NARLIDERE
BELEDİYESİ

SUSTAINABLE ENERGY AND CLIMATE ACTION PLAN (SECAP)

Narlıdere Municipality

2025

CONTRIBUTORS

This report has been prepared in partnership with Narlıdere Municipality Climate Change and Zero Waste Directorate with the technical support of Central Project Management Agency (CPMA) from Lithuania.

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2025

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PREFACE OF THE MAYOR

As it is known, climate change and environmental threats have become one of the biggest global problems of today. Extreme weather events, depletion of water resources, forest fires, sea level rise and loss of biodiversity are not only concerns about the future, but are now among the problems that require urgent solutions. These threats directly affect our cities, people and natural assets.

As Narlıdere Municipality, we are taking decisive steps to secure the future of Narlıdere, the pearl of Izmir, which has hosted many civilisations over the years, where nature and sea meet, and to leave a healthier city for future generations. Without compromising the principles of sustainable development, we develop comprehensive strategies to protect nature, ensure ecological balance and minimise environmental problems in our district.

In line with these goals, we have become a party to the Global Covenant of Mayors (GCoM) and prepared a Sustainable Energy and Climate Action Plan (SECAP). SECAP will provide a great opportunity to identify the climatic risks of our district, identify our vulnerable points and produce effective solutions, while at the same time, it will be an important guide for us to implement the strategies we have identified to reduce greenhouse gas emissions, increase energy efficiency and minimise environmental impacts.

We work together with our stakeholders to ensure that Narlıdere, the apple of our city's eye with its history, nature, connection with Izmir Bay and cultural heritage, suffers the least environmental impact of the transport and energy sectors; we carry out various activities to promote the use of renewable energy and increase energy efficiency. Within the framework of the concrete steps we have taken to reduce carbon emissions, we have established electric vehicle charging stations at three different points of our district and encouraged environmentally friendly transportation. In addition, we aim to develop solutions at the international level with the cooperation protocol we signed with Lithuania's Trakai Municipality. We see raising awareness as one of the most important steps in this struggle; we implement projects that will raise environmental awareness in our children and raise them as conscious generations.

We would like to thank all our stakeholders, academicians, SECAP project team and MLGP Climate Platform experts who contributed to our efforts to create a city model that reduces carbon footprint and promotes clean and renewable energy sources.

In this journey that we set out on with a management approach that adopts respect for nature and all living things as a principle, our biggest supporter is undoubtedly our neighbours, as always. Let us not forget that building a sustainable future will only be possible with the joint efforts of all the people of Narlıdere. The world we live in is not a legacy of the generations before us, but a trust that we will leave to future generations.

With love and respect

Erman UZUN

Mayor of Narlidere Municipality

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ABBREVIATIONS

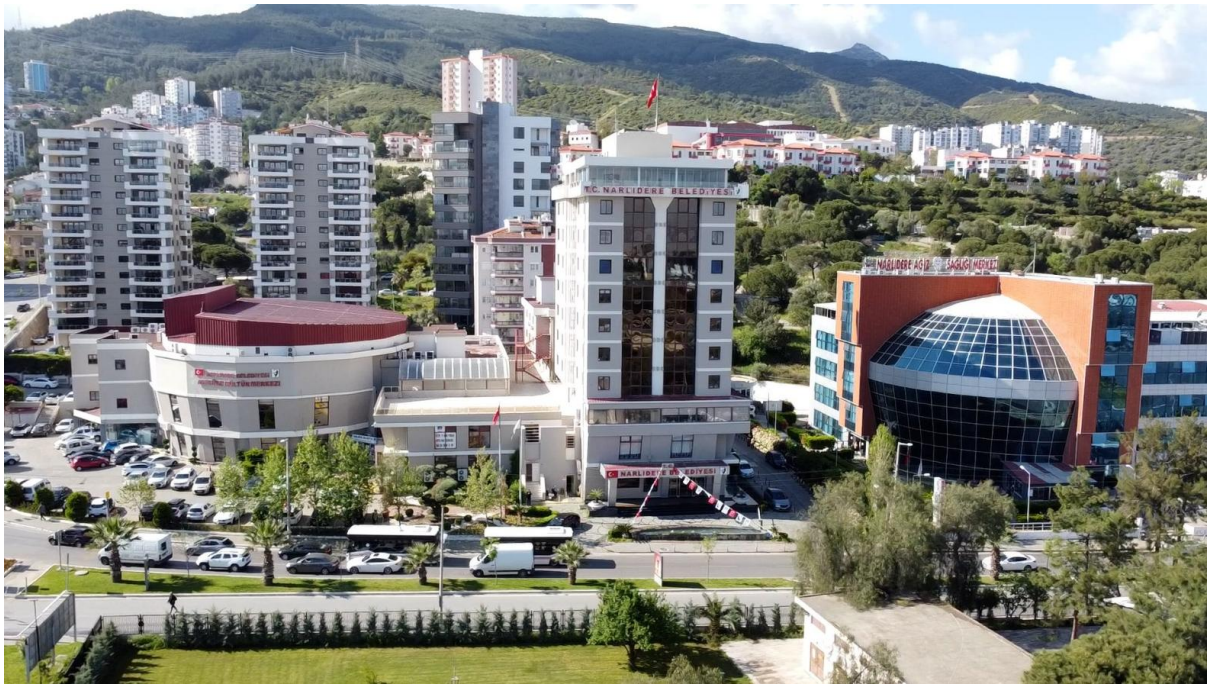
AB	European Union	**IPCC**	Intergovernmental Panel on Climate Change
ADNKS	Address Based Population Registration System	**IZMIRGAZ**	İZMİRGAZ Doğalgaz Dağıtım A.Ş.
BEP	Regulation on Energy Performance in Buildings	**IZSU**	Izmir Water and Sewerage Administration
CBS	Geographic Information System	**JRC**	European Commission Joint Research Centre
CDD	Number of Cooling Days in the Reference Year	**LULC**	Land Use and Land Organisation
CDP-ICLEI	Carbon Disclosure Project and Local Governments for Sustainability	**MEB**	Ministry of National Education
CO_2	Carbon Dioxide	**MEI**	Monitoring Emission Inventory
CO_2e	Carbon Dioxide Equivalent	**MWh**	Megawatt Hour
CoM	Covenant of Mayors for Climate and Energy Initiative	**MWhe**	Billion tonnes of Oil Equivalent
CPMA	Central Project Management Agency	**NDC**	National Contribution Declaration
MOEU	Ministry of Environment, Urbanisation and Climate Change	**NZEB**	Almost Zero Energy Buildings
EPDK	Turkey Energy Market Regulatory Board	**PV**	Photovoltaic
EPS	Energy Performance Contract	**RCPs**	Representative Concentration Paths
ESCO	Energy Service Contract	**SECAP**	Sustainable Energy and Climate Action Plan
MENR	Ministry of Energy and Natural Resources	**STB**	Ministry of Industry and Technology
EU4ETTR	EU4 Energy Transition in the Western Balkans and Turkey	**NGO**	Civil Society Organisation
GCoM	Global Covenant of Mayors for Energy and Climate	**SUMP**	Sustainable Urban Mobility Plan

GDZ	GDZ Electricity Distribution Co.	**TEE**	Basic Emission Inventory
GHG	Greenhouse Gas Emission	**TEP**	Tonnes of Oil Equivalent
GM	General Directorate	**TMGM**	Turkey General Directorate of Meteorology
GPC	Global Protocol for Greenhouse Gas Emission Inventories	**TMMOB**	Union of Chambers of Turkish Engineers and Architects
GDP	Gross Domestic Product	**TOB**	Ministry of Agriculture and Forestry
GWP	Global Warming Potential	**TUIK**	Turkish Statistical Institute
HDD	Number of Heating Days in the Reference Year	**UAB**	Ministry of Transport and Infrastructure
HMI	Heat Reduction Index	**UCLG-MEWA**	United Cities and Local Governments Middle East and West Asia Regional Organisation
HRL	High Resolution Layer	**UHI**	Urban Heat Island
HVAC	Heating, Ventilation and Air Conditioning	**USDA**	United States Department of Agriculture
IBB	Izmir Metropolitan Municipality	**WBCSD**	World Council for Sustainable Development
IEA	International Energy Agency	**WRI**	World Resources Institute
IPA	EU Instrument for Pre-Accession Assistance	**YY (LG)**	Local Governments

EXECUTIVE SUMMARY

With the Industrial Revolution, the use of fossil fuels increased rapidly, leading to an increase in greenhouse gas emissions in the atmosphere. According to the Intergovernmental Panel on Climate Change (IPCC) reports, human activities are 95-100 per cent certain to be the main source of climate change. With increasing fossil fuel consumption, carbon dioxide emissions have risen rapidly, far exceeding the amount that can be absorbed by the oceans and forests that maintain the natural balance. This has caused climate events such as extreme heat waves, sudden and intense rainfall, floods and droughts to become more frequent and severe. From 1850 to 2020, the average global temperature increased by about 1.1°C, and at this rate, the global temperature is expected to rise by up to 3°C by the end of this century. This change poses a major threat to ecosystems and risks causing environmental disasters and mass deaths.

Narlıdere Municipality took an important step to achieve its environmental sustainability goals and became a party to the Global Covenant of Mayors in 2024. Within the framework of this agreement, it has committed to reduce carbon emissions by 40% by 2030. 2023, where the most reliable data can be obtained, was selected as the reference year and a greenhouse gas inventory was prepared over this year. The prepared inventory will form a basis for determining the current environmental conditions and future targets of Narlıdere.



As a result of 2023 based greenhouse gas emission analysis, total greenhouse gas emissions of Narlıdere are calculated as approximately 564.089 MtCO2e. In the distribution of emissions, the stationary energy sector accounts for 85% of the total greenhouse gas emissions of Narlıdere district. Emissions in this sector reach 490,277 $MtCO_2$ e in total. The second important greenhouse gas emission source of Narlıdere district is the transport sector, which causes 85,358 $MtCO_2$ e emissions. This amount constitutes 15% of total emissions.

Within the scope of risk and vulnerability analysis studies, meteorological data and natural disasters experienced in the past years were examined, potential climate hazards for Narlıdere were identified and possible damages that these hazards may cause were analysed. In the risk assessment process, climate events such as **extreme heat, excessive precipitation, floods (river and urban), drought, landslides, forest fires**, etc. specific to the district were addressed; the impacts of these events on Narlıdere's infrastructure, natural environment and socio-economic structure were evaluated. The potential repercussions of the impacts of the identified climate threats on each sector have been comprehensively revealed through sectoral analyses. The risk and vulnerability analyses provide the basis for the development of strategies necessary to cope with possible future hazards by determining the sensitivity and adaptive capacity of Narlıdere to climate change.

Narlıdere Municipality has reached an important milestone in its efforts to combat and adapt to climate change. The analyses and measures taken aim not only to reduce current environmental risks, but also to contribute to the creation of a more sustainable living space for future generations. In this context, Narlıdere's climate action plan is a guide for building strong environmental, economic and social resilience. The strategies identified by the Municipality in line with global targets aim to create positive impacts on both local and global scales.

1.INTRODUCTION

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1.1. Presentation of SECAP and the EU Project for Energy Transition

The Covenant of Mayors (CoM) is an EU-based initiative launched in 2008. In 2015, it was extended as *the Covenant of Mayors for Climate and Energy.* With this transformation, adaptation and energy access were added to the targets of reducing CO_2 emissions by 20% by 2020 and 40% by 2030.

In 2017, the Covenant of Mayors was restructured as the Global Covenant of Mayors (GCoM), a global initiative bringing together the EU Covenant of Mayors and the US Covenant of Mayors.

The Global Covenant of Mayors (GCoM) is an international alliance of cities and local governments promoting voluntary action with the goals of combating climate change and transitioning to a low-emission, resilient society. Local authorities that sign the GCoM and the EU Covenant of Mayors commit to submit a *Sustainable Energy and Climate Action Plan (SECAP*), which sets out their sustainable energy and climate goals. The SECAP is a strategic plan that includes the objectives of the city's energy policy, the actions, measures, timelines and responsibilities set to achieve these objectives.

EU for the Energy Transition: Covenant of Mayors in the Western Balkans and Turkey is co-financed by the European Union and the German Federal Ministry for Economic Cooperation and Development and implemented by the German Society for International Cooperation (GIZ) and the Central Project Management Agency (CPMA). Under this project, municipalities in the Western Balkans and Turkey aim to create cities with access to secure, sustainable and affordable energy, resilience to climate change impacts and low carbon emissions.

In line with the European Union's 2030 CO_2 reduction target of 40% or more, it is planned to reduce emissions and increase climate resilience in cities. This vision will be in line with the goals of clean energy transition, reduction of greenhouse gas emissions and cleaner air in the urban context.

Narlıdere Municipality Strategic Action Plan has been published by Narlıdere Municipality for the period 2025-2029. This plan summarises the steps to be taken for the city in line with the main objectives and strategies aimed at combating climate change.

The Sustainable Energy and Climate Action Plan (SECAP), which is being prepared by Narlıdere Municipality, is designed as a supporting document to the Strategic Action Plan and focuses on measures to be taken especially in areas such as transport, buildings and facilities belonging to Narlıdere Municipality. SECAP develops actions for sustainable energy use and combating climate change specific to Narlıdere, and in this process, it shapes the targets determined by greenhouse gas emission inventory, risk and vulnerability assessment in accordance with local conditions. The targets are designed to be compatible with the existing capacity, activities and legal obligations of Narlıdere Municipality.

This agreement is an important initiative that brings together thousands of cities and regions that have voluntarily adopted climate and energy targets. Shaped by the power of a multi-stakeholder movement, this initiative brings together local and regional authorities with technical and methodological support provided by specialised offices and initiates an effective cooperation process. Participating cities and regions voluntarily contribute to the achievement of regional or national targets set within the framework of sustainability and are subject to an oversight process by preparing sustainable energy action plans. In line with a common vision for the year 2053, these cities and regions that have signed the Convention are working in cooperation with local, state and central governments;

- Accelerate the decarbonisation process of their regions,
- Strengthen the capacity to adapt to the inevitable impacts of climate change,
- It aims to ensure that its citizens have access to secure, sustainable and accessible energy.

Within the framework of the Memorandum of Understanding signed in 2024, Narlıdere Municipality (NB) has received support through the Project in the SECAP preparation process in line with the requirements of the Convention of Mayors (CPMA) and the Global Covenant of Mayors (GCoM). In this process, the report, which is planned to be completed by Narlıdere Municipality in 2025, will be an important step towards achieving these objectives.

1.2. Main Objectives and Targets within the Scope of SECAP

Narlıdere Municipality has voluntarily committed to reduce greenhouse gas emissions and increase the city's resilience to climate change by signing the Global Covenant of Mayors. The targets set in this context are as follows:

Reducing Carbon Emissions: Narlıdere Municipality aims to reduce the carbon emissions of the district by 40% by 2030. In line with this goal, energy efficiency will be increased throughout the district, greenhouse gas emissions will be minimised and the share of renewable energy sources will be increased instead of fossil fuel use. Environmental impact will be minimised through innovative energy solutions and green technology investments.

Resilience to Climate Change: Increasing Narlıdere's resilience to climate change is one of the main objectives. It is planned to harmonise the infrastructure and social structure with climate change, minimise risks and create a more resilient city structure against crisis situations. In this process, the natural and built environment of the city will be adapted to climatic changes.

Sustainable and Accessible Energy: Narlıdere aims to increase access to affordable and reliable energy through sustainable energy solutions and effective energy management strategies. Energy efficiency projects will be implemented, renewable energy investments will be encouraged and smart energy management systems will be implemented. In this way, all Narlıdere residents will benefit from sustainable and accessible energy sources.

SECAP constitutes the cornerstones of Narlıdere Municipality's energy policies and defines the actions and measures determined to achieve these goals in line with the responsibilities. In the report, it is envisaged that sustainable energy and climate action plans will be concentrated in the following sectors:

- **Built Environment:** The design of new and renovation of existing buildings will be carried out in accordance with the principles of energy efficiency and environmental sustainability. Insulation, energy-efficient materials and integration of renewable energy will be among the priorities in this area.

- **Municipally Owned Infrastructure:** Infrastructure projects managed by the municipality will be equipped with technologies such as energy-saving central heating systems, public lighting solutions and smart grids. These infrastructures will aim to reduce carbon emissions and increase energy efficiency.

- **Land Use and Urban Planning:** In urban planning, green areas will be increased, sustainable transport networks will be strengthened and energy efficient construction models will be adopted. With smart city planning strategies, more efficient use of resources will be targeted.

- **Public and Private Transport Policies and Urban Mobility:** Sustainable transport policies such as encouraging the use of electric and low emission vehicles, increasing bicycle lanes and pedestrianisation projects will be implemented. In this way, transport in Narlıdere will become more environmentally friendly and accessible.

- **Decentralised Renewable Energy Sources:** The use of renewable energy sources such as solar and wind will be encouraged in individual and collective energy production. Local energy production will be supported with off-grid energy solutions and Narlıdere's energy independence will be increased.

- **Waste Management and Environment:** The amount of waste will be reduced and environmental impacts will be minimised through practices such as waste recycling, composting projects and energy recovery. In addition, zero waste policies will be implemented and innovative solutions will be developed in waste management.

- **Smart Energy Movement:** Citizens, businesses and consumers in Narlıdere will be raised awareness on energy saving and renewable energy use. Energy efficiency will be increased and sustainable energy use will be popularised through smart energy management systems and digital solutions.

- **Citizen and Civil Society Participation:** Active participation of all segments of the society in climate action plans will be encouraged. Community support will be increased through training programmes, awareness raising campaigns and cooperation projects, and environmental awareness of individuals will be strengthened.

2.GENERAL OVERVIEW OF NARLIDERE

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2.1. About Narlidere

Narlıdere is a district of Izmir province in the west of the Aegean Region. Located approximately 11 km from Izmir city centre, Narlıdere attracts attention with its proximity to the city and its natural beauties. Narlıdere, one of the medium-sized districts of Izmir in terms of population, has been a rapidly developing settlement in recent years. The total population of the district in 2023 is 62,148.

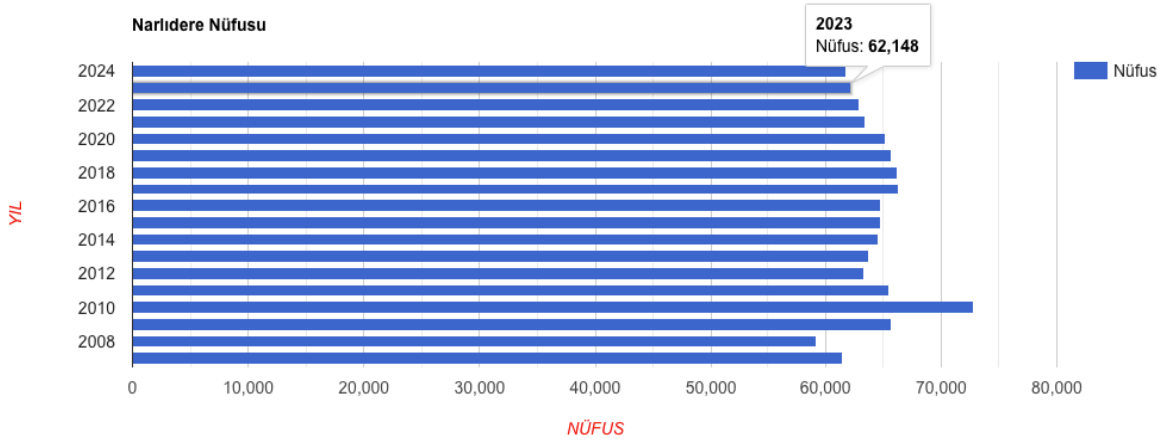
The district stands out with its historical texture and cultural richness. Within the borders of the district, there are important facilities such as the world's second largest nursing home and a 5-star touristic hotel. Narlıdere, which has both sea and mountain views, is also preferred for thermal tourism as one of the important residential areas of Izmir. There are various social facilities and recreational areas along the coast. Narlıdere is also an attractive location with its proximity to Izmir's transport network.

In addition to mountainous areas, Narlıdere's territory also includes wide plains along the coast. Surrounded by forested areas, the region experiences hot and dry summers and mild winters under the influence of the Aegean climate. Although Narlıdere is less developed in terms of industry, the trade and tourism sector has an important place in the economy of the district. Agricultural activities are carried out in the region, albeit to a lesser extent. Of the district's surface area, 20 per cent is residential area, 10 per cent is agricultural land, and 70 per cent is nursery, shrubland and woodland. The total surface area of Narlıdere is 43.9 km². Although there are no important rivers in Narlıdere, Ilıca and Alionbaşı streams and their tributaries flow into the Gulf of Izmir. In the district, which is located in an area determined as risky in the Earthquake Risk Map of Izmir, the Municipality aims to provide a safe living space by attaching great importance to infrastructure and construction works.

2.2. Population

According to the census results of the Address Based Population Registration System (ABPRS) prepared by the Turkish Statistical Institute (TURKSTAT), the population of Narlıdere is 62,148 in 2023. The population decreased by 775 people compared to the previous year's data. The 2023 population distribution consists of 30.270 males and 31.878 females. Considering the area, there are 141 people per km in Narlıdere province. The population development of Narlıdere province for the last 5 (2019-2023) years is given in Table 2.1.

Table 2.1 Narlidere Population (2007 - 2024)



2.3. Climate

The Aegean Region climate, which is a Mediterranean climate, is observed in the region. The summers are hot and dry and the winters are mild and mild. The average temperature varies between 8ºC and 19ºC between October and April. The lowest temperature is -8.2ºC in January. The highest temperature is recorded in July with 43.2ºC.

The data required for the study of regional meteorological characteristics were obtained from Izmir State Meteorological Observatory. Based on these data, the average height of regional precipitation is 712,1mm/year. The months with the highest precipitation are December 145,9mm, January 134,8mm and February 102,4mm, and the months with the lowest precipitation are July 4,1mm and August 6,6mm. The rainy period, which generally starts in October, transitions to a dry period starting in May and lasting until the end of September.

In the monthly temperature distribution; it is observed that the temperature decreases from September to February and the temperature starts to increase as of March. According to the average of the temperature values recorded from Izmir State Observatory, the coldest months are January 8.8$^{(o)}$ C, February 9.6$^{(o)}$ C; the hottest months are June 25.4$^{(o)}$ C, July 28$^{(o)}$ Cand August 27.7$^{(o)}$ C.

2.4. Ecosystem and Biodiversity

Narlıdere is a district with a very rich ecosystem and biodiversity thanks to its natural structure and climate. Under the influence of the Aegean Climate, the region shows diversity in terms of both land and marine ecosystems.

Vegetation Cover: The surface of Narlıdere is largely covered with forested areas. 70% of the district consists of nursery, scrub and forest areas. These areas are home to maquis and forest ecosystems harbouring species such as olive trees, pine, oak and red pine. Especially in mountainous areas, plants typical of the Mediterranean climate and endemic species are commonly found. This enriches the biodiversity of the region and offers natural habitats.

