

**CLIMATE NEUTRALITY  
IN LOCAL MUNICIPALITIES' ACTION PLANS:  
İZMİR CASE**

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**by  
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*To all the goals scored at 90+4...*

# ABSTRACT

## CLIMATE NEUTRALITY IN LOCAL MUNICIPALITIES' ACTION PLANS: İZMİR CASE

This thesis investigates the integration of climate neutrality within the action plans of local municipalities, focusing on the relationship between these plans and the actions proposed to achieve climate neutrality in the literature. Addressing the uncertainty surrounding the commitment of local municipalities to climate neutrality and the effectiveness of their actions, the study aims to provide insights for enhancing the efficacy of policies and strategies for climate neutrality at the local level. Through a comprehensive literature review and a case study approach focusing on İzmir Metropolitan Municipality in Turkey, the research develops a checklist for evaluating local action plans, with a particular emphasis on mitigation and adaptation measures. Utilizing this checklist, the study assesses the alignment of the İzmir Sustainable Energy and Climate Action Plan (SECAP) and the Green City Action Plan (GCAP) with climate neutrality principles. The evaluation methodology involves scoring each plan based on the presence or absence of specific actions related to climate neutrality criteria, providing both quantitative findings and qualitative insights into the plans' relationship with climate neutrality actions in the literature. This research contributes to understanding how local municipalities prioritize climate neutrality in their efforts to address climate change and offers recommendations for improving the integration of climate neutrality principles into local policies and action.

**Keywords:** *Climate Action Plan, Climate Change, Climate Neutrality*

# ÖZET

## YEREL BELEDİYELERİN EYLEM PLANLARINDA İKLİM TARAFSIZLIĞI: İZMİR ÖRNEĞİ

Bu tez, yerel belediyelerin eylem planlarına iklim nötrlüğünün entegrasyonunu inceleyerek, bu planlar ile literatürde iklim nötrlüğü elde etmek için önerilen eylemler arasındaki ilişkiye odaklanmaktadır. Yerel belediyelerin iklim nötrlüğüne bağlılığı ve eylemlerinin etkinliği konusundaki belirsizliği ele alarak, çalışma, yerel düzeyde iklim nötrlüğü politikaları ve stratejilerinin etkinliğini artırmak için içgörüler sunmayı amaçlamaktadır. Kapsamlı bir literatür taraması ve Türkiye'de İzmir Büyükşehir Belediyesi'ne odaklanan bir durum çalışması yaklaşımıyla, araştırma yerel eylem planlarını değerlendirmek için bir kontrol listesi geliştirmiştir, özellikle azaltma ve uyum önlemlerine odaklanmıştır. Bu kontrol listesi kullanılarak, İzmir Sürdürülebilir Enerji ve İklim Eylem Planı (SECAP) ile Yeşil Şehir Eylem Planı (GCAP)'nın iklim nötrlüğü prensipleriyle uyumunu değerlendirir. Değerlendirme yöntemi, her planın iklim nötrlüğü kriterlerine ilişkin belirli eylemlerin varlığı veya yokluğuna dayalı olarak puanlanmasıyla ilgilidir, bu da planların literatürdeki iklim nötrlüğü eylemleriyle ilişkisinin hem nicel bulgularını hem de nitel içgörülerini sunar. Bu araştırma, yerel belediyelerin iklim değişikliğiyle mücadele çabalarında iklim nötrlüğünü nasıl önceliklendirdiğini anlamamıza katkıda bulunur ve yerel politikaların ve eylemlerin iklim nötrlüğü prensiplerini daha iyi entegre etmek için öneriler sunar.

**Anahtar Kelimeler:** *İklim Değişikliği, İklim Eylem Planı, İklim Tarafsızlığı*

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## LIST OF SYMBOLS/ABBREVIATIONS

<b>CCAP</b>	: Climate Change Action Plan
<b>CCC</b>	: Climate City Contracts
<b>ÇİŞDB</b>	: Çevre, Şehircilik ve İklim Değişikliği Bakanlığı (Ministry of Environment, Urbanization and Climate Change)
<b>EU</b>	: European Union
<b>EBRD</b>	: European Bank for Reconstruction and Development
<b>GCAP</b>	: Green City Action Plan
<b>LCCAP</b>	: Local Climate Change Action Plan
<b>SECAP</b>	: Sustainable Energy and Climate Action Plan
<b>UCAP</b>	: Urban Climate Action Planning
<b>UN</b>	: United Nations
<b>UNDP</b>	: United Nations Development Programme
<b>VLR</b>	: Voluntary Local Review

# CHAPTER 1

## INTRODUCTION

### 1.1. Aim and Research Question

This thesis focuses on climate neutrality in the action plans of local municipalities and discusses the relationship between the actions included in these plans and climate neutrality. The study investigates the relationship between the mitigation and adaptation actions included in the plans and the framework of climate neutrality actions in the literature. The thesis aims to investigate the importance local governments attach to climate neutrality in coping with climate change through the evaluation of action plans.

What is the relationship between the actions included in the action plans of local municipalities and the actions put forward to achieve climate neutrality in the literature?

### 1.2. Problem Definition

There is uncertainty about how focused local municipalities are on climate neutrality and how much the situation is taken into account<sup>1</sup>. While the role of local municipalities in combating climate change is gaining importance, the problem addressed in this thesis is to understand how much action plans at the local level focus on climate neutrality and how effective they are<sup>2</sup>. To solve this problem, evaluations and recommendations should be developed to make local municipalities' policies and strategies for climate neutrality more effective<sup>3</sup>. However, a comprehensive analysis on this subject is not yet available in the literature. Therefore, this study examines the integration of climate neutrality in municipalities' action plans and the compliance of these plans with the climate neutrality principles in the literature<sup>4</sup>. This thesis study aims to identify the deficiencies and improvement potentials in policies and actions regarding climate neutrality at the local level. In this context, it aims to provide a framework for how local municipalities focus on climate neutrality and how aligned they are with this

goal. Additionally, evaluating local municipalities' actions towards climate neutrality can make an important contribution to the fight against climate change at both local and national scales.

## **1.2. Method of Research**

To answer the research question, this thesis proceeds in two main stages.

First, a comprehensive literature review was carried out, including the description of climate neutrality, studies aimed at determining the evaluation methods applied at the city scale, and case evaluations. In the second stage, a case study approach was adopted that focused on a specific case from Turkey and included climate neutrality and action plans where the relevant evaluation method was applied.

The literature review involves a comprehensive review of past research, creating a checklist to evaluate local municipalities' action plans. This includes searches in databases such as Elsevier and Scopus with keywords such as “climate neutrality” and “climate neutral city”. Considering the limited variety and number of studies accessed, studies measuring the "mitigation" and "adaptation" interventions included in neutrality through a single case were included.

Theses in Turkey benefit from the Higher Education Council National Thesis Center repository. Theses are sought based on specific departments, such as "City and Regional Planning," "Urban Planning," and topics related to specific departments and disciplines. Theses included in these categories are discussed between 2000-2024. Although all documents were scanned, no theses were found that directly addressed the concepts of "climate neutrality" or "climate neutral cities" or mentioned them in the abstract.

In order to determine the methods used in the studies obtained from the literature, the studies were categorized by preparing a list. As a result, it has been revealed that the evaluation method frequently used in studies evaluating plan documents is the evaluation method using a list. Therefore, it was decided to use a case study to propose a list for evaluating plan documents of local municipalities and to determine the results of climate neutrality assessments of plans.

Two city-scale action plans of İzmir Metropolitan Municipality were chosen as the focus of the study. Plan documents, planning reports, conformity assessments, other details regarding action plans and the status of these plans in Turkey were collected from İzmir Metropolitan Municipality and the Ministry of Environment, Urbanization and Climate Change. At the end of the research, an up-to-date climate action plan for the City of İzmir was identified: İzmir Sustainable Energy and Climate Action Plan (SECAP). The other action plan included in the study is the Green City Action Plan (GCAP), which was developed simultaneously with SECAP and presented in a complementary manner. Although the final action reports of these two plans were prepared separately, they were both selected for evaluation because the actions included in the reports were harmonized and complementary.

The two action plans in the study were chosen as case studies because they are primarily focused on combating climate change and include both mitigation and adaptation actions. Although these plans have the goal of achieving climate neutrality, questions arise about the extent to which all aspects of neutrality have been considered. Therefore, it is important that proposals are evaluated with the goal of climate neutrality in mind. The SECAP and GCAP scope prepared by İzmir Municipality allows a comprehensive evaluation of all relevant issues. İzmir was selected as the case study due to its accessibility to information and plans, as well as its proactive approach to addressing climate change.

In 2015, İzmir Metropolitan Municipality committed to reduce greenhouse gas emissions by signing the Mayors' Agreement and set a 40% reduction target by 2030 with the implementation of the SECAP. The city has also prioritized increasing resilience to the impacts of climate change. İzmir GCAP, put forward together with İzmir SECAP in 2020, aims to achieve certain environmental goals and identify important risks and priority actions for a sustainable future in İzmir. SECAP and GCAP serves as a guide on environmental and climate change issues in İzmir. Although separate action plan reports have been developed for both, they complement each other with compatible actions and practices.

The study proposes a checklist to evaluate action plans. For this purpose, research on climate neutrality, local scale (especially city scale) plan reports and climate neutral cities were used. In this way, a descriptive overview of the literature is presented. Instead of existing lists in the literature for measurement, a new checklist was created for this

thesis and is divided into two parts: action areas, actions (measures to achieve climate neutrality). The checklist is designed to evaluate plan documents so that the plans are consistent with the scale in the case studies (city scale). While the second section deals with policy issues such as the definition, content, emergence process and goals of climate neutrality, the third section focuses on previous research and measures developed to achieve climate neutrality. The checklist suggested here may be sufficient for this scenario, but additional elements may be required for different research areas and programs.

Using the suggested checklist, local action plans are evaluated, and their results analyzed. Each measure in the checklist is considered separately and relevant information from the plans is recorded in the evaluation list. The mitigation and adaptation actions included in both action plans are scored based on the framework from the literature. Scoring occurs as follows: "0" indicates that a component is not mentioned in the plan, and "1" indicates that it is included. Plans receive a score of "1" if actions and activities are clearly specified in written documents according to checklist criteria; otherwise, they receive a score of "0" for lack of documentation. Total scores, averages and percentages are calculated, tables and graphs are created, and findings are interpreted. Evaluating scores from both plans helps evaluate the plans' relationship to climate neutrality.

This section of the thesis provides quantitative findings through qualitative evaluation of the components. Additionally, it answers the "how" question by examining the relationship of local action plans with climate neutrality actions in the literature.



## **CHAPTER 2**

### **CLIMATE CHANGE AND CLIMATE NEUTRALITY**

#### **2.1. Concept of Climate Change**

##### **2.1.1. Climate Change**

Climate change is the phrase used to describe alterations in the fundamental features of the climate system, such as temperature and precipitation. Statistical analysis performed over a minimum of 10 years frequently identifies the causes of these changes, which can be either natural or human caused. The concept of climate change, which is considered as a global problem, indicates a change that occurs due to the negative effects caused by humans on the climate, which is actually found in the literature as an anthropogenic climate change<sup>5</sup>.

As a result of climate change, the average temperature on earth gradually increases, evaporation increases due to increases in sea water temperatures, especially in the oceans, which leads to an increase in the energy of the atmosphere. This increase in energy in the atmosphere is included in many climate scenarios where it can lead to serious increases in the number and frequency of extraordinary weather events, bringing with it sudden and severe weather events such as hurricanes, tornadoes, floods and floods. This brings to the agenda the issue that there will be an explosion in the number of natural disasters, especially climate-related, in the future. Due to these natural disasters, there is concern not only about loss of life and property, but also that many plant and animal species face the risk of extinction<sup>6</sup>.

Climate change can be caused by endogenous processes and exogenous influences. Internal processes within the climate system refer to alterations in the circulation patterns of both the ocean and the atmosphere. External factors encompass both natural phenomena, such as variations in solar radiation and volcanic eruptions, as well as human actions that alter the atmospheric composition<sup>7</sup>.

The problem of climate change has been presented as an unprecedented and urgent global policy problem that requires decision-making under uncertainty, based on the principle of precaution in the political arena. It has proven very difficult to formulate the precautionary principle satisfactorily regarding climate change. Since there is no single rational way to make decisions under uncertainty, many decision-making principles on emotional basis such as optimism and pessimism can be applied. The maximin principle, which requires urgent action and is based on pessimism and fear, preferred by the dominant scientific discourse on climate change, is not the only rational decision-making principle that can be applied against such a complex problem<sup>8</sup>.

In the context of theory and practice, list the characteristics that define climate change from a bureaucratic perspective as follows<sup>9</sup>:

- It takes place in a period where time to take action is extremely short.
- It seems that the factors that cause the problem are also those who make efforts to find a solution to the problem.
- Currently, there is no central authority that deals with the problem in a qualified and strong manner.
- Irrationally, the political groups that should be involved in the issue do not care about the future of the problem.
- In the traditional sense, techniques that claim to be analytical are insufficient to find a solution to the problem.

As revealed by the factors listed above, climate change still attracts attention as a problem that is not fully defined in terms of content, quality, and practical reflections. Because an understanding of society and government that ignores the picture that climate change has revealed are, in fact, the elements that best define climate change.

Climate change represents an issue that causes different problems in every region, together with the effects it creates. Although it is seen that there is a visible increase level of this problem in the eastern parts of North and South America, Northern Europe and Northern and Central Asia, it is more serious than the climate change problem in the Sahel, the Mediterranean, Southern Africa, and some parts of southern Asia. They stand out as less negatively affected regions. For this reason, it is understood that climate change has a structure that is affected by and affects regional climate and geography characteristics in terms of structure, quality and functioning<sup>9</sup>.

Although climate change is still a debated issue around the world, governments do not make intense efforts to prevent this problem from escalating. Historical milestones regarding critical turning points regarding the process are listed in Table 1 below.

Table 1: International Climate Meetings as Historical Milestone<sup>10</sup>

<u>Year/Location</u>	<u>Results</u>
1992, Rio de Janeiro	UN Framework Convention on Climate Change (UNFCCC). Countries agree to reduce emissions with “common but differentiated responsibilities.”
1995, Berlin	The first annual Conference of the Parties to the framework, known as a COP. U.S. agrees to exempt developing countries from binding obligations.
1997, Kyoto	At the third Conference of the Parties (COP-3) the Kyoto Protocol is approved, mandating developed countries to cut greenhouse gas emissions relative to baseline emissions by 2008-2012 period.
2001, Bonn	(COP-6) reaches agreement on terms for compliance and financing. Bush administration rejects the Kyoto Protocol; U.S. is only an observer at the talks.
2009, Copenhagen	COP-15 fails to produce a binding post-Kyoto agreement, but declares the importance of limiting warming to under 2°C. Developed countries pledge \$100 billion in climate aid to developing countries.
2011, Durban	(COP-17) participating countries agreed to adopt a universal legal agreement on climate change as soon as possible, and no later than 2015, to take effect by 2020.
2015, Paris	COP-21 195 nations sign the Paris Agreement, providing for worldwide voluntary actions (NDC’s) by individual countries.

When the meetings listed chronologically in Table 1 are examined, it is possible to say that 1997 Kyoto and 2015 Paris have an important place. Accordingly, governments made an important commitment for the future with the Kyoto Protocol in 1997. In 2015, it is seen that 195 countries were included in the structure of combating climate change with the Paris Agreement. Such intense participation shows that the concept of climate change and the problems it creates are perceived sufficiently and accurately.

In general, the main point of optimism of the authorities about the future of the Paris Agreement is related to the power of the agreement that will make all countries responsible for carbon emissions equal in this process. In the past, countries such as the

US, China, Russia and Germany have been accused of being primarily responsible for carbon emissions. However, with the Paris Agreement, the agreement brought equal responsibilities to these countries and directed them to change their policies on industrial policies with legal, financial and bureaucratic sanctions. In other words, it is possible to say that the Paris Agreement has an impact on the environmental transformation of the future of world trade<sup>11</sup>.

