging	Çine Municipality, Ministry of Environment, Urbanisation and Climate Change, Financial Institutions	● ● ●

Buildings

Action B8: Mandatory assessments of circular economy principles in all renovation, demolition, and new construction projects; promoting the use of low-carbon materials in this process

Sub-Actions and Steps

- Conducting an assessment of the current state to identify waste management and recycling opportunities in renovation and demolition projects
- Developing local regulations and guidelines that define circular economy principles and waste management processes
- Establishing standards for material selection in buildings, focusing on low-carbon materials and alternatives (e.g., recycled materials, wood, low-carbon concrete)
- Implementing processes for the classification, recycling, and monitoring of material reuse during renovation and demolition projects
- Tracking and evaluating the use of the identified low-carbon materials
- Developing financial incentives and support programs to promote the use of circular economy practices and low-carbon materials

Action Type	Responsible	Timing
Plan/Strategy	Çine Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer and Guiding	Universities, Professional Chambers	● ○ ○

Action B9: Integration of LED and photovoltaic (PV) technology into energy-efficient street ing systems

Sub-Actions and Steps

- Creating an inventory of street ing systems
- Integrating energy-efficient street ing systems
- Regularly monitoring the performance of street lighting systems

Action Type	Responsible	Timing
Research, Investment	Çine Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer	Universities, Professional Chambers, PV Panel and LED Provider Companies	● ● ○

Renewable Energy

Action YE1: Installation of renewable energy systems in residential areas

Sub-Actions and Steps

- Consulting with local communities and stakeholders to increase the acceptance of renewable energy systems (photovoltaic, wind, geothermal, etc.) and identify regional needs
- Analyzing the current energy consumption profile and renewable energy potential in residential areas
- Conducting research on the use of alternative energy sources such as sustainable biogas and green hydrogen
- Performing technical feasibility studies for renewable energy systems (photovoltaic, wind turbines, geothermal systems, etc.) in residential areas and determining the appropriate system types
- Identifying and implementing the necessary legal regulations and incentives for the installation of renewable energy systems
- Developing financing sources and incentive models for the installation of renewable energy systems, and exploring funding opportunities
- Organizing educational and informational programs for homeowners and local communities about the benefits, installation, and maintenance of renewable energy systems
- Launching pilot projects to test the feasibility of renewable energy systems in residential areas
- Carrying out the installation of selected renewable energy systems in residential areas
- Regularly monitoring the performance of installed renewable energy systems and evaluating their energy production and environmental impacts
- Ensuring the sustainability of renewable energy systems by conducting maintenance, improvements, and updates, and integrating new technologies

Action Type	Responsible	Timing
Research, Investment	Çine Municipality, Property Owners	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer	Universities, Professional Chambers, PV Panel and LED Provider Companies	● ● ●

Transportation

Action U1: Promoting the use of low-emission vehicles for businesses and citizens, along with increasing the capacity of electric vehicle charging infrastructure throughout the district

Sub-Actions and Steps

- Facilitating discussions and collaborations with relevant private and public entities to promote the widespread adoption of electric vehicles
- Expanding efforts to establish e-charging stations in central locations for electric vehicle charging, prioritizing integration in parking areas and roadside parking spaces
- Organizing informational campaigns, events, and other activities to encourage the use of electric vehicles in the district
- Increasing the number of charging stations to promote electric vehicle usage among citizens
- Supporting research on alternative fuel vehicles (LNG/Hydrogen, Bio-CNG, Bio-LNG, etc.)

Action Type	Responsible	Timing
Investment (public and private) and Plan/Strategy	Çine Municipality, Aydın Metropolitan Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer and Guiding	Ministry of Transport and Infrastructure, Ministry of Energy and Natural Resources, Iller Bank, Vehicle Manufacturers, Vehicle Maintenance Companies, E-charging Station Operators	● ● ●

Action U2: Prioritizing low-carbon vehicles in the municipal fleet and service vehicles

Sub-Actions and Steps

- Conducting a feasibility study for replacing the municipality's official vehicles with low-carbon vehicles
- Prioritizing low-emission vehicles for the municipal fleet based on usage rates
- Transitioning the service vehicle fleet to electric vehicles

Action Type	Responsible	Timing
Investment (public)	Çine Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer	Iller Bank, Vehicle Manufacturers, Vehicle Leasing Companies	● ● ●

Transportation

Action U3: Creating and implementing more efficient route planning for waste collection services and public transportation

Sub-Actions and Steps

- Conducting feasibility studies for waste collection routes
- Planning the routes and schedules of waste collection vehicles to reduce greenhouse gas emissions
- Creating alternative route simulations for public transportation
- Analyzing and evaluating fuel consumption of vehicles at regular intervals
- Electrifying waste collection and public transportation vehicles

Action Type	Responsible	Timing
Investment (public) and Plan/Strategy	Aydın Metropolitan Municipality, Çine Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer	Companies Developing Vehicle Tracking System, Companies Producing Waste Collection Vehicles	● ○ ○

Action U4: Providing economic driving training to municipal and transportation personnel

Sub-Actions and Steps

- Providing preliminary information to municipal service vehicle personnel, public transport, minibus, taxi, and logistics vehicle drivers
- Informing transportation and cargo companies in the district about the topic and organizing joint programs with educational institutions
- Collaborating with driving schools to provide this training, especially to individuals obtaining their driver's licenses for the first time
- Offering economic driving training to municipal personnel and citizens through various channels (publications, announcements, digital platforms, etc.)
- Collaborating with Aydın Metropolitan Municipality and neighboring districts to enhance the impact of these initiatives

Action Type	Responsible	Timing
Behavioural	Çine Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer and Guiding	Aydın Metropolitan Municipality, Ministry of National Education, NGOs, Vehicle Owners, Private Courses	● ○ ○

Transportation

Action U5: Diversifying transportation infrastructure and modes while considering sustainable transportation methods

Sub-Actions and Steps

- Establishing a working group to identify sustainable transportation methods specific to the district and municipality
- Transitioning to electric (or hybrid) vehicles for public transportation
- Pedestrianizing streets in the city center to increase the share of pedestrians in transportation
- Developing and expanding bicycle infrastructure to enhance its share in transportation
- Improving the safety of sidewalks and dedicated bike/e-scooter lanes while conducting awareness-raising activities for individuals
- Conducting feasibility studies to increase the number of e-scooter and shared bicycle projects

Action Type	Responsible	Timing
Plan/Strategy and Behavioural	Çine Municipality, Aydın Metropolitan Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer and Guiding	Financial Institutions, Entrepreneurs, Citizens	● ● ○

Action U6: Creating publications, announcements, and messaging that encourage citizens to use public transportation

Sub-Actions and Steps

- Preparing content that specifically highlights the impact of climate change and greenhouse gas emissions on public health when determining awareness-raising actions
- Establishing connections between public transportation vehicles (municipal buses, minibuses, etc.) and rail stations to encourage citizens to use public transport
- Promoting the use of smart card systems that facilitate fare collection and pricing options to encourage public transport usage

Action Type	Responsible	Timing
Behavioural	Çine Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer and Encouraging	Iller Bank, Vehicle Manufacturers, Vehicle Leasing Companies	● ○ ○

Waste & Wastewater

Action A1: Establishing a Solid Waste Management Plan and implementing regulations for waste separation

Sub-Actions and Steps

- Planning necessary training and awareness-raising activities to create awareness throughout the district
- Organizing a campaign across the district to reduce waste generation and promote waste separation
- Providing training on the utilization of agricultural waste
- Encouraging local businesses to reduce single-use plastic consumption through publications, notice boards, and guidance
- Banning the use of single-use plastics and similar packaging waste within municipal operations
- Promoting the separation of waste at the source according to zero waste principles and distributing different waste bins to households for this purpose
- Making it mandatory to separately collect the most important recyclable materials
- Increasing efforts toward zero waste initiatives
- Investigating the potential for waste collection services targeting the food sector (restaurants, hotels, etc.)
- Identifying the required recycling infrastructure (bins, trucks, routes, etc.) and collaborating with relevant institutions for investment
- Implementing smart route planning for waste collection and transfer vehicles
- Conducting pilot projects for more sustainable and innovative waste management
- Promoting and publicizing communal or home composting initiatives
- Establishing advanced recycling workshops for bulky waste
- Securing government support for increasing the capacity of biogas facilities

Action Type	Responsible	Timing
Plan/Strategy	Çine Municipality, Aydın Metropolitan Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer and Guiding	Ministry of Environment, Urbanisation and Climate Change, Provincial Directorate of Urbanisation and Climate Change, Citizens	● ○ ○

Waste & Wastewater

Action A2: Collaborating with the Metropolitan Municipality to improve the existing water management infrastructure

Sub-Actions and Steps

- Conducting awareness-raising activities regarding water usage in buildings
- Supporting these efforts through publications, announcements, and communication campaigns
- Creating awareness about the multiple effects of pouring products like oil and detergent down the sink by communicating these issues to citizens in an accurate and impactful manner
- Implementing a system that records and certifies water consumption classes, similar to the energy consumption classifications used in buildings. Initially, these applications should be rolled out in large-scale business centers that consume significant amounts of water
- Developing a sustainable wastewater management system based on the principles of circular economy
- Utilizing gray water for irrigation to enhance water efficiency

Action Type	Responsible	Timing
Plan/Strategy	Çine Municipality, Aydın Metropolitan Municipality	2024-2030
Municipality's Contribution	**Stakeholders**	**Impact of the Action on the Target**
Implementer and Guiding	Ministry of Environment, Urbanisation and Climate Change, Provincial Directorate of Urbanisation and Climate Change, citizens	● ○ ○

7. ADAPTATION TO CLIMATE CHANGE

Cities frequently face natural hazards such as floods, droughts, hail, and sudden heat and cold waves. Due to climate change, the intensity of these meteorological disasters is increasing over time. Therefore, understanding a city's risks and adaptation capacity, and developing prioritized strategies to ensure its resilience and sustainability, is crucial.

Even if greenhouse gas emissions were to stop completely today, the emissions already released into the atmosphere will continue to contribute to global warming. The sooner we reduce emissions, the easier it will be to cope with these effects in the future. However, in parallel with greenhouse gas reduction actions, adaptation efforts must also be pursued, and cities must be assessed in terms of risks and vulnerabilities. This will lay the groundwork for discussions on how to address future challenges. The preparation of adaptation plans will play a critical role in making cities more resilient to climate change-induced disasters.