Animal Diversity: Narlıdere's biodiversity ranges from birds to mammals. Forested and mountainous areas in the district are important habitats for wild animals. Olive groves and forests are home to mammals such as wild boars, rabbits, hedgehogs and squirrels, as well as many bird species. The region is also home to various insect, reptile and amphibian species in all seasons.

Marine Ecosystem: Narlıdere, as a seaside district, also has a marine ecosystem. Small streams flowing into the Gulf of Izmir are important for the vitality of the marine ecosystem.

Fish diversity is high along the coast. Narlıdere's coastline plays a critical role in terms of diversity in the marine ecosystem. In addition, the natural areas along the coast form transitional ecosystems between the sea and the land.

Threats and Protection Activities

Narlıdere's biodiversity is facing various threats such as human activities, climate change and habitat loss. For this reason, various studies are carried out to protect biodiversity in the region. These efforts include;

Creation of Protection Areas: Various protection plans are created for the protection of agricultural and forest areas.

2.5. Tourism and Culture

The cultural and touristic riches offered by Narlıdere allow the district to attract more visitors every year.

Culture:

Narlıdere Historical Cemevi-Kültürevi: Narlıdere Culture House, known as the Historical Cemevi, was built in 1874. In 2007, it was restored and started to serve as a museum and cultural centre.

Narlıdere Cemevi: An important place for the Alevi community, this building is a centre for both religious worship and cultural activities.

- **Yukarıköy**: With the restoration works carried out in Yukarıköy, which is located within the urban protected area of Narlıdere and is the first settlement area of the wooden flames, the village has become the centre of attraction of the district.

- **Atatürk Culture Centre:** The centre, which hosts cultural events such as concerts, exhibitions, theatre performances and seminars held in the district, makes important contributions to the artistic life of Narlıdere.
- **Thermal Tourism:** The 5-star Kaya Thermal Hotel in Narlıdere has a great importance in terms of health and thermal tourism and welcomes thousands of visitors every year.
- **Nature Tourism:** The natural and forested areas around Çatalkaya Mountain are suitable for activities such as nature walks, cycling tours, camping and photography.

2.6. Industry and Trade

Narlıdere has a rapidly developing potential in the field of trade and industry. The economy of the district is largely a combination of the service sector, construction, automotive sector and trade. While its proximity to Izmir city centre makes Narlıdere an attractive location for trade, diversification in the field of industry has also gained momentum with increasing investments and developments in recent years.

The industrial sector, in which small and medium-sized enterprises operate in the district, is particularly concentrated in the automotive sub-industry, textile and food sectors. In the small industrial site in Narlıdere, there are 71 enterprises serving in the automotive sector and these enterprises produce for the local market. This industrial site is one of the important building blocks of the district in the field of industry.

Commercial life is largely shaped around the construction sector and real estate investments. Housing projects and increasing commercial areas accelerate the economic growth in the district, which in turn expands the trade volume of Narlıdere. In addition, the retail sector in the district creates a vibrant trade environment with markets, shopping centres and artisan businesses. Cafes, restaurants and touristic establishments in the coastal area contribute to the economy of the district by benefiting from the tourism potential of Narlıdere.

There are 3,217 workplaces in the district. The workplaces in the district are legally classified in 21 different categories in terms of field of activity and the highest number of 857 workplaces with a rate of 26.64% is "Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles". The distribution of these workplaces is given in Table 2.2 below.

Table 2.2 Distribution of Enterprises Registered in Narlidere District

FAALİYET ALANI	MÜKELLEF SAYISI	YÜZDE ORANI
BİLGİ VE İLETİŞİM	68	2,11%
EĞİTİM	91	2,83%
ELEKTRİK, GAZ, BUHAR VE İKLİMLENDİRME ÜRETİMİ VE DAĞITIMI	6	0,19%
FİNANS VE SİGORTA FAALİYETLERİ	37	1,15%
GAYRİMENKUL FAALİYETLERİ	251	7,80%
HANEHALKLARININ İŞVERENLER OLARAK FAALİYETLERİ; HANEHALKLARI TARAFINDAN KENDİ KULLANIMLARINA YÖNELİK	2	0,06%
TARIM, ORMANCILIK VE BALIKÇILIK	11	0,34%
İMALAT	139	4,32%
İNŞAAT	363	11,28%
DİĞER HİZMET FAALİYETLERİ	304	9,45%
İDARİ VE DESTEK HİZMET FAALİYETLERİ	89	2,77%
İNSAN SAĞLIĞI VE SOSYAL HİZMET FAALİYETLERİ	142	4,41%
KAMU YÖNETİMİ VE SAVUNMA; ZORUNLU SOSYAL GÜVENLİK	7	0,22%
KONAKLAMA VE YİYECEK HİZMETİ FAALİYETLERİ	265	8,24%
KÜLTÜR, SANAT, EĞLENCE, DİNLENCE VE SPOR	47	1,46%
MADENCİLİK VE TAŞ OCAKÇILIĞI	3	0,09%
MESLEKİ, BİLİMSEL VE TEKNİK FAALİYETLER	240	7,46%
SU TEMİNİ; KANALİZASYON, ATIK YÖNETİMİ VE İYİLEŞTİRME FAALİYETLERİ	6	0,19%
TOPTAN VE PERAKENDE TİCARET; MOTORLU KARA TAŞITLARININ VE MOTOSİKLETLERİN ONARIMI	857	26,64%
ULAŞTIRMA VE DEPOLAMA	265	8,24%
BELİRSİZ	24	0,75%
TOPLAM	3217	100,00%

3.INTRODUCTION TO NARLIDERE MUNICIPALITY'S CLIMATE STUDIES

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3.1. National and International Framework

Turkey aims to achieve its sustainable development goals by taking important steps in the field of energy efficiency and combating climate change. In this process, the Ministry of Energy and Natural Resources (MENR) and the Climate Change Directorate under the Ministry of Environment, Urbanisation and Climate Change (MoEUCC) stand out as leading institutions. MENR is in charge of preparing energy efficiency strategies, legislative studies and action plans, monitoring practices and taking remedial measures. The Directorate of Climate Change is responsible for developing policies and strategies at national and international level, managing negotiation processes and ensuring inter-institutional coordination in line with Turkey's 2053 net zero emission target. In this context, studies in line with the EU acquis are carried out in areas such as renewable energy, energy efficiency and greenhouse gas mitigation, and climate action plans are implemented at local and national level.

Turkey National Energy Plan

This plan, prepared in line with Turkey's 2053 net zero emission target, envisages the transformation of the energy sector until 2035. Energy consumption is expected to increase from 147.2 million tonnes of oil equivalent in 2020 to 205.3 million tonnes of oil equivalent in 2035. The share of renewable energy sources is targeted to increase from 16.7 per cent to 23.7 per cent. The installed electricity capacity is planned to increase to 189,700 MW, with 74.3 per cent of this increase coming from solar and wind energy. This plan aims to increase Turkey's energy independence and combat climate change.[1]

Ministry of Energy and Natural Resources (MENR) Strategic Plan (2024-2028)

MENR's strategic plan covering the period 2024-2028 aims to increase the electricity generated from domestic resources to 270 billion kWh and to increase the share of domestic resources to 63%. It is planned to increase the installed capacity of solar energy to 33,100 MW and wind energy to 19,300 MW. In addition, 4,800 MW of nuclear power capacity is envisaged to be commissioned. The Plan includes various steps to increase energy efficiency, ensure sustainable energy supply security and achieve net zero carbon targets.[2]

[1] (Turkey National Energy Action Plan, 2022)

[2] (MENR Strategic Plan 2024-2028, 2024)

II. National Energy Efficiency Action Plan (2024-2030)

II. National Energy Efficiency Action Plan (II. NEEAP) includes a total of 61 actions in 7 sectors covering horizontal issues such as buildings and services, energy, transport, industry, agriculture, start-ups and digitalisation to be implemented between 2024-2030. Under this plan, it is targeted to invest USD 20.2 billion in energy efficiency and cumulatively save 37.1 million tonnes of oil equivalent (MTEP) of primary energy. This target corresponds to a 16% reduction in Turkey's primary energy consumption and will also result in a greenhouse gas reduction of 100 million tonnes CO_2 equivalent. In order to achieve the success of the Plan, it is envisaged that public financial resources will be directed to energy efficiency-oriented investments, improvement programmes and incentive practices by considering the cost-benefit balance. In addition, more active participation of non-public financial institutions in energy efficiency projects and mobilisation of international financial resources are of great importance.[3]

National Climate Change Mitigation Strategy and Action Plan (2024-2030)

This strategy and action plan, prepared to achieve Turkey's 2053 net zero emission target, covers the period 2024-2030. The plan aims to reduce greenhouse gas emissions in sectors such as energy, transport, industry, agriculture and waste management. Increasing the share of renewable energy resources, expanding energy efficiency practices and transition to low-carbon technologies are among the priority areas. In addition, local governments are encouraged to prepare and implement climate action plans.[4]

5. National Climate Change Adaptation Strategy and Action Plan (2024-2030)

This plan presents a strategy covering the period 2024-2030 to adapt to the impacts of climate change. It focuses on five key areas: public health, agriculture and food security, water resources management, ecosystem services and biodiversity, and natural disaster risk management. The plan aims to increase social and economic resilience against risks such as droughts, floods and heat waves that may be caused by climate change. Training, awareness raising and infrastructure projects are prioritised to strengthen the adaptation capacity of local governments. This strategy aims for Turkey to build a more resilient society and economy against climate change.[5]

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[3] (Energy Efficiency 2030 Strategy and II. National Energy Efficiency Action Plan (2024-2030), 2024)

[4] (National Climate Change Mitigation Strategy and Action Plan (2024-2030), 2024)

[5] (National Climate Change Adaptation Strategy and Action Plan (2024-2030), 2024)

3.2. Field Studies on Climate Monitored in Narlıdere

Narlıdere Municipality takes important steps in the fight against climate change. In this context, a series of projects have been implemented in order to achieve the sustainability targets of the district. In particular, 9 electric vehicle charging stations established at three different points of the district stand out as a concrete step to reduce carbon emissions. These stations not only encourage environmentally friendly transport alternatives, but also make a significant contribution to reducing the carbon footprint.

Narlıdere Municipality's efforts to combat climate change are not limited to infrastructure projects. Our municipality also attaches great importance to social awareness raising activities. Activities organised to raise environmental awareness in children play a critical role in ensuring that future generations grow up as environmentally conscious individuals. These activities contribute to raising children's awareness of environmental issues at an early age and learning sustainable living practices. Thus, an important step is taken towards raising not only today's but also tomorrow's environmentally friendly generations.

Our Municipality also pays attention to develop global co-operations on environmentally friendly technologies and sustainable solutions. In this direction, the cooperation protocol signed with Lithuania's Trakai Municipality aims to develop common solutions to combat the challenges brought by climate change. The protocol not only enables the exchange of information and experience between the two municipalities, but also contributes to the search for global solutions by establishing an international network.

The strategies followed by Narlıdere Municipality in combating climate change reveal a holistic approach that includes infrastructure projects as well as social awareness activities. The steps taken in this context constitute an important step towards developing effective and sustainable solutions not only at the local scale but also at the international level.

4.BASELINE EMISSION INVENTORY

NARLIDERE
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4.1. Introduction

The Sustainable Energy and Climate Action Plan (SECAP) is a study that aims to prepare monitoring and action plans for municipalities and local governments to reduce greenhouse gas (GHG) emissions and reduce final energy consumption. The commitments made under this agreement cover the entire geographical area of local governments (town, city, region). In the process of reducing the emissions of cities, it is of great importance to create a Baseline Emission Inventory (BIE) and determine emission reduction strategies compared to the current situation.

The Baseline Emissions Inventory (BIE) determines the baseline year amount of carbon dioxide (CO_2) emissions from activities such as energy production and consumption, use of fuel or electricity in transport, waste and wastewater management in the territory under the responsibility of local governments. This inventory is required for Global Covenant of Mayors (GCoM) and European Covenant of Mayors (CoM) members to define emission reduction targets by baseline year, beyond national targets.

Preparation of the TEI is an important tool that allows local governments to measure the impact of their actions to combat climate change. This inventory shows the current position of local governments by revealing the baseline situation, and the monitoring inventories prepared afterwards provide the opportunity to follow the progress made towards achieving the targets. These inventories are a source of motivation for all stakeholders who want to contribute to the CO_2 reduction targets of local governments and enable them to see the results of their efforts. The three main scopes included in the GHG inventory are:

Direct Emissions from Final Energy Consumption: Carbon emissions resulting from energy consumption in facilities or buildings (stationary combustion) or transport vehicles (mobile combustion) as a result of direct use of fuels such as coal, natural gas, diesel within the boundaries of the local area.

Indirect Emissions: Emissions resulting from the consumption of grid-supplied energy (electricity and heating/cooling) within local boundaries. These emissions are calculated using local electricity and heating/cooling emission factors.

Non-Energy Emissions: Emissions from waste and other non-energy sources within the region. Although not all non-energy emissions are included in SECAP, emissions from electricity consumption losses are included.

4.2. Selection of Included Sectors

The Greenhouse Gas Emission Inventory of Narlıdere Municipality is an important study that aims to calculate the greenhouse gas emissions in the city in detail and to determine the areas with high emission intensity in the light of these findings and to create action plans accordingly. This inventory covers data collected from both municipal activities and various sectors (housing, transport, industry, etc.) across the city.

Durağan Combustion Inventory includes data on fuels and electricity consumption used in municipal facilities and throughout the city. In addition to fuels such as natural gas, coal, diesel, electricity consumption was regularly monitored in all municipal facilities and these data were obtained from invoices or meters and added to the inventory. In addition, electricity generated from waste through solar energy and biogas power plants owned by the municipality has also been calculated and included in the inventory. At the city scale, energy consumption of residences, commercial buildings and public buildings were reported. Natural gas and electricity consumption in residential buildings and similarly fuel and electricity use in commercial and public buildings have been analysed in detail. In addition, the electricity consumption of lighting systems in the city is also reflected in the report and energy use in this area is analysed. In addition, the use of geothermal energy in Narlıdere has also been included in the inventory.

The Mobile Combustion Inventory covers the fuel consumption of the municipality's vehicle fleet and the overall fuel consumption of the city. In this context, the fuel consumption of public transport vehicles and vehicles used in operational services of the municipality is reported. Fuel consumption of public transport vehicles provided by private enterprises is also included in the report. However, some sectors are not included in the inventory. For example, since there are no rail systems (tram, metro, etc.) in Narlıdere, data on such transport vehicles are not included in the report. In addition, since there is no maritime transport activity in the city under the responsibility of the municipality, the emissions in this field are also excluded from the inventory. Sectors such as aviation activities are not included in the inventory since they are not under the direct responsibility of the municipality and are not included in action plan.

Waste Management activities are not included as they are under the responsibility of Izmir Metropolitan Municipality.

Narlıdere Municipality's Greenhouse Gas Emission Inventory provides an important data source for monitoring and reducing the city's carbon emissions. This study enables the city to monitor greenhouse gas emissions through energy consumption, transport and similar basic activities of the city and to create a more sustainable urban policy. Detailed analyses and scope details of all these inventories are shown in Table 4.1.

Table 4.1 Sectors and Categories Included in the Basic Emission Inventory

1. Stationary Incineration Inventory		**Scope Obligation**
1.1 Stationary Combustion Inventory of Municipality Management		
Fuel Expenditures of Municipal Facilities	Consumption of fuels such as natural gas, coal, diesel used in the combustion process in the facilities belonging to the municipal administration. It has been obtained and reported from all municipal facilities through invoices or inventory work.	Mandatory
Electricity Consumption of Municipal Facilities	It is the electricity consumption used in the facilities belonging to the municipal administration. Electricity consumption of all municipal facilities was obtained from invoices or electricity meters and reported.	Mandatory
Data on Energy Generation Plants Owned by the Municipality	Our municipality does not have a power generation plant.	Mandatory
1.2 Inventory of Stationary Combustion at City Scale		**Scope Obligation**
Fuel Expenditure for Housing Stock	Consumption of natural gas and LPG cylinders used for the combustion process of the housing stock has been obtained and reported.	Mandatory
Electricity Consumption of Housing Stock	Electricity consumption used in residential/residential buildings has been obtained and reported by considering the distribution system loss. Geothermal energy utilisation in the region has also been obtained and reported.	Mandatory
Fuel expenditures of Commercial and Public Buildings	Fuels such as natural gas etc. used for combustion in commercial and public buildings have been procured and reported.	Mandatory
Electricity consumption of Commercial and Public Buildings	Electricity consumption of commercial and public buildings was obtained and reported by considering distribution system loss.	Mandatory
Electricity consumption in lighting	Electricity consumption used in city lighting is obtained from the electricity distribution company and reported.	Mandatory
Industrial and industrial fuel consumption	Industrial and industrial consumption is excluded from the scope.	Optional

2. Mobile Combustion Inventory		Scope Obligation
2.1. Mobile Combustion Inventory of Municipal Fleet		
Fuel expenditures of the municipal vehicle fleet	Inventory of the entire fleet of vehicles owned or leased by the municipality, allocated to civil servants or used in operational services such as garbage collection etc.	Mandatory
Expenditures of road public transport vehicles provided by the Municipality	There is no public transport service provided by the municipality. However, the services belonging to the metropolitan municipality passing through Narlıdere district are included.	Mandatory
Expenditures of rail system vehicles provided by the municipality	Since there is no rail system such as tram, metro operated by the municipality, it is not included.	Mandatory
Municipal maritime transport expenditure	Since there is no maritime transport line in the region, it is not included.	Mandatory
Expenditure on off-road vehicles	Since the sector is outside the responsibility of the municipality, no measures are planned.	Optional
2.2. Inventory of Mobile Combustion at City Scale		**Scope Obligation**
Total fuel consumption of personal and commercial vehicles in the city	The fuel consumption of the vehicles used by the city residents for their personal and commercial activities has been obtained and reported.	Mandatory
Private subsidiary public road transport fuel expenditure in the city	Fuel consumption of minibuses and private public buses belonging to private subsidiaries providing public transport services were obtained and reported.	Mandatory
Private subsidiary public sea transport fuel expenditure in the city	Since there is no maritime transport line in the region, it is not included.	Mandatory
Aviation activities fuel expenditure	Since no action will be taken in the SECAP study for the sector, it is excluded from the scope.	Optional
Expenditure on off-road vehicles	Since the sector is outside the responsibility of the municipality, no measures are planned and excluded from the scope.	Optional

3. Emissions from Agriculture & Forestry & Fishing and Livestock Activities		Scope Obligation
Emissions from Agriculture and Forestry	Excluded from the scope.	Optional
Emissions from Fisheries		
Emissions from Livestock		
4. Emissions from Waste Management		**Scope Obligation**
Solid Waste Disposal	It is excluded from the scope since it is under Metropolitan Responsibility.	Mandatory
Biological Waste Treatment		
Waste Incineration and Open Burning		
Waste Water Treatment and Discharge		

4.3. Reference Year

The baseline year is the year against which the emission reduction achievements targeted to be achieved by 2030 are compared. The European Union has committed to reduce its emissions by 40 per cent by 2030 compared to 1990. In line with this target, the proposed reference year for BEI is set as 1990. However, since it is generally not possible for local governments to access comprehensive and reliable data sets for 1990, the closest year in which the most comprehensive and reliable data can be collected should be selected as the reference year. In this context, 2023 has been accepted as the reference year for determining GHG emissions and mitigation targets for Narlıdere Municipality. This year will be taken as the basis for collecting emission data and establishing future mitigation strategies. The data collection process was carried out in coordination with local administrations, relevant public institutions and organisations and non-governmental organisations within the boundaries of Narlıdere Municipality.

4.4. Basic Emission Inventory Boundaries

The Baseline Emission Inventory (BEI) is prepared within certain boundaries to calculate GHG emissions and identify mitigation strategies. These boundaries ensure that the inventory is comprehensive and consistent by clearly defining the scope and responsibility areas of emission sources. Inventory boundaries are divided into two main categories: **Municipal Government Emissions and City Scale Emissions**. Both categories cover different emission sources and data collection areas.

Emissions in Municipal Government includes emissions from areas for which the municipality is directly responsible and manages. Focusing on activities within the boundaries of the municipal government, these data are generally related to the services provided by the municipality. These data are critical for understanding the emission sources in the municipality's own service area and developing mitigation strategies for these sources. Emissions in municipal governance are considered as a priority area in mitigation efforts as they are under the direct control of the local government. The main emission sources considered in this context are as follows:

- **Energy Used in Municipal Buildings:** Emissions from the consumption of electricity, natural gas, coal and other fuels used in municipal offices, social facilities, sports complexes and other public buildings.
- **Fuel Consumption of Municipal Transport Vehicles:** Emissions resulting from fuel consumption of municipal service vehicles (refuse collection vehicles, fire trucks, maintenance vehicles, etc.) and public transport vehicles.

City Scale Emissions include emissions that are outside the direct control of the municipality but arise from the activities of all stakeholders across the city. In this category, emissions from energy consumption of residences, commercial buildings and industrial facilities, transport activities and other environmental processes are analysed. Emissions from city-wide environmental and economic activities are considered in this context. City-scale data covers sources that are outside the direct control of the municipality, but account for a significant proportion of city-wide emissions. These data are used to understand the sources of emissions contributed by all stakeholders in the city (private sector, civil society organisations, citizens, etc.) and to develop comprehensive mitigation strategies for these sources. City-scale emission sources include:

- **Energy Consumption of Buildings:** Emissions from the consumption of electricity, natural gas, coal and other fuels by all buildings (residential, commercial, public, etc.) in the city.
- **Transport Activities:** Emissions from fuel consumption of private vehicles, commercial transport vehicles and public transport in the city.
- **Other Sources:** Emissions from agricultural activities in the city, lighting systems and other non-energy sources.

The distinction between these two categories allows for a clearer identification of emission sources and more effective planning of mitigation strategies. While emissions at the municipal level represent areas where the local government can directly intervene, city-scale emissions include broader issues that can be addressed through the co-operation of all stakeholders. These boundaries provide a basic framework for reducing Narlıdere's greenhouse gas emissions and establishing a sustainable urban policy.

Table 4.2 shows the data we have collected for the sectors in our basic emission inventory study and the stakeholder institutions and affiliates that support the study. As can be seen in the table, stakeholders such as the relevant directorates serving within Narlıdere Municipality, **GDZ Electricity, Izmir Gas, Izmir Geothermal, EMRA, Narlıdere District Governorship, General Directorate of Eshot and Professional Chambers of Drivers** were provided and the requested information was obtained from the relevant institutions. In addition, during the emission inventory calculations, studies on the electricity consumed and fuel types used by municipal facilities, other public institution buildings and other residences in the city are included. These comprehensive data inventory creation studies with the relevant stakeholders have been very important for the realisation of the calculations in the emission calculation of this report at a minimal level.