### **2.1.2. Causes of Climate Change**

The subject of current climate change discussions is not about the natural greenhouse effect in the world. This relates to the enhanced greenhouse effect, which may or may not be caused by anthropogenic emissions of greenhouse gases<sup>12</sup>. In the quantification study on climate change research prepared by, it is stated that scientific consensus has been reached that human activities are warming the earth's surface and ocean basins, which continues to affect the world's climate.

Considering the effects of human-based climate change, changes such as population growth, urbanization, energy need, agriculture and animal husbandry, mining, transportation and waste, which can be increased, constitute human-induced, that is, artificial, factors of environmental degradation. The opening of the areas necessary for the increasing population to fit into cities has led to the expansion of cities directly into forest areas. This requirement also includes providing clean water, electricity, etc. to meet the energy and other needs of cities<sup>13</sup>.

When the issue is evaluated in a sociological sense, humanity's uncontrolled use of nature's resources and unconscious behavior since the first day of its existence are seen as the basis of climate change. However, in the early 1950s, with the legitimization of the use of nuclear bombs, an uncontrolled production and consumption order began. This order has also led to the construction of a system that is not compatible with nature<sup>14</sup>.

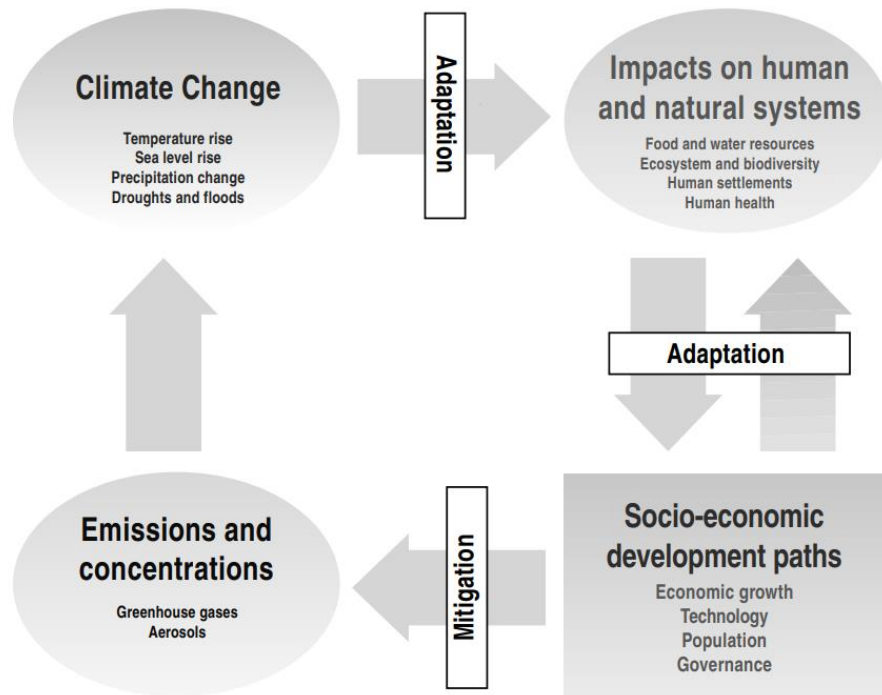


Figure 1 Human primary, socioeconomic sources of climate change<sup>15</sup>

In the diagram on Figure 1, the process of activities that cause climate change in a social sense is discussed. Accordingly, the direct and indirect elements of the investments made by people in socio-economic terms cause the global climate balance to deteriorate over time. In this way, the climate change infrastructure that people create with their own activities reveals elements that create problems for people from different perspectives in the long run. In particular, the earth resources used by humans cause a much more difficult standard of living in the long term due to the negativities caused by climate change.

But in general, climate change also refers to a situation that occurs together with natural elements. It is possible to explain these natural elements as follows<sup>16</sup>:

- Ocean current: The oceans have been shown to be the major component of the climate system. Changes in ocean circulation may affect the climate through the movement of CO<sub>2</sub> into or out of the atmosphere.
- Volcanic activities: Volcanic eruptions are known to throw out large volumes of sulfur dioxide (SO<sub>2</sub>), water vapor, dust and ash into the

atmosphere. It is known that large volumes of gases and ash can influence climate patterns for years.

- Earth's orbital changes: The earth makes one revolution around the sun once a year, tilted at an angle of 23.50 to the perpendicular plane of its orbital path. Changes in the tilt of the earth can lead to small but climatically important changes in the strength of the seasons, more tilt means warmer summers and colder winters; less tilt means cooler summers and milder winters.
- Solar variation: The sun is known to be the source of energy for the planet's climate system. Although the sun's energy output appears constant from an everyday point of view, small changes over an extended period of time can lead to climate changes.
- Cloud's contribution: Global satellite analysis supported by climate models have revealed that cloud cover accentuates warming because as earth's average temperature rises, clouds will accelerate global warming by trapping more heat.

The natural events mentioned above occur geographically within their own cycle. Therefore, at the initial stage, it is possible to say that the influence of humans for these natural events is limited. However, in the later stages, it is possible for the levels of negative factors of climate change to increase due to the problems arising from people's lifestyles.

The main argument of those who deny the existence of the environmental crisis caused by climate change and criticize approaches to this issue is that human-based practices around the world do not cause the global warming problem and therefore the climate change problems. The claim of these groups is that the phenomenon of global warming can also occur with factors other than humans, and that it is wrong to disrupt the activities of daily human life with the threat of climate change allegedly caused by global warming<sup>17</sup>.

### 2.1.3. Effects of Climate Change

While climate change causes the formation of a life form in which all living creatures are negatively affected, it can harm all elements in the life of humans, animals, and nature in general in different ways. In particular, climate change poses a great threat to all environments where humans live permanently or temporarily. Health, economy, agricultural production, etc. The strong effects of climate change are seen in a wide range of areas, especially on issues.

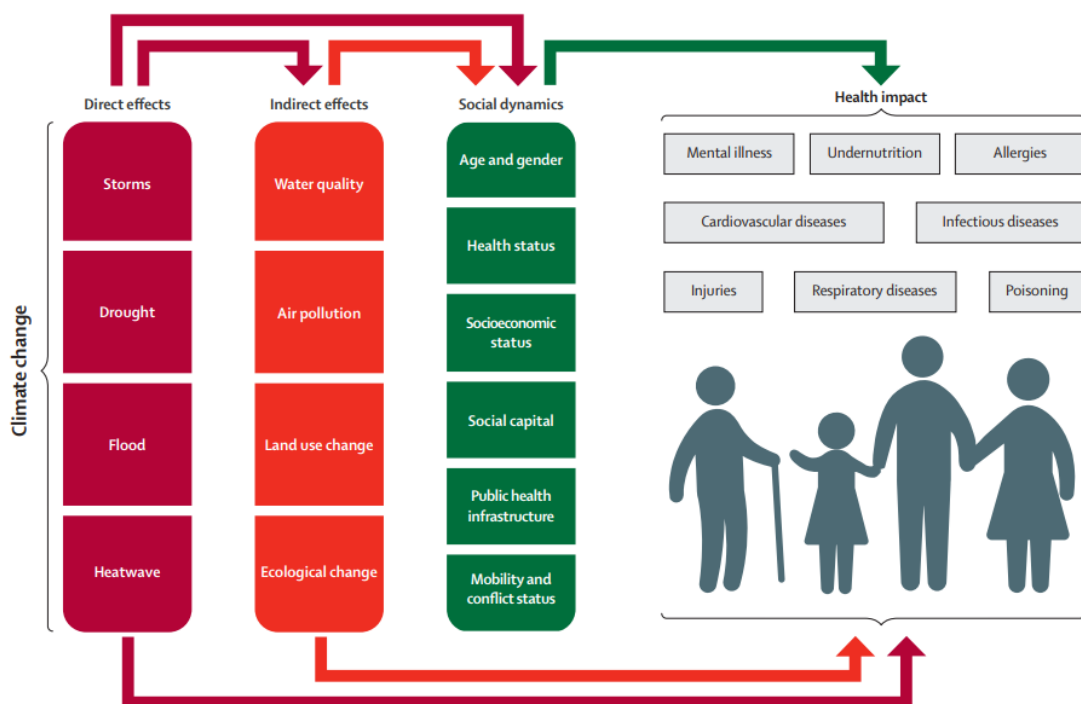


Figure 2 Diagram of the negative effects of climate change on public health, including its direct and indirect effects<sup>18</sup>.

Watts et. al. basically highlight the direct and indirect effects of climate change<sup>18</sup>. These effects ultimately have a negative impact on the social dynamics of the society. Moreover, the problem of climate change, which negatively directs social dynamics, can cause different health problems for each member of society, regardless of age.

When considered in general terms, it is possible to say that climate change has negative chain effects. Climate change, which primarily has negative effects on nature, affects animals over time. Ultimately, negative effects are observed on humans. Climate change, with its negative effects on humans, has the opportunity to spread to a wider area. However, the negative effects on humans are becoming permanent and sustainable, these irreversible negative effects of climate change. The problematic effects of the climate change process, which affects many people negatively, vary from individual to individual and become much stronger<sup>19</sup>.

Although weather and climate changes, which are at the forefront in parallel with the environmental effects, negatively affect human health from different perspectives, the issue with the most negative effects in this regard is related to human psychology. Individuals may have to struggle against different psychological problems in their living spaces, depending on seasonal conditions that become increasingly worse. Acute stress disorder, post-traumatic stress disorder, major depression, somatic disorders, alcohol and substance use, long-term psychological distress, general stress, aggression, and violence tendencies are the main problems<sup>20</sup>.

On the other hand, the most important and most negative physical reflection of climate change in terms of human life is the diseases that occur with this problem. The problem of disruption of the natural life cycle caused by climate change also brings with it many diseases in children. With the increase in the number of natural disasters, the possibility of the spread of water-borne diseases such as typhoid, cholera, leptospirosis and hepatitis, and vector-borne diseases such as malaria and yellow fever also increases. In this way, due to climate change, it becomes possible for different types of diseases to emerge that directly threaten human health<sup>21</sup>.

When evaluated from another perspective, one of the areas where climate change has the strongest impact is the economy. It is possible to consider the economic effects of climate change within the following elements<sup>22,23</sup>.

- Increases in the frequency and severity of natural disasters such as floods and storms may cause the capital to become out of use before its expected lifespan.
- Global warming, the effects of which will continue for many years, may bring about more frequent capital investment adjustments.



- In developed countries that allocate a significant portion of their national income to fixed capital investments, it may cause capital losses and lead to wear and tear of physical capital.
- Sea level rise will accelerate the depreciation of capital by increasing the risk of damage to infrastructure facilities, especially on the coastline.
- Alternative costs will arise as countries exposed to the negative effects of climate change use their resources to eliminate these damages and adapt to climate change.
- There is a possibility of increasing the production amount of some products in middle and high latitudes. Despite these and similar positive effects, the overall impact of climate change on agriculture is expected to be negative (due to the increase in temperatures).

Almost all of the effects and problems listed are related to the negative impact of climate change on the economy. In this way, climate change greatly damages the operational effectiveness of countries and companies.

The fact that economic interests are still being considered, compared to the obvious problems created by climate change, is an indication that environmental problems are not fully understood, or awareness of the issue is not yet clearly established. It is possible to say that the threat of drought now poses a serious threat worldwide, especially in this period when soil fertility has been extremely negatively affected. On the other hand, when we look at the destruction caused by severe storms and forest fires, it is observed that the benefits of the process are becoming more and more destructive<sup>24</sup>.

## **2.2. Triggers of Climate Change**

### **2.2.1. Global Warming**

Global warming is not just an increase in temperature in every region of the world. Global warming is the rapid spread of forest fires as a result of scorching heat in one part of the world, increasing desertification, reaching a level that even endangers human life, and at the same time, natural disasters such as floods and extreme erosion in another part

of the world, causing everywhere to be covered with water due to the effect of excessive precipitation. It is an event that happens<sup>25</sup>.

In other words, global warming means that the temperature of the world's atmosphere gradually increases as a result of the increase in the concentration of greenhouse gases in the air breathed by living things. These gases do not transmit long wave infrared rays and heat and create a greenhouse effect. The heat coming from the sun to the earth has short wavelengths and does not get blocked, but when it is cooled by the earth and re-emitted and reflected, the wavelengths become longer and some of it gets caught in the gases in the atmosphere, creating a greenhouse effect and causing global warming<sup>26</sup>.

Although global warming is a current and important issue, there are still aspects of it that are debated in the scientific world. While a significant portion of researchers describe this situation as a major environmental disaster, others see it as a natural process and claim that it is not possible to make predictions about future temperatures. It is possible to find many scientific studies on global warming. However, despite the abundance of studies, the weak theoretical foundations on the subject are seen as the main reason for the discussions<sup>27</sup>.

### **2.2.2. Greenhouse Gas Effect**

The Sun emits energy in the form of electromagnetic waves, with approximately 99% of this radiation having wavelengths between 0.2 and 0.4 micrometers. The solar radiation that reaches the Earth's atmosphere is composed of 8% ultraviolet radiation, which has a short wavelength of less than 0.3 micrometers, 46% visible light ranging from 0.39 to 0.78 micrometers, and 46% infrared energy at 0.78 micrometers. Visible sunlight absorbed on ground at temperature 20 °C, it emits infrared light of higher wavelength in atmosphere. Greenhouse gases absorb this high wavelength light and radiate back to the earth. When radiation strikes a solid or liquid it is absorbed and transformed into heat and heat conducts to surrounding material i.e. air, water, other solid or liquid. This hot material radiated to other materials of lower temperature. This is called greenhouse effect<sup>28</sup>.

The concentrations of greenhouse gases in the atmosphere (or greenhouse gas stock) are determined by the balance between the rate at which greenhouse gases are added to the atmosphere and the rate of destruction or exit (or flows) of greenhouse gases in the atmosphere. If the production rate (amount of release to the atmosphere) of a greenhouse gas is higher than the destruction rate in the atmosphere, the concentration of the greenhouse gas in the atmosphere should increase<sup>29,30</sup>.

Less than 1% of all gases in the atmosphere are greenhouse gases. The atmosphere is made up of gases such as carbon dioxide, methane, nitrogen dioxide, and others that are produced by energy and other industries. This layer sits between the earth's surface and the sun. Some of the energy entering the earth cannot pass into space and is absorbed by the greenhouse gases in the atmosphere, causing the earth to warm more than anticipated. This is because the gases that have accumulated in the atmosphere are permeable to the sunlight entering the earth but much less permeable to the earth's rays emitted back. The greenhouse effect is an inherent occurrence that contributes to both climate change and global warming<sup>31</sup>.

### **2.3. Climate Neutrality**

The concept of climate neutrality first emerged in 2018, during The Intergovernmental Panel on Climate Change meetings. The concept has been defined as “a situation in which human activities do not cause a net impact on the climate system.” In other words, climate neutrality means creating a balance between sources of carbon dioxide emissions. At the same time, climate neutrality, as a concept that includes negative emissions, also means balancing the level of anthropogenic emissions to the atmosphere caused by humans for a certain period of time<sup>32</sup>.

Conceptually, climate neutrality and carbon neutrality are evaluated on the same level. However, although climate neutrality has the same content and purpose as carbon neutrality, it makes evaluations that are much more human-oriented. Accordingly, climate neutrality is an approach that aims to evaluate and report environmental standards and conditions in a human-oriented manner and to develop solution methods in parallel. In other words, climate neutrality refers to a deeper analysis of the potential of

environmental problems that arise with carbon neutrality and diversification of the content elements<sup>33,34</sup>.

The issue of climate neutrality represents an effort to establish a balance. Accordingly, the system has the meaning of having a balance between releasing carbon from the atmosphere and absorbing carbon. For this reason, the system has an important feature in terms of evaluating the activities of people and institutions regarding carbon emissions. The removal of carbon oxide from the atmosphere and its subsequent storage is called "carbon sequestration". According to the climate neutrality perspective, in order to achieve net zero emissions, it is critical that all greenhouse gas emissions worldwide be more balanced with carbon sequestration activity<sup>35</sup>.

Climate neutrality, an approach that has certain difficulties in terms of implementation, is considered an indispensable practice for all authorities for a livable future. Accordingly, although climate neutrality is seen as an important and critical field of study for the future of humanity and nature, it necessitates radical changes in the functioning of human life. It is imperative to accept climate neutrality practices in a wide range of areas, from the way individuals move to food production, from the way buildings are constructed to the way our cities are organized. The ultimate goal of this process is determined as zero emission production<sup>33</sup>.