7.1. Climate Change Scenarios

Due to its vast geographical structure and various climate zones, our country frequently experiences severe meteorological events that often escalate to disaster levels. Meteorological disasters, especially storms, floods, hail, frost, snow, and drought, occur frequently and lead to significant loss of life and property. In Turkey's 8th National Communication, projections for the country up to 2100 have been provided. In this context, analyses were conducted based on the IPCC's RCP4.5 (optimistic scenario) and RCP8.5 (pessimistic scenario). According to these analyses:

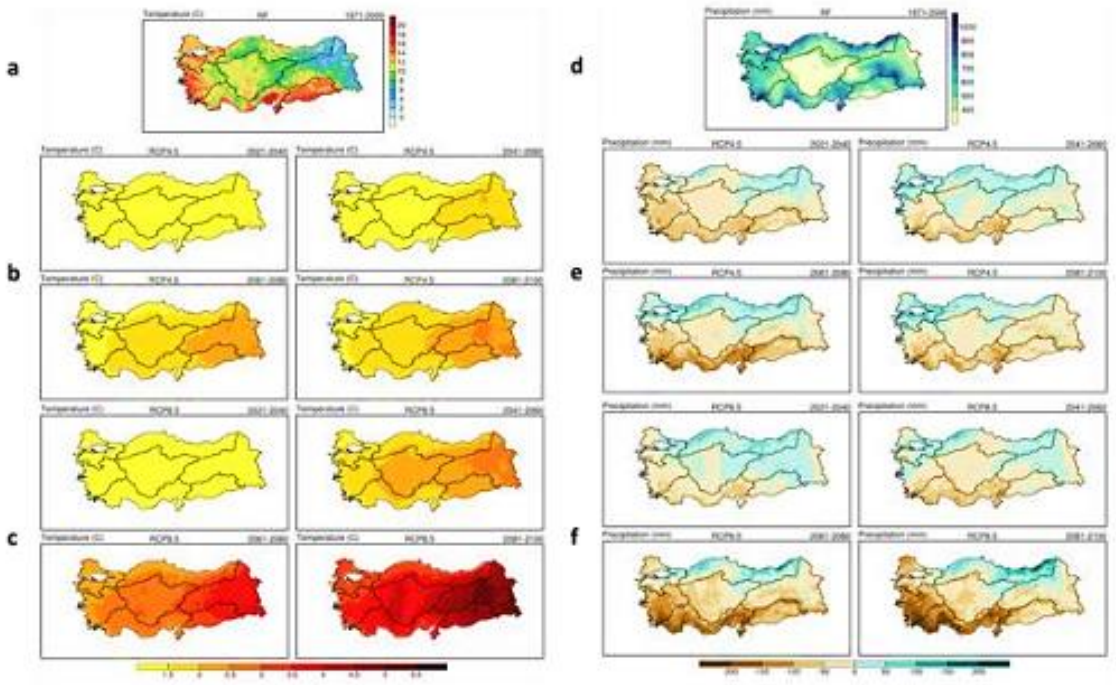


Figure 17. Changes in average temperature and total precipitation in the reference period according to RCP4.5 and RCP8.5
[10]

[10] *Türkiye Sekizinci Ulusal Bildirimi, 2023.*

- In the reference period, average temperatures ranged from 14°C to 19°C along the coastal areas of the Aegean, Mediterranean, and Southeastern Anatolia regions, while the average temperature in the Marmara region was approximately 12°C. In the eastern part of the country, particularly in the highlands of the Eastern Anatolia region, average temperatures dropped as low as 2°C. The highest average temperatures were recorded in the eastern part of the Mediterranean region, reaching up to 20°C (Figure 17-a).
- Projections of temperature changes indicate that temperatures will be higher than the reference period in both the RCP4.5 and RCP8.5 scenarios. The RCP4.5 scenario predicts an increase in average temperatures of approximately 2.5°C in the eastern part of the country and at least 1°C in the rest of the country by the end of the century (Figure 17-b).
- The RCP8.5 scenario projects that the average temperature in Turkey will increase by around 2.5°C by the 2060s and exceed 5°C by the end of the century. According to the RCP8.5 pessimistic scenario, it is estimated that during the 2081-2100 period, the Marmara region will experience a warming of at least 3°C, while the Eastern Anatolia region will see an increase of over 5°C.[11]

In addition to the projections, the current temperature changes have begun to increase the occurrence of disasters in Turkey. In 2022, various regions of the country experienced meteorological disasters of varying intensities. A total of 1,032 meteorological natural disasters were reported in 2022. This year was recorded as the year with the highest number of meteorological disasters during the 1940-2022 period. The meteorological disasters observed in Turkey in 2022 are shown in Figure 18. Among these disasters, the largest share was held by heavy rainfall and floods (33.5%), followed by storms (21.3%) and hail (18.5%).[12]

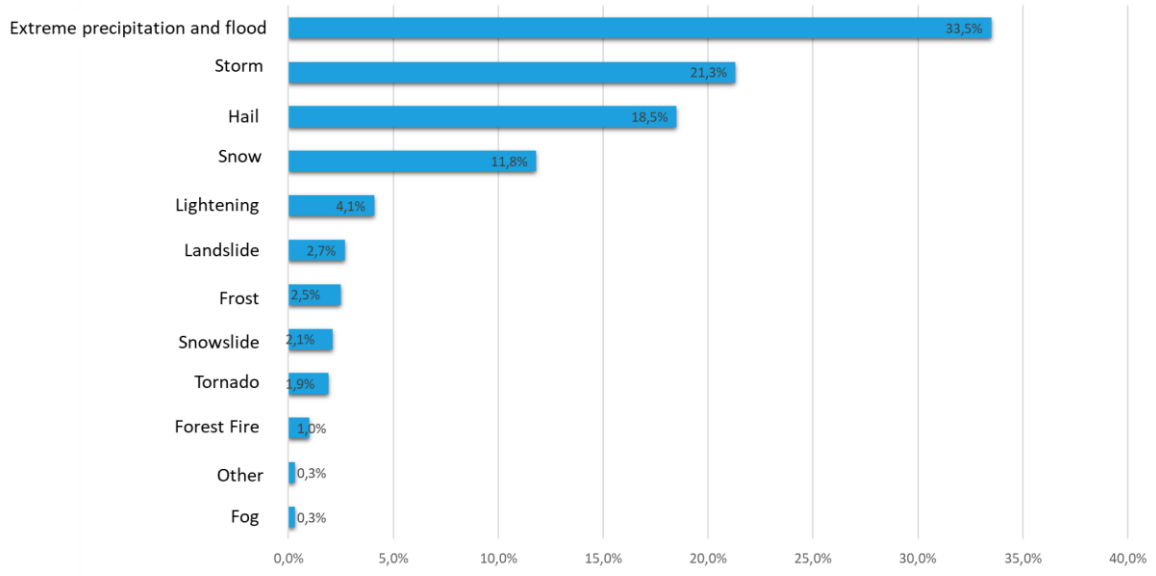


Figure 18. Percentages of occurrence of meteorological disasters in Turkey in 2022

Due to its geological characteristics and climate conditions, Aydın province carries various disaster and emergency risks. Across the province, earthquakes, as well as meteorological and climate-related

[11] *Türkiye Sekizinci Ulusal Bildirimi, 2023.*
[12] *MGM, 2022 Yılı Meteorolojik Afetler Değerlendirmesi, 2023*

disasters such as floods, droughts, and wildfires, frequently occur. As a result, Aydın is considered a high-risk region for disasters.

Temperature Increase

An increase in disasters is expected due to rising temperatures and changes in seasonal norms. When comparing the temperature norms of the Aegean Region, which includes Aydın province, for the period 1991-2020 with the temperatures of April 2024, temperature increases of more than 4 degrees have been recorded in the region [13] (Figure 19).

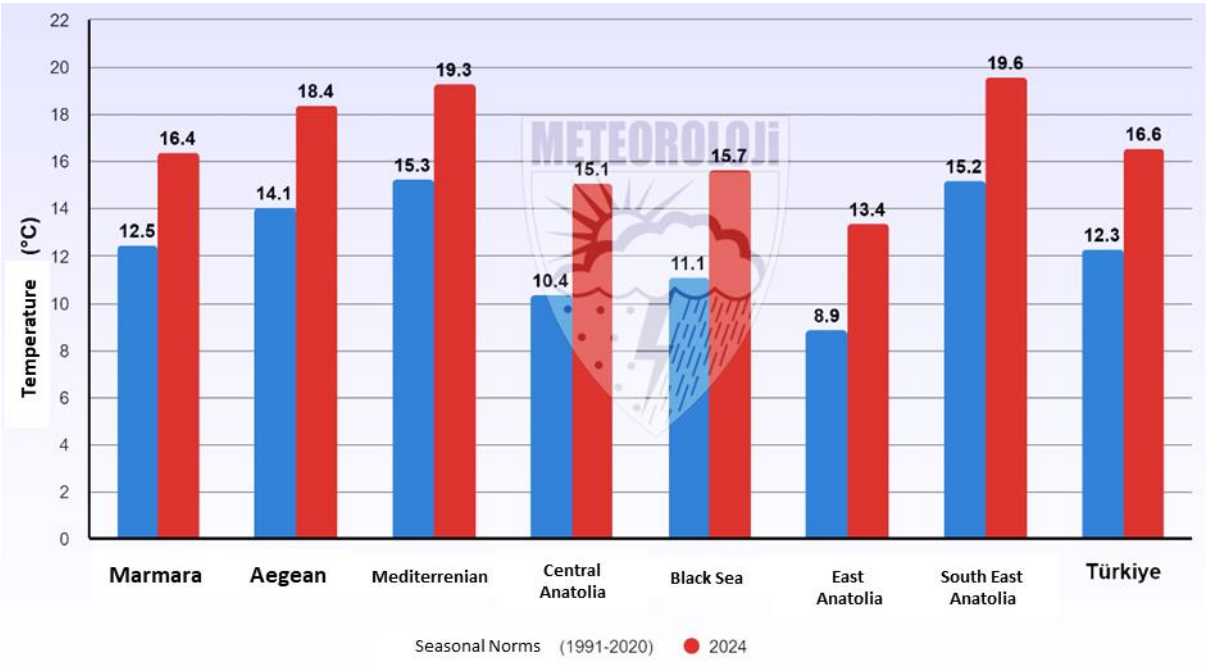


Figure 19. Comparison of 2024 April temperatures with normals (1991-2020)

[13] *MGM, Nisan, 2024 Sıcaklık ve Yağış Değerlendirmesi, 2024*

In climate projection studies conducted by the Turkish State Meteorological Service (MGM) for the 2015-2090 period, it is observed that there will be a significant increase in average temperature values for Aydın province in the coming years (Figure 20).

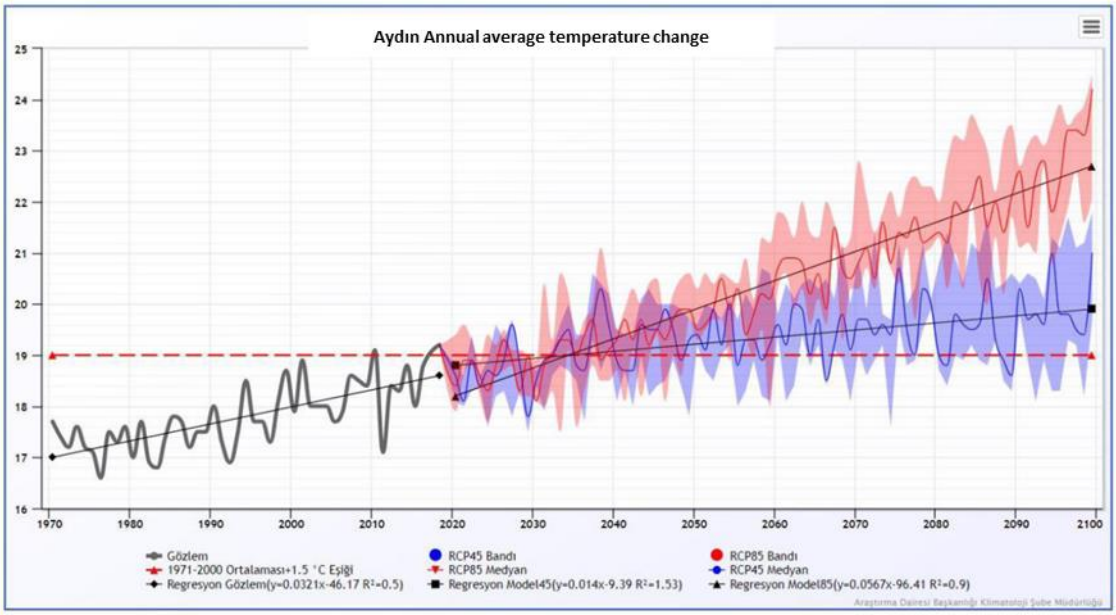


Figure 20. Annual Average Temperature Change [14]

Most recently, in June 2024, heatwaves affected Türkiye. According to meteorological data, the highest temperature in Türkiye was recorded as 46°C in Çileme Village, located in the Menderes district of İzmir. Additionally, in Aydın, temperatures were recorded as 45.2°C in Karpuzlu, 45.1°C in Köşk, 44.7°C in Çine, and 44.4°C in Çine Bahçearası Village. [15] During the same reference period, the April 2024 average temperature difference map for Turkey showed a 4-5 degree increase in Aydın (

Figure 21).