During the preparation phase of the report, the data flow on electricity consumption was provided by Narlıdere Municipality Directorate of Public Works, while the data flow on city-wide electricity consumption was provided by **GDZ Electricity.** Data inventory for city-wide heating was obtained **from Izmir Gas, Izmir Geothermal and Narlıdere District Governorship Social Assistance and Solidarity Foundation** (SYDV). Fuel consumption data of the vehicles belonging to the NB fleet used in public transport were obtained from **the Machinery and Workshops Unit of the Directorate of Cleaning Affairs.** In addition, fuel consumption data for public transport throughout the city were obtained from **ESHOT General Directorate, Professional Chambers of Drivers and EMRA**.

Table 4.2 Stakeholder Institutions in the Basic Emission Inventory Calculation

Sources		Direct emissions	Data sources	Indirect emissions	Data sources
Final Energy Consumption in Buildings					
Municipality	Municipal buildings, equipment and facilities	Fuel consumption	Directorate of Public Works.	Electricity consumption of municipal buildings	Directorate of Public Works.
	Municipality general lighting			Electricity	Directorate of Public Works.
City	Non-municipal buildings (commercial and services)	Fuel consumption	EPDK IzmirGas Izmir Geothermal	Electricity	GDZ Electricity
	Public buildings	Fuel consumption		Electricity	
Housing		Fuel consumption	EPDK IzmirGas Izmir Geothermal Narlidere District Governorate SYDV	Electricity	GDZ Electricity
Final energy consumption in transport					
Municipality	Road transport, municipal fleet	Fuel consumption	Directorate of Cleaning Works. (Machinery and Workshops Unit)	Electric car consumption	-
City	Private and commercial transport (road)	Fuel consumption	EPDK Eshot General Md. Izmir Chamber of Drivers and Automobile Tradesmen Izmir Chamber of Minibus Tradesmen Ozurlalılar Bus and Motor Carriers Cooperative Karaburun Chamber of Tradesmen and Craftsmen	Electric car consumption	-

4.5. Applied Greenhouse Gas Calculation Principles

The realisation of data collection and emission inventory processes in accordance with international standards and methodologies ensures consistency in monitoring and reporting emission reduction targets. This structure established for Narlıdere paves the way for the effective realisation of the strategic targets set within the scope of SECAP.

Greenhouse gas inventory calculations are based on the Greenhouse Gas Protocol (GHG Protocol) developed by the World Resources Institute (WRI) and the World Council for Sustainable Development (WBCSD). In the GHG Protocol, greenhouse gas emission categories are classified as follows:

- **Scope 1 - Direct greenhouse gas emissions:** Emissions from all fixed and mobile emission sources owned and directly controlled by Narlıdere Municipality and belonging to the city.
- **Scope 2 - Greenhouse gas emissions from indirect energy sources:** Emissions arising from energy purchased for the activities of Narlıdere Municipality, especially electricity purchased from the grid and other types of energy used for heating/cooling.
- **Scope 3 - Other indirect greenhouse gas emissions:** Greenhouse gas emissions arising from activities outside the activities of Narlıdere Municipality but under the control of the municipality.

Greenhouse gas direct and indirect emissions are calculated by multiplying the final energy consumption for each energy carrier by the relevant emission factor.

Table 4.3 presents the global warming potential (GWP) values of greenhouse gases and their GWP values in different IPCC assessment reports (5AR, 4AR, 3AR, 2AR). These values show how much each greenhouse gas contributes to global warming when released into the atmosphere. **Table 10 shows** the GWP values of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) gases in different years. These data are consistent with the 5th Assessment Report (5AR) values used in Narlıdere Municipality's GHG inventory calculations and were used to accurately reflect the impacts of emissions on global warming.

Table 4.3 References for Global Warming Potential (GWP)

Greenhouse gas		IPCC Assessment Report			
Formula	Name	5AR	4AR	3AR	2AR
CO2	Carbon Dioxide	1	1	1	1
CH4	Methane	28	25	23	21
N2O	Nitrous Oxide	265	298	296	310

4.6. Emission Factors

The activity-based approach, which is one of the most widely used methods for calculation, has been used to determine the baseline emission inventory of Narlıdere. In this approach, all CO2 (or GHG) emissions from energy consumption within the boundaries of Narlıdere are accounted for, either directly (through fuel combustion) or indirectly (through electricity consumption). While CO2 emissions are the largest GHG emissions, CH4 and N2O emissions from fuel combustion processes in the residential and transport sectors are of secondary importance. All CO2, CH4 and N2O emissions are calculated for each type of fuel along with their global warming potential (GWP) using the emission factors from the IPCC's Fifth Assessment Report (AR5)[6].

These are multiples that define the amount of greenhouse gases emitted per unit of a certain activity. Emission factors are multiplied by activity data to calculate the total amount of greenhouse gas emissions. Sample emission factors are as follows:

- CO_2 emitted per natural gas consumed (kg CO_2 /Sm3)

[6] https://www.ipcc.ch/assessment-report/ar5/

- CO_2 emitted per electricity consumed (kg CO_2 /MWh)
- Amount of CO_2 emitted per fuel consumed (kg CO_2 /litre or kg CO_2 /tonne)

The formula used to calculate greenhouse gas emissions within the scope of Narlıdere Municipality Greenhouse Gas Inventory is as follows:

Greenhouse Gas Emission Amount (tonnes) = Greenhouse Gas Activity Data x Greenhouse Gas Emission Factor (tonnes of greenhouse gas/activity data) x Oxidation Factor x Global Warming Potential

Table 4.4 contains emission factors for various fuel types. This table presents emission factors that quantify the contribution of each fuel to greenhouse gas emissions and global warming potential. The columns include emission values for carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and total CO2 equivalent (CO2e) for each fuel type. These data are provided with emission factors from different sources (e.g. TurkStat and IPCC reports).

Table 4.4 Emission Factors for Fuel Types

Fuel Type or Activity	CO2 (kg)	CH4 (kg)	N2O (kg)	CO2e (kg)	Source
Natural Gas	55.400	0.100	0.265	555.665	TUIK - Turkish GHG Inventory Report 1990-2021
Coal (Bituminous or Black Coal)	93.640	0.150	0.398	943.175	TUIK - Turkish GHG Inventory Report 1990-2021
Electricity	0.475	0.000	0.000	0.479	Turkey Electricity Generation and Electricity Consumption Point Emission Factors Information Form
Residual Fuel Oil	77.000	0.600	1.590	77.439	TUIK - Turkish GHG Inventory Report 1990-2021
Diesel Oil	72.300	0.600	1.590	72.739	IPCC - Chapter 3 - Mobile Combustion
Engine Gasoline (Petrol)	69.300	0.600	1.590	69.739	IPCC - Chapter 3 - Mobile Combustion
Liquefied Petroleum Gas (LPG)	63.100	0.100	0.265	632.665	TUIK - Turkish GHG Inventory Report 1990-2021
Kerosene (Paraffin)	71.900	0.600	1.590	72.339	TUIK - Turkish GHG Inventory Report 1990-2021
Other Liquid Biofuels	70.800	0.600	1.590	71.239	IPCC - Chapter 3 - Mobile Combustion
Compressed Natural Gas (CNG)	56.100	0.300	0.795	562.635	TUIK - Turkish GHG Inventory Report 1990-2021
Liquefied Natural Gas (LNG)	64.200	0.600	1.590	64.639	TUIK - Turkish GHG Inventory Report 1990-2021

Table 4.5 presents the density and calorific power values of the fuel types in Narlıdere inventory. GHG emissions calculated based on fuel types are determined by multiplying the density and calorific power values of each fuel. The data in this table are taken from national and international sources (IPCC 2006 Global and EMRA) and reflect the energy generating capacity of each fuel. The energy content of fuel types such as petrol, diesel, natural gas and lignite is one of the factors taken as basis for emission calculations. This information will be used in the calculations for the greenhouse gas inventory of Narlıdere Municipality.

Table 4.5 Fuels and Thermal Power Values

Fuel Type	Density	Thermal Power	Source
Gasoline	0.7475 kg/L	44.3 TJ/Gg	IPCC 2006 Global
Diesel (Diesel)	0.83 kg/L	43 TJ/Gg	IPCC 2006 Global
Natural Gas	0.67 kg/m³	48 TJ/Gg	EMRA, IPCC 2006 Global
Lignite	-	11.9 TJ/Gg	IPCC 2006 Global

These calculations are among the basic data used to determine the greenhouse gas emissions of Narlıdere. The densities and thermal powers of fuels are directly related to energy consumption and greenhouse gas emissions in the city.

5. BASELINE EMISSION INVENTORY OF NARLIDERE CITY

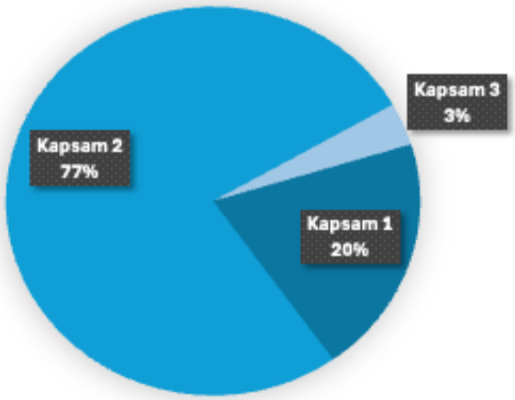
NARLIDERE
BELEDİYESİ

The baseline GHG emission inventory of the city of Narlıdere covers both the city as a whole and the stationary energy and transport sectors, which include municipal (institutional) control areas. The GHG Emission Inventory of Narlıdere for 2023 was calculated based on **the Global Protocol for Community Scale Greenhouse Gas Emission Inventories (GPC) 'BASIC' Standard**[7] . **The City Inventory Reporting and Information System (CIRIS)**[8] was used as emission accounting software. CIRIS is a tool prepared in accordance with IPCC's emission source categories and provides a standardisation setting for local governments' inventories.

As part of this inventory, the corporate GHG emissions of Narlıdere Municipality were also calculated for the reference year 2023. The reference/base year has been determined as the starting point for comparisons with future emission reduction targets such as 2030 and 2050.

Calculations of GHG emissions by sector at city level are presented in **Table 5.1**. This table shows that the total GHG emissions of Narlıdere is approximately **575.636 MtCO2e**.

Table 5.1 Greenhouse Gas Distribution by Scope



Scope 1 (Direct fuel use): **114,349 $MtCO_2$ e**

Scope 2 (Electricity consumption): **440,834 $MtCO_2$ e**

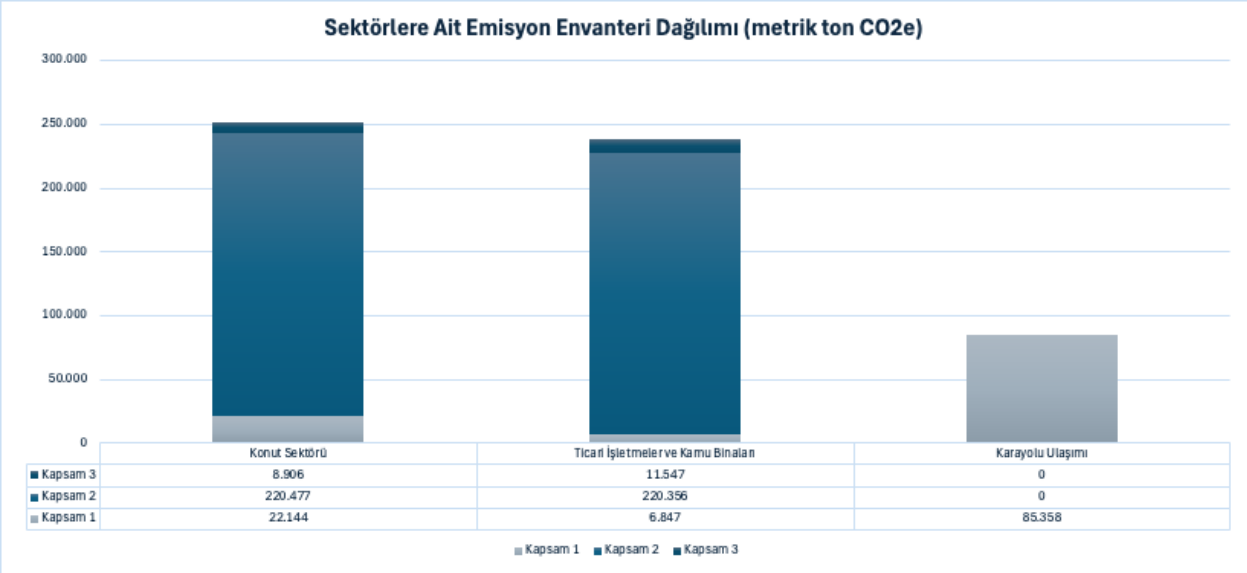
Scope 3 (Distribution losses and other): **20,453 $MtCO_2$ e**

The greenhouse gas inventory of Narlıdere district for 2023 is calculated as 575.636 $MtCO_2$ e in total. **85% of** these emissions are caused by **fixed energy and 15%** by the **transport** sector. In order to achieve climate targets, it has been observed that innovative and sustainable solutions should be put into use rapidly, especially in the transport and fixed energy sectors.

[7] https://ghgprotocol.org/sites/default/files/standards/GPC_Full_MASTER_RW_v7.pdf

[8]https://c40knowledgehub.org/s/article/City-Inventory-Reporting-and-Information-System-CIRIS?language=en_US

Table 5.2 Sectoral Breakdown of Narlıdere Province Greenhouse Gas Emission Inventory



5.1. Stationary Energy Sector

The stationary energy sector accounts **for 85%** of the total greenhouse gas emissions of Narlıdere district. **Emissions in this sector reach 490.277 $MtCO_2$ e in total**.

The stationary energy sector **is calculated in three categories: direct fuel consumption of buildings (Scope 1), electricity consumption (Scope 2) and indirect distribution losses (Scope 3)**.

- **Scope 1** (Direct fuel use): **28,991 $MtCO_2$ e**
- **Scope 2** (Electricity and Geothermal consumption): **440.834 $MtCO_2$ e**
- **Scope 3** (Distribution losses and other indirect emissions): **20,453 $MtCO_2$ e**

5.1.1. Housing Sector

The residential sector is the largest emission source in the stationary energy sector, causing a total emission of **251,527 $MtCO_2$ e**. This value constitutes **43.6%** of the total greenhouse gas emissions of Narlıdere district. **The largest source of emissions from residential buildings is the direct use of natural gas**.

- **Scope 1**: **22,144 $MtCO_2$ e** (Direct natural gas consumption: heating, hot water and cooking)

- **Scope 2**: **220,477 $MtCO_2$ e** (Electricity consumption - lighting, heating, cooling)
- **Scope 3**: **8,906 $MtCO_2$ e** (Distribution losses)

In particular, **residential electricity consumption and geothermal energy cause a high Scope 2 emission of 220,477 $MtCO_2$ e** and are the main source of residential sector emissions. Electricity consumption is largely driven **by air conditioning, electric heaters, water heaters and other household appliances**. On the other hand, the use of geothermal in the region is an important advantage as a low carbon heating alternative. Heat pumps and other electric heating and cooling solutions are widely used in the region due to the recent widespread use of natural gas. **Natural gas used for heating, hot water and cooking is** the second main emission source.

Table 5.3 Residential Sector Fixed Energy Consumption and Greenhouse Gas Emissions

Residential Sector Fixed Energy Consumption	Energy Consumption	Unit	Greenhouse Gas Emission (tCO2e)
Natural gas used in residential buildings	10.359.227	m^3	19.183
Coal distributed by the district governorship	300	tonne	840
Cylinder (LPG) Consumption at district scale	710	tonne	2.120
Electricity Used in Households	354.836.403	kWh	169.967
Geothermal Energy Use	41.391	Gcal	50.511
Loss-Leakage in Residential Electricity (5.24%)	18.593.428	kWh	8.906
Total			**251.527**

5.1.2. Commercial Enterprises and Public Buildings

Commercial enterprises and public buildings are the second largest emission source in the stationary energy sector, causing a total emission of **238,750 $MtCO_2$ e**. **These emissions constitute 41% of the total greenhouse gas emissions of Narlıdere district**. The high electricity use of commercial buildings accounts for a significant portion of the emissions in this area.

- **Scope 1**: **6,847 $MtCO_2$ e** (Direct fuel consumption)
- **Scope 2**: **220,356 $MtCO_2$ e** (Electricity consumption)

- **Scope 3**: **11,547 $MtCO_2$ e** (Distribution losses)

Electricity consumption plays an important role in this sector, with Scope 2 emissions totalling 220,356 $MtCO_2$ e. Heating, cooling, lighting, office equipment and large-scale electrical appliances in commercial and public buildings cause high energy consumption.

Table 5.4 Public and Private Sector Fixed Energy Consumption Excluding Municipalities

Public and Private Sector Constant Energy Consumption (Municipal Consumption Disaggregated)	Energy Consumption	Unit	Greenhouse Gas Emission (tCO2e)
Natural Gas Consumption of Commercial Subscriptions	2.815.928	m^3	5.215
Bulk cylinder consumption at district level	539	tonne	1.611
Commercial Electricity Consumption	440.748.551	kWh	211.119
Narlıdere Region Lighting Consumption (Under the Responsibility of EDAŞ)	18.570.491	kWh	8.895
Total Electricity Losses	24.105.801	kWh	11.547
Total			238.386

5.2. Transport Sector

The second important greenhouse gas emission source of Narlıdere district is the transport sector, which causes **85.358 $MtCO_2$ e** emissions. **This amount constitutes 15% of total emissions** and **is caused by road transport**. **Private and commercial vehicles are the biggest source of emission** since there is no rail system or sea transportation in Narlıdere district.

- **Scope 1**: **85,358 $MtCO_2$ e** (Direct fuel consumption)
- **Scope 2 & 3**: **0 $MtCO_2$ e (Electric Vehicle Consumption not disaggregated.)**

These data show **that transport-related emissions in Narlıdere district are almost entirely due to fossil fuel consumption**. Electric vehicle consumption is included in the overall electricity consumption and cannot be separated.

Table 5.5 Narlidere District Mobile Energy Consumption

Narlidere District Moving Energy Consumption	Energy Consumption	Unit	Greenhouse Gas Emission (tCO2e)
Average annual diesel usage of a 30-car taxi fleet	170.100	l (liter)	473
ESHOT Bus Service Consumption	1.335.629	l (liter)	3.717
Dolmus Fleet Fuel Consumption	377.028	l (liter)	1.049
Autogas Consumption Proportional to Narlidere Population	2.104	tonne	2.104
Gasoline Consumption Proportional to Narlidere Population	3.564	tonne	3.564
Diesel Consumption Proportional to Narlıdere Population	19.829	tonne	19.829
		Total	**85.358**

5.3. Narlidere Municipality Self-consumption

Narlıdere Municipality's greenhouse gas emissions due to energy consumption is an important indicator to understand the environmental impacts of the municipality's activities. In this context, the energy consumption sources of the municipality and the carbon emissions caused by them have been analysed in detail.

Stationary energy consumption includes energy used in municipal buildings, facilities and lighting systems. Emissions in this category arise from the use of natural gas and electricity. Narlıdere Municipality's total natural gas consumption was measured as **11,619 m³**. This consumption caused **22 tonnes of CO_2 e** greenhouse gas emissions. The electricity

consumption used in the municipality's parks and green areas and buildings was recorded as **715,332 kWh** and this consumption corresponded to **342 tonnes of CO_2 e** emissions.

Narlıdere Municipality's mobile energy consumption covers the fuel consumption of the municipal vehicle fleet and equipment. In total, **290,466 litres of fuel were consumed**, **corresponding to 804 tonnes of CO_2 e greenhouse gas emissions**. These data provide an important basis for understanding the environmental impacts of the municipality's mobile energy-related environmental impacts and developing mitigation strategies.

Table 5.6 Narlıdere Municipality Fixed and Mobile Energy Consumption

Narlıdere Municipality Stationary and Mobile Energy Consumption	Energy Consumption	Unit	Greenhouse Gas Emission (tCO2e)
Narlıdere Municipality Total Natural Gas Usage	11.619	m³	22
Narlidere Municipality Park Lighting Electricity Consumption	79.776	tonne	38
Narlidere Municipality Facilities Electricity Consumption	635.556	kWh	304
Municipal Fleet Petrol Usage	12.980	litre	31
Municipal Fleet Diesel Utilisation	272.171	litre	758
Diesel Used in Machine Workshop and Garage	5.315	litre	15
		Total	1.168

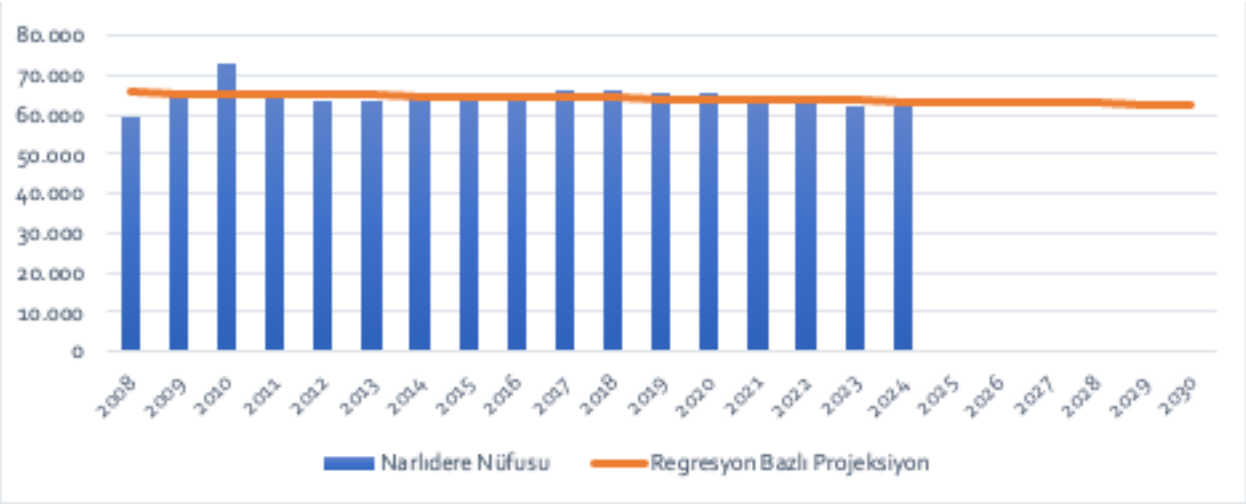
5.4. Greenhouse Gas Reduction Scenario

Narlıdere has created a strategic road map to reduce greenhouse gas emissions, taking into account its current urban structure, energy consumption habits and environmental impacts. In the face of the increasing threat of climate crisis, **a target of 40% reduction in greenhouse gas emissions by 2030** has been set in line with the principles of sustainable development. In this direction, sectoral intervention areas have been defined to reduce emissions, especially from stationary energy consumption and transport. This mitigation scenario is based on a scientific analysis of current emission trends. Expanding the use of renewable energy, increasing energy efficiency practices, low-carbon transport solutions and sustainable urban planning approaches are the basic building blocks of this process.