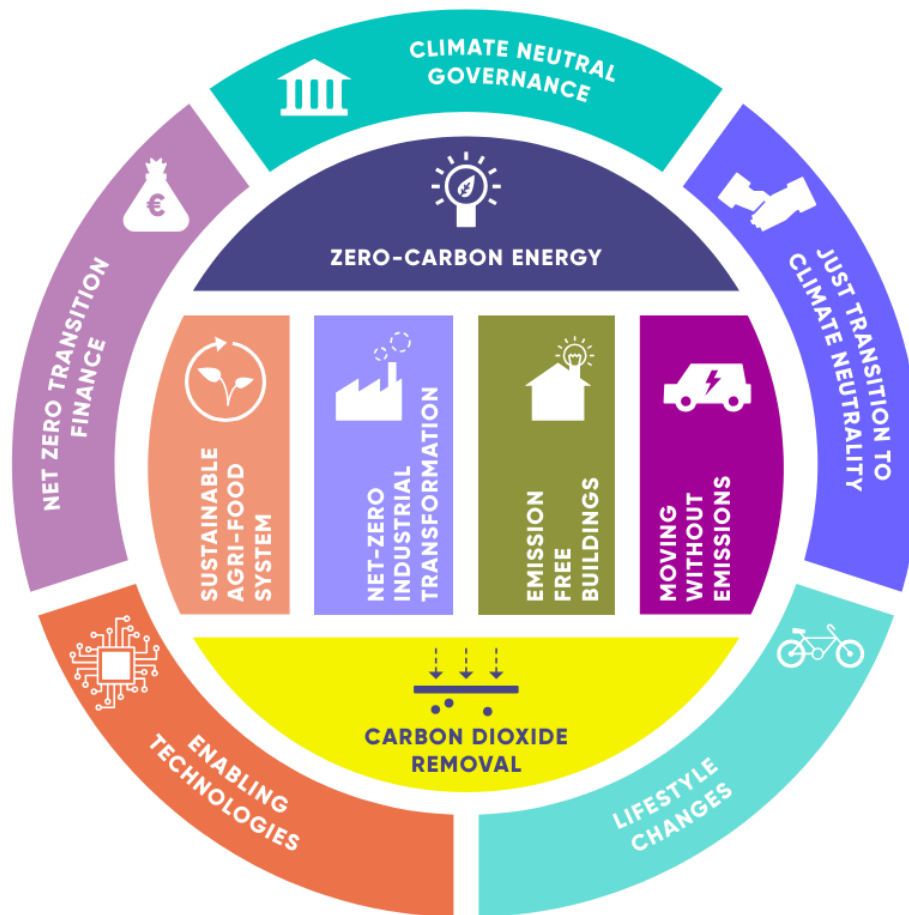


Figure 3 Elements for a climate neutrality future<sup>34</sup>

The diagram seen in Figure 3, which serves as a road map for climate neutrality activities by the European Climate Foundation, reveals the steps that need to be taken in many different areas. Accordingly, the foundation adopts a strategy focused on reducing carbon emissions at almost every stage, from food production to industrial activities and the construction of living spaces to transportation. The focal point of the elements in the diagram is that the main consumer and guiding element of the process is human. At the same time, this strategy requires governments to take important responsibilities in the management of these processes.

sees the concept of climate neutrality as an activity that serves common individual, social, institutional, and environmental interests when directed correctly<sup>35</sup>. According to the researcher's evaluations, the transition to a carbon-free economy offers broad and comprehensive opportunities in global competition for all actors of the global economy. For this reason, many governments and large-scale companies around the world are

adopting and implementing climate neutrality-oriented activities (albeit slowly and ineffectively).

On the other hand, climate neutrality has a structure that makes methodology, technological innovations, financial support, and multi-sectoral cooperation a necessity in order to achieve global environmental goals. However, the understanding of climate neutrality in the current process and the elements regarding the content of the concept are not evaluated sufficiently and positively. Inconsistencies and data gaps regarding approaches to the concept of climate neutrality make it difficult to understand the operational dimension of the concept. Accordingly, climate neutrality is a practice in terms of environmental awareness where global differences are currently observed regarding emission reductions, timelines and the overall plan to approach the target<sup>36</sup>.

Another issue related to the subject requires examining the effect of the climate neutrality approach on CO<sub>2</sub> concentration. At the same time, the system therefore requires a sustainable observation mechanism. After the issue of climate neutrality was seen as a critical element along with carbon emissions globally, global monitoring of the process has become technical. Climate neutrality necessitates keeping it under control, examining it, reporting it, and determining a global common action plan against this problem<sup>37</sup>.

Although conceptually climate neutrality seems to have a significant advantage in terms of increasing environmental awareness and protecting nature, its short-term effects are a matter of debate. Accordingly, it is obvious that there will be a decline in the production potential of countries and companies as a result of the change in the nature of work and the way of working in various sectors. With this situation, there is also a risk that many employees will lose their jobs. At the same time, climate neutrality requires large-scale financial investments, both short-term and long-term, for governments and companies, and it does not seem easy to realize these investments in the short term<sup>38</sup>.

Neuhoff et al. observed that within the climate neutrality concept and solution framework they determined for the EU, the concept was not taken seriously enough<sup>28</sup>. According to researchers' evaluations, climate neutrality is the kind of climate problem that will end business lines in the future, consume natural resources irreversibly, and render all people's solution efforts ineffective. Therefore, the system should pursue transformative innovations and investments in neutral production and material use, accelerate the commercialization of innovative climate-friendly technologies, and create

the business case for climate-neutral industrial technologies and processes. Because climate neutrality has become a problem that requires great attention and sensitivity as of the current process.

The issue of climate neutrality has a feature that requires the involvement of many actors in the process. However, for many years, world countries have not shown any inclination to accurately assess the dimensions of the issue. Although many negotiation processes have been carried out on the issue, it is not possible to say that qualified results have been achieved. At the same time, it is seen that the concept of climate neutrality is considered as a theoretical dimension. These problems further increase the future importance of the climate neutrality activity, which claims that carbon emissions have become uncontrolled along with the uncontrollability of the consumer roles of people and institutions<sup>39</sup>.

The EU, which is seen as the political actor carrying out the most qualified work on climate neutrality worldwide, has adopted a qualified road map with the "Green Deal" text it decided on in 2019. However, Küçük and Yüce Dural state that even the efforts put forward by the EU are not sufficient to create and adopt a qualified and permanent climate neutrality policy<sup>40</sup>. According to the evaluations of the researchers, the system is not at an adequate level in terms of both budget and operation, and a qualified perspective for the future has not been concretely presented.

### **2.3.1. Local Action Plan Against Climate Change**

The main issue for the fight against climate change and climate neutrality policies to be accepted within the social structure of a country is the steps taken to spread local efforts throughout the country. For this reason, in a significant part of developed and developing countries, there is a direction for all actors in the local area to be involved in the process. However, in order for the system to be permanent, different risk scenarios are highlighted<sup>41</sup>.

Table 2: Locally acceptable plans for climate change and climate neutrality policies

<b>General Planning</b>	<b>Climate Change Planning in Disaster Management</b>	<b>City Planning</b>
<p><b>Sustainable Energy Action Plan</b></p> <p>These programs aim to decrease the consumption of fossil fuels and energy for activities such as heating, transportation, and municipal services in the city. Given that emissions other than greenhouse gas emissions and energy consumption can be disregarded, it is possible that the scope of the subject matter may be more restricted. Local governments may choose to prioritize gaining experience prior to implementing a complete climate change plan.</p>	<p><b>Understanding disaster risk</b></p> <p>Developing policies and practices for an effective disaster risk management process.</p>	<p><b>Local Governments Managing Their Own Actions as Consumers and Role Models</b></p> <p>Among the applications that can be implemented by local governments in urban areas are pioneering green buildings that provide energy efficiency, renewing public transportation vehicles according to energy efficiency, meeting energy needs from renewable energy sources and producing projects that produce electricity from waste.</p>
<p><b>Mitigation Action Plan</b></p> <p>These plans are based on cities' greenhouse gas inventory reports and have a focus on reducing emissions. Emissions are calculated using energy consumption. Non-energy emissions (agriculture, waste management, changes in land use, industrial activities, etc.) may also be included. Hot spots for emissions are identified and emission reduction measures are developed.</p>	<p><b>Strengthening disaster risk management to manage disaster risk</b></p> <p>Realizing an effective and efficient management process by ensuring coordination between sectors with the participation of relevant stakeholders.</p>	<p><b>Local Governments as Facilitators to Manage by Enabling</b></p> <p>Steps such as local governments collaborating with stakeholders at different levels, supporting voluntary reduction actions of citizens and businesses, organizing awareness and training programs about climate change, organizing campaigns to reduce or reuse waste, and providing guidance on energy efficiency in new residential areas can be given as examples of the facilitator role of local governments.</p>



Table 2: (cont.)

<b>General Planning</b>	<b>Climate Change Planning in Disaster Management</b>	<b>City Planning</b>
<p><b>Compliance Action Plan</b></p> <p>These plans are based on historical data and estimates about climate change. The city's vulnerabilities to climate change are identified, risks are outlined, and various steps to mitigate these risks are put into a timetable and converted into an action plan. The success of such qualitative studies may vary depending on how well climate vulnerabilities are assessed, the risk assessment methodology used and how action plans are scaled.</p>	<p><b>Investing in disaster risk reduction for resilience</b></p> <p>Improving resilience in urban areas on social, economic, health and cultural issues</p>	<p><b>Local Governments Manage by Providing Service as Suppliers</b></p> <p>Local governments can encourage energy efficiency and renewable energy technologies in service delivery within the scope of combating climate change, create infrastructure and superstructures that produce less greenhouse gas emissions, and facilitate the production of combined systems in buildings. Smart life, smart environment, smart citizen and smart management elements, which are among the basic components of smart city applications, will thus be found in urban areas.</p>
<p><b>Integrated Mitigation and Adaptation Action Plan</b></p> <p>These blueprints represent the most extensive form of work. While action plans include strategies to decrease emissions, they also establish methods to adapt the city to the evolving climate. These studies need to evaluate action plans for mitigation and adaptation together, reveal the contradiction and synergy potentials among themselves, and ensure that different actions to be carried out by different institutions are compatible and integrative among themselves. Concrete actions should also be prioritized.</p>	<p><b>Disaster preparedness, recovery and rehabilitation for effective response and better construction</b></p> <p>Being prepared for disaster response, reducing disaster risk, and increasing accessibility opportunities for disadvantaged segments of society by ensuring response and recovery at all levels.</p>	<p><b>Local Governments as Regulators Manage by Making Regulations</b></p> <p>Through planning studies that local governments can carry out at different scales, it may be possible to rearrange urban uses for adaptation and adaptation to climate change.</p>

The planning structure shown in Table 2 and created by Parlak and Partigöç has a guiding nature for local climate change and climate neutrality activities<sup>42</sup>. Researchers, who determined the planning issues that all local actors should give importance to,

assessed the importance of the role of individuals in the process, as well as local governments.

### **2.3.2. Necessity of Climate Neutral Actions in Local Plans**

While in general terms, governments are expected to have a leading identity and role in matters related to climate neutrality, it is actually possible to say that the processes start with local actors. In addition, local climate neutrality planning is thought to be related to the management of population and migration in cities. This situation also shows that urban planning has an important guiding role in being the pioneer of national planning<sup>43</sup>.

Concentration threats starting from cities have a significant impact on the climate-related problems of countries and the world in general. Problems such as increasing migration, decreasing water resources, difficulties in accessing healthy food products, etc. are felt more locally in cities. Therefore, governments must develop policies starting from the local level, together with all local actors. Local and national policies on creating healthy cities will facilitate the solution of climate change problems and increase the level of positive effects of climate neutrality activities<sup>44</sup>.

Ari and Aydın in their evaluation of the subject specific to Turkey, touched upon the importance of the following legislative and implementation changes for the system<sup>45</sup>:

- To turn globally important, valuable and effective climate change policies and practices into locally and nationally valid rules.
- To encourage municipal governments that do not have a climate change and climate neutrality strategy and to update the road maps of municipalities that have such strategies.
- To strengthen the activities of units at all levels of local governments and to create a legal basis, especially regarding the protection of agricultural lands and water resources.
- To make decisions and provide guidance regarding contribution from both the government budget and local government budget to increase the quality of urban infrastructure activities.

- To determine a strategy for creating emergency action plans regarding climate change and carrying out awareness-raising activities on this issue.

Ari and Aydın's evaluations show that although local practices are seen as a beginning, governments have to take the first step to manage the process. In addition, the fact that governments are at a point where they can put pressure on local governments to implement active practices on these issues points to a critical role for researchers.

## CHAPTER 3

### METHODOLOGY

The aim of this study is to reveal to what extent cities take climate neutrality into account in the action plans prepared by local municipalities while combating climate change. This thesis focuses on climate neutrality in the action plans of local municipalities. It addresses how actions in action plans in many areas such as energy, transportation and buildings contribute to the balance between greenhouse gas emissions and the disposal of these gases through sinks. While doing this, it is evaluated to what extent the climate neutrality target is integrated into the city's action plans.

İzmir was chosen as a case study due to its accessibility to information and plans and its active approach on national and international platforms regarding climate change. İzmir Metropolitan Municipality first signed the Alliance of City Councils in 2015 and committed to reducing greenhouse gas emissions by 20% by 2020. In 2019, İzmir Metropolitan Municipality reviewed its greenhouse gas emissions reduction and climate adaptation targets and renewed its commitment to ensure compliance with European Union strategies. As a result, İzmir's commitment to reduce greenhouse gas emissions by 2030 through the implementation of the İzmir SECAP has been updated to 40%. The İzmir GCAP, which was prepared simultaneously and in harmony with this plan, complements each other in terms of environment and climate change, creating the road map of İzmir. The actions contained in GCAP and SECAP reports are complementary to each other in terms of mitigation and adaptation. For the first time in Turkey, a Green City Action Plan in line with international standards has been prepared for İzmir.

In 2017, İzmir Metropolitan Municipality was selected among 39 international projects with the "Nature Based Solutions" project under the largest budget grant program of HORIZON 2020 and took a leading and implementing role together with İzmir, Liverpool and Valladolid. In addition, within the scope of the Sponge City İzmir project carried out by İzmir Metropolitan Municipality, while aiming to reduce rainwater flow in urban areas, important steps have been taken towards rainwater harvesting in rural areas such as Küçük Menderes Basin. Additionally, with the decision taken by the European

Commission, it has been entitled to become a project stakeholder to develop urban quality and climate sustainability strategies within the scope of the Re-Value project. By participating in the "Cities Race to Zero" program, another European Union project in which İzmir is involved, which encourages bicycle transportation in the city, it has re-introduced its target of net zero carbon emissions by 2050<sup>39</sup>.

Finally, it was selected for the Climate Neutral and Smart Cities Mission, which was initiated by the European Union to create cities that are resilient to the threats posed by climate change. In this way, 24 cities from Turkey and 377 cities from Europe applied, and İzmir was among the 100 cities in the mission and committed to a zero-carbon target in 2030. It is aimed to lead many cities in the future with the road map it will obtain within the scope of the mission<sup>39</sup>.

When the studies that evaluated climate neutrality on a city scale and included case studies were scanned in the literature, 12 articles were found. Among these articles that make measurements with various methods in various fields, 9 studies that make evaluations through plan documents were selected. Finally, these 9 were divided into classes according to their working methods, and it turned out that the most used method was "listing". For this reason, a checklist-oriented comparison technique was used. First, a checklist was created with the actions collected from the literature, and then the climate neutrality evaluation of the selected case study/action plan was made through this checklist.

### **3.1. Case Studies Measuring Climate Neutrality on Local Scale**

This section examines studies measuring climate neutrality in cities, drawing on various approaches and different literature. Studies focusing on climate neutrality in the literature constitute approximately 20% of the research on combating climate change<sup>46</sup>. It is noteworthy that research on climate neutrality is widespread, especially in fields such as energy, environmental sciences, and engineering. However, the number of these studies is relatively small in fields such as social sciences, agriculture, and biology. In the field of city and regional planning, research evaluating climate neutrality, especially at the city scale, remains limited<sup>47</sup>.