[14] *Aydın, İl Afet Risk Azaltım Planı, 2019*

[15] *Meteoroloji Genel Müdürlüğü, En Yüksek Sıcaklıklar; https://www.mgm.gov.tr/sondurum/en-yuksek-sicakliklar.aspx*

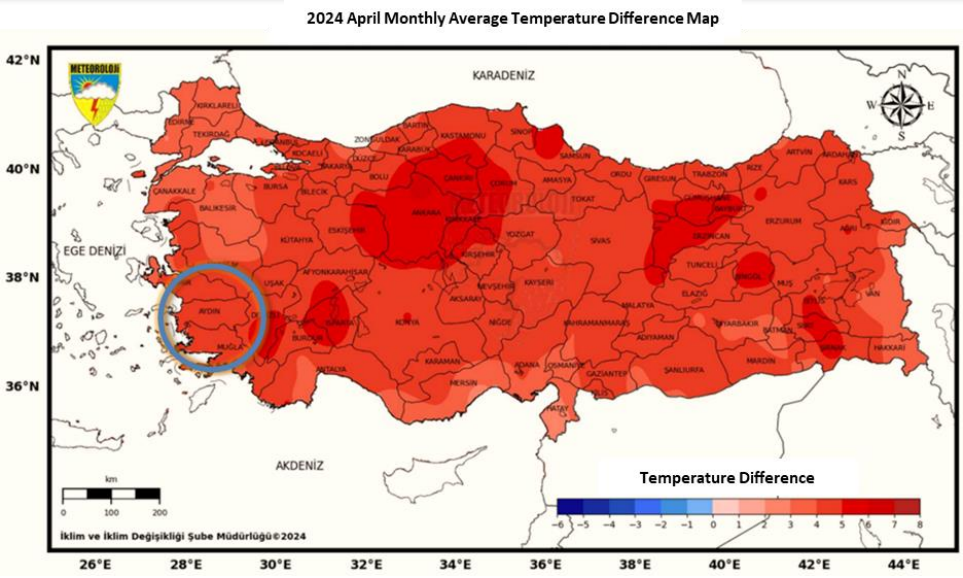


Figure 21. 2024 average temperature differences in April [16]

Heavy Rainfall/Floods and Overflow

In recent years, the largest share of meteorological disasters in Türkiye has been attributed to heavy rainfall and flood events (33.5%).

In the northern part of Aydın province, a limited area is located within the Küçük Menderes and Gediz Basins, while in the south, a very small section belongs to the Western Mediterranean Basin. However, the majority of the province lies within the Lower Büyük Menderes Basin.

Throughout 2019, a total of 499 flood and inundation events occurred in Türkiye. Among these, Samsun ranked first with 81 events, followed by Trabzon with 37 events and Afyonkarahisar with 33. **Aydın** was listed with 1 flood event.[17]

Aydın province is located within the Büyük Menderes Basin, one of Türkiye's largest river basins, which hosts significant agricultural areas, ecosystems, and residential zones.

The drainage area of the Büyük Menderes Basin is 24,976 km². The average annual rainfall is 664.0 mm/m², while the average annual runoff is 2.00 km³. The basin's average annual yield has been determined to be 2.54 l/s/km². [18] When examining the distribution of meteorological disasters in 2022, it is observed that Aydın experienced a minimum of 3 incidents of heavy rainfall/flood events per year.

[16] *MGM, Nisan, 2024 Sıcaklık ve Yağış Değerlendirmesi, 2024*
[17] *AFAD, 2019 Yılı Doğa Kaynaklı Olay İstatistikleri, 2020*
[18] *AFAD, İl Afet Risk Azaltım Planı, 2021*

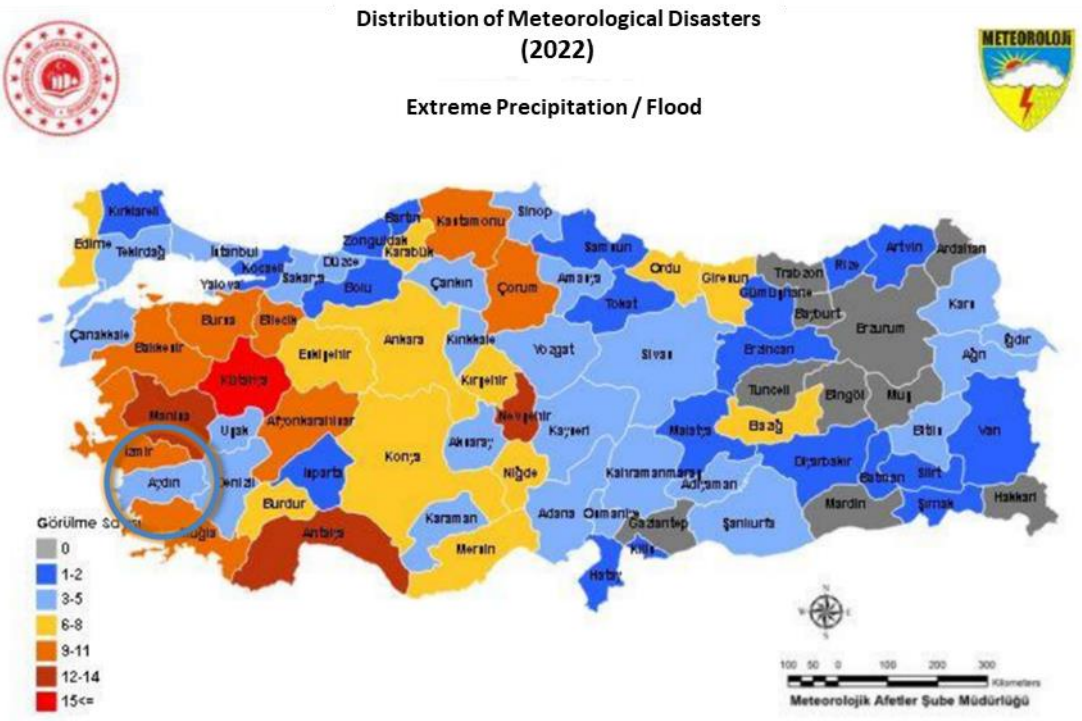
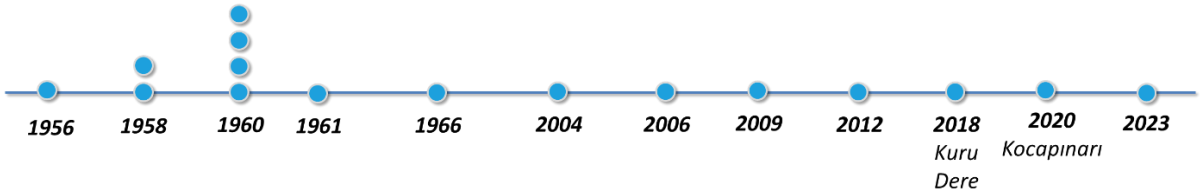


Figure 22. 2022 Turkey Heavy precipitation and flood events distribution map

The district of Çine is a settlement area located around the Çine Stream, one of the branches of the Büyük Menderes Basin. The Çine Stream is fed by various small streams and tributaries, such as the Akçaova Stream, Küçük Menderes Stream, and Kargılı Stream. This stream is an important irrigation source for the surrounding agricultural lands and is used to irrigate olive groves and cotton fields.

Çine is frequently exposed to floods and inundations. According to the information in the Aydın Provincial Disaster Risk Reduction Plan, there have been 15 flood and inundation events between 1956

and 2020. It can be stated that due to changes in rainfall patterns and intense sudden rainfall, these events have occurred periodically, especially after the year 2000.[19]



Finally, in 2023, heavy rainfall in the evening hours in Çine led to flood inundations. Following the overflow of the Kalabak Stream due to the rainfall, many teams mobilized to prevent loss of life and property.[20]

In the Büyük Menderes Basin (Aydın), the neighborhoods at risk of flooding in Çine have been identified as Eskiçine, Kahraman, Evciler, and Merkez.[21]

Drought

Drought is defined as a natural event that occurs when precipitation falls significantly below recorded normal levels, leading to adverse effects on land and water resources and disrupting the hydrological balance. Drought has three distinct types: meteorological, agricultural, and hydrological drought.[22]

The frequency, intensity, and impact level of drought vary according to the existing climatic, topographic, and hydrological characteristics of different regions. The main factors influencing drought in Turkey include atmospheric conditions, physical geography, and climate conditions.

With the effects of climate change, the reduction in precipitation leads to decreased water levels in reservoirs. Due to reasons such as lack of public awareness, population growth, and changes in consumption habits, water resources are diminishing, causing competition among different sectors. This situation adversely affects health, the environment, energy production, agriculture, and the economy.

The agricultural sector, which forms the foundation of Aydın's economic structure, is also evident in the fields of industry and commerce. Approximately 55% of the population earns their livelihood by working in the agricultural sector. Aydın ranks among the top 10 in Turkey for 25 different agricultural

[19] *AFAD, İl Afet Risk Azaltım Planı, 2021*
[20] *www.aydincesurhaber.com/haber/15297657*
[21] *TOB, Küçük Menderes Havzası Taşkın Yönetim Planı, 2019*
[22] *AFAD, 2021*

products, holding a significant position in the country's agriculture. The province is the leading producer of figs, olives, and chestnuts in Turkey, ranks second in cotton and artichoke production, and third in strawberry and okra production.[23]

In Çine, where the economy is based on agriculture and livestock, crops such as wheat, corn (for grain and silage), cotton, peanuts, and rye are cultivated. High-yield crops like apples, chestnuts, pears, and walnuts, along with vegetable and fruit farming, play a significant role in agriculture.

Irrigation needs in agriculture are met through the Topçam Dam and the Akçaova Çatak Irrigation Ponds, as well as electric and diesel pumps located within the plain. Additionally, there are 8,800 olive producers in the district, supported by income assistance, and approximately 4.5 to 5 million olive trees. [24]

The increase in temperature and drought due to climate change has numerous adverse effects on the agricultural sector. Plants that do not receive sufficient water suffer from yield loss, and soil quality deteriorates, increasing the risk of erosion. The reduction in water resources raises irrigation costs and decreases crop diversity, which narrows farmers' income sources. Drought negatively affects forage production, leading to problems in the livestock sector as well. The decline in agricultural productivity results in decreased incomes for farmers and economic losses in other sectors linked to agriculture. Drought leads to a reduction in water resources and makes plants more vulnerable to pests and diseases.

Like all provinces, Aydın has observation stations operated by the General Directorate of Meteorology. Four of these stations are located in Çine, Çine Bahçearası Village, Çine Hacıpaşalar Village, and Çine Kavşit Forest Area.

In the 70 years analyzed, there have been 22 years classified as drought years. Looking at the distribution of drought years: 4 years were classified as Extremely Dry, 1 year as Very Severely Dry, 2 years as Severely Dry, 11 years as Moderately Dry, and 4 years as Lightly Dry. The driest year recorded was 1972. It was observed that 26 years were around Normal, while 22 years were classified as humid. Among the humid years: 4 years were Extremely Humid, 2 years Very Humid, 9 years Moderately Humid, and 7 years Lightly Humid.