5.4.1. Narlidere's Population Projection

The regression analysis conducted to predict the future population structure of Narlıdere reveals that the population of the district **follows a stable course** and even **shows a very limited downward trend**. The population of 62,148 in 2023 is expected to decline **to approximately 62,535 in 2030**. However, this situation may lead to an unprecedented population increase with the scaling of the city over time. Therefore, **the amount of emissions per capita** can be considered as the main criterion **in greenhouse gas mitigation targets**.

Table 5.7 Narlidere's Population Projection

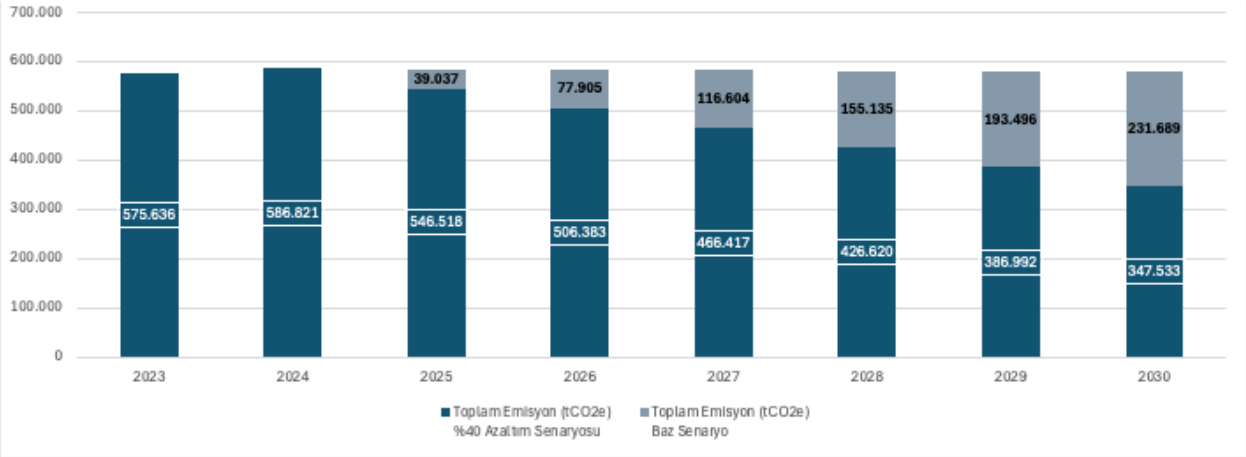


5.4.2. Current Emission Status and Reduction Target

According to the 2023 Baseline Emission Inventory results, **the total greenhouse gas emission of Narlıdere is 575,636 tCO_2 e**. Of this emission**, 114,349 tCO_2 e is from direct fuel consumption (Scope 1)**, **440,834 tCO_2 e from electricity consumption (Scope 2)** and **20,453 tCO_2 e from other indirect sources (Scope 3)**. For the same year, per capita greenhouse gas emission was calculated as **approximately 9.3 tCO_2 e**.

This calculation necessitates **that emission reduction targets should be shaped based on the amount of emissions per capita**. In line with **the 40% reduction target** set by 2030, it is envisaged **to reduce** per capita emissions **to approximately 5.6 tCO_2 e**. If this target is realised, **total greenhouse gas emissions** will decrease **to 347,533 tCO_2 e**. In **Table 5.8**, Narlıdere Emission Projection is shared.

Table 5.8 Narlıdere Province Greenhouse Gas Reduction Projection (2023 - 2030)



5.4.3. Strategies to be Implemented and Impact

Narlıdere Municipality has adopted **reducing greenhouse gas emissions** as **the main goal** in combating climate change and has shaped **its vision of sustainable urban transformation** in this direction. The **Mitigation Actions** developed include not only the reduction of environmental impacts, but also **energy efficiency, economic sustainability and improving the quality of social life**.

These actions include multidimensional strategies such as **increasing energy efficiency in buildings and facilities**, **expanding renewable energy systems**, **reducing fossil fuel consumption**, **supporting low-carbon solutions in urban transport** and **strengthening sustainable waste management practices. Insulation projects** to be implemented especially in public buildings and residences, **energy efficient lighting systems**, **heating-cooling improvements** and **awareness raising activities** stand out as important steps to reduce energy demand.

Furthermore, **renewable energy applications** will be supported by new generation approaches such as **the installation of solar energy systems** in municipal units and other public facilities, the **promotion of city-scale energy co-operatives** and **energy communities. In the transport sector**, it is planned to develop cycling infrastructure, promote the use of electric vehicles and reconsider public transport systems from an energy efficiency perspective.

For each mitigation action; **current situation analysis**, **alignment of the action with national and local plans**, **impact potential**, **stakeholders**, **implementation steps**, **cost-timing structure** and **potential risks** are defined in detail. Thanks to this multi-layered structure, not only municipal implementations but also **households, private sector and civil society actors** will be effectively included in the process.

With these actions, **Narlıdere Climate Action** Plan aims not only to reduce carbon emissions, but also to **increase energy security**, **provide economic savings** and **improve the quality of life in the city. Public-private sector collaborations**, **participatory management approach** and **active contribution of local people are** among the main priorities for the effective implementation of the plan.

6.RISK AND VULNERABILITY ASSESSMENT

NARLIDERE
BELEDİYESİ

6.1. Risk and Vulnerability Assessment for Narlidere

The impacts of climate change are not only caused by changes in the atmosphere; they are also directly related to **the vulnerability of** societies or systems to these changes. In order to better understand the situation of Narlıdere in the face of climate change, basic elements such as infrastructure systems, green areas, water management, waste management, public health and disaster management have been evaluated. A detailed risk and vulnerability analysis is needed in order to reveal the risks and impacts of climate change in the future. This analysis will provide a better understanding of the current and future climate risks that cities may face, and will also form the basis for the development of adaptation strategies and action plans.

Climate risk is a combination of three key components: **hazard, exposure and vulnerability**.

- **Hazards** are extreme weather events or long-term environmental changes caused by climate change. These include direct impacts such as floods and overflows, heat waves, sea level rise, droughts and storms. As the frequency and severity of these events increase, the potential damage to cities grows.
- **Exposure** is the degree to which a particular region or community is directly exposed to these hazards. The fact that coastal areas in Narlıdere are open to sea level rise, densely built-up areas are at risk of flooding in extreme rainfall, or that rising temperatures threaten the elderly and chronically ill individuals more increases the exposure level of the district.
- **Vulnerability** refers to the capacity to mitigate the negative consequences of exposure. Inadequate infrastructure, irregular urbanisation, reduction of natural areas and low social awareness increase the vulnerability of Narlıdere to climate change.

When vulnerable communities are exposed to a specific hazard, this makes climatic threats a direct risk. In order for Narlıdere to become more resilient to climate change, **adaptation strategies** need to be developed and implemented. Increasing the resilience of cities and regions to climate-related sudden events and long-term changes is a critical step towards a sustainable life. However, in order to develop such adaptation strategies, regional risks must first be identified and analysed.

In this direction, risk and vulnerability analyses were conducted for Narlıdere, taking into account risk factors such as flood and flood risk, extreme weather events, sea level rise, drought and heat waves. As a result of the analyses, the main issues requiring urgent intervention were identified and recommendations were presented to support the adaptation of the district to climate change. Measures to be taken against climate change should not only be limited to strengthening the physical infrastructure, but also strategies that aim to raise social awareness, reduce the level of vulnerability and reduce exposure should be developed.

In this framework, measures to be taken and strategies to be implemented for Narlıdere to become a sustainable and resilient city have been developed.

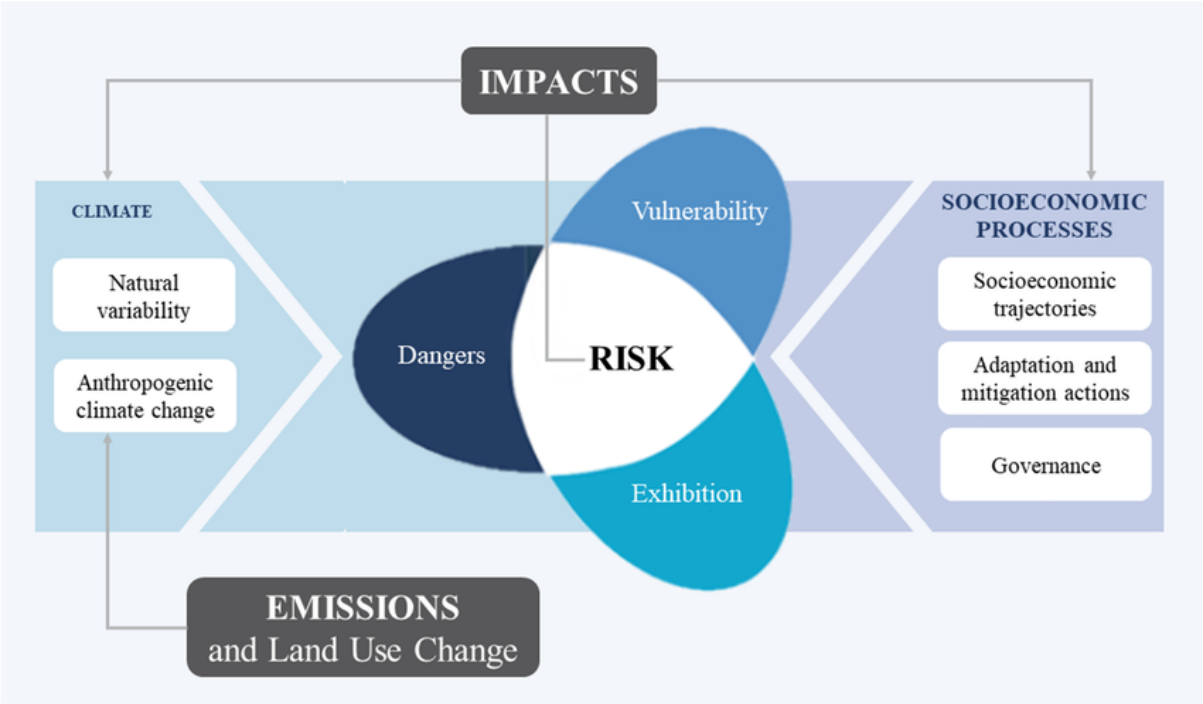


Figure1 Illustration of climate risk as a combination of hazard, exposure and vulnerability (IPCC, 2012)

6.2. Methodology

The methodology to be applied in this study is based on the methods used in the Convention of Mayors (CoM) risk and vulnerability assessment and the Ireland - Fingal Climate Change Action Plan 2019-2024[9]

The first step for climate change risk and vulnerability analysis is to create a projection in terms of various climatic disasters. These disasters are listed in detail in the relevant sections of the report. The climatic events considered for Narlıdere have been determined in line with the geographical location of the district and the risks it faces. In this context, climatic risk factors such as extreme heat waves, drought, soil erosion, forest fires, floods and flood risk are

[9] https://www.fingal.ie/sites/default/files/2019-08/20190812_fcc_climate_change_action_plan_final_0.pdf

discussed. In addition, since Narlıdere is located on the sea coast, sea level rise has been considered among the risk factors.

The sectors and areas where these climatic events will have an impact are analysed in detail in the section on Narlıdere's vulnerabilities. The identified areas are classified as infrastructure systems and transport, green infrastructure, water management, waste management, public health and disaster management. These areas also constitute the basis of the strategies and actions to be developed within the scope of the climate change action plan. As a result of the risk and vulnerability analysis, it is aimed to identify priority issues for Narlıdere and to create the necessary mitigation and adaptation plans.

However, when determining climate risks, the probability of occurrence of the hazard and the exposure status should be taken into account. As a result of this analysis, the risk level will be determined. Risk is the combination of the probability of occurrence of the hazard and exposure (Risk = Exposure x Probability). Accordingly, by focusing on the most vulnerable groups and areas with the highest risk, issues requiring priority intervention are identified and strategic action plans are developed accordingly.

The risk level is determined by evaluating these two factors. The risk level is calculated by multiplying the exposure and probability scores and classified as 1-6, 7-14 and 15-25 points. Low risk level is in the range of 1-6 points and refers to situations that require precautions but do not pose a major threat in the short term. Medium risk level is between 7-14 points and includes situations that need to be managed and require certain compliance strategies. The high risk level is between 15-25 points and includes threats that require urgent intervention and need to be addressed as a priority. By determining the risk levels, the vulnerable areas of Narlıdere are revealed and a guiding framework is provided for the development of necessary action plans.

Table 6.1 Risk Analysis Calculation Method

İklimsel bir olayın meydana getireceği hasarın ve/veya risklerin sonuçları:			*Risklerin gelecekte meydana gelme olasılığı:*			*Acilen ele alınması gerektiği anlamına gelen risk düzeyi:*	
Maruziyet Puanı			**Olasılık Puanı**			**Risk Düzeyi**	
Kritik	5		Neredeyse kesin	5		Neredeyse kesin	[15-25]
Önemli	4	x	Büyük ihtimal	4	=	Büyük ihtimal	[7-14]
Orta	3		Mümkün	3		Mümkün	[1-6]
Az	2		Pek mümkün değil	2			
İhmal edilebilir	1		Nadir	1			

In order to assess more concretely the climate risks that Narlıdere may face in the future, risk factors need to be addressed in a systematic framework. In this context, the matrix of climate

risks presented in Table 6.1 will help to present the impacts, probabilities and exposure levels of different hazards in detail. This matrix will guide decision makers and planners on which risks should be prioritised and contribute to the identification of the necessary interventions to increase the adaptive capacity of the district to climate change.

Table 6.2 Fragility Analysis Matrix

	SONUÇ				
	Varlık hasarı/mühendislik zaiyatları	**Sağlık&Güvenlik**	**Çevre**	**Hizmet önceliği**	**İtibar**
Kritik (5)	Varlığın veya mülkün kapanmasına veya çökmesine neden olan felakettir.	Tek veya çoklu ölümler ve kalıcı yaralanmalar meydana gelir.	Yaygın etkisiyle oluşan kritik ve önemli zararlar. Bu durumda iyileşmesi bir yıldan uzun sürmekte ve tam iyileşme olasılığı düşük olmaktadır.	Öncelikli hizmetlerin sağlanmasında başarısızlıkla sonuçlanır.	Hükümetin istikrarını etkileme potansiyeli olan ulusal ve uzun vadeli etkileri vardır.
Önemli (4)	Yalnızca olağanüstü veya acil faaliyetlerin sürekliliğinin sağlanabildiği kritik olaydır.	Uzun süreli sakatlık ile sonuçlanan büyük ve çok sayıda önemli yaralanmalar meydana gelir.	Yerel etki ile oluşan önemli zarar. Bu durumda iyileşme bir yıldan uzun sürer ve çevre düzenine uyum sağlanamaz.	Öncelikli hizmetlerin sağlanması üzerinde büyük bir etkisi vardır.	Ulusal basında olumsuz şekilde yer alır ve kamuoyu üzerinde kötü bir etki bırakır.
Orta (3)	Acil durum gerektiren faaliyetlerde sürekliliğin sağlanabildiği ciddi bir olaydır.	Profesyonel müdahale gerektiren orta dereceli yaralanmalar veya çoklu küçük yaralanmalar meydana gelir.	Orta etki ile meydana gelmiş orta derecede zarar. Bu durumda bir yılda iyileşme sağlanır.	Öncelikli hizmetlerin sağlanması üzerinde orta düzeyde etkisi vardır (olumlu veya olumsuz)	Ulusal basında yer alır ve kamuoyu üzerinde ters bir etki bırakır.
Az (2)	Faaliyetlerin yürümesinin sağlanabildiği olumsuz olaydır.	Minimal düzeyde müdahale veya tedavi gerektiren küçük yaralanmalar meydana gelir.	Belirli sınırlar içinde etki eden olaylar. Bu durumda etkiden sonraki bir ay içinde ölçülebilir iyileşme sağlanır.	Öncelikli hizmetlerin sağlanması üzerinde küçük bir etkisi vardır Olumlu veya olumsuz).	Belirli bir kesim için kamuoyu üzerinde kısa vadeli etkisi vardır.
İhmal edilebilir (1)	Faaliyetlerin normal düzeyde devam ettirilme kabiliyetini etkiler.	Sadece ilkyardım gerektiren minimum yaralanmalar meydana gelir.	Çevrenin temel bulgular üzerinde hiçbir etkisi yoktur. Noktasal kaynak kullanımları mevcuttur ve iyileşmeye ihtiyaç duyulmaz.	Hizmet veya öncelikli hizmet üzerinde olumlu bir etkisi vardır.	Belirli bir kesim için kamuoyu üzerinde geçici bir etkisi vardır.

6.3. Narlıdere Municipality Climate Workshop and Findings

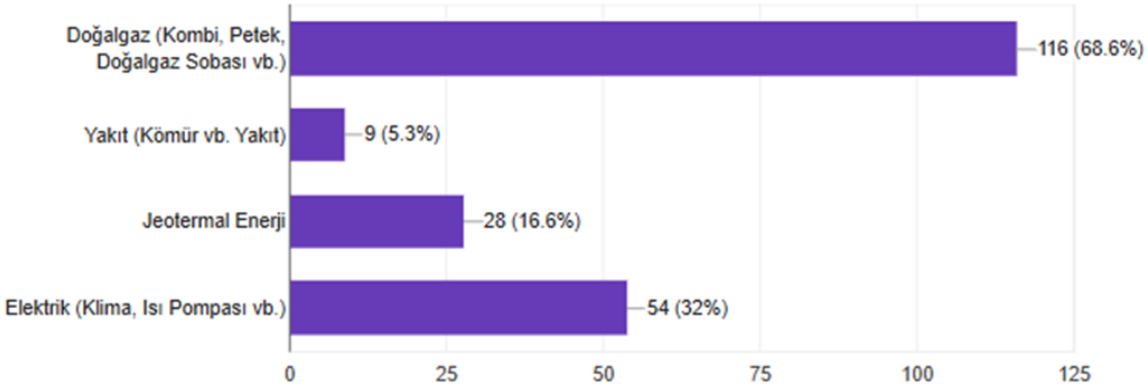
During the preparation process of Narlıdere Municipality's Sustainable Energy and Climate Action Plan (SECAP), it was considered important to include internal and external stakeholders in the SECAP process. In this context, a "Risk and Vulnerability Assessment Workshop for Narlıdere in terms of Climate Change" was held on 5 March 2025 to address the risks and vulnerabilities that climate change may cause in the region with a multidisciplinary approach. The risks and vulnerabilities that climate change may cause in the region were evaluated, and adaptation and mitigation measures to be taken to deal with these threats were determined by conducting common sense. In the workshop, the prominent data from the Citizen Participation Survey conducted to include the people of Narlıdere in the SECAP process were shared with the participants. The workshop was organised with the participation and active contributions of all relevant institutions.

6.3.1. Citizen Participation Survey Findings

171 people participated in the Citizen Participation Survey. Although the participation rate seems to be low, valuable information was collected that will contribute to the SECAP process.

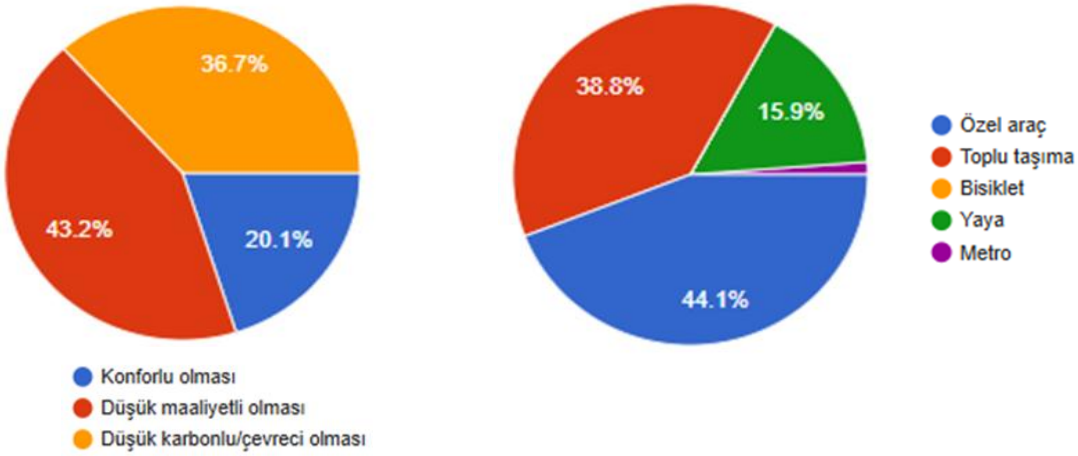
Table 6.3 below **shows** the sources used by the citizens living in Narlıdere for heating their houses. From the survey results, it is seen that the heating preferences in Narlıdere are mostly natural gas (68.6%) and electricity (32%). However, the use of fossil fuels is still present (5.3%). It is aimed to end the use of fossil fuels in order to realise the goals of transition to sustainable energy. Geothermal energy (16.6%) draws attention as an environmentally friendly alternative. Considering the potential of geothermal resources in Narlıdere, it is predicted that investments in this field will accelerate the transition to sustainable energy.

Table 6.2 Narlıdere Citizens' Use of Energy Sources in Residential Heating



Transport preferences and the most frequently used means of transport are given in **Table 6.4**

Table 6.3 Narlıdere Citizens' Transport Preferences



The survey results on transport preferences show that economic and environmental factors are at the forefront. While private car use (44.1%) is the most common choice, public transport (38.8%) and pedestrian transport (15.9%) also have a significant share. These data show that public transport and pedestrian routes need to be further improved for sustainable transport. Furthermore, 20.1% stated that they prioritise comfort in their transport preferences, which emphasises the need for user-friendly transport systems.

6.3.2. Information and Identification of Action Areas

In the first phase of the workshop, participants were provided with a comprehensive information presentation on climate change, adaptation process, risks and vulnerabilities. In

the presentations, the potential impacts of climate change on Narlıdere were discussed in detail and the areas of action that can be developed to mitigate these impacts were focussed. In addition, the current situation of Narlıdere Municipality and the activities carried out in this field were shared with the participants. At the end of the workshop, several critical action areas were identified and the steps to be taken in these areas were discussed. The main action areas identified within the scope of the workshop are as follows:

- **Infrastructure Systems**: Developing infrastructure solutions that are resilient to climate change.
- **Transport**: Adoption of sustainable transport modes with a low carbon footprint.
- **Green Infrastructure**: Increasing green areas within the city, protecting existing areas and strengthening ecosystem services.
- **Water Management**: Effective utilisation of water resources and development of sustainable solutions against climate impacts such as drought.
- **Public Health**: Establishing health strategies to minimise the negative impacts of climate change on health.
- **Disaster Management**: Develop comprehensive plans for preparedness and rapid response to extreme weather events.
- **Waste Management**: Developing strategic solutions to reduce waste generation and increase recycling rates.

6.3.3. Mapping Risks and Vulnerabilities

Participants identified the risks and vulnerabilities that climate change may create in Narlıdere in the above-mentioned action areas and discussed feasible solutions to deal with these threats. In particular, assessments were made on climatic hazards such as extreme weather conditions, floods, drought, landslides and sea level rise.