The concept of climate neutrality includes "mitigation" and "adaptation" methods, and these methods are discussed at different levels. In the literature, the importance of adaptation methods, which address strategies to cope with specific climate change impacts at the local level, has been emphasized<sup>9</sup>. However, before adaptation efforts to combat climate change, mitigation practices have received more attention, often involving international, national, or regional large-scale projects<sup>48</sup>.

Climate neutrality measures set by international organizations at national, international, and global scales focus on larger scales when addressing the problem of greenhouse gas emissions. Therefore, most research on neutrality focuses on higher scales. This study measures the city's climate neutrality in the fight against climate change through the local municipality's action plans.

While selecting research articles, local research was conducted directly on evaluations based on "climate neutrality" principles. Due to the limitation in the number and diversity of the studies obtained, studies that evaluated adaptation and mitigation actions together are also included. While selecting articles, attention was paid to the possibility of case studies. In the next stage, those who made evaluations based on the plan documents were determined among the studies obtained. In the last stage, the progressed studies were identified using the listing method. The actions in the checklist were put forward by compiling the actions in the lists in the final articles in a common language.

### ***Localizing and Monitoring Climate Neutrality through the Sustainable Development Goals (SDGs) Framework: The Case of Madrid***<sup>49</sup>

This research aims to compare the strategies and policies of different local and regional governments to achieve climate neutrality. The study analyzed and compared the policy approaches adopted by Madrid's "Road Map" document and other localities. In this context, efforts to achieve climate neutrality were evaluated by examining the VLR of 22 local governments. Madrid's policy document was chosen because it focuses entirely on climate neutrality, unlike the policy focuses of other localities.

Among the prominent findings of the study are that settlements contain indicators related to climate neutrality, and in some settlements, climate neutrality indicators

constitute a significant percentage. Additionally, it was examined how the update of Madrid's "Road Map" document in 2022 affected the policy documents of other localities.

The results of the study emphasize that monitoring climate neutrality at the local level can make significant contributions globally. It is stated that Madrid can be a model for other European cities and regions and lead the sharing of best practices.

The checklist outlined in the thesis encompasses various actions aimed at promoting renewable energy, enhancing energy efficiency, reducing emissions in transportation, managing waste, and integrating nature into industrial practices.

Efforts to improve energy efficiency involve transitioning to more efficient equipment such as heat pumps and natural gas condensing boilers. Additionally, there's a focus on advocating for efficient appliances and lighting. Measures to curtail work-related and domestic travel are being implemented alongside an emphasis on proximity-oriented urban planning. Promoting pedestrian mobility, public transport, cycling, and shared transport modes is also prioritized, as well as optimizing urban goods distribution and developing logistics centers.

In the realm of transportation, initiatives are underway to support national government plans for reducing emissions in the aviation sector. Moreover, there's a concerted effort to enhance energy efficiency in commercial, institutional, and municipal buildings. Implementation of smart heating and lighting control systems is being pursued, along with the promotion of self-energy production. Additionally, there's a push to promote procedures, platforms, and methods for product reuse and waste reduction.

Waste management strategies encompass reducing packaging, establishing reverse logistics processes, and minimizing food and construction waste through updated waste management centers. Efforts are also being made to improve the efficiency of waste facilities and invest in compost facilities for vegetable waste. Awareness campaigns highlighting waste-to-energy conversion and waste separation are being conducted. Furthermore, support for research on mitigating gases impacting the atmosphere is being advocated.

In the industrial sector, there's a focus on reducing emissions and increasing the utilization of electrical energy. Natural integration initiatives, including tree planting campaigns, are being promoted. Natural solutions are also being incorporated into urbanization and renewal projects to mitigate environmental impact.

As a result of the research, it was determined that Madrid's strategies for achieving climate neutrality are different from other settlements and have specific policy focuses. It has been revealed that Madrid, which focuses especially on energy efficiency, has developed its own way in accordance with its geographical, demographic and climate characteristics. It is also emphasized that Madrid's strategies for achieving climate neutrality have no clear relationship with the strategies of other settlements and major cities in Europe.

### *Climate neutral cities in Sweden: True commitment or hollow statements?* <sup>50</sup>

An assessment is made through annual reports and climate action plans of nine cities in Sweden. The study evaluated factors such as political commitment of cities, setting goals, effectiveness of plans and strategies, feasibility of actions and strength of institutional capacity.

The content analysis method was used in the study. Researchers evaluated the climate policies and practices of cities according to the determined criteria. This content analysis process is a method used to objectively measure and compare the performance of cities. This method has been used as an effective tool to thoroughly examine and evaluate cities' efforts to achieve climate neutrality.

The checklist compiled in the thesis encompasses a range of actions targeting sustainable consumption, waste management, environmentally friendly housing construction, clean energy transition, and transportation.

In the domain of sustainable consumption and waste management, efforts are directed towards enhancing waste management practices by implementing household waste reduction strategies, with a particular focus on segregating and recycling food waste. Additionally, the utilization of carbon absorption ponds to store a significant portion of emissions generated during agricultural production is advocated. Promoting sustainability and reducing overall waste volumes are emphasized through improved waste management and recycling practices.

In the sphere of clean energy transition, strategies include reducing reliance on fossil fuels and actively investing in carbon capture technologies. Furthermore, there's an emphasis on promoting locally sourced renewable energy production, such as wind, solar,



and district heating. Energy efficiency measures are being implemented to decrease energy consumption in buildings, alongside an expansion of renewable energy source usage.

Regarding transportation, the focus is on promoting active modes of transport like increased cycling and public transit usage. The introduction of electric buses and the preference for fossil fuel-free alternatives are being encouraged. Efforts to reduce emissions from road travel are prioritized, with a specific focus on increasing biogas production for vehicles.

Additionally, initiatives include enhancing the accessibility of electric vehicle charging stations and fostering a sustainable transportation system by promoting more efficient vehicles, renewable fuels, and shorter driving distances.

*Achieving 100 climate neutral cities in Europe: Investigating climate city contracts in Sweden*<sup>51</sup>

This study focuses on CCCs in Sweden. Contracts are documents that contain the policies in which municipalities determine their climate neutrality commitments and implement policies in the fight against climate change. In the study, the content of CCCs, municipalities' strategies, financing models, governance structures, communication strategies and multi-sectoral collaborations were examined.

The study adopts a research approach that includes three key components: systematic literature review, document analysis and interviews with municipalities. The research conducts a literature review to examine the processes by which cities gain legitimacy as climate actors, how climate urbanism evolves, and how missions are adopted as action mechanisms at the city level. It then aims to examine in detail the Climate Change Framework Documents (CCCs) of nine municipalities in Sweden and evaluate their content. This document analysis is used to understand the commitments, strategies and policy instruments taken by municipalities to combat climate change.

The study highlights that CCCs promote cooperation between municipalities, support policy integration at national and European level and contribute to the creation of sustainable financing models. It is stated that these practices help municipalities to be successful in combating climate change.

The thesis underscores the utilization of various applications to develop the checklist, with a focus on addressing climate change challenges. Municipalities play a pivotal role in determining and implementing strategies to combat climate change, while also embracing concepts from the green and circular economies. Financial instruments and financing plans are employed to support these initiatives, alongside the identification and integration of policy tools into development processes. Governance structures are bolstered, and effective audit and reporting mechanisms are established to ensure accountability.

Communication strategies are developed to facilitate robust engagement with stakeholders, fostering a collaborative environment. Multi-sectoral collaborations are emphasized, promoting integration across different sectors to maximize impact. Furthermore, diversification of funding sources and the creation of sustainable financing models are pursued to ensure the longevity and effectiveness of climate change mitigation and adaptation efforts.

***Research and innovation paving the way for climate neutrality in urban transport: Analysis of 362 cities on their journey to zero emissions***<sup>52</sup>

In the study, the strategies of 362 candidate cities to achieve climate neutrality within the scope of the European Union Mission were examined. The European Union Mission is an ambitious initiative that aims to create 100 climate neutral and smart cities by 2030. The city of İzmir is one of the cities within the scope of this mission. This mission will act as trial and innovation centers so that other cities across Europe can achieve climate neutrality.

In the study, a survey method was used for evaluation. Data was collected through surveys for detailed analysis of the candidate cities' expressions of interest in the European Union Mission and their preparations. Information from the surveys was used to identify and evaluate cities' strategies to achieve climate neutrality goals.

The study evaluated cities' policies, preparations, and commitments by analyzing and comparing data collected through surveys. During this evaluation process, the data in the surveys were examined in detail and the approaches and strategies of cities to achieve their climate goals were analyzed.

The cities within the scope of the study implement various practices in areas such as renewable energy use, transportation and mobility policies, infrastructure development, technology and innovation, policy, and governance. It is emphasized that these practices support cities' efforts to achieve climate neutrality and that research and innovation activities play an important role.

In crafting the checklist for the thesis, several measures were employed to address greenhouse gas emissions. First and foremost, targets for reducing greenhouse gas emissions were established. Next, the main sectors responsible for these emissions were identified, and specific intervention methods were prioritized for each sector. Additionally, measures were taken and implemented to address fixed energy consumption elements such as buildings, equipment, facilities, and public lighting. This comprehensive approach aimed to effectively mitigate greenhouse gas emissions and promote sustainability.

***Implementation of local climate action plans: Copenhagen e Towards a carbon-neutral capital***<sup>53</sup>

Among the carbon neutral actions in this study, climate neutral actions were selected and used in the checklist.

This study examines the efforts of the Copenhagen municipality in combating climate change and how the implementation of these efforts and their performance are evaluated. The study covers a period of the last 15 years as of 2002 and evaluates the changes in the municipality's energy supply and reductions in greenhouse gas emissions. As a result of the study, it is stated that Copenhagen demonstrated high implementation performance and significantly exceeded its 2015 target. However, it is emphasized that due to some inconsistencies and the use of balancing, situations may arise that may hinder system development in the post-2015 period. The study highlights the importance of activity-related evaluation metrics and that there are transferable lessons to other cities.

It is stated that document analysis and content analysis techniques were used in the study. Documents include greenhouse gas accounts, environmental accounts, municipal budgets, climate action plans, strategies, and other relevant documents. With the content analysis performed on these documents, the goals and initiatives of

Copenhagen's climate action plans were determined, and the implementation was evaluated accordingly.

In the formulation of the thesis checklist, a series of actions were outlined to address various aspects of energy efficiency and sustainability. This included the establishment and development of low-energy consumption systems integrating innovative energy production techniques. Furthermore, efforts were made to calculate energy consumption in the port and explore alternative energy sources. The installation of electric charging stations for electric vehicles was prioritized, alongside measures to transition municipal vehicles to alternative fuels.

To reduce environmental impact, shifts towards sustainable alternatives such as biomass for energy production were advocated. Additionally, wastewater generated in treatment plants was earmarked for biogas production, contributing to renewable energy efforts. Programs for the separation and recycling of plastic waste were implemented and managed to mitigate plastic pollution.

Technological advancements were explored for the processing and utilization of organic waste, aiming to maximize resource efficiency. Moreover, steps were taken to fulfill the municipality's energy requirements through alternative sources such as wind energy, aligning with broader sustainability goals. These comprehensive measures aimed to promote environmental stewardship and foster a more sustainable future.

### *Multi-level climate change planning: An analysis of the Italian case*<sup>54</sup>

On December 11, 2019, Italy proclaimed a state of "Climate and Environment Urgency" in response to the declaration made by the European Parliament in November 2019. At present, a total of 88 local governments in Italy have officially declared a state of Climate and Environment Urgency. The study seeks to contribute by analyzing the current status of multi-level climate planning in Italy. The examination of adaptation and mitigation plans adopted by regional, district, and municipal authorities allows for an exploration of the interaction and collaboration between different levels of government. Furthermore, an analysis is conducted on international local government networks to comprehend their contribution to the advancement of regional, district, and local climate planning in Italy.

The study methodology involves the process of choosing a representative sample of plans and then thoroughly reviewing and assessing their content. In addition, a methodical assessment methodology was utilized to evaluate the strategies for mitigating and adapting to climate change in a selection of cities. This methodology entails evaluating three levels: mitigation, adaptation, and the incorporation of both mitigation and adaptation. For the first two levels, three indicators were chosen, whereas for the third level, just one indicator was picked. These indicators are designed to evaluate the effectiveness of efforts to address mitigation and adaptation challenges.

In the evaluation of the plan outlined in the study, several key indicators were utilized to assess its effectiveness and comprehensiveness. Firstly, the plan was assessed based on whether it included greenhouse gas reduction targets set for specific dates, such as 2030 or 2050. Additionally, the presence of reduction targets for the amount of CO<sub>2</sub> or greenhouse gas emissions, expressed as percentages like 20% or 40%, was considered.

Furthermore, the inclusion of future climate projections or vulnerabilities that cities might face was examined, reflecting a forward-looking approach to climate action. The presence of a monitoring and evaluation system was also deemed essential to track progress and adjust strategies accordingly. Moreover, the integration between mitigation and adaptation strategies was evaluated, emphasizing the importance of addressing both aspects of climate change in a cohesive manner. These indicators guided the creation of the checklist, ensuring that actions aligned with the overarching goals of the study and were conducive to effective climate action planning.

*EU Mission on ‘Climate-Neutral and Smart Cities’ – Assessing Readiness to Join of 12 Greeks*<sup>55</sup>

The study aims to evaluate the preparations of Greek cities and their level of participation in climate neutrality, in line with the objectives set by the European Cities Mission. REGIME multi-criteria evaluation method was used in the study. Focusing on adaptation and mitigation strategies, the performances of cities on issues such as greenhouse gas and carbon emission reduction and smart city initiatives were examined.

The research evaluated the degree to which 12 Greek cities, primarily regional capitals, aligned with the aims of the European Cities Mission. The cities' status and

assessments were unveiled through a comprehensive multi-criteria analysis, which included numerous factors such as emission levels, participation in the Mayors' Convention, waste management, use of digital infrastructure, implementation of smart city apps, and adherence to governance norms.

The evaluation criteria included numerous crucial aspects for assessing the readiness and adaptability of cities in response to climate change. Initially, the focus was on identifying and planning for climate change hazards that are unique to each community. In addition, the evaluation of infrastructure projects took into consideration their ability to withstand the consequences of climate change and their support to sustainable development initiatives.

Efforts to enhance the presence of vegetation in urban areas and safeguard natural habitats were deemed crucial for the preservation of biodiversity and the ability of cities to withstand climate change. In addition, the study encompassed an analysis of the impact of climate change on water resources, specifically emphasizing the formulation of sustainable water management tactics to alleviate potential hazards.

Emergency plans specifically targeting climate change were considered essential in order to adequately confront extreme weather occurrences and other emergencies connected to the environment. An assessment was conducted to evaluate the effectiveness of policies targeting the reduction of CO<sub>2</sub> emissions and the promotion of renewable energy projects in mitigating climate change.

The need to promote cleaner and sustainable transport systems, as well as expanding public transport networks, was emphasized as essential for decreasing emissions and enhancing urban air quality. Efforts to improve the energy efficiency of buildings and promote the utilization of renewable energy sources were seen as crucial in the quest to decrease carbon footprints.

Strengthening waste management policies, promoting recycling, and supporting green infrastructure projects were also identified as key criteria for fostering sustainable urban development and resilience to climate change impacts. Additionally, protecting natural ecosystems within cities was emphasized to maintain biodiversity and enhance overall resilience. These criteria provided a comprehensive framework for evaluating cities' climate resilience and sustainability efforts.

On the other hand, the articles that follow do not directly measure climate neutrality like the ones above. Instead, studies that measure the mitigation and adaptation measures of city-scale plans together.

***Integration of mitigation and adaptation in urban climate change action plans in Europe: A systematic assessment***<sup>56</sup>

The study examines the integration of adaptation and mitigation measures in combating climate change in cities. He emphasizes the importance of integration of adaptation and mitigation measures, stating that this approach can increase synergies and reduce conflicts in cities. The study analyzes the climate change action plans of 885 cities in Europe and finds that 17% have integrated adaptation and mitigation planning.