According to the evaluations prepared by the General Directorate of Meteorology for the year 2024 using the Standardized Precipitation Index (SPI) method:

- Over a 6-month period, conditions were assessed as severe and moderate drought.

[23] *Aydın İl Tarım ve Orman Müdürlüğü*
https://aydin.tarimorman.gov.tr/Belgeler/Belgeler/Ayd%C4%B1n%20Hakk%C4%B1nda/Genel%20Bilgiler.pdf
[24] *https://www.cine.bel.tr/icerik/tarihce Erişim tarihi: Temmuz 2024*

Over a 12-month period, conditions were assessed as moderate and light drought (Figure 23).

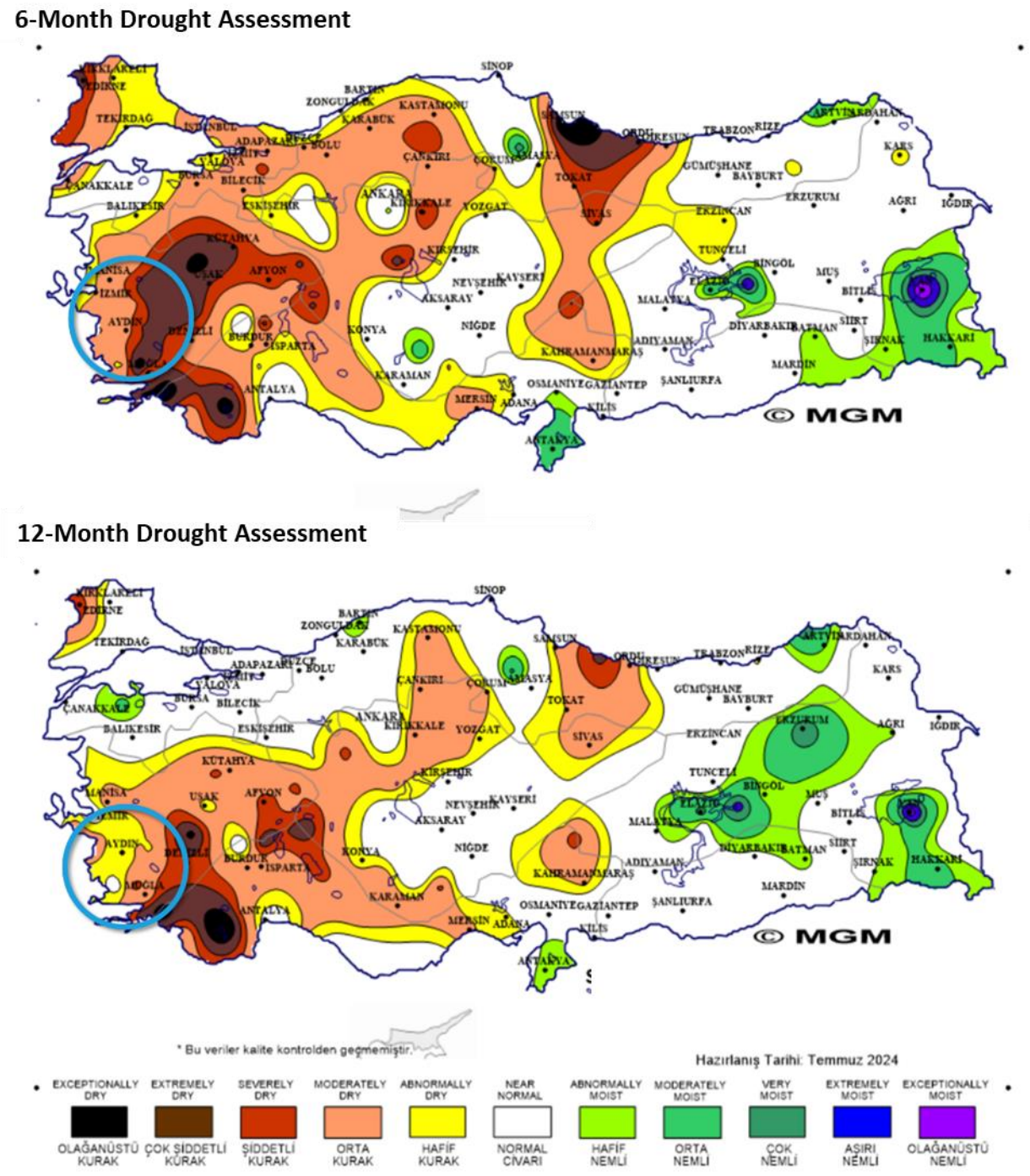


Figure 23. Meteorological drought situation analysis

According to the Business As Usual (BAU) scenario for 2050 in the Water Risk Atlas (AQUEDUCT) developed by the World Resources Institute, the **drough**t risk for Çine is assessed as ***"medium-high"*** [25]. (Figure 24)

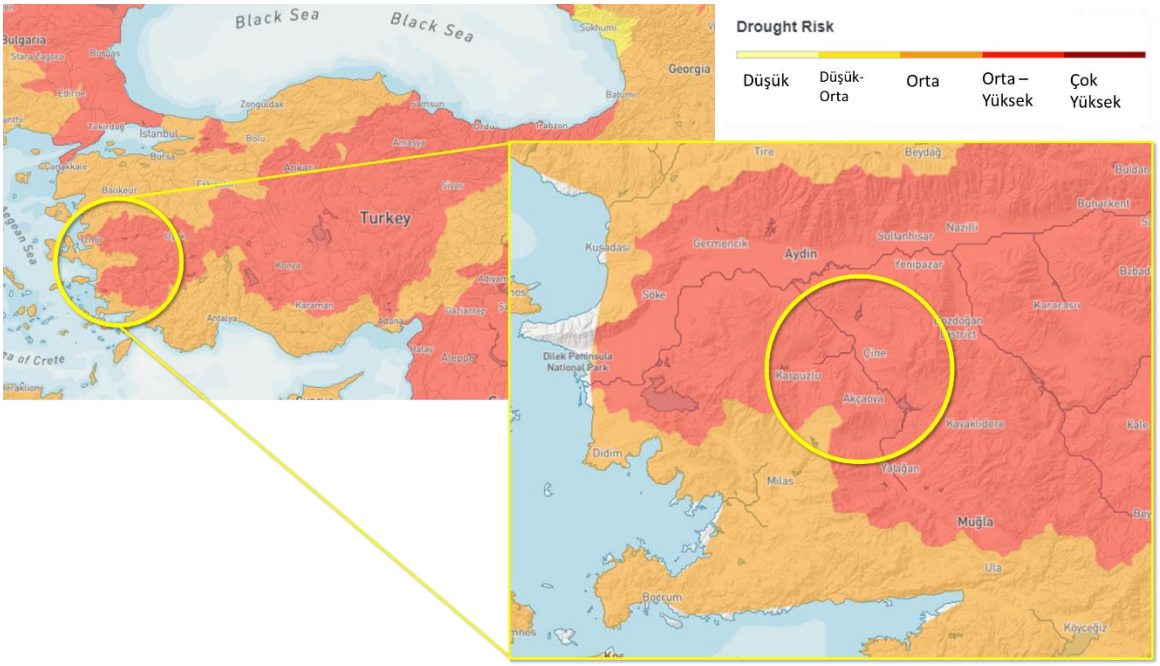


Figure 24. AQUEDUCT drought risk map

Water stress in cities occurs when urban water demand exceeds existing water resources or when those resources become insufficient. This stress can adversely affect the growth and development processes of plants and crops, potentially leading to their death. Additionally, water stress significantly impacts the overall health of ecosystems and agricultural productivity. According to the WRI Water Risk Atlas, Çine's **water stress** is assessed as ***"very high,"*** indicating that water consumption far exceeds the water potential. [26] (Figure 25)

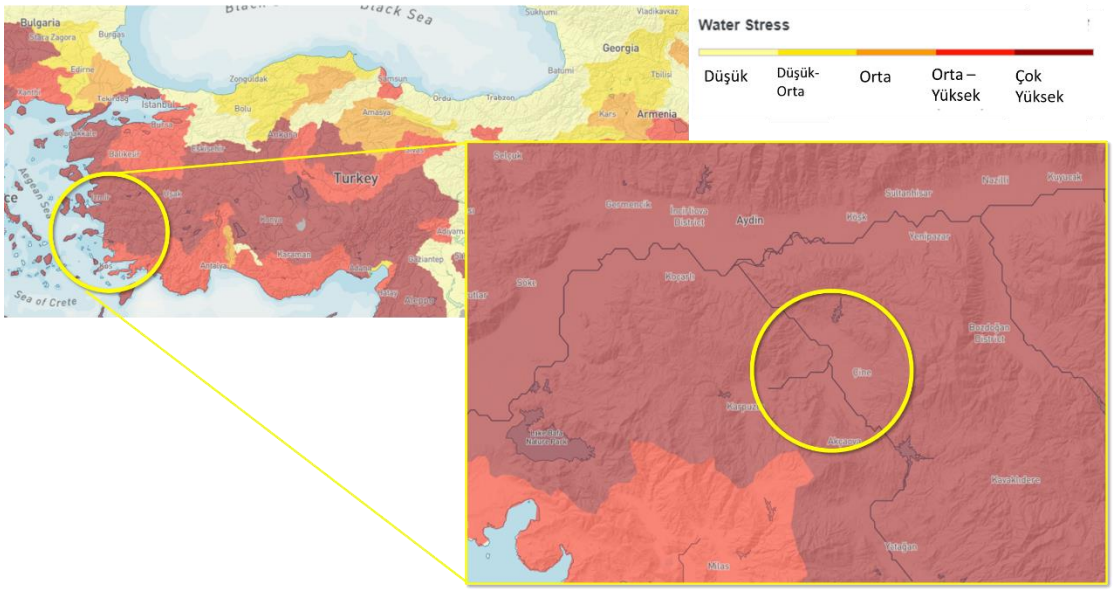


Figure 25. AQUEDUCT drought risk map

[26] https://www.wri.org/applications/aqueduct/water-risk-atlas

Forest Fires

Forest fires are a type of disaster that destroys both living and non-living entities in the forest and tend to spread freely. In recent years, increasing temperatures due to climate change have heightened the frequency, intensity, and spread rate of forest fires.

The region of Aydın is predominantly covered with maquis vegetation, and plants such as olives, figs, and chestnuts can be found in their natural environment. The densest forests are located in the mountains of the Menteşe region in the south. In the forested areas of Aydın, there are tree species such as red pine, black pine, turpentine pine, sandalwood, black alder, spruce, heather, red beech, plane tree, oak, juniper, willow, walnut, and poplar. The districts with the most forested areas in Aydın are Didim, Kuşadası, Efeler, Koçarlı, and ***Çine***.[27]

In Aydın, forest areas have decreased over the years due to various reasons, primarily forest fires (Figure 26). In the last 10 years, 556 fires have occurred in Aydın, damaging an area of 1,214.27 hectares. Of these fires, 18 took place in the district of ***Çine***.[28] Forest fires pose a significant risk, especially for the settlements in the forest villages located in the eastern part of the city, and it is expected that these risks will increase due to rising temperatures.