Analyses of sectoral vulnerabilities are presented below:

Infrastructure Systems: The acceleration of urban transformation processes in Narlıdere, but the fact that the existing zoning plans are not organised in a way to adequately protect green areas creates a significant vulnerability in terms of environmental sustainability. Urban planning needs to be reconsidered in order for new buildings to be more resilient to climate change and energy efficient. In addition, dense construction prevents air flow, leading to the formation of heat islands and deterioration of the environmental balance. Increasing construction density in some areas creates uncertainties about whether the infrastructure will be able to cope with the new density, threatening the sustainability of services such as transport, water supply and waste management. Solving these problems requires urban regeneration to be carried out in a more planned and environmentally friendly manner.

Transport Despite the increase in the number of electric buses in public transport throughout the province, the fact that public transport is still not perceived as a comfortable alternative constitutes one of the most important vulnerabilities in the transport sector. In addition, sudden weather events and the effects of climate change can cause disruptions in transport systems. The inadequacy of existing mechanisms to incentivise the transition to alternative fuel vehicles limits the speed and impact of this transformation and constitutes a significant obstacle to achieving environmental targets. In order to overcome these deficiencies, transport infrastructure needs to be strengthened and incentive mechanisms need to be activated.

Green Infrastructure: The increase in concretisation hinders air flow in the city, leading to the formation of heat islands. These effects cause excessive increase in temperatures and decrease in quality of life, especially in summer months. In addition, the unplanned creation of green areas within the city and the fact that they are not managed in line with a specific strategy cause these areas to be inefficiently used and insufficient to ensure environmental balance. These vulnerabilities can be overcome by reorganising green areas, nature-friendly urban planning and sustainable designs.

Water Management: In Narlıdere, water floods occur after sudden rainfall and the existing water infrastructure is not adequate for this situation, which creates a serious vulnerability in the water management sector. Effective policies are needed by the municipality to ensure water savings in green area irrigation and public buildings. In particular, the lack of long-term strategies for rainwater harvesting hinders the efficient use of water resources. The risk of water scarcity brought about by climate change exacerbates these vulnerabilities and makes it imperative to address water management in a more integrated and sustainable manner. In this context, the efficient use of water and the development of reuse systems are of great importance.

Public Health: Increasing dense construction and concretisation can lead to the formation of heat islands by blocking air flow, which, together with heat waves, can increase health problems such as heart disease and respiratory problems. In addition, deficiencies in water management and inadequate infrastructure can lead to infectious diseases by increasing the risks of flooding and water pollution. Deficiencies in the management of organic wastes also trigger environmental pollution, paving the way for food-borne diseases and other health problems.

Disaster Management: Although landslide and flood risk areas have been identified, the measures taken against these risks remain insufficient. Existing infrastructure and management strategies do not provide adequate measures and preparations to prevent the impacts of such natural disasters. On the other hand, although sea level rise does not pose a major threat in the short term, it should be emphasised that this risk should be taken seriously in long-term assessments. Considering factors such as climate change and sea level rise, it is important to take more comprehensive and sustainable measures to protect coastal areas.

Waste Management: Although citizens are conscious about the separation of household wastes, the fact that the system is not fully established creates a significant vulnerability in waste management. Failure to effectively implement the separation process leads to underutilisation of the recycling potential and to a failure to reduce the environmental impact of waste. Moreover, organic waste management is not yet sufficiently developed; infrastructure deficiencies and implementation inadequacies in this area prevent the efficient treatment of organic waste. This situation both increases environmental pollution and makes it difficult to achieve sustainable waste management targets. Building a stronger infrastructure and an efficient system for the management of organic waste is critical to overcome these vulnerabilities.

6.3.4. Climate Workshop Outputs

1. Increasing Green Areas:

- Encouraging vertical architecture.
- Planning urban transformation processes with public participation, taking into account social and environmental impacts.

2. Sustainable Building Design:

- Making thermal insulation, green roof and green wall applications compulsory.
- Construction of buildings with sustainable materials.
- Conducting energy efficiency analyses of buildings with digital twin modelling and implementing renovation projects in areas with high energy consumption.

3. Water Management:

- Making grey water and rainwater collection systems compulsory in buildings to be newly licensed.
- Encouraging the use of grey water and rainwater in the service areas of the municipality.
- Detailing flood risk analyses in coordination with IZSU and DSI and taking necessary measures.
- Preparation of long-term plans and projects for water supply in dry periods.

4. Transport and Public Transport:

- Increasing the number of electric and hydrogen-fuelled buses and expanding the use of these public transport vehicles on a district scale in co-operation with Izmir Metropolitan Municipality.
- Planning public transport routes taking into account climate change impacts and creating alternative routes.
- Extending air conditioning systems and user-friendly features to increase comfort in public transport vehicles.
- Expanding the electric vehicle charging infrastructure and encouraging the use of electric vehicles in the municipal fleet.

5. Management of Environmental Risks:

- Active use of vulnerability analyses obtained from AFAD and IRAP reports.
- Analysing landslide, flood and sea level rise risks with detailed modelling.
- Improvement of urban drainage systems and prevention of sudden surface floods.

6. Urban Planning and Green Infrastructure:

- Creating green corridors along motorways and urban roads.
- Planning of new buildings on the coastal area in a way not to obstruct the air flow.
- Encouraging green wall and green roof applications in the exterior design of buildings.

7. Waste Management and Recycling:

- Ensuring the management of organic wastes with composting systems.
- Making recycling bins compulsory in apartment blocks.

8. Energy Efficiency and Renewable Energy:

- Expanding the use of geothermal energy.
- Promote energy efficient appliances for low-income families.

- Development of energy efficiency projects for low-income neighbourhoods.

The Climate Workshop organised by Narlıdere Municipality contributed significantly to the development of a comprehensive understanding of climate change mitigation and adaptation processes in the region. The critical action areas identified in the workshop and the risk analyses in these areas have provided strategies for producing more resilient and sustainable solutions to the climatic threats faced by Narlıdere. Vulnerabilities and potential solutions in many sectors from infrastructure to transport and water management were discussed in detail, and various suggestions were put forward for concrete steps to be taken. The outputs of this workshop have created an important road map that will help Narlıdere to build a stronger structure against future climate risks and laid a foundation that will enable all stakeholders to achieve environmental sustainability goals in cooperation.

6.4. Risk Level Analysis

The risk analysis includes regional risk analyses considering the current and future climatic conditions of Narlıdere. Climate events such as **extreme heat, extreme precipitation, floods (river and urban), drought, landslides, forest fires**, etc. specific to the district have been addressed; the impacts of these events on Narlıdere's infrastructure, natural environment and socio-economic structure have been evaluated. According to these assessments, the risk level classification in the table below has been taken as a basis.

Table 6.4 Risk Level Classification

MARUZİYET	OLASILIK				
	Nadir	Olası değil	Mümkün	Büyük ihtimal	Nerdeyse kesin
Kritik	5	10	15	20	25
Önemli	4	8	12	16	20
Orta	3	6	9	12	15
Az	2	4	6	8	10
İhmal edilebilir	1	2	3	4	5

While determining the risk levels related to climate change, **İzmir Metropolitan Municipality Sustainable Energy and Climate Action Plan (SECAP), Ministry of Environment, Urbanisation and Climate Change 2023 State of Environment Report, IRAP, meteorological data from Meteorology 2nd Regional Directorate** and other national publications were used.

Since Narlıdere district is located within the borders of Izmir province, it has the same geography and faces similar risks in terms of the negative impacts that may be caused by climate change. For this reason, the SECAP study prepared by Izmir Metropolitan Municipality

in 2020 was taken as a basic reference point in the risk and vulnerability assessment for Narlıdere.

As a result of the risk analysis conducted by Izmir Metropolitan Municipality by analysing past climate events, it has been determined that **6 of the 9 main climate hazards identified in the COM methodology are at "high", 2 are at "medium" and 1 is at "low" risk level.** These risks are summarised **in Table 6.2**.

Table 6.5 Primary Climate Hazards and Current Identified Risk Levels

Climate Hazards	Current Risk Level
Extreme heat	High
Extreme cold	Low
Heavy precipitation	High
Floods (riverine and urban)	High
Sea level rise	Medium
Drought	High
Storms (strong winds)	Medium
Landslides	High
Forest fires	High

6.4.1. Climate Change Projections and Prospects for Izmir

During the period when the 2nd Regional Directorate of Meteorology assumed the role of Meteorological and Climate Change Based Disasters Desk Coordinator within the scope of Climate Change Risk Analyses Project (CRAP), climate change projections and inferences were prepared for Izmir province. Data and projections obtained from these projections are presented below.

Table 6.6 Climate Risk Representative Concentration Routes (RCP)

RCPs	Radioactive Forcing	Time	Radioactive Forcing Variation	Total Concentration (CO_2 equivalent)	Emissions (KYOTO protocol greenhouse gases)
RCP 8.5	> 8.5 W/m²	In 2100	Upgrade	~1370 ppm (at 2100)	The increase continues until 2100
RCP 6.0	~6.0 W/m²	After 2100	Stabilisation without crossing the target	~850 ppm (in 2100)	Decline in the last quarter of the century

RCP 4.5	~4.5 W/m²	Before 2100	Stabilisation without crossing the target	~650 ppm (in 2100)	Decline from the middle of the century
RCP 3.0 PD*	~3.0 W/m²	Before 2100	Peak and decline before reaching 3.0 W/m²	Peak ~490 ppm and decline (in 2100)	Decline in the first quarter of the century

In the light of climate change projections, especially assessments made over the RCP 4.5 scenario are important for understanding regional climate changes. Considering that the RCP 3.0 scenario is no longer possible, in line with our current observations and model projections, climate change impacts in Narlıdere and Izmir are projected as follows:

- **Temperature Increases:** Temperatures are expected to increase in the period between 2071-2099. As a result of global model projections for the period 2016-2099, the average temperature increase for Izmir is projected as follows:
  - An increase of between 1.5°C and 2.5°C according to the RCP 4.5 scenario,
  - According to the RCP 8.5 scenario, an increase between 2.5°C and 3.5°C is predicted unless necessary measures are taken.
- **Changes in Precipitation Pattern:** Although precipitation is generally decreasing, a sustained trend of decrease or increase is not expected. Instead, increasing trends in rainfall irregularities are observed. In total annual precipitation, periodically:
  - Increases up to 140-150 mm,
  - Decreases of up to 240-250 mm are predicted.
- **Extreme Weather Events:** A significant increase in the frequency and severity of extreme weather events related to heat waves and warming is expected. This may adversely affect both public health and infrastructure.
- **Sea Water Temperatures and Biological Problems:** Due to the increase in sea water temperatures, in addition to the biological problems experienced in the Gulf of Izmir, the frequency of cyclones, which were rarely seen in the region before, and flash floods as a result of hail and short-term strong downpours along the coastline are expected to increase.
- **Sea Level Rise:** An annual sea level rise of 3 to 4 mm is predicted. This will lead to an increase in the frequency of sea flooding events, especially in Konak and Karşıyaka districts, while there is a risk of similar problems in areas where sea level is not rising.

These projections and observations have formed an important basis for shaping the measures and adaptation strategies to be taken by Narlıdere Municipality against climate change. Accordingly, sustainable energy and climate action plans have been designed to build local resilience against the impacts of climate change.

6.4.2. Risk Analysis in the Context of Extreme Weather Events

Narlıdere District, as a region that is increasingly feeling the effects of climate change as in the whole world, is also faced with overheating and related risks. The main reasons for this situation are global climate change, rapid urbanisation and urban heat island effect.

Table 6.7 Risk and Vulnerability Analysis in the Context of Extreme Weather Events

SPHERE OF INFLUENCE/SECTOR	EXPLANATION	VARIABLES	EXPOSURE/RESULT	POSSIBILITY	SCORE	RISK LEVEL
Infrastructure Systems	Projected increases in temperature, wind speeds, cold weather and precipitation are particularly stressful on the environment. Critical infrastructure systems (such as electricity, communication networks) and residential areas (especially the living areas of vulnerable populations) are areas of impact.	Cold Air Branch.	3	1	3	Possible
		Heat Wave	5	3	15	Almost Certain
		Heavy Rainfall	5	3	15	Almost Certain
		Hailstorm	2	2	4	Possible
		Strong winds	3	3	9	Great Possibility
Transport	Increases in wind speeds, cold temperatures and rainfall put pressure on transport networks, which can lead to disruption of transport services and material damage during extreme weather events.	Cold Air Branch.	3	1	3	Possible
		Heat Wave	5	3	15	Almost Certain
		Heavy Rainfall	5	3	15	Almost Certain
		Hailstorm	3	2	6	Possible
		Strong winds	3	3	9	Great Possibility
Green Infrastructure	Projected increases in temperature, wind speeds, cold waves and precipitation lead to damage, habitat loss and increased prevalence of invasive species, putting further pressure on biodiversity.	Cold Air Branch.	2	1	2	Possible
		Heat Wave	5	3	15	Almost Certain
		Heavy Rainfall	5	3	15	Almost Certain
		Hailstorm	3	2	6	Possible
		Strong winds	3	3	9	Great Possibility

Water Management	Projected increases in temperature, cold waves and precipitation affect the flow and quality of water resources. Temperature increases and dry days can lead to reduced water resource availability, while cold waves can lead to deterioration of water services.	Cold Air Branch.	2	1	2	Possible
		Heat Wave	5	3	15	Almost Certain
		Heavy Rainfall	5	3	15	Almost Certain
		Hailstorm	2	2	4	Possible
		Strong winds	2	3	6	Possible
Waste Management	Predicted increases in temperature, heat waves and drought can increase the risk of fire in landfill sites and create vermin and odour problems.	Cold Air Branch.	2	1	2	Possible
		Heat Wave	5	3	15	Almost Certain
		Heavy Rainfall	5	3	15	Almost Certain
		Hailstorm	2	2	4	Possible
		Strong winds	3	3	9	Great Possibility
Public Health	The negative impact of extreme weather events and related disasters on natural resources and environmental degradation have negative impacts on human health. Changes in air, soil and water quality have a direct impact on human health such as quality of life and food security.	Cold Air Branch.	3	1	3	Possible
		Heat Wave	5	3	15	Almost Certain
		Heavy Rainfall	5	3	15	Almost Certain
		Hailstorm	2	2	4	Possible
		Strong winds	3	3	9	Great Possibility

1. **Infrastructure Systems**

Heatwaves and Extreme Precipitation (15): Heat waves and excessive rainfall pose serious threats to infrastructure systems. Heat waves may cause increased energy demand and power outages, while water supply problems may also occur. Extreme rainfall can render drainage systems inadequate, leading to blocked roads and damaged bridges. These climate events challenge the resilience of infrastructure. It is necessary to strengthen infrastructure systems against these threats, establish early warning systems and increase the resilience of energy infrastructure.

2. **Transport:**

Heat waves and excessive rainfall (15): Heat waves may cause deformation of road asphalts and disruptions in transportation. Excessive rainfall can cause flooding, blocking roads and increasing traffic accidents. It is of great importance to make the transport infrastructure resilient against heat waves and extreme rainfall. These measures will ensure uninterrupted and safe transport.

3. **Green Infrastructure**

Heatwave and Extreme Precipitation (15): Heat waves negatively impact green infrastructure and can cause damage to vegetation and increased pressure on water resources. Excessive rainfall leads to soil erosion and habitat loss. Nature-based solutions and sponge city practices against these threats are very important for the protection of green infrastructure and efficient use of water. In this way, both the ecosystem is protected and water management in the city can be improved.

4. **Water Management**

Heatwaves and Extreme Precipitation (15): Heat waves put pressure on water resources and increase water demand, while excessive rainfall can cause flooding and water quality deterioration. Therefore, it is crucial to strengthen water management and flood management strategies, improve drainage infrastructure and increase water efficiency. These measures will ensure sustainable management of water resources.

5. **Waste Management**

Heatwaves and Heavy Rainfall (15): Heat waves can cause difficulties in waste collection and transport processes and lead to rapid deterioration of waste. Extreme rainfall can lead to waste accumulation, blocked waterways and water pollution. Increasing the resilience of waste management systems against these climatic events and conducting regular audits are important to protect environmental health.

6. **Public Health**

Heatwaves and Extreme Precipitation (15): Heat waves can increase the incidence of health problems such as heat stroke, heart attack and stroke, while excessive rainfall can lead to drinking water pollution and the spread of infectious diseases. In order to protect public health, effective health measures and measures to prevent water pollution should be taken against these threats.

General Fragility Assessment

Most Vulnerable Sectors: Green Infrastructure, Water Management

Most Urgent Intervention Area: It is necessary to make the infrastructure resilient against the effects of heat waves and excessive rainfall, and to establish early warning systems.

Recommendations:

- Early warning systems should be established and flood management plans should be prepared.
- Buildings should be insulated against heat waves.
- Water management should be provided with nature-based solutions and green areas should be protected.
- Infrastructure, transport networks and water management systems should be strengthened against heat waves and extreme rainfall.
- Public health measures should be improved to reduce the risks of health problems and water pollution caused by heat waves and extreme rainfall.

6.4.3. Extreme Heat and Heat Islands

Increasing greenhouse gas emissions on a global scale accelerate the temperature increase in the atmosphere and increase the frequency and severity of heat waves. In urban areas such as Narlıdere, concretisation, the prevalence of asphalt surfaces and the decrease in green areas

strengthen the urban heat island effect and cause local temperatures to rise further. In addition, human activities such as increasing population, heavy traffic and energy consumption are also important factors that trigger overheating in the district.

According to the data shared in **Table 6.10 in** the examination carried out within the framework of the data obtained **from the General Directorate of Metrology**, high temperatures continue uninterruptedly especially in July and August. This situation shows that high temperatures are exceeded in Narlıdere region in the summer months at a level that may affect commercial activities and life.

Table 6.8 Number of Days with Daily Maximum Temperature Above 30 Degrees

Number of Days with Monthly Maximum Temperature Above 30°C					
Year/Month	**May**	**June**	**July**	**August**	**September**
2014	4	11	27	23	5
2015	6	5	30	31	13
2016	2	19	31	28	9
2017	1	17	29	28	14
2018	7	14	30	29	13
2019	3	18	26	29	5
2020	9	13	29	30	21
2021	7	11	30	31	8
2022	8	21	29	26	16
2023	2	12	31	30	17
2024	4	30	31	31	12

As seen **in Table 6.10**, the highest temperatures of the months in Narlıdere region can exceed 40 degrees Celsius and this temperature is at a level that can be directly characterised as extreme temperature.

Table 6.9 Monthly Maximum Temperatures in Narlidere Region[10]

Monthly Maximum Temperatures in Narlidere Region						
Year/Month	**April**	**May**	**June**	**July**	**August**	**September**
2014	26,9	31,9	38,7	36,8	35,8	33,5
2015	26,7	32,3	33,8	37,5	36,7	36,7
2016	29,9	33,6	40,5	38	36,7	34,6
2017	28,4	31,3	40,1	41,3	36,7	36,1
2018	29,6	33,3	36	36,2	36,7	33,4
2019	26,6	34	37,2	36,7	37,1	32,5
2020	25,5	37,5	33,6	36,9	37,2	36,1
2021	29,8	32,1	35,9	39,2	39,7	35,2
2022	27,1	34,3	35,4	37,3	37,1	35,3
2023	23,1	32,2	33,8	42,3	39	34,6
2024	29,4	31,6	40,1	40,9	37,9	35,2

Overheating has serious impacts on both human health and environmental systems in Narlıdere. High temperatures pose life-threatening risks, especially for the elderly, children and individuals with chronic diseases, leading to an increase in health problems such as heat stroke, dehydration and respiratory problems. In addition, extreme heat increases energy consumption and puts pressure on electricity networks. In agricultural areas, the risk of water stress and drought increases, which reduces crop productivity and threatens food security. In addition, high temperatures adversely affect the natural ecosystems in the district, putting pressure on vegetation and animal populations, and significantly increasing the risk of forest fires in the district, 70% of the surface area of which is composed of nursery, shrub and forest areas. Infrastructure systems are also affected by extreme heat; problems such as deterioration of asphalt roads, deformation of building materials and decrease in water resources arise.

When all these risk factors are analysed by taking into account exposure situations and probabilities, extreme temperatures are considered as a high-risk climatic threat both in our district Narlıdere and throughout Izmir province.

[10] Directorate General of Metrology Corporate Archive

The figure below from the Izmir SECAP report shows the projected increases in annual average temperatures for Izmir province. Based on the figure, a temperature increase of 1-2°C is expected in the Narlıdere region between 2050-2100 under the RCP8.5 scenario. Although this expected temperature increase may seem small in numerical terms, it is at a level that will cause major natural events, ecosystem and human health damages. Even a difference between 1.5°C and 2°C can have major consequences. Scientists are trying to limit the global temperature increase to 1.5°C with the Paris Agreement. Because reaching 2°C may have much more irreversible consequences. For these reasons, it is necessary to take necessary measures to limit this temperature increase in our district Narlıdere.

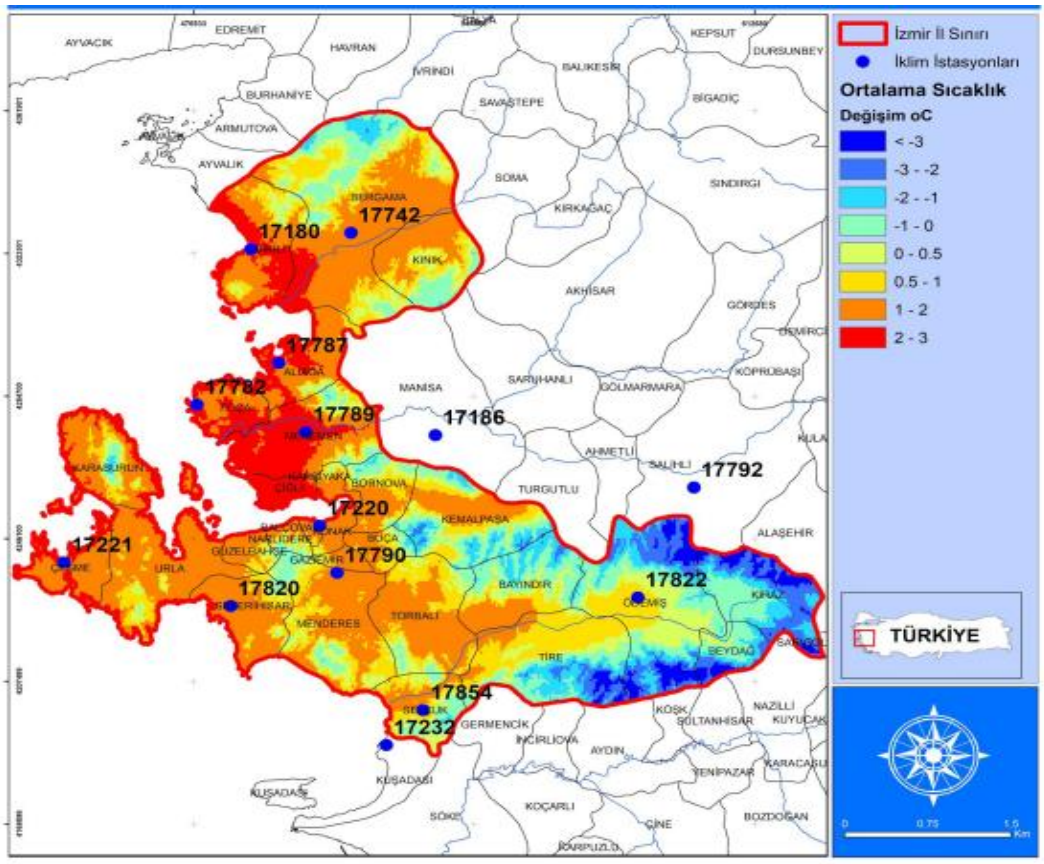


Figure 2 Izmir province current (1971-200) and future (2050-2100) temperature changes according to RCP8.5 scenarios

In addition to excessive heat, climate change, drought, anthropogenic activities and geographical conditions are the main causes of threatening forest fires. Climate change creates favourable conditions for forest fires by increasing temperatures and changing precipitation regimes. Drought causes vegetation to dry out and fires to spread more easily. Human activities, especially

uncontrolled fires in picnic areas, stubble burning and unconscious disposal of cigarette butts lead to the start of fires. In addition, sparks from power lines also increase the risk of fire.