The paper uses a new index, the “Urban Climate Change Integration Index”, to assess the level of integration of adaptation and mitigation policy objectives. This index evaluates the level of integration of adaptation and mitigation policy targets in cities and identifies synergies and co-benefits. It uses a scoring framework developed in the evaluation. This framework includes specific criteria and benchmarks to evaluate action plans.

The research concludes by emphasizing the positive interactions and additional advantages of implementing both adaptation and mitigation strategies. Special emphasis is placed on the interconnections and cooperative efforts between the "Green urban infrastructure" and "Construction, energy efficiency and buildings" sectors. Furthermore, it emphasizes the influence of national policy on local initiatives. Lastly, it underscores the significance of enhancing the technical capability needed for cities to include adaptation and mitigation strategies.

In the evaluation of adaptation and mitigation strategies within the study, a comprehensive range of actions were considered.

Adaptation actions included the identification of climate change risks and the establishment of adaptation targets. Strategies were developed to address these risks, encompassing infrastructure enhancements such as flood protection systems and water management initiatives. Implementation of green infrastructure projects, like green roofs and rain gardens, aimed to bolster resilience against climate impacts. Additionally, efforts

to raise public awareness and provide training programs were undertaken to enhance adaptive capacity. Emergency plans were created to respond effectively to climate-related events, alongside structural arrangements to increase overall resilience.

Mitigation actions focused on reducing greenhouse gas emissions. Targets were set to guide emissions reduction efforts, alongside initiatives to improve building energy efficiency. Promotion and utilization of renewable energy resources were prioritized to decrease reliance on fossil fuels. Policies targeting carbon emissions reduction in the transportation sector were implemented to curb emissions from vehicular sources. Industrial facilities were also targeted for emissions reduction measures. Waste management and recycling programs were instituted to minimize greenhouse gas emissions from waste streams. Green infrastructure projects, such as afforestation and the creation of green areas, were implemented to sequester carbon and mitigate climate impacts. Additionally, projects aimed at increasing energy efficiency in public buildings were undertaken to further mitigate greenhouse gas emissions. These comprehensive actions spanned both adaptation and mitigation domains, aiming to enhance resilience and reduce climate risks effectively.

***Urban change climate mitigation and adaptation planning: Are Italian cities ready?***<sup>57</sup>

This study examines city-level plans to analyze Italian cities' mitigation and adaptation efforts to combat climate change. The study examined local climate plans, including mitigation and adaptation plans, with reference to Italian cities in the urban audit database of the European Statistical Office (Eurostat). The aim of the study is to understand the mitigation and adaptation strategies of Italian cities in combating climate change and to determine what kind of policies and plans these cities have developed to cope with climate change.

The study shows that Italian cities are generally more focused on mitigation, and most of the cities participating in the Covenant of Mayors initiative have mitigation plans. On the adaptation side, it is stated that cities are less active and only some cities have adaptation plans. The study emphasizes that Italian cities need to adopt a more holistic



approach to combating climate change, and that international networks and European funding programs provide support to cities.

In the study's evaluation of adaptation and mitigation actions, a diverse array of measures were identified and categorized.

Adaptation actions focused on addressing climate change risks and vulnerabilities through meticulous planning. This involved creating detailed inventories to assess potential risks and vulnerabilities, particularly in agricultural areas and natural resources. Strengthening the technical infrastructure within cities, including smart systems and diverse transportation modes, was prioritized to enhance resilience. Additionally, measures were taken to bolster health services against potential climate-related epidemics. Increasing urban green areas, effective management of water resources, and strengthening disaster management plans were also key components of adaptation strategies. Furthermore, efforts to reduce urban heat islands and establish special funds to support adaptation projects were undertaken, with a focus on securing national and international financing sources. Communication strategies were developed to raise awareness among various stakeholders and foster cooperation, while specific indicators were determined to monitor and evaluate the effectiveness of adaptation strategies. Regular publication of reports assessing compliance studies further ensured accountability and transparency.

Mitigation actions aimed to reduce greenhouse gas emissions by implementing various measures. These included enhancing energy efficiency in buildings through insulation, energy-efficient lighting systems, and smart building technologies. Efforts to decrease dependence on fossil fuels and invest in renewable energy sources like solar, wind, hydroelectricity, and biomass were prioritized. Targets were set to reduce emissions by specific percentages within defined timeframes, supported by action plans developed at sectoral and urban levels. Financing from diverse sources, including government subsidies, EU funds and private sector investments, was sought to support mitigation projects. Additionally, campaigns, training programs, and events were organized to raise awareness and promote stakeholder participation in climate change mitigation efforts. Specific indicators were established, and regular monitoring reports were published to assess the effectiveness of applied mitigation strategies, ensuring progress towards emission reduction goals.

***Urban planning policy must do more to integrate climate change adaptation and mitigation actions*** <sup>58</sup>

The objective of the study is to assess the incorporation of climate change-related adaptation and mitigation strategies in urban planning documents in the city of Victoria. The study technique entails a comprehensive evaluation of urban planning documents (including policy, regulation, and legislation) in Victoria, using both qualitative and quantitative analysis. This study examines three policy disciplines (urban planning, climate change, and flood management) at both state and local level to address climate change adaptation and mitigation. The evaluation framework was created as a tool to analyze legislative rules, policies, and strategy documents pertaining to climate change.

In the study's document evaluation process, scoring was conducted based on predetermined criteria for both adaptation and mitigation measures.

For adaptation, documents were assessed based on their clarity in identifying and highlighting targets for climate change adaptation and mitigation. Specific attention was paid to whether documents specified levels regarding sea level rise and developed strategies to address this issue. Sector-specific adaptation and mitigation efforts were scrutinized to ensure resilience across various sectors. Regular updating of adaptation action plans and the adoption of system-based planning approaches were also evaluated.

Mitigation actions were evaluated similarly, with a focus on identifying emission reduction requirements and targets. Emphasis was placed on increasing resilience through adaptation and disaster preparedness actions for government infrastructure, the built environment, and communities. Documents were expected to establish guidelines for risk management and adopt system-based planning approaches. Furthermore, mitigation strategies for key systems such as infrastructure, education, health services, natural environment, transportation, and water cycle were assessed.

Specific criteria included the setting of clear targets for climate change mitigation, as well as the emphasis on energy efficiency and the use of renewable energy sources. Documents were also evaluated based on their coverage of emissions reduction strategies in sectors like transportation, building design, and industry. Additionally, clear policy objectives for reducing greenhouse gas emissions were expected to be stated within the

documents. These criteria guided the evaluation process, ensuring thorough assessment of adaptation and mitigation efforts outlined in the study.

According to the results of this study, it is emphasized that policies should be aligned harmoniously between different disciplines and levels of government. It has been stated that land use policies do not focus sufficiently on climate change targets and this issue should be addressed as a priority. It was found that the integration of adaptation and mitigation was weak and that documents generally focused on either adaptation or mitigation. These findings show that urban planning policies in the city need a more comprehensive and holistic approach to combating climate change.

### ***Urban adaptation climate and mitigation action plans: A critical review*** <sup>46</sup>

The objective of the study is to examine 257 urban climate action plans from across the world and assess their efficacy. The study employed the UCAP framework, which was established by Grafakos in 2019, to perform an examination. The researchers initially did a comprehensive analysis of existing literature and studied climate planning frameworks gathered from several international climate-related organizations. Subsequently, they scrutinized 257 urban climate action plans based on the established criteria and assessed their effectiveness in relation to certain criteria.

UCAP framework is employed to assess the strategies in this study. This paradigm utilizes a tripartite methodology. The initial phase starts the process of local action planning. Utilizes scientific knowledge and situation analysis to inform climate actions and initiatives. In the second phase, the task at hand is to ascertain the city's climate vision, objectives, and strategies. Comprehensive stakeholder engagement is crucial in contemporary local climate action planning. Furthermore, it is necessary at this stage to develop awareness campaigns and communication strategies to inform city citizens about the climate vision, goals, and activities. The last level, known as the third stage, involves directing the decision-making process to execute, monitor, and evaluate climate measures. During this phase, considerations are made about financial commitments, estimates of resources (such as human resources and budget), and potential sources of finance. Furthermore, the establishment of institutional and regulatory frameworks is crucial in the implementation of climate initiatives. At this point, it is crucial to define an

implementation strategy or program, establish a management structure, and identify monitoring and evaluation indicators.

The framework outlined in the thesis encompasses a comprehensive set of criteria for evaluating climate action plans and guiding their development. These criteria cover various aspects, including acknowledging the uncertainty of climate impacts and conducting risk profiling to understand climate hazards and vulnerabilities. Furthermore, the framework emphasizes the importance of specifying greenhouse gas emissions reduction targets and incorporating adaptation goals and actions.

Deep carbon reduction targets are highlighted, alongside support systems for implementation and clear governance structures. Financial budgets, detailed presentation of individual budgets, and consideration of urban health adaptation strategies are also integral to the framework. Mainstreaming sustainability issues, integrating technological advances and innovative governance, and incorporating appropriate financing solutions are emphasized.

Conflict resolution and consideration of sacrifices in local climate change action planning are deemed essential, as is the availability of comprehensive models, tools, and frameworks to guide planning. The framework recommends city-specific climate action plans compatible with globally accepted standards and criteria, ensuring their feasibility and establishing mechanisms for monitoring and evaluation.

The importance of promoting reporting, sharing, and ongoing learning is highlighted, as well as the need for transparent disclosure of funds and sectoral objectives. The importance of efforts in several areas, such as transportation, industry, waste management, and agriculture, forestry, and land use (AFOLU), is emphasized. Encouragement is given for collaboration with national governments, the commercial sector, and civil society. It is also recommended to aim for balanced adaptation and mitigation aims and to consider the long-term implications.

Efforts to ensure effectiveness across cities of different sizes and contributions to reducing global greenhouse gas emissions are prioritized. Promotion of energy efficiency, air quality improvement, and long-term sustainability are integral components of the framework, guiding the development and evaluation of robust and impactful climate action plans.

As a result of the evaluation, the researchers focused on issues such as financing, sectoral targets, energy efficiency and increasing public awareness of urban climate action plans. Practices such as cities setting targets in specific problematic sectors and monitoring these targets in accordance with SMART (specific, measurable, achievable, realistic and time bound) criteria, stating their financing sources transparently and raising public awareness about climate come to the fore.

***Climate change response in New Zealand communities: Local scale adaptation and mitigation planning***<sup>59</sup>

This article analyzes the approaches adopted by communities in New Zealand to deal with the challenges posed by climate change. The research assesses the reactions of local elected officials to climate change, with a specific emphasis on strategies for adapting to and mitigating its effects.

The study centers on adaptation and mitigation methods, specifically examining the perspectives of climate change among local administrators and the challenges they encounter in implementing these tactics. Additionally, it analyzes the involvement of local-scale planning and online surveys in the efforts of New Zealand communities to address climate change. Analyzed data was used to evaluate local-level perceptions, actions, and obstacles to adaptation and mitigation initiatives. The assessment phase involved an examination of the awareness level, action plans, and implementation methods of New Zealand communities in response to climate change. The findings indicate that communities possess a broad understanding of the risks associated with climate change, but they lack a sense of urgency and fail to prioritize taking action.

Prominent practices include strategies such as water resources management, infrastructure strengthening, emergency preparedness plans, energy efficiency improvement projects, and educational programs to raise public awareness about climate change. These practices are expected to contribute to communities becoming more resilient and sustainable.

The study proposes a set of strategies for both adaptation and mitigation to address the challenges posed by climate change.

For adaptation, the focus is on the development and implementation of adaptation plans tailored to specific contexts. Strategies include the management of water resources to enhance resilience against changing climatic conditions. Infrastructure strengthening efforts are also recommended to withstand climate-related impacts. Additionally, creating emergency preparedness plans is highlighted to improve response capabilities in the face of climate-related disasters. Furthermore, organizing training programs aimed at raising awareness among societies about climate change is deemed crucial for fostering adaptive capacity.

The study recommends doing research and implementing renewable energy options as a way to decrease dependence on fossil fuels in order to mitigate the problem. Proposals to implement emission limitations or reductions are considered crucial steps to alleviate the consequences of climate change. Implementing initiatives focused on enhancing energy efficiency is recognized as an essential strategy to decrease total energy usage and the resulting emissions of greenhouse gases. Moreover, there is a strong emphasis on using tactics that promote active engagement from society in order to decrease greenhouse gas emissions. The ultimate goal is to cultivate a culture that prioritizes sustainability and environmental accountability. These adaptation and mitigation strategies have a common goal of reducing the negative effects of climate change and strengthening the ability of communities and ecosystems to withstand and recover from them.

### 3.2. General Evaluation

The 12 studies reviewed above were analyzed in terms of evaluation techniques.

Table 3: General evaluation of the studies used in the research

Studies Assessing Plan Documents	Assessment Techniques		
	List	Questionnaire and Interview	Other
Ciambra, Stamos, and Siragusa <sup>49</sup>	X		
Vanhuyse, Piseddu, and Jokiah <sup>50</sup>	X		
Shabb and McCormick <sup>51</sup>		X	
Christidis et al. <sup>52</sup>		X	
Damsø, Kjær, and Christensen <sup>53</sup>	X		
Pietrapertosa et al. <sup>54</sup>	X		
Panagiotopoulou, Agalioti, and Stratigea <sup>55</sup>			REGIME-multi criteria evaluation
Grafakos et al. <sup>56</sup>	X		
Filom Pietrapertosa et al. <sup>54</sup>	X		
Hurlimann, Moosavi, and Browne <sup>58</sup>	X		
Aboagye and Sharifi <sup>46</sup>	X		
Archie, Chapman, and Flood <sup>59</sup>		X	

Studies include road maps published by local governments<sup>49</sup>, climate action plans<sup>46</sup>, Sustainable Energy Action Plans<sup>53</sup>, CCC documents<sup>51</sup>, transportation plans<sup>52</sup>. Additionally, 3 studies evaluated one case, while the other 9 studies evaluated more than one case.

In terms of evaluation techniques, these studies were found to use three different categories of techniques: listing, survey/interview, and others (REGIME multi-criteria decision making). Some used more than one method. 8 studies used lists to analyze

climate neutrality. While 3 studies used surveys or interviews for evaluation, 1 study was evaluated using the REGIME - multi-criteria evaluation method.

When data from studies that evaluate plan documents with a list are analyzed, it becomes clear that no study categorizes a plan as “climate neutral” or “not climate neutral.” The results are “good but needs improvement”<sup>50</sup>, “limited”<sup>55</sup>, “showing enthusiasm”<sup>54</sup>, and “a planning approach that pays attention to climate neutrality criteria”<sup>46</sup>.

The actions of climate neutrality in the methods section were evaluated according to the subject headings of 12 articles used. Action areas featured in the case study are marked with plus, while those not featured are marked with mines. C1=Case1, C2=Case2... signify. This table shows the contribution of each case study to the proposed checklists used for measurement.

C1: Madrid

C2: Nine Cities Sweden 1

C3: Nine Cities Sweden 2

C4: 362 EU cities

C5: Copenhagen

C6: 88 Italian Cities

C7: 12 Greek Cities

C8: 885 EU Cities

C9: Whole Italian Cities

C10: Victoria

C11: 257 Action Plans

C12: New Zealand Communities



Table 4: General Evaluation of the Case Studies contributed to assessment

	Cases Measuring Climate Neutrality							Cases Measuring Mitigation and Adaptation				
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Energy	+	+		+	+		+	+	+	+	+	+
Transport	+	+		+			+	+		+	+	
Finance			+						+			
Waste	+	+			+		+	+			+	
Water					+		+	+		+		+
Health									+	+		
Environment and Biodiversity	+						+	+		+	+	
Governance and Planning	+		+	+		+		+	+	+	+	

Action plans are evaluated according to the proposed checklists below. All checklists are prepared according to the theme to which the actions are relevant. These themes are energy, water, waste, transportation, health, environment and biodiversity, governance and planning, finance. These are divided into thematic areas to illustrate elements relevant to climate neutrality, from general to specific. All items in the proposed checklist are evaluated separately, and the wording in the plans is noted in an appended column. Action plans are evaluated based on the statements they contain, with scores of "0" (not mentioned in the plan) and "1" (mentioned in the plan). At the end of this scoring, checklists containing the scores of both plans are obtained. Plans receive points for actions in the checklist prepared according to the relevant topics. That is, each plan's rubric includes wording of climate neutrality-related action in the plan. Therefore, in the lists where the evaluation takes place, in addition to the main column in the proposed checklist, four more columns are added for the statements and evaluation scores in the plans, making a total of five columns.