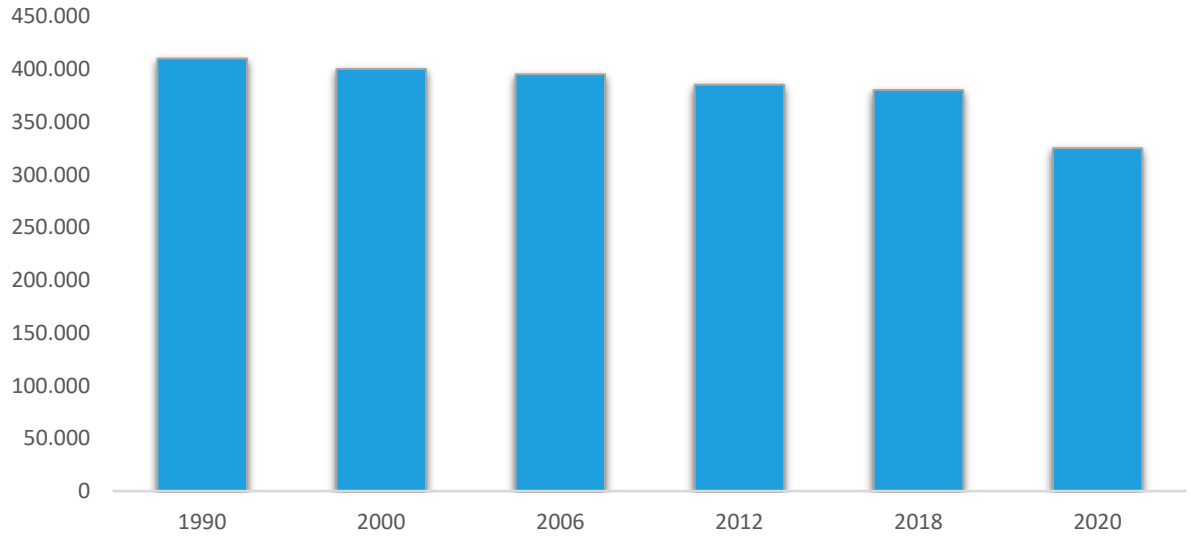


Figure 26. Changes in Aydın Forest Areas by Years

Erosion/Landslide

Climate change significantly increases the risks of erosion and landslides by causing an increase in the intensity and amount of rainfall. Severe and sudden downpours quickly wash away the soil from the surface, eroding it and reducing productivity in agricultural lands. Continuous and heavy rainfall causes the soil to become saturated with water, leading to a loss of stability and resulting in erosion. This situation particularly heightens the risk of landslides on steep terrains.

[27] *AFAD, Aydın İl Afet Risk Azaltma Planı, 2021*
[28] *AFAD, Aydın İl Afet Risk Azaltma Planı, 2021*

When examining the mass movements that have occurred in Aydın province in previous years, 36 landslides have occurred at 47 locations where a Disaster-Affected Area Decision (AMB) has been made, 16 of which have had a significant impact on public life. Fourteen locations associated with these landslides, which pose a risk and are not economically feasible for improvement, have been included in the Disaster-Affected Area (AMB) and closed to settlement. According to the information in the Aydın Provincial Disaster Risk Reduction Plan, landslide events have occurred periodically in the district of ***Çine,*** with the most recent one happening in Alabayır in 2009.[29]

Storms, Tornadoes, and Hail Events

In Turkey, the increase in events such as storms, tornadoes, and hail has begun to cause significant loss of life and property, while also leading to long-term inefficiencies in regions where agricultural activities are concentrated. According to the long-term distribution data from the General Directorate of Meteorology covering 1940-2023, there has been a significant increase in the number of meteorological disasters in recent years. From January 1 to November 30, 2023, the most frequently observed meteorological disaster was heavy rainfall and flooding. The share of heavy rainfall and flooding among all meteorological disasters is 39.6%. In this period, storms ranked second (22.7%), followed by hail in third place (16.9%).

7.2. Socioeconomic Status Assessment

When examining climatic risks, conducting a socioeconomic status assessment is critical for understanding how vulnerable communities are to climate change. Low-income and impoverished communities are more fragile to the negative impacts of climate change due to their limited access to resources, making them less resilient to sudden climate events. Socioeconomic status determines people's access to the resources and services necessary to adapt to climate change; factors such as education, healthcare, infrastructure, and financial resources influence how prepared communities are for climate risks.

Socioeconomic assessments ensure that climate policies and adaptation strategies are designed more fairly and effectively, helping to identify which groups need more assistance and which areas should be prioritized. Additionally, since climate change can deepen existing social and economic inequalities, evaluating socioeconomic status allows for the development of strategies aimed at reducing these inequalities. Different communities with varying socioeconomic conditions require diverse adaptation and resilience strategies against climate change, making it essential to consider socioeconomic status

[29] *AFAD, Aydın İl Afet Risk Azaltma Planı, 2021*

in developing locally appropriate and effective solutions. This assessment facilitates a better understanding of climatic risks and the development of more inclusive, effective, and equitable adaptation strategies. According to the Turkish Statistical Institute, the vulnerable population is defined as "groups that can be described as having a high risk of poverty and social exclusion compared to the general population. These groups include those living in poverty and deprivation, individuals with disabilities, children, youth, women, the elderly, the unemployed, the homeless, and other similar population groups."[30]

According to TÜİK 2023 data, approximately 49.7% of the population of Çine consists of males, while 50.3% comprises females. When looking at the age distribution, the elderly population, which can be considered vulnerable, makes up 20% of the population.

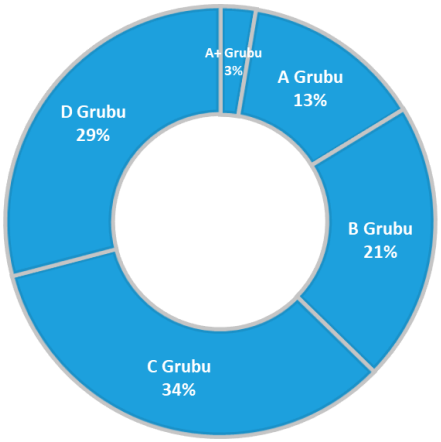


Figure 27. Distribution of the district population according to socio-economic groups

The socioeconomic status groups of the district provide significant information regarding the vulnerabilities of the residents. When examining the distribution of socioeconomic status groups based on influencing parameters such as the effective age group, the proportion of elderly population, land property values, rental prices, education levels, household size, and spending habits, the D Status group can be considered the socioeconomic status group with the most vulnerable households. In Çine, the household-based distribution of socioeconomic status groups shows that Group C is the most prevalent at 34%. The households with D group socioeconomic status, which can be classified as vulnerable populations, constitute 29% of the total, which is above the Aydın average of 23%. Çine is also addressed in the 2014-2023 Regional Plan[31], as a region where the economy is still predominantly based on agriculture or natural resources, and it has not yet diversified away from dependence on a few sectors. The area has not made sufficient progress in industrialization, and it is among the groups that experience youth migration. The population density is 60 people/km² or lower, the population of the district center has been on a declining trend over the past five years, and the elderly dependency ratio is above 20%. In this context, the city's vulnerability to climate change can be considered high.

During the workshops conducted as part of the Çine Sustainable Energy and Climate Action Plan studies, participants were asked, "Considering the social structure of the district, which social groups are most vulnerable to the impacts of climate change?" According to the participants, the groups that

[30] TÜİK, 2015
[31] GEKA, TR32 Düzey 2 Bölgesi Aydın Denizli Muğla Bölge Planı 2014-2023

will be most affected by the issues created by climate change were evaluated as those with chronic illnesses, the elderly, children, and small farmers (Figure 28).

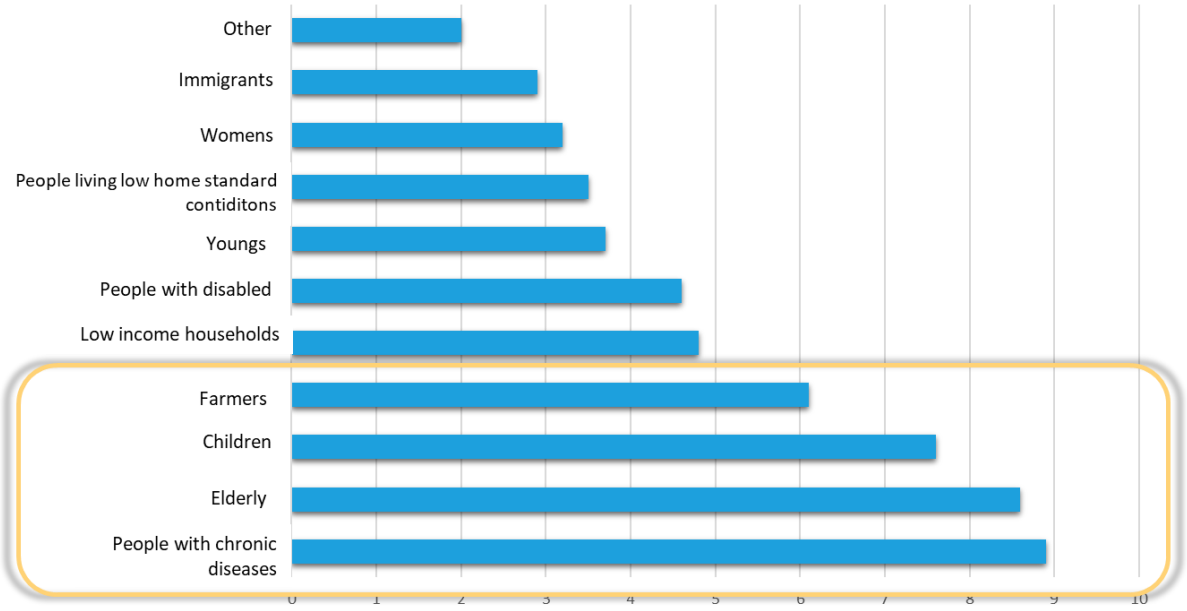


Figure 28. Vulnerable groups most affected by climate change in Çine

7.3. Risk and Vulnerability Assessment

Climatic risk assessments are systematic analyses conducted to understand how a specific region will be affected by climate change. These assessments begin by determining the climate hazards the region faces (e.g., heatwaves, floods, droughts), the level of exposure to these hazards, and how vulnerable the community or ecosystem is to them. By collecting and analyzing data, future climate conditions are predicted using climate models. The results indicate where and how risks are concentrated and form the basis for developing adaptation strategies. Additionally, suitable measures are planned and implemented to reduce risks and increase resilience, considering social, economic, and environmental factors.

Figure 29. Components of the concept of climatic risk

According to the IPCC AR6 (6th Assessment Report), the elements of climate risk are hazard, exposure, and vulnerability (Figure 29). In other words, when vulnerable communities are exposed to a specific hazard, these hazards become climate risks.

According to the identified risks, an assessment is made to determine which groups, sectors, and areas are more vulnerable. Subsequently, based on foundational studies, climate scientists and experts contribute to the integration of ecosystem and economic elements into the plans for resilience. Considering limited resources and competing options, it is essential to identify and prioritize projects for

building resilience. In the final stage, the implementation of the identified actions is ensured, and the impacts of these implementations are monitored regularly.

Considering the geographical and physical characteristics of the district of Çine, the climatic hazards for the city have been identified as extreme weather events such as Temperature Increase/Heat Waves, Urban Heat Island Effect, Extreme Rain/Flooding, Drought, Landslides/Erosion, Forest Fires, and Storms and Tornadoes. Based on the assessments conducted, heat waves, drought, and forest fires have been identified as the most dangerous climatic disasters for Çine. The methodology of Risk = Exposure x Vulnerability, developed by the Intergovernmental Panel on Climate Change (IPCC) and widely accepted, has been employed as a prominent risk assessment approach. This methodology focuses on the two key components of risk: exposure and vulnerability. While exposure refers to the level at which a system is exposed to the effects of climate change, vulnerability indicates the degree to which the system will be adversely affected by these impacts. Accordingly, considering the dominant economic sectors in Çine and their exposure and vulnerability to the prioritized climatic hazards, the sectors at the highest risk have been assessed as Agriculture, Water Resources, Public Health, and Biodiversity, in that order (Figure 30).