The surface area of Narlıdere District consists of 20 per cent residential area, 10 per cent agricultural land and 70 per cent nursery, shrub and forest areas. Such a large percentage of forested areas significantly increases the risk of fire. Especially in the summer months, the increase in temperatures and the intensification of drought increase the probability of fire in these areas. The proximity of forest areas to residential areas further increases the risk of fires spreading rapidly and causing loss of life and property. The recent forest fire incidents in Izmir also suggest the necessity of taking necessary measures in this regard.

Forest fires cause serious negative impacts on both the natural environment and human life. Fires lead to the destruction of forest ecosystems, loss of vegetation cover and decrease in biodiversity. In addition, forest fires increase soil erosion and cause loss of fertile soils. Fires in forested areas close to settlements can cause loss of life and property and damage to houses and infrastructure systems. Economically, forest fires cause serious losses in agriculture, tourism and forestry sectors. In addition, smoke and particles released during fires reduce air quality and adversely affect the health of all living things.

According to the information obtained from the TMMOB Union of Chambers of Turkish Engineers and Architects Izmir İKK report, a total of 2579 forest fires occurred throughout Izmir in 2023, burning 15,520 hectares of land. In recent years, urbanisation, especially in areas close to forests, has increased the risk of fire and possible destruction. Considering the proximity of forest areas to residential areas, geographical structure, climatic conditions and human activities in Narlıdere District, forest fires are considered as a high-risk threat in our District, even though there has not been a large-scale forest fire in Narlıdere in the recent past.

6.4.4. Heavy Rainfall

Among the main causes of extreme precipitation events in Narlıdere District, factors such as climate change, geographical structure and rapid urbanisation come to the fore. The increase in the amount of moisture in the atmosphere as a result of global warming increases the frequency and intensity of intense and sudden precipitation. The sloping lands of the district and its location close to the sea cause rainwater to flow rapidly, increasing the risk of flooding. In addition, rapid population growth and concretisation prevent infiltration of rainwater into the soil and increase surface runoff. Conversion of stream beds into residential areas also prevents the natural flow of water and increases the risk of flooding and inundation. These factors make Narlıdere more vulnerable to extreme rainfall events, considering that there are many stream beds in our district.

Excessive rainfall can cause serious damage to both the natural environment and human life by bringing many negative effects. Heavy rainfall can cause sudden floods and floods, especially in areas close to stream beds, causing loss of life and property. In agricultural areas, excessive rainfall increases soil erosion, causing loss of fertile soils and damage to crops. Although the agricultural lands in Narlıdere, which are located close to the coast and are also protected areas, are used to a limited extent due to urbanisation, this value should be protected against the threat of excessive rainfall. In cities, the inability to drain rainwater in areas with dense concretisation causes infrastructure systems to overflow, roads to be flooded and transport to be disrupted. In addition, excessive rainfall can trigger landslides, especially on sloping terrains, creating a serious risk of landslides. In addition, it can also have impacts on natural ecosystems and threaten biodiversity.

All these effects show that excessive rainfall has important consequences both economically and socially. When we look at the history of our district, it is seen that there are incidents of loss of life and property in flood events. Considering this situation and exposure and probabilities, extreme precipitation is rated as a high-risk threat both in our district and in Izmir Province.

In addition, landslides pose a significant risk due to factors such as the geographical structure of Narlıdere, climatic conditions, rapid urbanisation and human activities. The sloping lands and geological structure of the district prepare a ground prone to landslides. Especially in rainy periods, the saturation of the soil with water can trigger landslides as explained above. Rapid population growth and unplanned settlement also increase the risk of landslides by disrupting the balance on sloping lands. These factors make Narlıdere more vulnerable to landslides.

Landslides cause serious negative impacts on both natural environment and human life. Landslides occurring in settlement areas can cause loss of life and property. They can cause serious damage to infrastructure systems, roads and buildings. Landslides in agricultural areas cause loss of fertile soils and damage to crops. In addition, landslides disrupt natural ecosystems, leading to destruction of vegetation and reduction of biodiversity. This situation has important consequences both economically and ecologically.

Considering the geographical structure of Narlıdere District, climatic conditions and human activities, landslides are considered as a high-risk threat. Considering the slope of the region, especially in the south of our district, it is inevitable to include retaining walls as an infrastructure system in the construction process. Retaining walls have been damaged due to landslides caused by excessive rainfall and reduction of green areas, resulting in loss of property. The landslide events experienced in the past reveal the reality of this risk.

Table 6.11 from the Izmir SECAP report shows the distribution of buildings damaged by landslides by districts in Izmir. According to this table, the Narkent area in Narlıdere district is one of the most important landslide zones in Izmir and there are 800 damaged buildings. However, it is thought that the number of damaged buildings is higher as it is foreseen that not all of the damages in the illegal buildings located in the north of the mentioned region will be detected.

Table 6.11 Important landslide areas of Izmir (2008)

District	Damaged Buildings (units)
Çiğli – Güzeltepe	440
Konak – Gürçeşme	10
Kadifekale	3162
Altındağ – Merkez / Kuyu Çamdibi	86
Hâkimiyeti Milliye	64
Narlıdere – Narkent	800

6.4.5. Floods (River and Urban)

Increasing extreme precipitation events as a result of global warming significantly increases the risk of flooding. The sloping lands of the district and its location close to the sea cause rainwater to flow rapidly, increasing the risk of both river and urban flooding. In addition, rapid population growth and concretisation prevent the infiltration of rainwater into the soil and increase surface runoff and pave the way for urban floods.

Although there are no major rivers in Narlıdere, the Ilıca and Alionbaşı streams and their tributaries in the district carry the risk of flooding as a result of heavy rainfall. Narrowing the stream beds, disrupting the natural flow paths of water by turning them into settlement areas, passing infrastructure systems and vehicle-pedestrian roads over the streams with the idea that the streams are dry increases the risk and severity of floods. Flood events experienced in the past have caused loss of life and property and caused damages in residential areas.

Rapid urbanisation and concretisation is an important factor increasing the risk of urban flooding in Narlıdere. Impervious surfaces that prevent rainwater infiltration into the soil cause water to accumulate rapidly on the surface and exceed the capacity of infrastructure systems. This

situation leads to flooding, unusable roads and disruption of transportation, especially in the district. In addition, inadequate sewerage and storm water drainage systems further increase the impact of urban flooding. In addition, floods can trigger landslides, increasing the risk of landslides, especially on sloping terrains. They can also have negative impacts on natural ecosystems and threaten biodiversity.

Since the majority of the surface area of our district consists of forest areas, it is considered that biological diversity is also at risk for our district in this context, considering the presence of living organisms living in that region. In addition, considering the past flood events experienced in Narlıdere District and current risk factors, floods are considered as a high-risk climate threat.

The figure below, taken from the Izmir Metropolitan Municipality SECAP report, shows 22 different locations in Izmir that are known to have experienced flooding, as well as areas considered to be at risk of flooding. As can be seen in the figure, Narlıdere District stands out as an area that has been subjected to flood events in the past and is still under the risk of flooding due to its geographical structure, rapid urbanisation and the effects of climate change .[11]

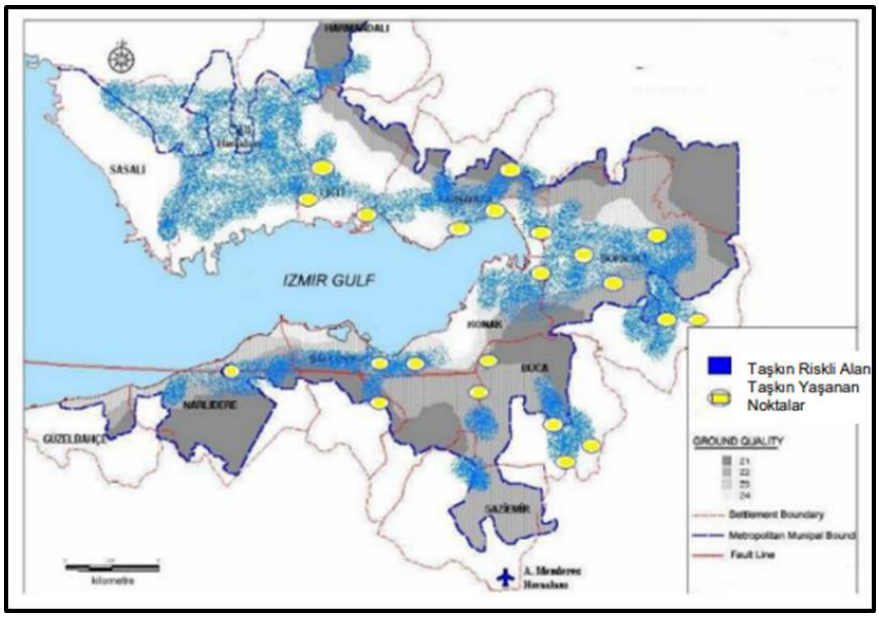


Figure 3 Flood risk areas (blue) and flood hotspots (yellow) in İzmir Bay Region

[11] Izmir Sustainable Energy and Climate Action Plan

Table 6.10 Risk and Vulnerability Analysis in the Context of Floods and Floods

SPHERE OF INFLUENCE/SECTOR	EXPLANATION	VARIABLES	EXPOSURE/ RESULT	POSSIBILITY	SCORE	RISK LEVEL
Infrastructure Systems	Coastal, river and rainfall-induced flooding brings additional stress and risk to the built environment. This additional risk causes damage to businesses, residences, critical infrastructure, etc. in the built environment	Sudden Surface Floods	5	3	15	Almost Certain
		Groundwater Floods	3	2	6	Possible
Transport	Increases in coastal, river and rainfall-induced flooding cause road damage and disruptions to all transport services.	Sudden Surface Floods	5	3	15	Almost Certain
		Groundwater Floods	3	2	6	Possible
Green Infrastructure	Impervious surfaces in green areas increase the risk of flooding. In addition, an increase in extreme flood events can lead to loss of habitats and damage to ecosystems.	Sudden Surface Floods	5	3	15	Almost Certain
		Groundwater Floods	3	2	6	Possible
Water Management	Increases in flooding events put more pressure on water systems, which are often located at lower altitudes and are therefore at higher risk of flooding.	Sudden Surface Floods	5	3	15	Almost Certain
		Groundwater Floods	3	2	6	Possible

Waste Management	Flood water affecting the landfill sites may lead to contamination of surface and groundwater and bacteria-virus proliferation. This situation may cause contamination of landfill sites and organic-chemical substances in the landfill sites may mix with water and cause environmental pollution and threaten drinking water resources. In addition, soil and ecosystem balance is adversely affected.	Sudden Surface Floods	5	3	15	Almost Certain
		Groundwater Floods	2	2	4	Possible
Public Health	The increase in surface and groundwater pollution due to floods poses a risk to human health, such as the spread of water-borne infectious diseases. In addition, flood waters pose a vital risk for the society.	Sudden Surface Floods	5	3	15	Almost Certain
		Groundwater Floods	4	2	8	Great Possibility

In the risk and vulnerability analysis table in **Table 6.12**, vulnerabilities in the relevant sectors in the context of flooding and flooding are evaluated. According to this assessment:

1. **Infrastructure Systems**

Flash Surface Floods (15): Flash surface floods pose a high threat to infrastructure systems. Flooding can damage roads, bridges and drainage systems, leading to transport interruptions, power failures and disruptions in water supply. Strengthening infrastructure against floods is critical to prevent disruptions.

Groundwater Floods (6): Groundwater flooding can cause blockages and failures in underground infrastructure. Rising groundwater levels put pressure on water pipes, reducing water quality and preventing efficient operation of infrastructure. Strengthening groundwater management in Narlıdere will reduce these risks.

2. **Transport**

Flash Surface Floods (15): Flash surface floods pose a high risk to the transport networks in Narlıdere. Situations such as road closures may cause interruptions in transport. Strengthening the transport infrastructure against floods is important to reduce these risks.

Groundwater Flooding (6): Groundwater flooding causes moderate vulnerability of transport systems. Regular maintenance and renewal of drainage infrastructure can reduce the impacts of groundwater flooding.

3. **Green Infrastructure**

Flash Surface Floods (15): Flash surface floods directly threaten the green infrastructure in Narlıdere. Such events create very high vulnerability, leading to ecosystem destruction and soil erosion. Reducing impervious surfaces and protecting natural drainage areas can reduce these risks.

Groundwater Flooding (6): Groundwater floods negatively affect green areas, creating high vulnerability. Therefore, it is important to take measures against such risks in green infrastructure areas.

4. **Water Management**

Flash Surface Floods (15): Flash surface floods have direct negative impacts on water resources. It causes problems such as water flow reaching the sea and groundwater cannot be fed. Therefore, it carries a great risk in terms of water management.

Groundwater Floods (6): The intrusion of saline water from the sea into groundwater resources increases with rising groundwater levels, reducing the quality of groundwater resources. Saline water restricts the availability of water for agricultural irrigation and causes crop burns in plants with low salt tolerance. Groundwater floods necessitate hydrological modelling and early warning systems. An approach based on scientific modelling is necessary to minimise the impacts of such floods.

5. **Waste Management**

Flash Surface Floods (15): This type of flooding creates a high level of vulnerability in waste management systems. Flood waters can affect waste containers and cause water pollution. Waste management systems need to be made flood-resilient.

Groundwater Floods (4): Can cause blockages and failures in underground infrastructure. Rising groundwater levels put pressure on water pipes, reducing water quality and preventing efficient operation of infrastructure. Strengthening groundwater management in Narlıdere will reduce these risks.

6. **Public Health**

Flash Surface Floods (15): Floods and inundation can lead to drinking water contamination and the spread of infectious diseases. This risk to public health is high and protection of health infrastructure is vital.

Groundwater Floods (8): Groundwater flooding can affect the quality of groundwater resources, leading to contamination of drinking water. This increases health risks. Early warning systems and regular monitoring of water resources are critical to protect public health.

Overall Assessment of Fragility Results

Most Vulnerable Sectors: Green infrastructure, Water management

Most Urgent Response Area: Building resilience against flash surface floods is the most urgent intervention area. Infrastructure needs to be made flood-resilient, early warning systems need to be installed and green infrastructure needs to be strengthened.

Recommendations:

- Early warning systems should be established and flood management plans should be prepared.

- Ecosystem-based solutions such as rainwater harvesting, reduction of impervious surfaces and protection of natural drainage areas should be emphasised.

- Infrastructure, transport networks and water management systems should be strengthened against floods.

- Public health measures should be improved to reduce water pollution risks.

6.4.6. Drought and Water Scarcity

The risk of drought in Narlıdere District is increasing due to factors such as climate change, water resources management, population growth and rapid urbanisation. Changes in precipitation regimes as a result of global warming increase the frequency and severity of prolonged dry periods. The geographical structure of the district and limited water resources further increase the risk of drought. In addition, rapid population growth and urban development increase water demand and put pressure on existing water resources. These factors make Narlıdere more vulnerable to drought.

Table 6.13 shows the number of rainy days obtained from the General Directorate of Meteorology for Izmir Region. As can be seen in the graph, there are long uninterrupted periods between June and September without significant rainfall. During these periods, it is likely that problems will be encountered in the supply of water resources to the existing population.

Table 6.11 Izmir Rainy Day Graph

Number of Monthly Rainy Days												
Year/Month	1	2	3	4	5	6	7	8	9	10	11	12
1990	2	6	1	9	3	2	0	1	3	4	6	18
1991	6	8	5	9	13	0	1	1	0	6	3	11
1992	0	6	9	6	3	2	0	1	0	5	7	11
1993	10	8	9	8	8	1	0	0	1	2	11	10
1994	10	13	6	5	5	2	0	1	0	12	7	9
1995	16	9	15	8	3	0	0	1	3	4	14	13
1996	7	13	11	9	4	1	0	1	11	7	6	17
1997	4	9	8	14	4	3	0	0	0	8	11	16
1998	7	6	11	7	12	0	1	0	5	6	14	16
1999	9	22	10	8	1	1	0	0	1	4	9	9
2000	9	9	9	11	3	0	0	1	0	6	7	8
2001	9	10	5	10	5	1	0	1	2	0	16	19
2002	7	7	9	13	2	0	2	0	10	9	9	15
2003	12	15	5	12	4	1	0	0	0	10	3	13
2004	18	7	3	7	5	2	1	0	0	2	8	10
2005	14	18	11	4	6	2	0	1	2	2	11	10
2006	10	11	13	4	1	3	0	0	6	5	6	4
2007	5	7	5	4	5	2	0	0	0	8	13	13
2008	4	3	11	8	3	1	0	0	4	6	9	15
2009	13	16	15	7	7	3	0	0	6	6	9	14
2010	16	16	6	6	10	5	0	0	3	10	6	15
2011	11	10	4	13	9	1	0	0	2	6	0	14
2012	14	11	4	8	12	2	0	0	0	3	4	17
2013	16	16	11	3	6	5	0	1	1	4	10	6
2014	11	5	10	11	7	9	1	1	3	6	9	19
2015	15	14	17	6	4	5	0	3	3	6	7	0
2016	13	9	12	5	8	1	0	1	2	3	9	4
2017	16	6	12	7	10	3	0	1	0	5	8	12
2018	13	18	14	2	5	8	0	2	3	5	11	13
2019	22	10	4	6	3	5	2	0	3	3	11	14
2020	5	9	8	8	10	3	0	0	0	5	3	13
2021	19	7	12	12	1	5	0	0	1	4	6	17

The main causes of drought are climate change, rapid urbanisation, inadequate management of water resources and population growth. Global warming causes prolonged dry periods by changing precipitation regimes, and decreasing rainfall and increasing evaporation lead to depletion of water resources. Rapid urbanisation, concretisation and reduction of green areas prevent infiltration of rainwater into the soil and adversely affect the supply of groundwater reserves. Inefficient use of water resources, waste of water and infrastructure deficiencies also increase the risk of drought. Increasing population creates additional pressure on water resources by increasing water demand.

Drought causes serious negative impacts on both the natural environment and human life. Water scarcity leads to a decrease in water resources required for drinking water, agriculture and industry. The decrease in agricultural production reduces crop productivity and threatens food security. The decrease in water resources leads to the deterioration of ecosystems by causing damage to vegetation and decrease in biodiversity. Water scarcity can negatively affect public health and lead to social conflicts over access to water resources.

Considering the geographical structure of Narlıdere District, climate change impacts and pressures on water resources, drought is considered as a high-risk threat.

Table 6.12 Risk and Vulnerability Analysis in the Context of Drought and Pollution

SPHERE OF INFLUENCE/ SECTOR	EXPLANATION	VARIABLES	EXPOSURE/ RESULT	POSSIBILITY	SCORE	RISK LEVEL
Infrastructure Systems	Drought-induced water scarcity poses a serious risk to the supply of clean water to urban environments.	Water scarcity	4	4	16	Almost Certain
		Pollution of water	4	3	12	Great Possibility
Green Infrastructure	Scarcity of water, which is the source of life for living organisms, negatively affects biodiversity. Decrease in biodiversity has negative impacts on ecosystem services.	Water scarcity	4	4	16	Almost Certain
		Pollution of water	4	3	12	Great Possibility
Water Management	Drought affects the ground and surface water system and leads to a decrease in water resources.	Water scarcity	4	4	16	Almost Certain
		Pollution of water	4	3	12	Great Possibility
Waste Management	Water scarcity due to drought makes it essential to recycle wastewater and make it suitable for different uses.	Water scarcity	4	4	16	Almost Certain
		Pollution of water	4	3	12	Great Possibility
Public Health	Water scarcity makes it difficult to access clean water, which is the source of life. Difficulty in accessing clean water jeopardises the sustainability of life, while deteriorating hygiene conditions increase the risk of health problems.	Water scarcity	4	4	16	Almost Certain
		Pollution of water	5	3	15	Almost Certain

In the risk and vulnerability analysis in **Table 6.14**, vulnerabilities in the relevant sectors are assessed in the context of drought and water scarcity. According to this assessment:

1. Infrastructure Systems

Water Scarcity (16): Drought creates high vulnerability in infrastructure systems. It can cause major difficulties in the provision of clean water. Water scarcity can lead to disruptions in the systems needed to ensure water supply, threatening the sustainability of infrastructure. This situation requires strengthening infrastructure for the effective management and supply of water.

Pollution of Water (12): Pollution of water resources adversely affects the functioning of infrastructure systems. This can create great difficulties in meeting the need for clean water.

2. Green Infrastructure

Water Scarcity (16): Water is a key resource for the sustainability of green infrastructure. Water scarcity has negative impacts on the ecosystem by threatening biodiversity. This is critical for the healthy functioning of green spaces and leads to a deterioration of the natural balance

Water Pollution (12): Polluted water puts severe pressures on green infrastructure, negatively affecting biodiversity and ecosystem services. Polluted water threatens the health of natural areas, further reducing biodiversity and destabilising ecosystems.

3. Water Management

Water Scarcity (16): Drought prevents the efficient functioning of ground and surface water systems and leads to a reduction in water resources. This jeopardises water sustainability and makes water management more complex.

Water Pollution (12): Polluted water resources pose serious threats to water management. Deterioration of water quality makes it difficult for water treatment systems to operate efficiently and makes it more difficult to protect water resources.

4. Waste Management

Water Scarcity (16): Increasing water scarcity due to drought poses a significant risk to waste management. Limited water resources increase the need for waste reuse and recycling. This requires the strengthening of waste management infrastructure and the introduction of new technologies.