Table 5: Proposed Checklist about Energy

<b>Actions in the Field of Energy</b>
1. Ensuring energy savings in buildings.
2. Reducing urban heat islands through the use of urban heating/cooling systems.
3. Application of smart heating and lighting control systems in public buildings.
4. Determining alternative energy sources by calculating the amount of energy consumed in the port.
5. Expansion of electric bus fleets
6. Abandoning the use of fossil fuels in the industrial sector
7. Investing in renewable energy sources.
8. Carrying out studies for energy efficiency in commercial areas.

Table 6: Proposed Checklist about Transport

<b>Actions in the Field of Transport</b>
1. Encouraging short driving distances with intelligent traffic systems.
2. Increasing pedestrian mobility by providing safe pedestrian paths.
3. Strengthening infrastructure to popularize bicycle use
4. Increasing the use of bicycles and public transportation with economic incentives
5. Increasing the accessibility of electric vehicle charging stations.
6. Expansion of shared transportation modes
7. Optimizing urban logistics.
8. Integrating cycling and public transport with metro services.

Table 7: Proposed Checklist about Waste

<b>Actions in the Field of Waste</b>
1. Implementation of programs for the separation of plastic waste.
2. Alternative fuel production from wastewater treatment plants
3. Evaluation of technologies for processing organic waste.
4. Ensuring controls to reduce construction waste.
5. Investing in waste compost facilities.
6. Development of recycling practices

Table 8: Proposed Checklist about Water

<b>Actions in the Field of Water</b>
1. Ensuring effective management of water through water saving measures.
2. Increasing water efficiency by organizing water saving campaigns.
3. Organizing water pollution prevention activities to protect water resources.
4. Improving water management of agricultural areas.

Table 9: Proposed Checklist about Health

<b>Actions in the Field of Health</b>
1. Creating emergency preparedness plans in health services.
2. Training emergency response teams.

Table 10: Proposed Checklist about Environment and Biodiversity

<b>Actions in the Field of Environment and Biodiversity</b>
1. Expansion of urban green areas
2. Supporting green infrastructure projects to protect natural ecosystems.
3. Supporting afforestation projects.
4. Carrying out urban transformation/renewal projects using nature-based solutions.
5. Planning for the protection of natural habitats.
6. Targeting emission reduction in the aviation industry

Table 11: Proposed Checklist about Governance and Planning

<b>Actions in the Field of Governance and Planning</b>
1. Ensuring the participation of stakeholders in the planning process.
2. Include a monitoring and evaluation framework in the plan to monitor progress and results.
3. Defining the local government coordination structure.
4. Emphasizing the importance of integration in climate action planning.
5. Considering frameworks that guide the development of city-scale climate action plans.
6. Leveraging an integrated framework that is compatible with globally accepted standards and benchmarks.

Table 11: (cont.)

<b>Actions in the Field of Governance and Planning</b>
7. Ensuring cooperation between local governments in climate action planning.
8. Regular publication of reports evaluating the results of adaptation studies.
9. Setting targets that aim to reduce greenhouse gas emissions over a certain period of time.
10. Creating action plans for emission reduction at sectoral level.

Table 12: Proposed Checklist about Finance

<b>Actions in the Field of Finance</b>
1. Applying to national and international sources for financing large-scale projects.
2. Establishing special funds to support adaptation projects.
3. Incorporating strategies that promote the green economy into the plan.
4. Integrating appropriate financing solutions into climate action planning.
5. Budgets are presented in detail and the governance structure is clearly stated.

Table 13: Evaluation of action plans of İzmir with actions in the field of energy

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
1. Ensuring energy savings in buildings.	1	Recommendations for thermal insulation in existing houses	0	-
2. Reducing urban heat islands with urban heating/cooling systems.	1	Identification and application of techniques to reduce the urban heat island effect	1	Identification and application of techniques to reduce the urban heat island effect
3. Application of smart heating and lighting control systems in public buildings.	1	Energy efficiency in existing residences Encouraging lighting systems (LED etc.)	0	-

Table 13: (cont.)

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
4. Determining alternative energy sources by calculating the amount of energy consumed in the port.	0	-	0	-
5. Expansion of electric bus fleets	1	Municipal vehicle fleet and service vehicles: Electric and low-carbon vehicles	1	Municipal vehicle fleet and service vehicles: Electric and low-carbon vehicles
6. Abandoning the use of fossil fuels in the industrial sector	1	Attaching industrial and/or public sector buildings to networks for geothermal heating	1	Attaching industrial and/or public sector buildings to networks for geothermal heating
7. Investing in renewable energy sources.	1	To promote the expansion of solar energy installations launch of a municipally financed subsidy program	0	-
8. Carrying out studies for energy efficiency in commercial areas.	1	Implementation of an environmental labeling program for companies in İzmir	1	Implementation of an environmental labeling program for companies in İzmir

Table 14: Evaluation of action plans of İzmir with actions in the field of water

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
<p>1. Ensuring effective management of water through water saving measures.</p>	<p>1</p>	<p>Putting into practice a plan for managing water resources, building the suggested facilities, and maintaining drinking water supply systems.</p> <p>Reviewing existing design and implementation standards to improve the effectiveness of new water infrastructure networks.</p> <p>Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles.</p> <p>Establishment of rainwater storage systems at building level, underground, and connected to green areas in municipality-owned or operated buildings and infrastructure.</p>	<p>1</p>	<p>Putting into practice a plan for managing water resources, building the suggested facilities, and maintaining drinking water delivery systems.</p> <p>Reviewing existing design and implementation standards to improve the effectiveness of new water infrastructure networks.</p> <p>Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles.</p> <p>Establishment of rainwater storage systems at building level, underground, and connected to green areas in municipality-owned or operated buildings and infrastructure.</p>

Table 14: (cont.)

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
2. Increasing water efficiency by organizing water saving campaigns.	0	-	0	-
3. Organizing water pollution prevention activities to protect water resources.	1	Enhancing the current water infrastructure to guarantee that rainwater and wastewater lines are kept apart	1	Enhancement of current water infrastructure to guarantee the segregation of wastewater and stormwater pipelines
4. Improving water management of agricultural areas.	0	-	0	-

Table 15: Evaluation of action plans of İzmir with actions in the field of waste

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
1. Implementation of programs for the separation of plastic waste.	1	The municipality pledges to prohibit the utilization of disposable plastics in municipal facilities, while promoting local businesses to adopt the same prohibition.	1	The municipality pledges to prohibit the utilization of disposable plastics in municipal structures, while promoting local enterprises to adopt the same prohibition.

Table 15: (cont.)

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
2. Alternative fuel production from wastewater treatment plants	0	-	0	-
3. Evaluation of technologies for processing organic waste.	1	Exploring the feasibility of offering specialized garbage collection services to restaurants and food industry professionals, aligned with the existing management infrastructure and technology.	1	Exploring the feasibility of offering specialized garbage collection services to restaurants and food industry professionals, aligning with the existing management infrastructure and technology.
4. Ensuring controls to reduce construction waste.	0	-	0	-
5. Investing in waste compost facilities.	1	Promoting and expediting investments in waste segregation (dry recyclable trash and organic waste) and the establishment of efficient material recovery infrastructure and composting facilities, in accordance with the İzmir Integrated Solid Waste Management Plan (2018)	1	Providing assistance and expediting investments in waste segregation (dry recyclable waste and organic waste) and the establishment of clean material recovery infrastructure and composting facilities, in accordance with the İzmir Integrated Solid Waste Management Plan (2018)



Table 15: (cont.)

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
6. Development of recycling practices	1	Making separate collection of recyclable dry materials mandatory	1	Making separate collection of recyclable dry materials mandatory

Table 16: Evaluation of action plans of İzmir with actions in the field of transport

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
1. Encouraging short driving distances with smart traffic systems.	1	Smart traffic management: e.g. command center	0	-
2. Increasing pedestrian mobility by providing safe pedestrian paths.	1	Enhanced sustainable urban mobility: focusing on the improvement of public transportation and local mobility options.	1	Enhanced sustainable urban mobility: focusing on the improvement of public transportation and local mobility options.
3. Strengthening infrastructure to popularize bicycle use	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.	1	Enhanced urban mobility sustainability: focusing on improving public transportation and local mobility options.
4. Increasing the use of bicycles and public transportation through economic incentives	0	-	0	-

Table 16: (cont.)

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
5. Increasing the accessibility of electric vehicle charging stations.	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.	1	Enhanced urban mobility sustainability: focusing on improving public transportation and local mobility options.
6. Expansion of shared transportation modes	1	Enhanced sustainable urban mobility: focusing on the improvement of public transportation and local mobility options.	1	Enhanced sustainable urban mobility: focusing on improving public transportation and local mobility options.
7. Optimizing urban logistics.	1	Adopting more sustainable logistics practices	1	Adopting more sustainable logistics practices
8. Integrating cycling and public transport with metro services.	1	Enhanced urban mobility sustainability: focusing on improving public transportation and local mobility options.	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.

Table 17: Evaluation of action plans of İzmir with actions in the field of health

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
1. Creating emergency preparedness plans in health services.	0	-	0	-
2. Training emergency response teams.	0	-	0	-

Table 18: Evaluation of action plans of İzmir with actions in the field of biodiversity

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
1. Expansion of urban green areas	1	Advancement of methods for the further development of environmentally friendly infrastructure and water management systems	1	Advancement of methods for the further development of environmentally friendly infrastructure and water management systems
2. Supporting green infrastructure projects to protect natural ecosystems.	1	Preserving, safeguarding, and improving the current biodiversity and ecological habitats by restoring natural wetlands, lagoons, and plantations (including the construction of natural ecosystems)	1	Preserving, safeguarding, and improving the current biodiversity and ecological habitats by restoring natural wetlands, lagoons, and plantations (including the establishment of natural ecosystems)
3. Supporting afforestation projects.	1	Continued advancement of solutions for green infrastructure and blue infrastructure	1	Continued advancement of solutions for green infrastructure and blue infrastructure
4. Carrying out urbanization and renewal projects using nature-based solutions.	1	Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles	1	Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles
5. Determining actions for emission reduction at sectoral level	0	-	1	Reducing emissions and pollution in industrial areas

Table 19: Evaluation of action plans of İzmir with actions in the field of finance

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
1. Applying to national and international sources for financing large-scale projects.	0	-	0	-
2. Establishing special funds to support adaptation projects.	1	Establishing funds to support the renovation of housing to a higher and more environmentally friendly energy standard	1	Establishing funds to support the renovation of housing to a higher and more environmentally friendly energy standard
3. Providing incentives for projects that promote the green economy	1	Implementing circular economic assessments, which prioritize recycling, in all repair and demolition projects undertaken by the municipality and promoting necessary improvements in specific projects.	1	Implementing circular economic assessments, which prioritize recycling, in all restoration and demolition projects undertaken by the municipality, while also promoting improvements in specific projects.
4. Integrating appropriate financing solutions into city-scale action planning.	1	Creation of İzmir bioeconomy strategy and action plan	1	Creation of İzmir bioeconomy strategy and action plan
5. Presentation of budgets in detail	1	Budgets are stated in detail in the report.	1	Budgets are stated in detail in the report.

Table 20: Evaluation of action plans of İzmir with actions in the field of governance and planning

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
1. Ensuring the participation of stakeholders in the planning process.	1	Identification and collaboration of stakeholders to lobby for "Risky Areas". Working with infrastructure companies to understand the current renewable energy capacity and ensure the transition to a renewable energy-based electricity system.	1	Identification and collaboration of stakeholders to lobby for "Risky Areas". Working with infrastructure companies to understand the current renewable energy capacity and ensure the transition to a renewable energy-based electricity system.
2. Include a monitoring and evaluation framework in the plan to monitor progress and results.	1	Reviewing and updating local level policies, planning regulations and guidelines The necessary tools and mechanisms to implement climate change adaptation strategies determination	1	Reviewing and updating local level policies, planning regulations and guidelines The necessary tools and mechanisms to implement climate change adaptation strategies determination
3. Defining the local government coordination structure.	1	Developing an administrative institutional structure for the implementation and monitoring of GCAP and SECAP actions	1	Developing an administrative institutional structure for the implementation and monitoring of GCAP and SECAP actions

Table 20: (cont.)

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
4. Creating a disaster management plan against risks	1	<p>Ensuring the provision of safe and uncontaminated water during emergency situations, such as natural catastrophes.</p> <p>Creating flood management plans for high-risk areas such as industrial areas and residential areas</p> <p>Creating a drought action plan</p> <p>Establishing a management strategy for forest fires</p>	0	-
5. Leveraging an integrated framework that is compatible with globally accepted standards and benchmarks.	1	<p>The plan was prepared within the international framework by signing the Covenant of Mayors (CoM).</p>	1	<p>The plan was prepared within the international framework by signing the Covenant of Mayors (CoM).</p>
6. Ensuring cooperation between local governments in climate action planning.	1	<p>Establishing partnerships and collaborating with appropriate institutions to jointly invest in the required recycling infrastructure, such as waste bins, vehicles, and routes, in compliance with the Zero Waste Regulation.</p>	1	<p>Establishing partnerships and collaborating with pertinent organizations to jointly invest in essential recycling infrastructures such as waste bins, trucks, and routes, in compliance with the Zero Waste Regulation.</p>

Table 20: (cont.)

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
7. Regular publication of reports evaluating the results of adaptation studies.	0	-	0	-
8. Setting targets to reduce greenhouse gas emissions over a specific period of time.	1	The municipality is committed to net zero energy consumption in all new municipality-controlled buildings by 2030.	0	-

## CHAPTER 4

# THE CASE STUDY: ASSESSMENT OF THE CLIMATE ACTION PLANS OF İZMİR IN TERMS OF CLIMATE NEUTRALITY

### 4.1. Climate Action Plans in Turkey

Cities prioritize the development and execution of climate change action plans as their primary effort to address and mitigate the effects of climate change. Cities, as major contributors to climate change and greenhouse gas emissions, formulate policies and enact legislation to reduce their emissions. Considering that urban areas experience the majority of climate change impacts, it is crucial to adapt to changing conditions and increasing incidence of extreme weather events caused by climate change. As a result, plans are being developed to address climate change, which include methods to reduce its impact and adapt to its effects. The objective is to improve the overall quality of life and strengthen the ability of cities to withstand and recover from climate-related challenges.

The Ministry of Environment of Turkey, formed in 1991, underwent a name change in 2003 and became the Ministry of Environment and Forestry. In 2011, several establishments in Turkey were consolidated under the Ministry of Environment and Urbanization. Consequently, a more centralized framework for environmental management was established<sup>45,60</sup>. In 2021, there was a notable alteration in the institutional aspect of the endeavors to address climate change. Specifically, the "Ministry of Environment and Urbanization" underwent a name change and is now referred to as the "Ministry of Environment, Urbanization, and Climate Change." The Ministry formed the Climate Change Directorate. The management of the organization is overseen by a single president and three deputy presidents, namely ÇŞİDB and 2023. This transition is a significant milestone, as the ministry now holds the primary responsibility and power for addressing climate change in our country.

A comprehensive "Integrated Urban Development Strategy and Action Plan" has been established for the years 2010-2023. This plan is a significant milestone in tackling



climate change challenges in cities, as it covers a wide range of areas for the first time. Subsequently, the "Republic of Turkey CCAP" was established, including the period from 2011 to 2023. CCAP encompasses aims for both mitigating greenhouse gas emissions and adapting to the impacts of climate change. In the same year, Turkey produced "Turkey's Climate Change Adaptation Strategy and Action Plan" for the years 2011-2023. This plan specifically focuses on the impacts of climate change in Turkey. This strategy primarily concentrates on five fundamental areas of vulnerability and establishes goals in this approach. The following areas are: (1) Water resources management, (2) Agriculture and food security, (3) Ecosystem services, biodiversity, and forestry, (4) Natural disaster risk management, and (5) Human health.