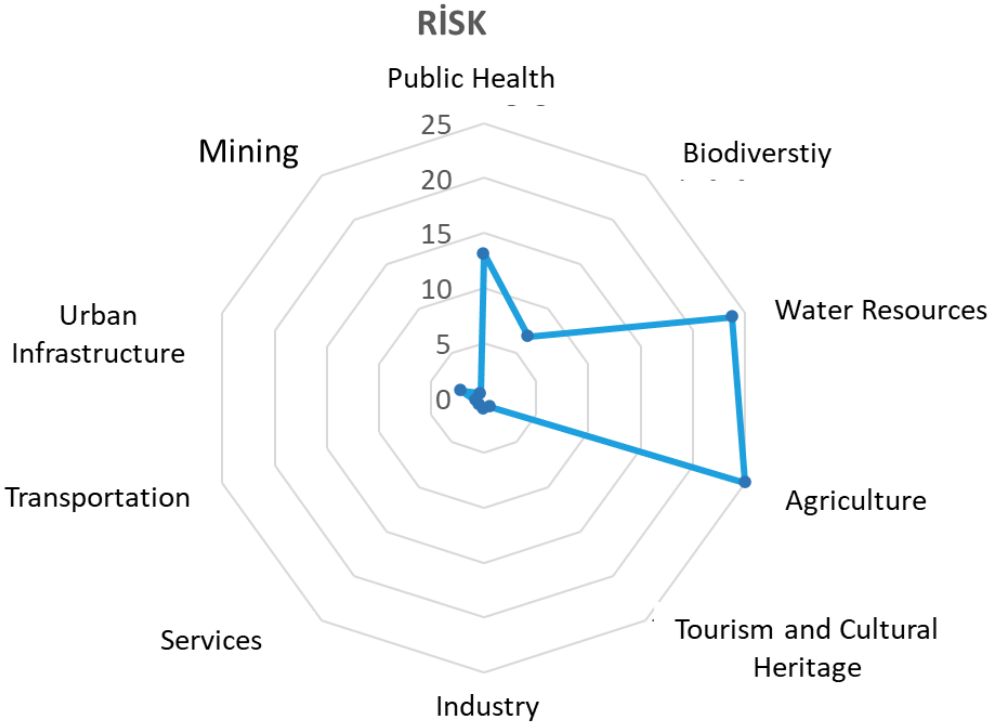


Figure 30. Vulnerability of sectors to climatic risks

8. CLIMATE ADAPTATION ROADMAP

Based on the risk and vulnerability assessments conducted considering climate change projections, as well as the socioeconomic evaluations that are crucial for the adaptation capacity of the district of Çine, adaptation actions have been identified. In the decision-making process for these actions, the stakeholder opinions expressed during the workshops have been taken into account.

8.1. Adaptation Workshop

To enhance Çine's social, economic, and environmental resilience against climate change, it is necessary to identify climate adaptation activities. In this context, the proposed actions for implementation in the district have been categorized and discussed during the Climate Change Adaptation workshop held with the participation of the municipality and relevant internal and external stakeholders.

Figure 31. Adaptation workshop

Participants with expertise in fields such as water management, biodiversity, agriculture, disaster management, and public health were asked to evaluate the importance and feasibility of the proposed actions for Çine.

A) Among the actions evaluated under the title of **water management**, the actions with the highest levels of importance and feasibility are the *Development of Flood Control Systems and the Implementation of Measures to Prevent Water Pollution in Urban Areas and from Industrial Sources.*

B) Among the actions evaluated under the title of **agriculture**, the action with the highest levels of importance and feasibility is Informing Farmers About Climatic Risks and Establishing an Information Communication Network. Additionally, the widespread implementation of early warning systems for resilience against climate disasters, diseases, and their impacts is among the actions with high importance levels.

C) Among the actions evaluated under the title of **biodiversity**, the action with the highest levels of importance and feasibility is the implementation of preventive measures in combating forest fires in the district.

D) Among the actions evaluated under the title of **urban management**, the action with the highest levels of importance and feasibility is the identification of afforestation areas in urban areas. Additionally, increasing the proportion of green spaces, corridors, and shading areas in urban areas is among the actions with high importance levels.

E) Among the actions evaluated under the title of **disaster management**, the action with the highest levels of importance and feasibility is the provision of professional training on climate emergencies to disaster and emergency response teams, along with the development of drills at regular intervals. Additionally, limiting roadside parking opportunities and improving evacuation conditions during emergencies are among the actions with high importance levels.

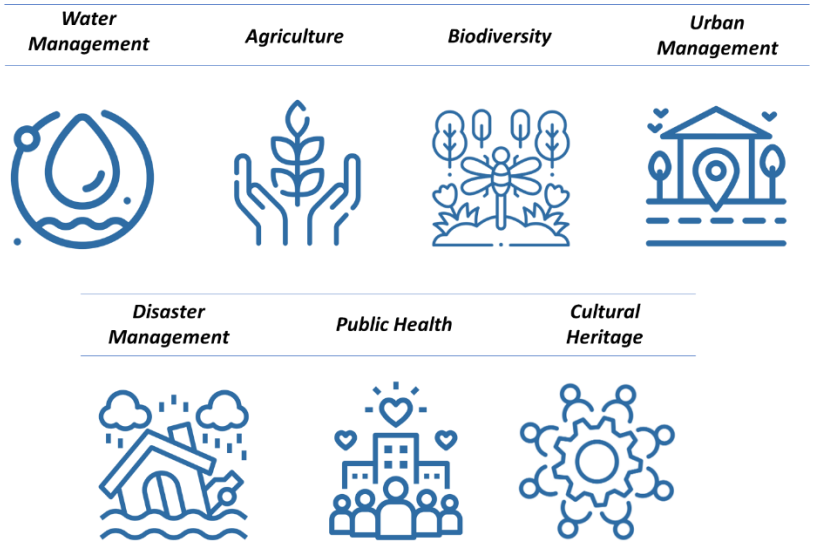
F) Among the actions evaluated under the title of **public health**, the action with the highest levels of importance and feasibility is the information dissemination to citizens to ensure food security against drought risk.

Based on the responses given by the participants regarding the importance and feasibility levels of the actions and the topics discussed during the workshop, adaptation actions to climate change have been identified.

Additionally, the participants were asked, "What are the ***barriers*** to implementing adaptation actions?" They identified the most significant barriers as lack of financial resources and bureaucracy. The high level of public support has been identified as a ***facilitating factor*** in the implementation of adaptation actions.

8.2. Adaptation Actions

The adaptation-related objectives have been identified as Water Management, Agriculture, Biodiversity, Urban Management, Disaster Management, Public Health, and Cultural Heritage.



The actions related to these objectives have been determined to be integrated with national climate change adaptation targets, climate projections, regional plans, the Provincial Disaster Risk Reduction Plan, the Basin Drought Management Plan, and the municipality's strategic plans. The implementation processes of the adaptation actions are comprehensive actions that need to be carried out through collaborative efforts of various public sectors, and coordination and collaboration processes are crucial in this regard. In this context, 33 actions have been identified under 7 main targets for adaptation actions.

Water Management

TARGET 1. Protection and enhancement of water resources

Sub-actions and Steps

- **Action 1.1:** Establishment of water retention and storage systems in urban areas
- **Action 1.2:** Implementation of measures to prevent water pollution originating from urban and industrial areas
- **Action 1.3:** Adoption of additional measures for agricultural irrigation during drought periods; identification, rehabilitation, and restoration of degraded wetlands
- **Action 1.4:** Development of water monitoring and information systems; updating inventories of surface and groundwater resources according to projections; monitoring water quality and levels in areas with sectoral water extraction
- **Action 1.5:** Awareness-raising activities and/or guidelines to inform commercial entities, citizens, and water-consuming sectors about drought and water usage

Action Type	Responsible
Investment (public and private), awareness raising	Çine Municipality
Municilipality's Contribution	**Stakeholders**
Enforcer/encourager	All public institutions, industrial organizations

Timing	Related Climatic Hazards
2024-2026	Drought, water scarcity
Priority Level	**Related Sectors**
💧 💧 💧	Agriculture, water management, health

Agriculture

TARGET 2. Ensuring continuity in agricultural production and food security

Sub-actions and Steps

- **Action 2.1:** Expansion of early warning systems to increase resilience against climate disasters, diseases, and their impacts
- **Action 2.2:** Conservation, support, and promotion of plant species and local breeds with high adaptation capacity
- **Action 2.3:** Informing farmers based on climate risks, establishing an updated and dynamic information network for farmers, and organizing training programs on climate-resilient agriculture
- **Action 2.4:** Providing support to farmers to increase production diversity and quantity
- **Action 2.5:** Establishment of rainwater storage tanks for agricultural irrigation
- **Action 2.6:** Development of special support tools for women farmers, women agricultural workers, and women-focused production cooperatives; prioritizing women farmers and workers in support measures, and enhancing their adaptation capacities with additional support

Action Type	Responsible
Investment (public and private), awareness raising	Provincial Directorate of Agriculture and Forestry, Çine Municipality
Municilipality's Contribution	**Stakeholders**
Implementer/collaborator	Research Institutes, Universities, affiliated to TOB Agricultural Cooperatives, Chambers of Agriculture, Irrigation Associations
Timing	**Related Climatic Hazards**
2024-2026	Drought, extreme heat
Priority Level	**Related Sectors**
	Agriculture, health, biodiversity

Biodiversity

TARGET 3. Protection of forest areas and biodiversity

Sub-actions and Steps

- **Action 3.1:** Identification and reduction of pressure factors threatening biodiversity in the district, such as pollution (air, water, soil, noise, light), biotrafficking, illegal hunting, and invasive alien species
- **Action 3.2:** Implementation of preventive measures to combat forest fires in the district
- **Action 3.3:** Raising public awareness about forest fires, involving citizens in disaster management, and developing necessary improvement recommendations
- **Action 3.4:** Conducting efforts to introduce species less affected by drought into the ecosystem

Action Type

Plan/Strategy

Municilipality's Contribution

Implementer/collaborator

Responsible

Provincial Directorate of Agriculture and Forestry, Çine Municipality

Stakeholders

AFAD, TOB-affiliated Research Institutes, Universities, Chambers of Agriculture

Timing

2024-2026

Priority Level

Related Climatic Hazards

Drought, biodiversity loss, water scarcity, forest fires

Related Sectors

Disaster management, health, environment and biodiversity

URBAN MANAGEMENT

TARGET 4. Increasing the resilience of urban areas against climate change

Sub-actions and Steps

- **Action 4.1:** Increasing the proportion of green spaces, ecological corridors, and shaded areas in urban areas to reduce the urban heat island effect
- **Action 4.2:** Preventing urban sprawl and the misuse of land for purposes outside of designated plans
- **Action 4.3:** Identifying high-risk areas, structures, and infrastructure in urban areas that are vulnerable to climate risks, and mitigating these risks through spatial planning
- **Action 4.4:** Considering new plant species with lower irrigation needs suited to changing climate conditions in park and garden designs, and limiting water-intensive turf applications
- **Action 4.5:** Identifying areas for afforestation in urban settings