Water Pollution (12): Water contamination creates major risks in waste management. Polluted waters can lead to loss of efficiency during the management and processing of wastes and damage the environment

5. Public Health

Water Scarcity (16): Water scarcity poses serious risks to public health by making access to clean water difficult. Difficulty in access to clean water leads to deterioration of hygiene and increases the risk of spread of infectious diseases.

Water Pollution (15): Polluted water sources pose great threats to health. The spread of water-borne diseases endangers public health.

Overall Assessment of Fragility Results

Most Vulnerable Sectors: Infrastructure Systems, Green Infrastructure, Water Management

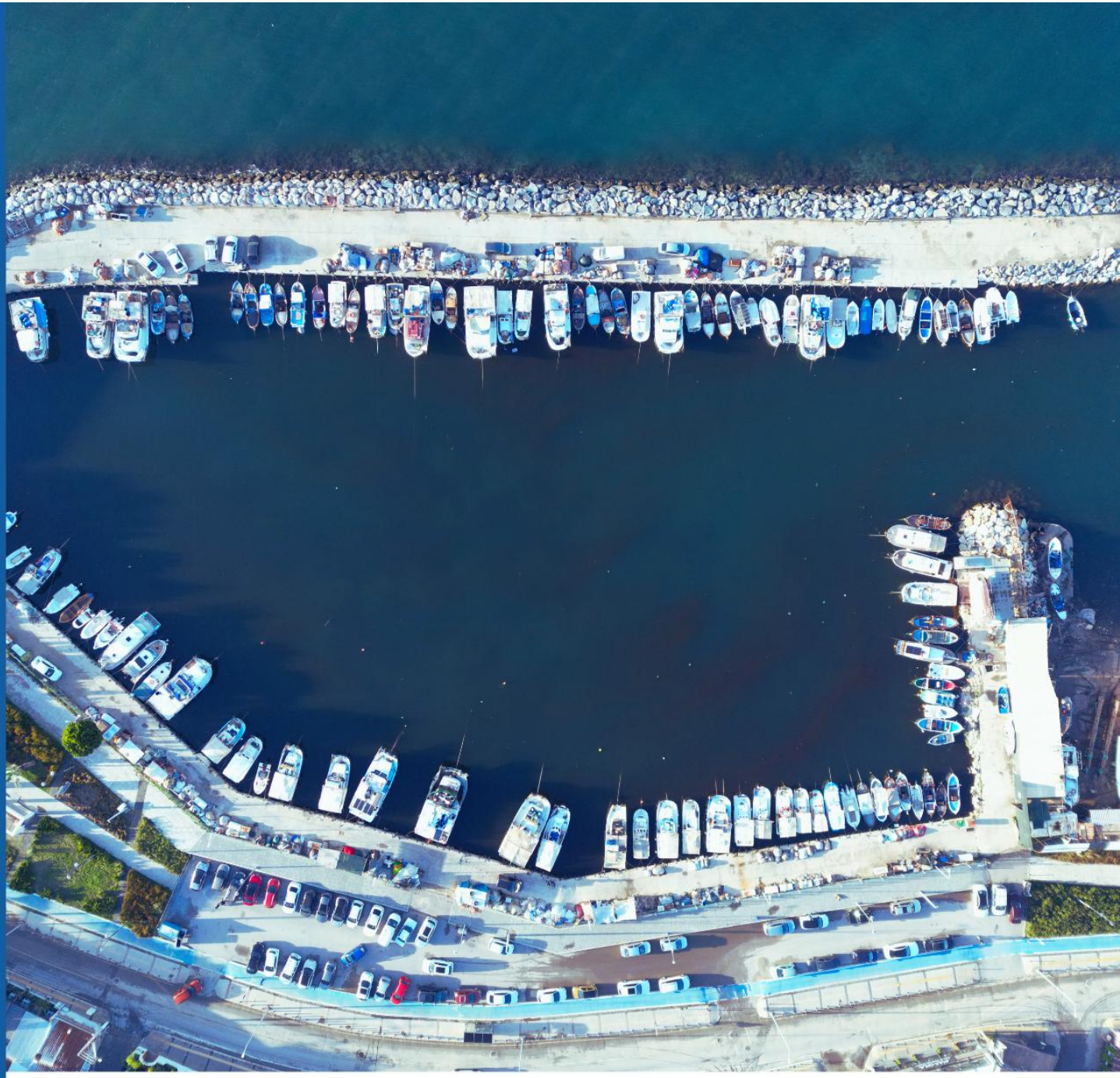
The Most Urgent Area of Intervention: Building resilience to water scarcity, strengthening infrastructures and efficient management of water is the most urgent area of intervention.

Recommendations:

- Sustainable solutions should be developed in water management. Practices such as rainwater harvesting and grey water management should be encouraged to save water.

- Technology and infrastructure for reuse of wastewater should be strengthened. Water recovery systems should be established.

- Measures should be taken to prevent pollution of water resources and access to clean water should be facilitated.



7.ENERGY POVERTY

NARLIDERE BELEDİYESİ

7.1. Energy Poverty: Definition, Analysis and Causes

Energy poverty refers to the inability of individuals or households to access basic energy services. This includes problems that directly affect daily life, such as the inability to provide adequate heating and cooling, to meet lighting needs or to pay energy bills. **The United Nations Development Programme (UNDP)** defines energy poverty as the inability of individuals to access modern cooking fuels and basic levels of electric lighting. Similarly, **the International Energy Agency (IEA)** defines energy poverty as households' **difficulties in accessing reliable, affordable and clean energy solutions**. These definitions are addressed in the context of **the UN Sustainable Development Goals** and emphasise the goal of "clean and affordable energy for all by 2030".

Some criteria come to the fore in the assessment of energy poverty. One of these **is the ratio of energy expenditures in the household budget**. **Allocating more than 10 per cent of** a household's total income **to energy expenditures** is a common indicator of energy poverty. For example, in countries such as **the UK** and **Spain**, this threshold varies between 10 per cent and 15 per cent**, whereas in Turkey it can exceed 25 per cent for some households**. Furthermore, **electricity consumption of less than 100 kWh per month or less than 1200 kWh per year** indicates that a household cannot adequately meet its energy needs and these households are defined as **electricity poor**.

Energy poverty is a multidimensional problem. **In the economic dimension**, **income inequality** plays an important role. Low-income households both struggle to bear high energy costs and **lack access to insulated housing or energy efficient appliances**. **Increasing energy prices**, especially with fluctuations in fossil fuels and liberalisation of energy markets, make them even more vulnerable. **Old, uninsulated buildings and low-efficiency systems** lead these households to consume more energy and thus face higher costs. **Inadequate energy infrastructure** limits access to energy, especially in rural areas, and in some regions leads to instability of energy supply. Moreover, **policy and structural deficiencies**, i.e. the lack of effective support mechanisms for low-income groups, deepen energy poverty. **Climate change** is also an important factor, with rising temperatures and extreme cold **increasing the demand for heating and cooling, driving up energy costs**.

In conclusion, energy poverty is not only an economic issue but also a comprehensive problem that directly affects **social inequalities, environmental impacts** and **quality of life**. Therefore, solution strategies require holistic approaches.

7.2. Energy Poverty in Turkey and Narlıdere

Energy poverty is a significant problem, especially in low-income areas and regions with insufficient electricity consumption. In Turkey, energy poverty can be defined as the inability

of households to obtain the energy necessary to meet their basic needs. This problem is particularly pronounced in the Southeastern and Eastern Anatolia regions of Turkey. Provinces in the Aegean region are less likely to experience energy poverty. Access to electricity constitutes a serious quality of life problem for households that cannot use sufficient energy.

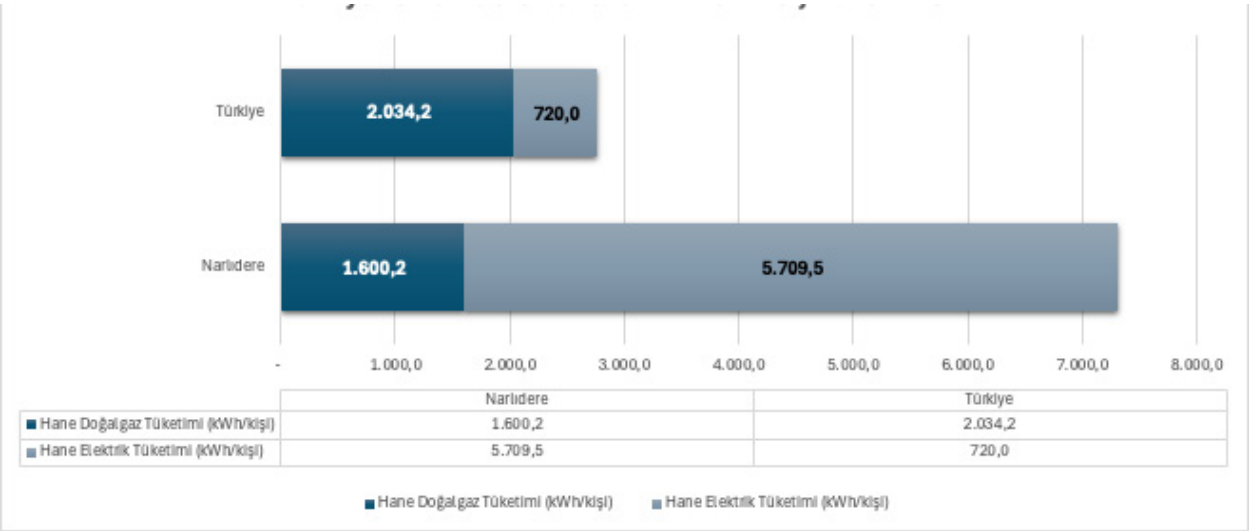
Energy poverty in Turkey stems from economic inequalities on the one hand and structural problems in the energy sector on the other. Electricity tariffs can be high, especially for low-income households. Electricity prices vary according to the tariffs set by energy companies, which creates difficulties for consumers. Moreover, energy losses reinforce this price increase and deepen energy poverty. Loss and leakage rates in the electricity distribution system in Turkey lead to both increased costs and higher prices for low-income households[12]

In the comparison made within this framework, remarkable differences are observed between **Narlıdere district** and **Turkey in** terms of household energy consumption. According to the data shared in **Table 7.1, natural gas consumption per household in Narlıdere is 1,600.2 kWh/person** and **electricity consumption is 5,709.5 kWh/person**. On the other hand, **the average natural gas consumption in Turkey is 2,034.2 kWh/person** and **electricity consumption is only 720.0 kWh/person**. The results are presented in **Table 7.1**.

In the light of these data, the **fact that electricity consumption** in Narlıdere **is approximately 8 times higher than the average of Turkey** shows that households in the region have to meet their energy needs mainly with electricity. This is due to the fact that the natural gas infrastructure has only recently reached the region. **It is seen that electricity is widely used** especially **for heating, hot water supply and other basic services.** On the other hand, the use of air conditioning is common due to the high temperatures of the region. Although this situation creates an opportunity for sustainable energy use, it may cause energy access problems for citizens who pay high bills due to the staggered electricity tariff.

[12] Eke, Erdem & AYRANCI, Emine. (2018). Evaluation of the Electricity Sector in Turkey in terms of Energy Poverty. Political Economic Theory. 2. 109-129.

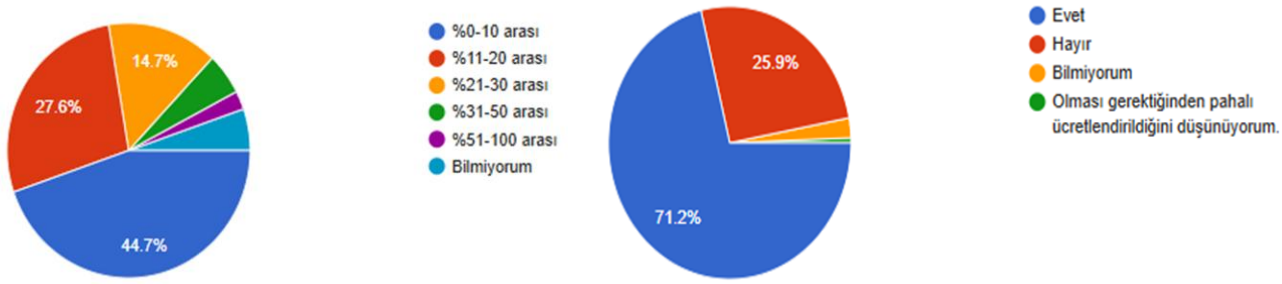
Table 7.1 Narlıdere District Energy Consumption Comparison



	Narlıdere	Türkiye
Hane Doğalgaz Tüketimi (kWh/kişi)	1.600,2	2.034,2
Hane Elektrik Tüketimi (kWh/kişi)	5.709,5	720,0

On the other hand, in order to analyse citizens' energy access problems more clearly, questions on energy poverty were shared in our citizen survey. **Table 7.1 and Table 7.2** present the responses on what percentage of households' income electricity and natural gas consumption constitute and whether they have difficulty in meeting their energy expenses.

Table 7.2 Narlidere Citizen Survey: Statistics on Household Energy Expenses



While the majority (44.7%) stated that energy expenditures are between 0-10% of their income, it is seen that energy costs constitute a serious burden for almost 55% of the respondents. In addition, 71% of the respondents stated that they have difficulty in meeting their energy consumption expenses. This survey study emphasises the importance of energy efficiency measures and sustainable energy solutions for low-income households.

7.3. Strategies and Solutions for Combating Energy Poverty

Energy poverty refers to the difficulties experienced by low-income households in accessing basic energy needs. As Narlıdere Municipality, developing innovative and fair solutions that are both economically and environmentally sustainable in the fight against energy poverty and taking an egalitarian approach in access to energy are among the main goals. In this direction, strategies to reduce energy poverty are shaped based on the principles of social, economic and environmental sustainability. It is possible to list the solution strategies that can be effective in combating energy poverty as follows:

Dissemination of Energy Efficiency Projects

In Narlıdere, one of the priority targets is to develop projects that will increase the energy efficiency of residences. The use of innovative technologies such as insulation, energy-efficient appliances and solar energy will be encouraged to enable households to meet their basic energy needs such as heating and cooling at lower costs. These projects will also support environmental sustainability by reducing energy consumption of households.

Promoting Renewable Energy Sources

It is aimed to reduce the energy costs of low-income households by increasing the use of renewable energy sources such as solar energy and wind energy in Narlıdere. In particular, the installation of solar energy panels for households will be encouraged to both save on energy bills and reduce environmental impacts. This strategy will contribute to achieving the sustainability goals of our district by increasing the use of renewable energy sources while ensuring fairness in access to energy.

Increasing Social Assistance and Support Programmes

Narlıdere Municipality aims to provide more comprehensive social assistance and support programmes for households struggling to pay their energy bills. These programmes will facilitate access to energy for low-income families, alleviate the effects of energy poverty and improve the quality of life of households struggling to pay their energy bills. The Municipality aims to provide a fair solution by integrating energy assistance into its social assistance policies.

Education and Awareness Campaigns

Raising public awareness on energy saving, informing about energy efficiency and renewable energy sources play an important role in changing the energy usage habits of the society. Narlıdere Municipality will encourage the public to use more sustainable energy by organising

various training and awareness campaigns. These campaigns will be an important step towards preventing energy poverty in our district and will also raise environmental awareness.

7.4. Strategic Approach of Narlidere Municipality

Narlıdere feels the impact of energy poverty intensely due to the difficulties faced by low-income households in accessing energy, along with heating difficulties in winter and cooling costs in summer. In the citizen survey, 44.7% of the respondents stated that their energy expenditures were between 0-10% of their income, while almost 55% stated that energy costs were a serious burden on their family budgets. In addition, 71% of the respondents emphasised that they have difficulty in meeting their energy consumption expenses. This situation negatively affects the quality of life of households in our district and creates serious barriers to access to energy for a large segment of the society.

Narlıdere Municipality adopts the following strategic approaches in order to solve energy poverty and provide more sustainable and accessible energy services to our people:

Energy Efficiency Increasing Projects

Projects to increase energy efficiency and sustainable energy use will be realised. In order to increase the energy efficiency of old buildings in Narlıdere, insulation will be strengthened and the use of energy-saving devices will be encouraged. In addition, it is aimed to implement these projects on a wider scale by providing incentives and support to households on energy efficiency.

Promotion of Renewable Energy Sources

Narlıdere is a region with high solar energy and wind energy potential, and it is planned to disseminate solar energy systems and wind energy systems in order to use these resources more efficiently. It is aimed to increase the use of solar energy with government incentives, especially for low-income households.

Social Support Programmes

High energy costs constitute a significant problem for low-income households. In this context, it is planned to support households to cover their energy bills more easily by increasing energy subsidies, providing direct financial support and subsidies.

Social Awareness and Education

Large-scale training and awareness campaigns will be organised in Narlıdere on energy saving and renewable energy use. These campaigns will raise the awareness of the

community on energy efficiency and sustainable energy solutions and enable them to become more widely acquainted with these solutions.

Green Infrastructure and Climate Resilience Projects

It is aimed to create an infrastructure that is resilient to climate change in Narlıdere. Green infrastructure projects will enable the construction of a city structure that is prepared against natural disasters, while also increasing environmental sustainability. These projects will both increase energy efficiency and make public access to energy more efficient.

Establishment of Local Energy Cooperatives

Local energy co-operatives will be established, enabling communities to access renewable energy solutions more easily and reduce energy costs. Cooperatives will play an important role in combating energy poverty by increasing social solidarity and providing environmental benefits at the same time.

Narlıdere Municipality's strategic approaches to combat energy poverty aim to ensure that households in our district have easier access to energy and are introduced to sustainable energy solutions. Steps to be taken in a wide range of areas, from energy efficiency improvement projects to the promotion of renewable energy sources, from strengthening social support programmes to social awareness activities, will make Narlıdere a more energy independent and environmentally friendly city. This strategic approach will not only reduce energy poverty, but also ensure that our district moves rapidly towards a sustainable future.

8.ACTION PLANS

NARLIDERE
BELEDİYESİ

Narlıdere Municipality has developed a comprehensive Climate Action Plan in order to minimise the impacts of climate change and create a sustainable city vision. This plan consists of two main headings: **Mitigation Actions** to reduce greenhouse gas emissions and **Adaptation Actions** to adapt to climate change.

Mitigation actions include strategies such as increasing energy efficiency, promoting renewable energy sources and making waste management sustainable, while adaptation actions are designed to reduce climate-related risks and increase the resilience of city infrastructure.

8.1. Mitigation Actions

Narlıdere Municipality has set the reduction of greenhouse gas emissions as the main goal within the scope of combating climate change and has implemented sustainable urbanisation policies in this direction. The mitigation actions developed by the municipality aim to reduce the environmental impact by reducing energy consumption and at the same time improve the quality of life of the city residents.

These actions include a wide range of strategic practices from public buildings to housing, from transport to energy production. **Ensuring energy efficiency in buildings and facilities**, **dissemination of renewable energy resources**, **reduction of fossil fuels**, **energy saving in housing and awareness raising activities** constitute the main components of this strategy.

Under each action heading, **baseline analysis**, **alignment with national plans**, **priority level**, **action steps**, **impact**, **stakeholders**, **cost**, **timing** and **risks** are defined in detail. Through this comprehensive approach, the municipality aims to promote sustainability-oriented transformation not only in internal practices but also at household and private sector level.

Practices such as electric/hybrid vehicle conversion projects, construction of new buildings in compliance with green building standards, insulation and energy efficiency campaigns in dwellings are among the concrete outputs of the plan, thus supporting both short and long-term carbon reduction targets.

8.1.1. Energy Efficiency Action Plans for Buildings and Facilities

Action 1.1 Mitigation	Development of Energy Management System in Municipal Buildings and Facilities
Current Situation/Purpose	To reduce energy consumption in municipal buildings in accordance with the communiqué sent to municipalities on 22.09.2020 by the General Directorate of Local Governments of the Ministry of Environment, Urbanisation and Climate Change. To minimise greenhouse gas emissions emitted by the system to be installed.
Relationship with Existing Plans	National Energy Efficiency Improvement Action Plan 2024-2030, Energy Efficiency Law No. 5627
Priority Level	High
Action Steps	1. Conducting energy efficiency studies in Narlıdere Municipality buildings, monitoring and reporting energy loss analyses annually, 2. Establishment of ISO 50001 Energy Management System, internal audits and annual review of system performance, 3. Developing an internal structure and organisation within the municipality to manage SECAP and Energy Management System processes, 4. Organising information and project sharing meetings with energy management units of other public institutions, 5. Preparation of a "General Green Procurement Specification" based on "Lifetime cost, energy efficiency and sustainability" criteria instead of "Purchase cost" in public procurement.
Action Type	Finance and implementation
Impact Amount	20% saving in energy consumption of municipal buildings
Responsible	Narlidere Municipality
Stakeholders	Energy Companies
Municipality's Contribution	Preparation of Energy Audit and Action Plans. Establishment, maintenance and certification of ISO 50001 Energy Management System.
Cost	450.000 TL
Timing	2025-2030
Risks	Technological Challenges, Insufficient Training and Awareness, Budget Exceedance, Legal and Regulatory Changes

Action 1.2 Mitigation	Municipal Practices for Energy Efficiency and Greenhouse Gas Reduction
Current Situation/Purpose	By reducing energy consumption in the buildings owned by the Municipality, environmental impacts will be reduced and the construction of sustainable buildings will be supported. In order to ensure energy efficiency standards in new buildings, it is aimed to introduce an Energy Identity Certificate (EPC) obligation.
Relationship with Existing Plans	National Energy Efficiency Improvement Action Plan 2024-2030, Energy Efficiency Law No. 5627
Priority Level	High
Action Steps	6. Providing the energy needs of existing and newly constructed buildings belonging to the Municipality from renewable energy sources, 7. Design and realisation of new municipal facilities in accordance with green building standards, 8. Construction of a 'Carbon Zero Park' that will raise awareness in the society by providing practical examples of energy efficiency and water saving solutions, 9. Realisation of renewable energy production with solar panels in areas such as indoor market place, roofs of sports facilities, etc. 10. Switching to smart lighting systems in all possible streets, alleys and parking areas.
Action Type	Finance and Application
Impact Amount	30 per cent savings in energy consumption
Responsible	Narlidere Municipality
Stakeholders	Project Firms and Contractors
Municipality's Contribution	Implementer
Cost	30.000.000 TL
Timing	2025-2030
Risks	High Cost

Action 1.3 Mitigation	Energy Efficiency Practices in Houses
Current Situation/Purpose	In the distribution of greenhouse gas emissions in Narlıdere, residences have a share of 43.6%, while the share of commercial and institutional buildings/facilities is 41%. Significant reductions in electricity and fuel consumption can be achieved through measures such as taking insulation measures, raising awareness on the use of appliances and LED lighting.
Relationship with Existing Plans	Strategic Action Plan 2025-2029 Objective (A1) - Target (H1.1-H1.3)
Priority Level	High
Action Steps	11. Inspection of insulation applications in existing buildings throughout the city and ensuring that renovation projects are carried out, 12. Increasing incentives for insulation, 13. Ensuring the improvement of thermal insulation standards in newly built houses, 14. Implementation of LED transformation campaigns, seeking "Nearly Zero Energy Building" criterion in buildings with a construction area larger than 1000m², 15. Making it compulsory for existing buildings in Narlıdere to obtain Energy Identity Certificate, 16. Encouraging the transition from coal to natural gas and geothermal in residential buildings, 17. Conducting awareness-raising activities to popularise thermal insulation applications in residential and commercial buildings, 18. Encouraging and supporting SPP and RES applications in residential and commercial buildings, 19. Encouraging the use of efficient space heating and cooling systems in residential and commercial buildings, 20. Encouraging the use of electrical household appliances with high energy class in residential buildings, 21. Raising awareness of sector stakeholders and the public on renewable energy, efficient lighting, energy efficient devices, insulation, etc, 22. Organising campaigns and activities for energy efficiency in schools and educational institutions, 23. Organising energy efficiency seminars, giving 'Energy Detective Cards' to kindergarten and primary school students and ensuring that they take responsibility for energy.