The Republic of Turkey's Climate Change Action Plan was developed as part of the Development of Turkey's National Climate Change Action Plan Project. The project was funded by the 'Low Carbon High Growth Program' under the Strategic Program Fund of the UK Ministry of Foreign Affairs, as well as the Ministry of Environment and Urbanization and UNDP. Turkey provided in-kind contributions to help the implementation process of the project. The project, initiated in January 2009, was concluded in July 2011, spanning a duration of 18 months.

The Climate Change Action Plan aims to establish cooperation with international organizations regarding climate change and to achieve this in accordance with sustainable development policies within the framework of Turkey's special conditions. The strategic objectives of this plan include integrating policies to combat climate change into national development plans within special conditions, considering the principle of "common but differentiated responsibilities" of the UN Framework Convention on Climate Change.

Furthermore, the plan seeks to contribute towards the reduction of greenhouse gas emissions in accordance with sustainable development objectives within our nation's capabilities, with the goal of decreasing greenhouse gas emissions in alignment with international regulations. Additionally, its objective is to enhance the country's capacity for national preparation and extend the benefits to surrounding nations, with the purpose of mitigating and adjusting to the impacts of climate change. This will be achieved through the implementation of multilateral policies resulting from these collaborations. Another goal is to actively engage in international initiatives to align with global strategic objectives and establish evidence-based decision-making processes by contributing to the efforts to combat global climate change and facilitate adaptation.

CCAP, which consists of 541 actions, does not contain a quantified greenhouse gas reduction target both on an action and plan basis. Instead, it includes 541 actions to achieve 107 targets for 49 purposes.

Table 21: CCAP purposes and targets

Sector	Purposes	Targets
Energy	4	9
Building	3	7
Industry	3	5
Logistic	5	10
Waste	1	6
Agriculture	3	5
Land Use and Forestry	4	9
Common Topics Across Sectors	9	12
Adaptation to Climate Change	17	44
<b>Total</b>	<b>49</b>	<b>107</b>

It has been noted that several initiatives outlined in the 2013 Climate Change Action Plan have already been specified by certain departments. Furthermore, the absence of explicit descriptions of the consequences of programs designed to adapt to climate change has resulted in a state of ambiguity. In addition, the idea of transparency was disregarded during the execution of the Action Plan. Turkey's delayed involvement in international accords about climate change and its inadequate adherence to the necessary procedures have resulted in several deficiencies in the Climate Change Action Plan. Although several countries that joined the agreements early have ample reserves on various climate change matters, Turkey became a participant in the agreements just before the Action Plan was formulated, and thus lacks adequate information and resources<sup>61</sup>.

The National Climate Change Adaptation Strategy and Action Plan emphasizes sectors that may face the effects of climate change. These sectors include water

resource management, agriculture and food security, ecosystem services, biodiversity and forestry, natural catastrophe risk reduction, and human health. The sub-objectives associated with the priority targets identified in the context of the adaptation of CCAP have been defined, encompassing the activities to be implemented for these sub-goals, their timeframe, outcomes, accountable parties, and relevant organizations. The adaptation strategy and action plan encompass a range of concerns that are addressed within this framework. The text highlights Turkey's challenge in managing its vulnerable water resources and coastal areas, with the goal of adjusting its agricultural practices to the existing climatic circumstances.

The primary objective is to examine the impacts of climate change and adaptation measures on sea level rise. This includes ensuring the long-term viability of marine and coastal protected areas, conducting mapping studies of agricultural areas and residential areas at risk of flooding, and implementing strategies to adapt to rising sea levels. The objectives of natural disaster risk management encompass the identification of risks associated with climate change, such as floods, overflows, and landslides. This involves the preparation of disaster, hazard, and risk maps, the development of disaster management plans for affected sectors, and the evaluation of legislation pertaining to natural disasters resulting from climate change. In the medium term, it is regarded a sub-goal to include hazard and risk analysis into urbanization and planning regulations in order to decrease the hazards associated with disasters and settlements.

At the local level, as well as at the global and national levels, the fight against climate change was initially dominated by mitigation policies and practices in this direction. However, today, adaptation policies, whose results can be seen in both the short and long term, provide direct benefits at the local level. Local climate change strategies include not only action planning in certain sectors for emission reduction such as energy, transportation, and waste, but also adaptation action planning of the same weight<sup>62</sup>. Local governments now include adaptation policies in their climate change action plans or directly prepare adaptation action plans.

Cities, due to their high population density and economic activity focused on expansion, are the primary contributors to greenhouse gas emissions worldwide<sup>63</sup>. Metropolitan municipalities must possess greenhouse gas inventories to effectively develop a Local Climate Change Action Plan. Incorporating greenhouse gas reduction

objectives into Action Plans and subjecting them to annual evaluation by the ministry would be highly beneficial. Nevertheless, the law does not provide any information on the extent or range of greenhouse gas inventories.

The Strategic Plan (2018-2022) of the Ministry of Environment, Urbanization and Climate Change discusses the initial formal process for developing local climate action plans in Turkish cities. The Ministry announced its anticipation for 30 metropolitan cities to formulate and execute action plans for the year 2023. Therefore, the implementation of the LCCAP will first focus on major cities before gradually expanding to smaller local units and achieving extensive coverage. Despite the Ministry's directive to have action plans ready and executed by 2023, the current number of metropolitan municipalities having a Local Climate Change Action Plan is somewhat limited.

The Bursa Metropolitan Municipality, Denizli, Gaziantep, Istanbul, Kocaeli, and Konya have all successfully implemented their Climate Change Action Plans as part of the YİDEP initiative, which requires all metropolitan cities to prepare such plans by 2023. Several metropolitan municipalities are now in the process of developing action plans, such as Bostancı in 2022. When developing climate action plans, it is important to collaborate with non-governmental organizations and local councils to ensure collaboration and involve the public in the process<sup>45</sup>.

#### **4.2.1. Sustainable Energy and Climate Action Plan (SECAP)**

The İzmir SECAP, developed by the İzmir Metropolitan Municipality in 2020, provides a crucial blueprint for attaining the city's objective of decreasing greenhouse gas emissions by 42% by 2030. This strategy was formulated in compliance with the European Union's "Sustainable Energy and Climate Action Plan (SECAP)" and was funded by the European Union. The concept is expected to need an investment of 10 billion Euros. İzmir Metropolitan Municipality has developed Turkey's first and exclusive Sustainable Energy and Climate Action Plan, which is based on the province. During the development and execution of the plan, collaboration is established with non-governmental groups, the corporate sector, and academia<sup>61</sup>.

SECAP covers a range of industries, including energy, buildings, transportation, waste management, land use, and forestry. Within the scope of SECAP, 58 actions have been identified, comprising 28 reduction actions and 30 adaptation actions, with 44 of them also integrated into the Green City Action Plan<sup>61,64</sup>.

The SECAP provides a comprehensive analysis of İzmir's climate change situation and its potential for emission reduction, including baseline analysis, emission estimates, and reduction targets for each sector, along with the necessary policies, measures, and investments to achieve these targets. Key features of the plan include calculating the city's greenhouse gas emissions by sector based on 2018 data, identifying İzmir's climate change risks and vulnerabilities, determining sector-specific actions to achieve emission reduction targets by 2030, and establishing a monitoring and evaluation framework for plan implementation.

The primary objectives of SECAP are to reduce greenhouse gas emissions by 42% by 2030, increase the share of renewable energy sources to 30%, decrease energy consumption by 20%, improve energy efficiency in buildings by 30%, cut emissions in the transportation sector by 20%, boost recycling and compost rates in waste management, ensure sustainable land use management, and reduce emissions while enhancing carbon sequestration in agriculture and forestry.

Actions outlined in the SECAP fall into various categories including investment projects, policy measures, plans and strategies, behavioral measures, training initiatives, and sanctions aimed at enhancing compliance with environmental regulations.

#### **4.2.2. Green City Action Plan (GCAP)**

İzmir GCAP was prepared by İzmir Metropolitan Municipality with the support of the EBRD in 2020 and was put into effect in 2021. The main aim of the plan is to make İzmir a greener, sustainable, and livable city by 2030. For this purpose, the plan consists of 5 main components; sustainable energy and climate change, green spaces and biodiversity, water resources management, zero waste and recycling, sustainable transportation.

GCAP comprehensively addresses the environmental challenges facing İzmir, encompassing 47 different actions in areas such as protecting and developing green areas, reducing air and water pollution, waste management, and energy efficiency. These actions include investing in public transportation and increasing the capacity of wastewater treatment facilities to achieve the targets determined for each component. The categorization of actions within the scope of GCAP aligns with the SECAP categories specified in the previous title, including investment projects, policy measures, plans and strategies, behavioral measures, education, and enforcement. The main objectives of the GCAP are to protect the quality of environmental assets and use natural resources sustainably, reduce and adapt to climate change risks, improve the quality of life of city residents, promote economic development, increase social inclusion, strengthen institutional capacity, and encourage research and development.

#### **4.2. Scoring and Assessing of Action Plans in İzmir**

Using the suggested checklist, local action plans are assessed, and their results analyzed. Each measure in the checklist is considered separately and relevant information from the plans is recorded in the evaluation list. The mitigation and adaptation actions included in both action plans are scored based on the framework from the literature. Scoring occurs as follows: "0" indicates that a component is not mentioned in the plan, and "1" indicates that it is included. Plans receive a score of "1" if actions are clearly specified in written documents according to checklist criteria; otherwise, they receive a score of "0" for lack of documentation. Evaluating scores from both plans helps evaluate the plans' relationship to climate neutrality.

Table 22: Evaluation of action plans with proposed checklist

<b>ACTION AREAS</b>	<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
Energy	Providing thermal insulation of non-residential buildings	1	Providing insulation of non-residential buildings	0	-
	Providing energy efficiency incentives in residential areas	1	Recommendations for thermal insulation in existing houses	0	-
	Reducing urban heat islands through the use of urban heating/cooling systems.	1	Identification and application of techniques to reduce the urban heat island effect	1	Identification and application of techniques to reduce the urban heat island effect
	Application of smart heating and lighting control systems in public buildings.	1	Energy efficiency in existing residences Encouraging lighting systems (LED etc.)	0	-
	Determining alternative energy sources by calculating the amount of energy consumed in the port.	0	-	0	-
	Expansion of electric bus fleets	1	Municipal vehicle fleet and service vehicles: Electric and low-carbon vehicles	1	Municipal vehicle fleet and service vehicles: Electric and low-carbon vehicles
	Abandoning the use of fossil fuels in the industrial sector	1	Connecting public sector and/or industrial buildings to geothermal heating networks	1	Connecting public sector and/or industrial buildings to geothermal heating networks

Table 22: (cont.)

ACTION AREAS	ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
Energy	Investing in renewable energy sources.	1	To promote the expansion of solar energy installations Launch of a municipally financed subsidy program	0	-
	Carrying out studies for energy efficiency in commercial areas.	1	Implementation of an environmental labeling program for companies in İzmir	1	Implementation of an environmental labeling program for companies in İzmir
Water	Ensuring effective management of water through water saving measures.	1	Implementation of a maintenance program for drinking water supply systems, water management plan and construction of proposed facilities. Reviewing existing design and implementation standards to improve the effectiveness of new water infrastructure networks. Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles. Establishment of rainwater storage systems at building level, underground, and connected to green areas in municipality-owned or operated buildings and infrastructure	1	Implementation of a maintenance program for drinking water supply systems, water management plan and construction of proposed facilities. Reviewing existing design and implementation standards to improve the effectiveness of new water infrastructure networks. Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles. Establishment of rainwater storage systems at building level, underground, and connected to green areas in municipality-owned or operated buildings and infrastructure.



Table 22: (cont.)

<b>ACTION AREAS</b>	<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
Water	Increasing water efficiency by organizing water saving campaigns.	0	-	0	-
	Organizing water pollution prevention activities to protect water resources.	1	Improvement of existing water infrastructure to ensure separation of wastewater and stormwater lines	1	Improvement of existing water infrastructure to ensure separation of wastewater and stormwater lines
	Improving water management of agricultural areas.	0	-	0	-
Waste	Implementation of programs for the separation of plastic waste.	1	The municipality commits to banning the use of single-use plastics in municipal buildings, thereby encouraging local businesses to implement the same ban.	1	The municipality commits to banning the use of single-use plastics in municipal buildings, thereby encouraging local businesses to implement the same ban.
	Alternative fuel production from wastewater treatment plants	0	-	0	-
	Evaluation of technologies for processing organic waste.	1	Examining the possibility of providing special waste collection services to restaurants and tradesmen working in the food industry in accordance with the management infrastructure and technology.	1	Examining the possibility of providing special waste collection services to restaurants and tradesmen working in the food industry in accordance with the management infrastructure and technology.
	Ensuring controls to reduce construction waste.	0	-	0	-

Table 22: (cont.)

<b>ACTION AREAS</b>	<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
Waste	Investing in waste compost facilities.	1	Supporting and accelerating investments in waste separation (dry recyclable waste and organic waste) and clean material recovery infrastructure and composting facilities, based on the İzmir Integrated Solid Waste Management Plan (2018)	1	Supporting and accelerating investments in waste separation (dry recyclable waste and organic waste) and clean material recovery infrastructure and composting facilities, based on the İzmir Integrated Solid Waste Management Plan (2018)
	Development of recycling practices	1	Making separate collection of recyclable dry materials mandatory	1	Making separate collection of recyclable dry materials mandatory
Transport	Encouraging short driving distances with smart traffic systems.	1	Smart traffic management: e.g. command center	0	-
	Increasing pedestrian mobility by providing safe pedestrian paths.	1	More sustainable urban mobility: public transport and local mobility.	1	More sustainable urban mobility: public transport and local mobility.
	Strengthening infrastructure to popularize bicycle use	1	More sustainable urban mobility: public transport and local mobility.	1	More sustainable urban mobility: public transport and local mobility.
	Increasing the use of bicycles and public transportation through economic incentives	0	-	0	-

Table 22: (cont.)

<b>ACTION AREAS</b>	<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
Transport	Increasing the accessibility of electric vehicle charging stations.	1	More sustainable urban mobility: public transport and local mobility.	1	More sustainable urban mobility: public transport and local mobility.
	Expansion of shared transportation modes	1	More sustainable urban mobility: public transport and local mobility.	1	More sustainable urban mobility: public transport and local mobility.
	Optimizing urban logistics.	1	Adopting more sustainable logistics practices	1	Adopting more sustainable logistics practices
	Integrating cycling and public transport with metro services.	1	More sustainable urban mobility: public transport and local mobility.	1	More sustainable urban mobility: public transport and local mobility.
Health	Creating emergency preparedness plans in health services.	0	-	0	-
	Training emergency response teams.	0	-	0	-
Environment and Biodiversity	Expansion of urban green areas	1	Further development of green infrastructure and blue infrastructure strategies	1	Further development of green infrastructure and blue infrastructure strategies

Table 22: (cont.)

<b>ACTION AREAS</b>	<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
Environment and Biodiversity	Supporting green infrastructure projects to protect natural ecosystems.	1	Maintaining, protecting, and enhancing existing biodiversity and ecological habitats through the restoration of natural wetlands, lagoons and plantations (including natural ecosystem formation)	1	Maintaining, protecting, and enhancing existing biodiversity and ecological habitats through the restoration of natural wetlands, lagoons and plantations (including natural ecosystem formation)
	Supporting afforestation projects.	1	Further development of green infrastructure and blue infrastructure strategies	1	Further development of green infrastructure and blue infrastructure strategies
	Carrying out urbanization and renewal projects using nature-based solutions.	1	Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles	1	Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles
Finance	Determining actions for emission reduction at sectoral level	0	-	1	Reducing emissions and pollution in industrial areas
	Applying to national and international sources for financing large-scale projects.	0	-	0	-
	Establishing special funds to support adaptation projects.	1	Establishing funds to support the renovation of housing to a higher and more environmentally friendly energy standard	1	Establishing funds to support the renovation of housing to a higher and more environmentally friendly energy standard

Table 22: (cont.)