Action Type

Plan/Strategy

Municilipality's Contribution

Implementer

Responsible

Çine Municipality

Stakeholders

Aydın Metropolitan Municipality, ÇŞİDB

Timing

2024-2030

Priority Level

Related Climatic Hazards

Extreme temperatures, heat island effect, excessive rainfall/flooding

Related Sectors

Buildings, urban planning, health, environment, biodiversity

Disaster Management

TARGET 5. Increasing resilience against climate-related meteorological disasters

Sub-actions and Steps

- **Action 5.1:** Strengthening public infrastructure and facilities to withstand the projected impacts of climate and disaster risks
- **Action 5.2:** Providing professional training for disaster and emergency response teams on climate emergencies and conducting periodic drills
- **Action 5.3:** Identifying and mapping vulnerable groups
- **Action 5.4:** Designating safe spaces for citizens to take refuge during heatwaves and informing the public about these locations
- **Action 5.5:** Designing hail protection methods (such as early warning systems) for agricultural lands and private properties
- **Action 5.6:** Limiting roadside parking to improve evacuation conditions in emergencies

Action Type	Responsible
Plan/Strategy, awareness raising	Çine Municipality, AFAD
Municilipality's Contribution	**Stakeholders**
Implementer/collaborator	Aydın Metropolitan Municipality, MGM
Timing	**Related Climatic Hazards**
2024-2030	Heavy rains, floods, extreme heat, mass movements
Priority Level	**Related Sectors**
	Urban planning, emergency management, health

Public Health

TARGET 6. Protecting public health against the short and long-term effects of climate change

Sub-actions and Steps

- **Action 6.1:** Coordinating with the Provincial Health Directorate to identify individuals with chronic illnesses at the district level
- **Action 6.2:** Identifying, monitoring, and assessing the impacts and potential risks of current and future climate scenarios on human health at the district level
- **Action 6.3:** Providing information on diseases and prevention methods
- **Action 6.4:** Implementing measures to prevent vector breeding

Action Type	**Responsible**
Plan/Strategy, awareness raising	Çine Municipality, Provincial Health Directorate
Municilipality's Contribution	**Stakeholders**
Implementer/collaborator	Aydin Metropolitan Municipality
Timing	**Related Climatic Hazards**
2024-2026	Heavy rains, floods, extreme heat, mass movements
Priority Level	**Related Sectors**
♥ ♥ ♥	Health

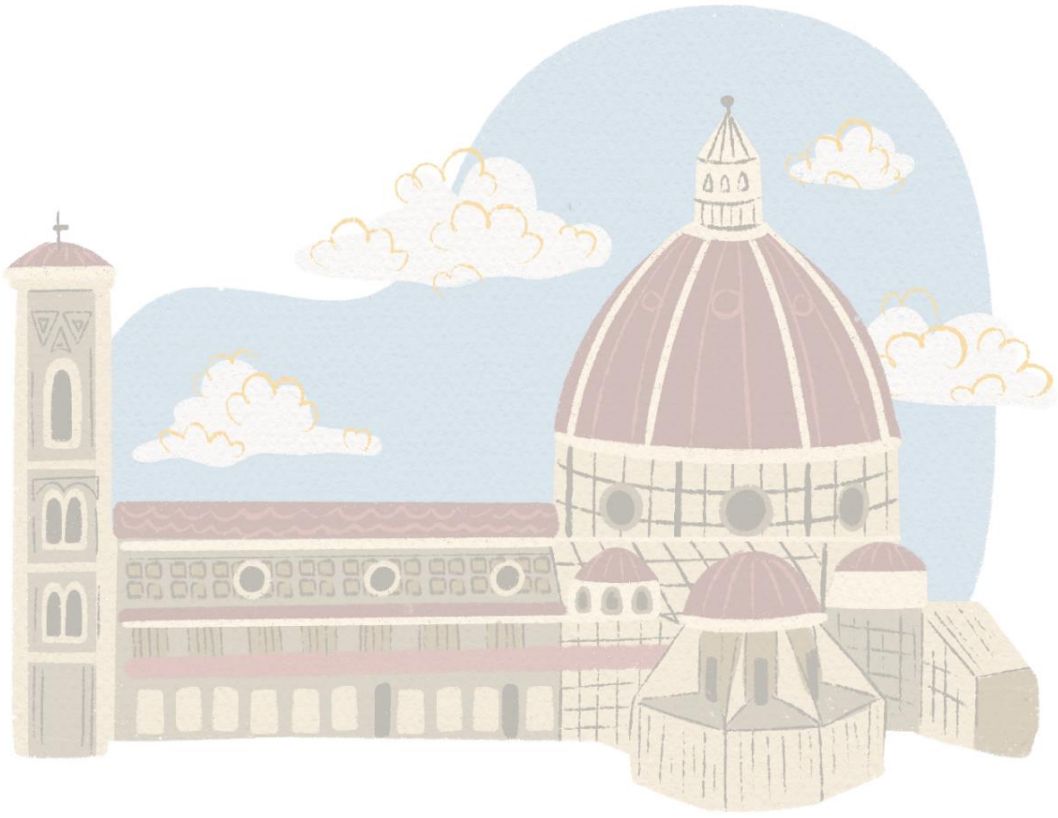
Cultural Heritage

TARGET 7. Increasing the resilience of natural and cultural heritage elements against climate hazards

Sub-actions and Steps

- **Action 7.1:** Determining the vulnerability levels of cultural heritage to climate hazards and establishing protective measures through local and central coordination
- **Action 7.2:** Documenting and registering natural assets, local products, and tangible and intangible cultural heritage at risk of loss due to climate hazards and risks, and promoting suitable ones as tourism products to ensure their sustainability

Action Type	Responsible	Timing
Plan/Strateji	Çine Belediyesi, İl Kültür Turizm Müdürlüğü	2024-2030
Contribution of the Municipality	**Stakeholders**	**Priority Level**
Uygulayıcı/işbirliği yapan	Aydın Büyükşehir Belediyesi	



9. ENERGY POVERTY

Energy poverty is defined as the inability of a household to meet its energy needs and is a complex situation arising from a combination of many factors. This situation includes elements such as the inability of households to access energy for heating and cooling, even if they can access it, the insufficient provision of adequate heating and cooling, and the inability to access energy services at an affordable cost. Additionally, the use of polluting fuels for heating and other basic needs is one of the factors negatively impacting both household health and environmental health.

To understand the complex structure of energy poverty, it is important to present a simplified approach based on three main themes. Commonly identified root causes include low-income levels, low energy-efficient buildings, and high energy prices. When evaluating the energy poverty profile of Çine, inferences have been made regarding households, buildings, and energy consumption.

Use of Polluting Fuels

In the Çine district, approximately 466 households received coal assistance from public institutions in 2023.[32] Additionally, based on assumptions made using the natural gas and electricity consumption data along with the number of households in the district, it is estimated that approximately 8,400 households may continue to use polluting fuels (such as coal) during certain periods.[33] This situation is an important indicator that Çine may have a high risk of energy poverty.

Vulnerable Population DensityThe socioeconomic status groups of the district provide important information about the vulnerabilities of the residents and their assessment of energy poverty. When examining the distribution of socioeconomic status groups based on effective parameters such as active age group, elderly population ratio, property values, rent values, education level, household size, and spending habits, the D Status group can be considered the most vulnerable households. In Çine, the household-based distribution of socioeconomic status groups shows that the C group is the most prevalent (34%). The D group households, which can be considered vulnerable, make up 29% of the population, which is above the Aydın average (23%). This situation can also be seen as another significant indicator that the district may have a high risk of energy poverty.

9.1. Actions

As mentioned above, the assessment of energy poverty encompasses a range of factors such as buildings, energy prices, and income. Approximately 65% of the energy consumed in buildings is used for heating, cooling, hot water, and ventilation systems, while about 20% is spent on lighting. Improving the energy efficiency of existing buildings and constructing new buildings based on energy efficiency principles reduces energy consumption.

The existence of poor households, which cannot meet their energy needs despite having no access issues due to their current income levels, is described as energy poverty. In this context, identifying energy poverty includes various socioeconomic analyses. It is essential to identify households with

[32] Çine Belediyesi'nden elde edilen veriler doğrultusunda hesaplanmıştır.
[33] Çine Belediyesi aracılığıyla enerji dağıtım şirketlerinden elde edilen veriler doğrultusunda hesaplanmıştır.

limited access to energy, those that cannot provide adequate heating/cooling even if they have access, and those that must cope with high energy costs.

Finally, there are various policies and measures that municipalities can implement to combat energy poverty. These actions are shaped by local characteristics, needs, and resources. Accordingly, the action areas for energy poverty in Çine are identified as: *Buildings, Households, and Policies.*

Energy Poverty

ACTION 1. Inventorying the heating systems and current conditions of buildings in Çine

Action Steps

- **Action 1.1.** Analyzing the issues of energy use in existing buildings, their energy efficiency, polluting solid fuels (coal, wood, etc.) for heating purposes.

TARGET 2. Data collection to assess household energy poverty

Action Steps

- **Action 2.1:** Assessing the presence of factors that increase vulnerability, such as household thermal comfort levels, the ratio of energy expenses to total household income, unemployment, and the prevalence of respiratory diseases
- **Action 2.2:** Conducting feasibility studies to analyze these factors through location-based applications in order to develop localized actions for energy-poor and/or at-risk households

ACTION 3. Raising awareness on energy efficiency and renewable energy and providing small-scale application support

Action Steps

- **Action 3.1:** Organizing seminars and workshops to raise public awareness about energy conservation
- **Action 3.2:** Establishing social assistance programs, such as energy subsidies for low-income families or special energy tariffs for low-income groups

Action Type	Responsible	Timing
Plan/Strateji	Çine Belediyesi	2024-2030
Contribution of the Municipality	**Stakeholders**	**Priority Level**
Implementer/collaborator	Aydin Metropolitan Municipality	⚡ ⚡ ⚡

10. IMPLEMENTATION & MONITORING

10.1. Mitigation Action Indicators

Monitoring activities are critical in helping local governments fulfill their commitments to climate change and sustainable energy. The monitoring process involves the regular collection and analysis of data to assess progress towards established goals, evaluate advancements, and identify challenges encountered. These efforts contribute to enhancing the effectiveness of municipalities in combating climate change and continuously improving their policies.

A monitoring plan has been prepared for the indicators to be tracked between 2024 and 2030. In the initial phase, it is recommended to focus on awareness-raising activities in the building sector, promoting the adoption of electric vehicles in the transportation sector, creating route plans to improve the efficiency of waste collection and public transport services, and offering eco-driving training. In the waste sector, the goal is to reduce waste volumes and make processes more efficient.