Action Type	Application and Training
Impact Amount	Savings of up to 40 per cent in residential energy consumption
Responsible	Narlidere Municipality
Stakeholders	District Directorate of National Education, Energy Companies, Professional Chambers
Municipality's Contribution	Implementation, supervision, financing.
Cost	2.000.000 TL
Timing	2025-2030
Risks	Resistance to energy efficiency solutions from building occupants and owners can make improvements difficult.

Action 1.4 Mitigation	Increasing the Use of Renewable Energy in Buildings
Current Situation/Purpose	The rate of renewable energy use in buildings in Narlıdere remains at low levels. In the current situation, it is planned to expand the use of renewable energy sources such as solar energy and wind energy due to the high number of sunny days and being located in a windy region.
Relationship with Existing Plans	National Energy Efficiency Improvement Action Plan 2024-2030
Priority Level	High
Action Steps	24. Identifying potential areas in the region to increase the use of solar and wind energy and supporting the installation of appropriate systems, 25. Providing incentives for the installation of solar energy systems in residential and commercial buildings in Narlıdere, 26. Organising campaigns to inform the public about renewable energy sources such as solar energy and wind energy, 27. Improvement of infrastructure for the installation and integration of renewable energy systems, 28. Taking necessary steps for more effective and widespread utilisation of geothermal energy resources 29. Providing information about state supports for the installation of renewable energy systems.
Action Type	Finance, Implementation and Training
Impact Amount	20 per cent savings in energy consumption
Responsible	Narlidere Municipality
Stakeholders	Site managements, Chamber of Commerce and Industry, Energy Companies
Municipality's Contribution	It will provide the necessary infrastructure and co-operation.
Cost	10.000.000 TL
Timing	2025-2030
Risks	High Cost.

Action 1.5 Mitigation	Zoning Plans for Carbon Zero Emission in New Settlement Areas
Current Situation/Purpose	Izmir Metropolitan Municipality zoning regulations are not compatible with renewable energy systems and energy efficiency criteria. Furthermore, energy efficiency practices are not set as threshold criteria in zoning plans. In order to address these shortcomings, Narlıdere Municipality aims to promote energy efficient solutions.
Relationship with Existing Plans	National Energy Efficiency Improvement Action Plan 2024-2030
Priority Level	High
Action Steps	30. Updating the Izmir Metropolitan Municipality Zoning Regulations in line with the criteria for rooftop solar energy systems, rainwater harvesting, grey water systems and energy efficiency, 31. Prioritising energy efficient applications in urban transformation projects, 32. In urban regeneration, use centralised heating and cooling systems and prefer high efficiency heat pumps when necessary, 33. Determining energy efficiency practices as a threshold criterion in master and implementation development plans, 34. Rewarding ecological housing projects that produce renewable energy and make environmentally friendly landscaping to encourage them, 35. Providing the necessary incentives to promote the use of waste shredding devices in buildings that will receive new licences, 36. Providing necessary support to encourage the use of heat pumps in new buildings.
Action Type	Finance, implementation and training
Impact Amount	30 per cent savings in energy consumption
Responsible	Narlidere Municipality, Izmir Metropolitan Municipality
Stakeholders	Construction Companies, Energy Companies, Professional Chambers
Municipality's Contribution	It will provide the necessary infrastructure and co-operation.
Cost	3.000.000 TL
Timing	2025-2030
Risks	High Cost

Action 1.6 Mitigation	Replacing Fossil Fuels with Clean Energy Alternatives
Current Situation/Purpose	The ratio of fossil fuels in energy use in Narlıdere is high and this situation creates environmental impacts. It aims to replace fossil fuels with clean energy alternatives, thus reducing carbon emissions and ensuring environmental sustainability.
Relationship with Existing Plans	National Energy Efficiency Improvement Action Plan 2024-2030, Climate Change Mitigation Strategy and Action Plan (2024-2030)
Priority Level	High
Action Steps	37. Identification and mapping of regions with low socio-economic level using fossil fuels, 38. Identification of alternative clean energy sources (solar energy, wind energy, geothermal energy, etc.) to replace fossil fuels, 39. Carrying out incentive studies for transition to clean energy, 40. Promoting the use of clean energy through awareness and information activities.
Action Type	Finance and implementation
Impact Amount	20 per cent savings in energy consumption
Responsible	Public Institutions
Stakeholders	Energy companies
Municipality's Contribution	It will provide the necessary infrastructure and co-operation.
Cost	3.000.000 TL
Timing	Long Term (2025-2030)
Risks	High Cost

Action 1.7 Mitigation	Improving Waste Management and Increasing Waste Recycling Practices
Current Situation/Purpose	Narlıdere Municipality aims to create social awareness on waste management and recycling and to establish an effective and sustainable system to contribute to the circular economy. In line with this goal, the prevention of environmental pollution and efficient use of resources will be encouraged by separating and recycling wastes, disseminating environmentally friendly practices and increasing social participation.
Relationship with Existing Plans	National Energy Efficiency Improvement Action Plan 2024-2030, Climate Change Mitigation Strategy and Action Plan (2024-2030)
Priority Level	High
Action Steps	41. Establishing a system for separate collection of packaging waste from households, 42. Establishing a recycling facility to recycle park-garden and market place wastes and contribute to the circular economy, 43. Organising awareness raising activities on the importance of recycling in schools, workplaces and community centres, 44. Organising recycling competitions and trainings for students, 45. Encouraging zero waste certificate and green workplace practices in municipal workplaces, 46. Rewarding businesses and individuals who contribute to recycling by providing incentives and certificates.
Action Type	Finance and implementation
Impact Amount	35% savings in energy consumption
Responsible	Narlidere Municipality, Izmir Metropolitan Municipality
Stakeholders	Izmir Metropolitan Municipality-District Directorate of National Education
Municipality's Contribution	It will provide the necessary infrastructure and co-operation.
Cost	50.000.000 TL
Timing	2025-2030
Risks	High Cost

8.1.2. Transport Action Plans

Action 2.1 Mitigation	Conversion of Municipality's Service Vehicles to Electric/Hybrid Models
Current Situation/Purpose	It is aimed to convert 63 existing vehicles used in municipal services into environmentally friendly electric and hybrid models. In particular, it is aimed to purchase electric or hybrid vehicles with low emissions and high energy efficiency instead of leased vehicles and vehicles that break down. Thus, environmental sustainability will be supported by reducing carbon emissions, improving air quality and saving energy.
Relationship with Existing Plans	Transport and Logistics Master Plan 2023-2053, Izmir Transport Master Plan (UPI 2030)
Priority Level	High
Action Steps	47. Determining the existing vehicle inventory and identifying the vehicles to be replaced, 48. Prioritise the replacement of leased and broken down vehicles with low carbon vehicles, 49. Meeting the need for electricity by creating electric vehicle charging stations, 50. Providing waste collection service with electric mini garbage trucks
Action Type	Investment, strategy
Impact Amount	45% savings in energy consumption
Responsible	Narlidere Municipality
Stakeholders	Vehicle Companies, Energy Companies
Municipality's Contribution	Conversion of municipal vehicles
Cost	60.000.000 TL
Timing	2025-2050
Risks	Failure to allocate sufficient funding for the renewal of the NB vehicle fleet. Inadequate charging infrastructure. High cost of electricity.

Action 2.2 Mitigation	Promoting Environmentally Friendly Transport and Establishing the Necessary Infrastructure
Current Situation/Purpose	Narlıdere Municipality aims to make the transport system sustainable, environmentally friendly and energy efficient. It aims to reduce traffic density, encourage environmentally friendly transport habits and increase the use of public transport.
Relationship with Existing Plans	Transport and Logistics Master Plan 2023-2053, Izmir Transport Master Plan (UPI 2030)
Priority Level	High
Action Steps	51. Organising information events in cooperation with relevant stakeholders to encourage the use of electric vehicles, 52. Establishing charging stations in car parks for electric vehicles, using renewable energy sources to feed charging stations, 53. Implementation of bicycle road network planning and implementation, 54. Providing awareness raising trainings to citizens on the use of bicycles and public transport, 55. Shared electric scooter or shared bicycle etc. dissemination of micro-mobility applications, 56. Expansion of bicycle parking areas and repair stations, 57. Increasing the number of streets and areas closed to traffic, 58. Optimise public transport routes to reduce fuel consumption, 59. Realisation of the rail system, 60. Establishing 'Park, Continue' points so that citizens passing through Narlıdere route can be directed to public transport vehicles from where they come by car, 61. Installing bicycle carrying apparatus on public transport vehicles.
Action Type	Investment, plan and strategy
Impact Amount	50 per cent savings in energy consumption
Responsible	Izmir Metropolitan Municipality, Narlidere Municipality
Stakeholders	Ministry of Transport and Infrastructure, Ministry of Environment, Urbanisation and Climate Change
Municipality's Contribution	Organisation of awareness trainings. Establishment of electric vehicle charging stations.
Cost	30.000.000 TL
Timing	2025-2030
Risks	Inability to allocate financing for the rail system project. Difficulty in changing the transport habits of citizens. A significant portion of the existing roads are not suitable for bicycle lanes.

Action 2.3 Mitigation	Organising Eco-Friendly Economic Driving Trainings
Current Situation/Purpose	It is aimed to reduce fuel consumption by providing training on economical driving techniques to public transport vehicle drivers, taxis, all commercial vehicles and private vehicle owners, especially municipal personnel. Studies show that economical driving techniques provide fuel savings of up to 10%.
Relationship with Existing Plans	Transport and Logistics Master Plan 2023-2053, Izmir Transport Master Plan (UPI 2030)
Priority Level	High
Action Steps	62. Organising economic driving trainings for municipal staff and city residents, 63. Informing the district transport and cargo companies and organising joint programmes with educational institutions 65. Creation of Economic Driving Training content with relevant stakeholders.
Action Type	Information and Training
Impact Amount	10 per cent savings in energy consumption
Responsible	Izmir Metropolitan Municipality, Narlidere Municipality
Stakeholders	IZBB, Private Sector (logistics companies), District Directorate of National Education
Municipality's Contribution	Organisation of municipal training programmes and awareness raising activities.
Cost	1.000.000 TL
Timing	2025-2030
Risks	Inability to allocate time for trainings, inability to change citizen behaviour patterns.

8.2. Adaptation Actions

Adaptation actions have been developed in order to minimise the impacts of climate change on Narlıdere and to create a structure prepared against climate risks in different areas of urban life. These strategic actions aim to create an urban system that is resilient to regional climate threats such as **heat waves**, **floods**, **droughts**, **sea level rise** and **storms**.

Adaptation actions include priority topics such as **protection of vulnerable community groups**, **development of early warning systems**, **increasing urban green areas**, **reducing water consumption and raising awareness on rain harvesting**. Each action is structured by taking into account the existing adaptation capacity and vulnerability levels of the relevant sectors.

Through these actions; it is aimed to make health systems prepared for climate shocks, reduce the urban heat island effect with green infrastructure, structural solutions for the prevention of natural disasters and increase the level of climate awareness of the society.

Each activity developed under the adaptation heading has been defined in a holistic manner with components such as **adaptation impact**, **timeframe**, **responsible institutions and organisations**, **estimated cost** and **implementation risk**, thus creating a clear roadmap for implementation.

Action 1.1 Adaptation	Protecting and Supporting Vulnerable Sections of Society against Climate Hazards
Climate Hazards	Heat waves, Floods, Drought, Sea Level Rise
Available Compliance Capacity	Limited emergency response systems, existing social support networks, local awareness programmes
Important Sectors Affected	Health, Housing, Agriculture, Water Resources, Infrastructure
Sub-Actions and Activities	1. Establishment of local disaster plans, 2. Establishment of emergency shelters in flood-prone areas, 3. Organising special climate change awareness programmes for vulnerable groups, 4. Increasing the capacity of local health and disaster management teams and making them prepared for disasters through trainings and drills, 5. Providing rapid social service support for vulnerable groups in disaster situations in co-operation with local NGOs, 6. Develop social support programmes to increase the resilience of vulnerable segments of society against extreme climate impacts, 7. Develop support programmes for the protection of stray animals against extreme climate impacts, 8. Improving the settlement needs of communities that are critically vulnerable to climate impacts, 9. Addressing climate migration problems with a process management approach and preparing a regional action plan, 10. Conducting research to better analyse heat-related morbidity and mortality
Time Interval	2025-2030
Responsible Institutions and Organisations	Narlıdere Municipality, Ministry of Health, AFAD, NGOs
Effect of Action on Harmony	1. Increasing resilience to climate hazards, 2. Reduction of health risks, 3. Providing better disaster response and recovery.
Approximate Cost	25.000.000TL

Action 1.2 Adaptation	Development of Early Warning Systems and Applications
Climate Hazards	Heat waves, floods, drought, storms, sea level rise, forest fires
Available Compliance Capacity	Limited early warning systems and disaster preparedness capacity; existing systems focus only on some climate hazards.
Important Sectors Affected	Health, Agriculture, Water Resources, Infrastructure, Housing, Transport
Sub-Actions and Activities	11. Establish regional early warning systems for climate hazards and strengthen existing infrastructures, 12. Developing mobile applications and digital platforms for the public to be informed about early warning systems, 13. Conducting trainings and drills for local people, municipal staff and disaster response teams for effective use of early warning systems.
Time Interval	2025-2030
Responsible Institutions and Organisations	Narlıdere Municipality, AFAD, General Directorate of Meteorology, NGOs, Ministry of Agriculture and Forestry, IZSU, DSI
Effect of Action on Harmony	1. Increasing resilience to climate hazards 2. Preventing possible disasters by implementing early measures and precautions
Approximate Cost	30.000.000TL

Action 1.3 Adaptation	Increasing the Number of Urban Green Areas
Climate Hazards	Heat waves, floods, drought, erosion, air pollution
Available Compliance Capacity	Local Awareness Programmes
Important Sectors Affected	Health, Agriculture, Water Resources, Infrastructure
Sub-Actions and Activities	14. Improvement and protection of existing green areas, 15. Increasing green areas, especially in densely populated neighbourhoods lacking green areas, 16. Popularisation of green area applications on roofs and buildings, 17. Carrying out activities to increase tree planting in urban areas with species adapted to local climatic conditions, 18. Organising training programmes to raise public awareness on the importance of green areas and climate change, and conducting these programmes in schools at regular intervals.
Time Interval	2025-2030
Responsible Institutions and Organisations	Narlıdere Municipality, Provincial Directorate of Environment, Urbanisation and Climate Change, Provincial Directorate of Health, NGOs, District Directorate of National Education.
Effect of Action on Harmony	1. By increasing urban green areas, temperature differences in the city will decrease and the impact of heat waves will be reduced. 2. Preventing natural disasters (floods, erosion, landslides, etc.) that occur as a result of sudden changes in weather events due to climate change 3. Green areas will contribute to the protection of natural habitats and biodiversity. 4. It will contribute to the prevention of drought. 5. Increasing green areas will reduce air pollution and create a cleaner environment.
Approximate Cost	80.000.000TL

Action 1.4 Adaptation	Nature Based Water Management Practices and Water Saving
Climate Hazards	Drought, Extreme Weather Events, Floods
Available Compliance Capacity	Local Awareness Programmes
Important Sectors Affected	Agriculture, Energy, Housing
Sub-Actions and Activities	19. Create green roofs on the roofs of buildings that allow water to be retained and slowly evaporate, 20. Use permeable surfaces that allow water to be absorbed instead of asphalt and concrete, 21. Water collection systems for rainwater storage 22. Implementation of grey water management systems, 23. Use of efficient irrigation system in municipal parks-gardens and green areas 24. Implementation of sponge city practices to improve water management throughout the city (green roofs, green corridors, water storage systems, etc.) 25. Establishment of surface water storage systems in newly constructed facilities 26. Raising awareness of local people and construction sector professionals about sponge city applications, 27. Training and awareness campaigns for water saving 28. Provide training and technical support to small-scale agricultural operators in the district on sustainable irrigation methods and rainwater harvesting techniques to increase agricultural resilience to water scarcity, 29. Dissemination of saving apparatus and sensors in taps (Pilot applications in public institutions, educational institutions and municipal buildings),
Time Interval	2025-2030
Responsible Institutions and Organisations	Narlıdere Municipality, Provincial Directorate of Environment, Urbanisation and Climate Change, Provincial Directorate of Agriculture, Mukhtars, District Directorate of National Education.
Effect of Action on Harmony	1. Prevention of floods and floods, 2. Use of separately collected rainwater as irrigation and domestic water in agriculture 3. Preventing the depletion of natural water resources
Approximate Cost	20.000.000TL

8.3. Energy Poverty Actions

Narlıdere Municipality does not limit the processes of combating climate change to technical and infrastructural solutions, but takes a holistic approach that puts social justice at the centre. Accordingly, reducing inequalities in access to energy and effectively combating energy poverty is an important component of the Sustainable Energy and Climate Action Plan (SECAP).

Energy poverty is caused by multidimensional reasons such as difficulties experienced by low-income households in accessing basic energy services, inadequate insulation of dwellings, inefficient appliance use and lack of awareness. Reducing energy poverty in Narlıdere will not only increase individual welfare, but also strengthen social resilience and reinforce the social aspect of the fight against climate change.

The actions developed in this context offer both **infrastructure support** and **social inclusion-based solutions**. Various instruments such as energy efficiency programmes, direct financial support mechanisms, smart meter systems, establishment of energy cooperatives and awareness-raising campaigns are used to improve the living conditions of vulnerable groups.

In addition, **the Energy Information Desk, which will provide direct information support to citizens,** will increase individuals' access to information on both energy efficiency and renewable energy technologies. Such structures not only provide short-term solutions, but also play a critical role in the long term in terms of spreading sustainable energy transformation to the grassroots.

Energy poverty actions are located at the intersection of social policy and energy and climate policies, and are a concrete indicator of Narlıdere Municipality's vision of just transformation. The municipality's decisive stance in this area will be decisive in the construction of a sustainable and resilient urban structure that includes all segments of society.

Action 1.1	Implementation of Energy Efficiency Programmes to Combat Energy Poverty
Current Status/Target	It is aimed to identify the number of neighbourhoods and households experiencing energy poverty that have not yet been identified, to ensure that these households have access to clean energy, to achieve savings in energy consumption through energy efficiency programmes and to improve their quality of life.
Action Steps	1. Mapping of energy-poor households, 2. Establish incentive programmes to increase energy efficiency and access to renewable energy for low-income households, 3. Providing direct financial support to low-income households to cover their energy bills, 4. Providing services such as suspended invoices and ease of bill payment by co-operating with energy companies 5. Enabling households to manage their energy consumption more effectively by installing smart meters and energy monitoring systems, 6. Organising awareness-raising campaigns for households living in energy poverty; educating the society on energy saving and transition to renewable energy, 7. Organising trainings on energy efficiency and renewable energy in schools and community centres, 8. Green infrastructure and climate resilience projects, 9. Establishment of local energy co-operatives
Responsible Institution(s)	Narlidere Municipality, Gdz Electricity, Ministry of Energy and Natural Resources
Stakeholders	Izmir Metropolitan Municipality, Narlıdere District Governorship, NGOs, District Directorate of National Education
Municipality's Contribution	Conducting awareness-raising campaigns, providing financial support.
Estimated Cost	5.000.000TL
Timing	2025-2030
Risks	Budget Inadequacy, Inadequacy of Technical Personnel

Action 1.2	Establishment of Energy Advisory Desk
Current Status/Target	Establish an information point where citizens can get information on energy consumption, energy efficiency and renewable energy sources.
Action Steps	10. Preparation of a guide on efficient energy use in co-operation with professional chambers and engineering faculties of universities 11. Establishment of energy desks; 12. Organising energy efficiency consultancy activities for low-income households, 13. Providing technical support to requesting households, 14. Creating content on the municipality's web page where citizens can obtain information about energy efficiency
Responsible Institution(s)	Narlidere Municipality, IZBB
Stakeholders	Universities, Professional Chambers, GDZ Electricity, Ministry of Energy and Natural Resources, IZBB
Municipality's Contribution	Carrying out information activities, offering incentives.
Estimated Cost	3.000.000TL
Timing	2025-2030
Risks	Financial inadequacies, lack of specialised technical personnel, lack of interest of citizens.

9. CONCLUSION

With the Sustainable Energy and Climate Action Plan (SECAP) prepared to build a sustainable future, Narlıdere Municipality has both assumed responsibility for global environmental problems and put forward a strong and determined climate policy on a local scale. Against the climate crisis caused by the increasing greenhouse gas emissions after the Industrial Revolution, the need for a common struggle at the global level arose; in this context, Narlıdere Municipality signed the Global Covenant of Mayors in 2024 and adopted the goal of reducing carbon emissions by 40% by 2030.

Within the scope of the SECAP, the greenhouse gas inventory prepared by taking 2023 as the reference year clearly revealed the current emission profile of Narlıdere, and the mitigation and adaptation actions were shaped with the strategies developed in this direction. It has been determined that the stationary energy and transport sectors are the priority emission sources; energy efficiency projects, renewable energy investments and environmentally friendly transport practices have been planned for these areas. In addition, district-specific climate threats were identified through risk and vulnerability analyses and comprehensive adaptation strategies were developed to mitigate the impacts of these threats.

SECAP is not only a technical roadmap, but also a holistic plan that addresses environmental justice, social inclusion and economic sustainability together. With multidimensional policies such as combating energy poverty, protecting vulnerable social groups, increasing green infrastructure and water management, climate-oriented transformation is targeted in all areas of urban life.

The participation of all segments of the society is of great importance in this process. With the joint efforts of citizens, civil society organisations, private sector and public institutions, SECAP actions will be implemented and collective success will be achieved in achieving climate targets. Active participation of the public will be supported through training, awareness-raising and consultation mechanisms, and the energy transition will be spread to the grassroots at the local level.

This action plan developed by Narlıdere Municipality is not only a local climate policy, but also a reflection of a strategic vision that aims to leave a liveable environment for future generations in line with regional and national goals. SECAP will be a strong guide in Narlıdere's sustainability journey and will contribute to the creation of an environmentally friendly, resilient and livable city model.