Table 7. Data that can be monitored for mitigation actions

Action No	Indicator	Unit
Buildings and Renewable Energy		
Action B1.	Note on changes/additions to the sustainability plan	var/yok
	Sustainable urban design guide	var/yok
	Number of new projects aligned with sustainability principles	adet/yıl
Action B2.	Number of buildings transitioned to LED lighting systems	adet/yıl
Action B3.	Rate of implementation of energy-efficient renovations in commercial buildings	%
Action B4.	Share of renewable energy usage in municipal buildings	%
	Number of zero-energy buildings owned by the municipality	units/year
	Share of zero-energy municipal buildings in total municipal buildings	%
Action B5.	Number of awareness and education activities conducted in residential buildings	units/6 months
Action B6.	Number of awareness and education activities conducted in commercial buildings	units/year
Action B7.	Number of residential buildings with insulation	units/year
	Number of residential buildings permitted for green/white roof applications	units/year
	Number of commercial (or residential and commercial) buildings permitted for green/white roof applications	units/year
Action B8.	Number of projects assessed for circular economy	units/year
	Proportion of low carbon emission material usage	%

Action No	Indicator	Unit
Action B9.	Number of streetlights equipped with LED lighting systems	units/year
Action YE1.	Number of residential buildings using renewable energy sources	units/year
	Share of renewable energy use in total energy consumption of residential buildings	%
Action YE2.	Number of residential buildings transitioned to low carbon energy systems	units/year
Transportation		
Action U1.	Number of charging stations powered by renewable energy	units/year
	Number of electric vehicles in the district	units/year
Action U2.	Number of purchased/leased electric passenger vehicles	units/year
	Number of low emission vehicles (electric, hybrid, etc.) used by the municipality	units/year
Action U3.	Time taken for waste collection vehicles to reach the integrated solid waste disposal and energy production facility	hours/day
Action U4.	Number of trainings on eco-driving techniques	units/year
Action U5.	Number of public transport vehicles	units/year
	Number of electric vehicles used in public transport	units/year
Action U6.	Number of awareness and education activities conducted related to public transport	units/6 months
Waste and Wastewater		
Action A1.	Annual waste amount per capita	tonnes/person
	Number of trainings on zero waste	units/year
Action A2.	Annual wastewater amount per capita	m^3/year

10.2. Adaptation Action Indicators

Monitoring climate change adaptation activities at regular intervals is of great importance. This monitoring process allows for the assessment of the success of implementations, necessary improvements to be made, and revisions to be carried out in response to emerging new needs. In cases where there is no data source for adaptation indicators, it is essential to plan the necessary data collection processes and prepare data to support monitoring activities. Below are the indicators developed to track the implementation status of actions identified for climate change adaptation.

Table 8. Data that can be monitored for adaptation actions

ActionNo	Indicator	Unit
Water Management		
Action 1.1	The capacity of established water retention and storage systems	m^3/year

ActionNo	Indicator	Unit
	The amount of rainwater collected annually through water storage systems	m^3/year
Action 1.2	The number of projects implemented for the purpose of improving water quality.	number
	Rate of change in water pollution levels	%
Action 1.3	Water savings during drought periods due to additional irrigation measures taken	%
	The number of restored wetlands and the total area of these wetlands	hectare
Action 1.4	The scope of developed water monitoring and information systems (number of covered regions or population)	number
	The number of regular monitoring reports on water quality and water levels	number/year
Action 1.5	The number of awareness-raising events organized	number
	The number of participants in the awareness-raising events organized	number
	Guides for informing about water consumption	yes/no
Agriculture		
Action 2.1	The number of established early warning systems and the area covered	km²
	The number of villages using the early warning system	number/year
Action 2.2	The number of supported investments	number/year
	The number of protected breeds and plant species	number
	Number of relevant projects	number/year
	Annual growth rate of planting areas for these species and breeds	%
Action 2.3	Number of users of the established information communication network and frequency of updates	number
	Number of training programs organized	number
	Number of participants in the organized training programs	number
Action 2.4	Number of supported farmers	number
	Total support amount (TL)	€
	Annual growth rate (%) in production diversity and quantity	%
Action 2.5	Number of rainwater storage systems established and total storage capacity	m^3
Action 2.6	Number of supported women farmers, workers, and cooperatives	number
	Number of special support programs for women	number
	Number of individuals benefiting from special support programs for women	number/year
Biodiversity		
Action 3.1	Number and type of identified pollution and pressure factor events	number

ActionNo	Indicator	Unit
	Invasive alien species monitoring and management methodology	yes/no
	Number of studies	number
Action 3.2	Length of forest safety strips	km
	Number of preventive measures taken and the forest area covered by these measures	hectare
	Reduction in the number of fires and the affected area size due to preventive measures	%
Action 3.3	Number of awareness-raising activities conducted	number/year
	Number of participants in awareness-raising events and campaigns organized	number/year
Action 3.4	Number of species reintroduced to the ecosystem	number
	Size of the planting areas for reintroduced species	hectare
Urban Management		
Action 4.1	Ratio of green space area to total area	%
	Annual growth rate of green spaces	%
	Number of green corridor/street arrangements	number
	Amount of green space per capita	m^2
Action 4.2	Amount of land opened for new settlement	hectare
	Amount of land identified as being used for purposes other than intended	hectare
Action 4.3	Number and scope of measures taken against identified climate risks (number of building and infrastructure projects)	number/year
Action 4.4	Amount of water used in parks and gardens	m^3
	Identified species	yes/no
Disaster Management		
Action 5.1	Number of strengthened public infrastructure and facilities	number
	Total investment amount spent on strengthening	€
Action 5.2	Number of training programs conducted	number
	Number of participants in training programs conducted	number
	Number of drills	number
Action 5.3	Study conducted to identify vulnerable groups	yes/no
	Number of support programs developed for vulnerable groups	number
	Number of individuals benefiting from these programs	number
Action 5.4	Number of usable shelter areas during heatwaves	number
	Total usable indoor area during heatwaves	m^2
	Percentage of citizens informed about shelter areas	%

ActionNo	Indicator	Unit
Action 5.5	Number of villages using the early warning system	number/year
Action 5.6	Measures taken to limit roadside parking areas	yes/no
Public Health		
Action 6.1	The proportion of individuals with identified chronic illnesses to the total population	%
	The frequency of updates for chronic illness data	number/year
Action 6.2	The number of identified and assessed climate-related health risks	number
	The number of reports and analyses prepared as a result of monitoring and evaluation studies	number
Action 6.3	The number of informational sessions conducted regarding diseases and prevention methods	number
Action 6.4	The number of implementations conducted	number/year
	Vector-borne disease control guide	yes/no
Cultural Heritage		
Action 7.1	The number of cultural heritage assets that have undergone risk assessment against climate hazards	number

10.3. Energy Poverty Indicators

Monitoring energy poverty indicators in sustainable energy and climate action plans is vital for ensuring social justice and inclusivity. Energy poverty refers to the challenges faced by many individuals and communities regarding access to energy, energy security, and sustainable usage. These indicators serve as an important tool for evaluating the impacts of plans, identifying disadvantaged groups, and making policy guidance more effective. Monitoring energy poverty contributes to the development of strategies aimed at reducing economic and social inequalities by taking into account the social dimension of sustainable energy practices. Below are indicators developed to assess energy poverty at specific intervals.

Table 9. Indicators for assessing energy poverty

Indicator	Unit
Climate-Related Indicators	
Frequency of heatwaves	annual average
Frequency of cold waves	annual average
Number of annual heatwave days	number/year
Number of annual cold wave days	number/year
Building-Related Indicators	
Number of dwellings in F + G + H band (EPC) / total number of dwellings	%
Per capita energy consumption / national per capita energy consumption	%

Indicator	Unit
Annual share of renovated buildings	%
Population living in households with leaks, damp, or rot / Total population	%
Percentage of households or individuals experiencing heating problems	%
Percentage of households or individuals experiencing cooling problems	%
Number of households connected to the electrical grid / total number of households	%
Number of individuals or households connected to the gas network / total number of individuals or households	%
Number of buildings with an energy class higher than B / total number of buildings	%
Number of households with heating and cooling systems / total number of households	%
Number of households with central heating systems / total number of households	%
Number of households with central cooling systems / total number of households	%
Low absolute energy consumption	€
Number of households with only fuel oil boilers, wood boilers, or conventional gas boilers / total number of households	%
Average age of buildings	year
Homeownership rate	%
Percentage of households/individuals with access to clean cooking fuels and technologies within municipal boundaries	%
Mobility-Related Indicators	
Population unable to access basic services within 1 hour by walking/bicycling or using public transport / total population	%
Number of individuals living within 1 km of the nearest public transport station / total number of individuals	%
Does local public transportation operate frequently enough to meet the basic needs of the population?	yes/no
Population receiving assistance to pay for public transportation services / total population	%
Socioeconomic Indicators	
Annual average household income	€
Average annual expenditure on energy	€
Ratio of the vulnerable household rate to the total number of households	%
Households with outstanding electricity bills / total households	%
Percentage of individuals unable to keep their homes adequately warm	%
Percentage of individuals unable to keep their homes adequately cool	%
Average electricity price	€
Average gas price	€

Indicator	Unit
Amount spent to support energy poor households or individuals / local GDP	%
Percentage of the population below the poverty line	%
Risk of poverty rate	%
Proportion of households receiving social support	%
Unemployment rate	%
Percentage of the population under 14 years old	%
Percentage of the population aged 65 and over	%
Number of individuals with respiratory diseases and circulatory issues	number
Percentage of individuals with an education level below middle school	%
Indicators Related to Policy and Regulatory Frameworks	
Existence of strategies for addressing energy poverty	yes/no
Existence of regulations for rent control	yes/no
Existence of specific measures related to energy poverty	yes/no
Existence of programs and incentives for homeowners	yes/no
Indicators Related to Participation and Awareness Activities	
Awareness-raising programs for vulnerable individuals	number
Participation and collaboration activities with local stakeholders in the context of energy poverty	number

Action Monitoring

In addition to the indicators mentioned above, an action monitoring table has been prepared to track and evaluate the actions defined for mitigation, adaptation, and energy poverty. This table will systematically monitor the current status of each action, responsible and supporting institutions, completion percentages, and progress status throughout the implementation process of the plan. Thus, it will be possible to observe the degree to which the plan's objectives have been achieved and whether necessary interventions have been made in a timely manner. This table is a critical tool for enhancing the effectiveness of the SECAP and ensuring the achievement of sustainability goals. The municipality and other responsible institutions should regularly update this table to continuously monitor the progress of the actions.

Action Monitoring Table	
Action Number	
Action Name	
Monitoring Period	
Responsible Institution(s)	
Supporting Institution(s)	
Action Current Status	( ) Did not start ( ) In Progress ( ) Completed
Percentage of Action Completion	%..
Planned Activities Related to the Action	
Current Situation at the Beginning of the Action	

11. GENERAL ASSESSMENT

This study conducted for the Çine district aims to identify the city's priorities in greenhouse gas reduction and climate change adaptation. It provides decision-makers with a valuable document that can guide the roadmap to be followed in the future. However, this study symbolizes not an end, but rather a beginning. Following the preparation of climate change action plans, the implementation of the identified actions and the regular monitoring and evaluation of these processes is of great importance.

The implementation of Sustainable Energy and Climate Action Plans requires collaboration across multiple disciplines. One of the biggest challenges that may arise during this process is the lack of collaboration and coordination. Regular data collection related to the established indicators or the establishment of the necessary organizational and technical systems to facilitate this data collection is a priority requirement.

Another significant risk is the insufficient citizen participation or the lack of allocation of adequate financial resources, despite increased public awareness on the subject. Generally, due to the high initial costs of investments, these costs take precedence. However, because the financial gains that can be obtained throughout the life cycle are not sufficiently known, they may be overlooked. Additionally, citizen participation plays a critical role in the dissemination of actions, especially concerning mitigation, adaptation, and energy poverty. At this stage, raising awareness and participatory planning models gain importance.

If there is an increase in examples of good practices and accurate planning regarding other risks, the successful implementation of the Sustainable Energy and Climate Action Plan and the rates of achieving targets will significantly increase.

ANNEX-1 Workshop Participants

Departments in Çine Municipality

Efeler Municipality

Kuşadası Municipality

Aydın Provincial Directorate of Environment and Urban Planning

Çine District Directorate of Agriculture and Forestry

Adnan Menderes University Çine Vocational School

Aydın Chamber of Environmental Engineers

Çine District Forest Management Directorate

TEMA Foundation Çine District Representation

Çine Neighborhood Muhtars

ADM Electricity

ENERYA Aydın

Çine Chamber of Agriculture

Egem Environment

"WE JOIN FORCES FOR THE GREEN FUTURE PROJECT"

"Yeşil Bir Gelecek İçin Güçlerimizi Birleştiriyoruz Projesi"

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