<b>ACTION AREAS</b>	<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
Finance	Providing incentives for projects that promote the green economy	1	Conducting circular economic (recycling-based) evaluations in all renovation and demolition projects of the municipality and encouraging updates in special projects.	1	Conducting circular economic (recycling-based) evaluations in all renovation and demolition projects of the municipality and encouraging updates in special projects.
	Integrating appropriate financing solutions into city-scale action planning.	1	Creation of İzmir bioeconomy strategy and action plan	1	Creation of İzmir bioeconomy strategy and action plan
	Presentation of budgets in detail	1	Budgets are stated in detail in the report.	1	Budgets are stated in detail in the report.
Governance and Planning	Ensuring the participation of stakeholders in the planning process.	1	Identification and collaboration of stakeholders to lobby for "Risky Areas". Working with infrastructure companies to understand the current renewable energy capacity and ensure the transition to a renewable energy-based electricity system.	1	Identification and collaboration of stakeholders to lobby for "Risky Areas". Working with infrastructure companies to understand the current renewable energy capacity and ensure the transition to a renewable energy-based electricity system.

Table 22: (cont.)

ACTION AREAS	ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
Governance and Planning	Include a monitoring and evaluation framework in the plan to monitor progress and results.	1	<p>Reviewing and updating local level policies, planning regulations and guidelines</p> <p>The necessary tools and mechanisms to implement climate change adaptation strategies</p> <p>determination</p>	1	<p>Reviewing and updating local level policies, planning regulations and guidelines</p> <p>The necessary tools and mechanisms to implement climate change adaptation strategies</p> <p>determination</p>
	Defining the local government coordination structure.	1	Developing an administrative institutional structure for the implementation and monitoring of GCAP and SECAP actions	1	Developing an administrative institutional structure for the implementation and monitoring of GCAP and SECAP actions
	Creating a disaster management plan against risks	1	<p>Establishing access to safe clean water in emergencies such as disasters</p> <p>Creating flood management plans for high-risk areas such as industrial areas and residential areas</p> <p>Creating a drought action plan</p> <p>Establishing a management strategy for forest fires</p>	0	-
	Leveraging an integrated framework that is compatible with globally accepted standards and benchmarks.	1	The plan was prepared within the international framework by signing the Covenant of Mayors (CoM).	1	The plan was prepared within the international framework by signing the Covenant of Mayors (CoM).

Table 22: (cont.)

ACTION AREAS	ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
	Ensuring cooperation between local governments in climate action planning.	1	Partnership and/or cooperation with relevant institutions that can act together in accordance with the Zero Waste Regulation to invest in the necessary recycling infrastructures (garbage bins, trucks, routes, etc.).	1	Partnership and/or cooperation with relevant institutions that can act together in accordance with the Zero Waste Regulation to invest in the necessary recycling infrastructures (garbage bins, trucks, routes, etc.).
	Regular publication of reports evaluating the results of adaptation studies.	0	-	0	-
	Setting targets to reduce greenhouse gas emissions over a specific period of time.	1	The municipality is committed to net zero energy consumption in all new municipality-controlled buildings by 2030.	0	-
<b>Total Score of The Plan</b>		<b>35</b>		<b>29</b>	

## CHAPTER 5

### RESULTS AND DISCUSSION

First of all, 7 of the 8 actions proposed for SECAP are in the plan, and 5 of the 8 actions recommended for GCAP are in the plan. SECAP appears to have proposed further action in the field of energy. However, the actions included in the GCAP also represent important steps that can contribute to the climate neutralization goal.

Table 23: Evaluation of SECAP and GCAP about Energy

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
1. Ensuring energy savings in buildings.	1	Recommendations for thermal insulation in existing houses	0	-
2. Reducing urban heat islands through the use of urban heating/cooling systems.	1	Identification and application of techniques to reduce the urban heat island effect	1	Identification and application of techniques to reduce the urban heat island effect
3. Application of smart heating and lighting control systems in public buildings.	1	Energy efficiency in existing residences Encouraging lighting systems (LED etc.)	0	-
4. Determining alternative energy sources by calculating the amount of energy consumed in the port.	0	-	0	-
5. Expansion of electric bus fleets	1	Municipal vehicle fleet and service vehicles: Electric and low-carbon vehicles	1	Municipal vehicle fleet and service vehicles: Electric and low-carbon vehicles
6. Abandoning the use of fossil fuels in the industrial sector	1	Establishing connections between public sector and/or industrial buildings with geothermal heating networks.	1	Establishing connections between public sector and/or industrial buildings with geothermal heating networks.



Table 23: (cont.)

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
7. Investing in renewable energy sources.	1	To promote the expansion of solar energy installations, launch of a municipally financed subsidy program	0	-
8. Carrying out studies for energy efficiency in commercial areas.	1	Implementation of an environmental labeling program for companies in İzmir	1	Implementation of an environmental labeling program for companies in İzmir

Looking at the content of the actions, it can be seen that strategies aimed at basic goals such as saving energy, investing in renewable energy sources, and reducing the use of fossil fuels are included in both plans.

Both plans have shortcomings. For example, an action such as promoting lighting systems to increase energy efficiency is included in GCAP but not in SECAP. Likewise, actions such as determining alternative energy sources and calculating energy consumption in the port recommended in SECAP are not included in GCAP. These shortcomings show that both plans have areas that need improvement.

However, it is particularly noteworthy that some of the actions recommended in SECAP are not included in GCAP. For example, actions such as promoting solar installations recommended in GCAP are not included in SECAP. It is also noteworthy that an important action such as promoting energy-efficient lighting systems such as LED is not included in the GCAP. This may indicate that SECAP proposes more specific and perhaps more innovative approaches in certain areas.

Overall, both plans offer various recommendations for action in the field of energy, indicating that İzmir has developed various strategies to achieve its climate neutralization goal. However, the inclusion of more actions, particularly in SECAP, and the absence of some important actions in both plans, may indicate the need for greater focus or strategy development in certain areas.

In places where climate neutrality is directly measured, such as in the cases of Madrid<sup>49</sup>, Nine Cities in Sweden<sup>51</sup>, Copenhagen<sup>53</sup>, clear measures regarding energy efficiency are seen, especially in the transition of public buildings. In this regard, İzmir actions are parallel to literature.

In the Copenhagen case, there is no mention of calculating energy consumption in ports and turning to alternative energy sources in either plan. Since İzmir has ports, it can be expected to develop actions on this issue.

Since the first strategies used in combating climate change are reduction-oriented and many developments in the field of energy are reduction-targeted, all measures that are common in all cases that measure both mitigation and adaptation are included in the SECAP plan of the city of İzmir. In the action plans of <sup>56</sup>, <sup>57</sup> and the evaluations of <sup>58</sup> on the structure of the city, the importance of transitioning to renewable energy sources and investing in them in adapting to climate change is emphasized. It also touches upon the importance of incentive practices such as certification regarding energy efficiency in public buildings<sup>58</sup>. However, no action was found regarding these measures in GCAP. However, considering that SECAP and GCAP were prepared to complement each other; Since these actions, which are not in GCAP, are included in SECAP, it may indicate that İzmir is approaching its climate neutrality target.

Table 24: Evaluation of SECAP and GCAP about Water

Actions in the Field of Water	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
1. Ensuring effective management of water through water saving measures.	1	<p>The execution of a maintenance schedule for drinking water supply systems, the development of a water management plan, and the construction of suggested infrastructure.</p> <p>Reviewing existing design and implementation standards to improve the effectiveness of new water infrastructure networks.</p> <p>Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles.</p> <p>Establishment of rainwater storage systems at building level, underground, and connected to green areas in municipality-owned or operated buildings and infrastructure.</p>	1	<p>The execution of a maintenance schedule for drinking water supply systems, the development of a water management plan, and the construction of suggested infrastructure.</p> <p>Reviewing existing design and implementation standards to improve the effectiveness of new water infrastructure networks.</p> <p>Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles.</p> <p>Establishment of rainwater storage systems at building level, underground, and connected to green areas in municipality-owned or operated buildings and infrastructure.</p>
2. Increasing water efficiency by organizing water saving campaigns.	0	-	0	-
3. Organizing water pollution prevention activities to protect water resources.	1	Enhancement of current water infrastructure to guarantee the segregation of wastewater and stormwater pipelines	1	Enhancement of current water infrastructure to guarantee the segregation of wastewater and stormwater pipelines
4. Improving water management of agricultural areas.	0	-	0	-

As a result of the evaluation made on the actions in the field of water, it is seen that similar actions are included in SECAP and GCAP. Both plans propose various strategies focusing on the effective management of water resources. For example, actions such as water conservation measures, water pollution prevention activities and the integration of water management techniques into the city's green areas are included in both plans.

However, while both plans have the potential to include more action in the field of water, some actions appear to be missing. For example, actions such as water saving campaigns to increase water efficiency are excluded from both plans. This may indicate the need for more comprehensive strategies to manage water resources more effectively and sustainably.

However, important actions such as water saving campaigns to increase water efficiency is not included in SECAP and GCAP. This may suggest that more emphasis should be placed on water conservation.

In general, both plans include various actions on effective management of water resources and protection of water resources. However, more actions in the field of water may need to be included in the plans by developing a more comprehensive and inclusive strategy.

In the studies of Panagiotopoulou et. al. and Christidis et. al. climate neutrality was directly measured and there are measures related to water management<sup>53,56</sup>. In studies directly measuring climate neutrality, it is seen that measures in the water field are more limited than in other areas. The water management actions mentioned in these studies are mainly linked to green infrastructure. There is more than one action on this issue in both action plans of İzmir.

Grafakos et. al. measure such as flood protection systems and water management initiatives such as implementation of green infrastructure projects, like green roofs and rain gardens, sea level reducing<sup>56</sup>, mentioned in the studies of Case of Victoria<sup>58</sup>. It is included in both plans.

Regarding water management in agricultural areas were not found in both plans<sup>46</sup>. However, in both plans, there are actions for agricultural areas that are not on the checklist, but these actions trigger the decrease in biodiversity and related ecosystem services due to the use of fertilizers and pesticides.

Similar to the situation encountered in the energy field, in the water field, there is a deficiency in both plans in terms of encouraging the user to save and transition through economical means. Hurlimann et. al. touched upon the importance of directing society to savings with these incentives<sup>59</sup>.

Table 25: Evaluation of SECAP and GCAP about Waste

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
1.Implementation of programs for the separation of plastic waste.	1	The municipality commits to banning the use of single-use plastics in municipal buildings, thereby encouraging local businesses to implement the same ban.	1	The municipality commits to banning the use of single-use plastics in municipal buildings, thereby encouraging local businesses to implement the same ban.
2.Alternative fuel production from wastewater treatment plants	0	-	0	-
3.Evaluation of technologies for processing organic waste.	1	Examining the possibility of providing special waste collection services to restaurants and tradesmen working in the food industry in accordance with the management infrastructure and technology.	1	Examining the possibility of providing special waste collection services to restaurants and tradesmen working in the food industry in accordance with the management infrastructure and technology.
4.Ensuring controls to reduce construction waste.	0	-	0	-

Table 25: (cont.)

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
5. Investing in waste compost facilities.	1	Facilitating and expediting investments in waste segregation (dry recyclable trash and organic waste) and the establishment of efficient material recovery infrastructure and composting facilities, in accordance with the İzmir Integrated Solid Waste Management Plan (2018)	1	Enhancing and expediting investments in waste segregation (dry recyclable trash and organic waste) and the development of clean material recovery infrastructure and composting facilities, in accordance with the İzmir Integrated Solid Waste Management Plan (2018)
6. Development of recycling practices	1	Making separate collection of recyclable dry materials mandatory	1	Making separate collection of recyclable dry materials mandatory

According to this table, a checklist was used to evaluate the actions of two plans, SECAP and GCAP, in the field of waste management. Each action was scored according to whether it was specified in the plans or not.

Both plans propose various actions on waste management. There are 6 actions recommended in both plans. This shows that İzmir has adopted a comprehensive approach to waste management and developed various strategies.

Actions generally include waste reduction, promoting recycling, evaluating waste processing technologies and separate collection of recyclable materials. This shows that İzmir has taken various steps to achieve sustainability goals in the field of waste management.

However, an action mentioning wastewater treatment plants for alternative fuel production is not included in SECAP and GCAP. This may indicate that a strategy to

evaluate the potential of alternative fuel production from wastewater treatment plants is missing.

In general, both plans include various actions on waste management and reflect that İzmir has developed various strategies to achieve sustainability goals in the field of waste management.

He touched upon the importance of waste management in his works<sup>49,50</sup>. These measures, put forward by these studies that attach importance to the issue of waste management, especially plastic and food consumption, have found a response in both plans of İzmir.

The ecofriendly housing construction issue mentioned by Vanhuyse et. al. was not met in both plans because there was no action regarding the controlled dumping of construction waste<sup>50</sup>.

There is no action in either plan regarding the wastewater treatment plants precaution encountered in the Copenhagen case<sup>53</sup>.

Table 26: Evaluation of action plans of İzmir with actions in the field of transport

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
1. Encouraging short driving distances with smart traffic systems.	1	Smart traffic management: e.g. command center	0	-
2. Increasing pedestrian mobility by providing safe pedestrian paths.	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.
3. Strengthening infrastructure to popularize bicycle use	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.

Table 26: (cont.)

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
4. Increasing the use of bicycles and public transportation through economic incentives	0	-	0	-
5. Increasing the accessibility of electric vehicle charging stations.	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.
6. Expansion of shared transportation modes	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.
7. Optimizing urban logistics.	1	Adopting more sustainable logistics practices	1	Adopting more sustainable logistics practices
8. Integrating cycling and public transport with metro services.	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.	1	Enhanced urban mobility sustainability: focusing on the improvement of public transportation and local mobility options.

First of all, 7 of the 8 proposed actions are included in the SECAP, and within GCAP, 6 of the 8 proposed actions are included in the plan. Both plans cover most of the proposed actions, indicating that İzmir has developed a variety of strategies to achieve climate neutralization goals. Overall, both plans appear to focus on increasing urban mobility and developing more sustainable transportation systems.



Both SECAP (Sustainable Energy and Climate Action Plans) and GCAP (Global Climate Action Plans) scores appear to be predominantly 1, indicating that the proposed actions are mostly close to the climate neutral goals of both plans. In particular, actions such as encouraging bicycle use, increasing pedestrian mobility, and increasing the accessibility of electric vehicle charging stations are supported by both plans.

In the GCAP report, no action was found to integrate smart applications such as smart traffic management into the existing transportation system. This may be due to the fact that the actions in the field of transport found in the literature are generally mitigation-oriented, while GCAP consists of compliance-oriented actions.

However, some proposed actions, such as economic incentives to increase cycling and public transport use, do not appear to have been considered in either plan. This may suggest that the importance of economic incentives should perhaps be emphasized more, and policies should be created in this direction.

Actions such as increasing the number of electric charging stations and increasing pedestrian mobility, public transport, cycling, and shared transport modes included in studies<sup>49,50,53,57</sup>. It found a response in both plans. However, while the smart traffic systems mentioned in the study by [NO\_PRINTED\_FORM] <sup>57</sup> found a response in SECAP, they did not find a response in GCAP. It is known that there will be a decrease in GHG emissions thanks to this system.

As mentioned by Pietrapertosa et. al. no action has been found in either plan to provide economic incentives to users to encourage the use of public transportation and shared transportation networks<sup>54</sup>.

Table 27: Evaluation of action plans of İzmir with actions in the field of health

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
1. Treating emergency preparedness plans in health services.	0	-	0	-
2. Training emergency response teams.	0	-	0	-

According to this table, the two plans, SECAP and GCAP, do not include emergency preparedness plans and training of emergency responders. Therefore, neither plan proposes any action on the two proposed measures and therefore do not score points in either plan.

This situation shows that both plans contain deficiencies in emergency preparedness and response. This assessment shows that these important issues should be included in plans in future updates. Emergency preparedness and response should be considered a key component to achieving the climate neutrality goal.

There is an action that is not included in the checklist but is included in GCAP; "organizing events to raise awareness about the effects of climate change on human health".

Table 28: Evaluation of action plans of İzmir with actions in the field of biodiversity

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
1. Expansion of urban green areas	1	Advancement of initiatives for the further development of environmentally friendly infrastructure and water-based infrastructure	1	Advancement of initiatives for the further development of environmentally friendly infrastructure and water-based infrastructure
2. Supporting green infrastructure projects to protect natural ecosystems.	1	Preserving, safeguarding, and improving the current biodiversity and ecological habitats by restoring natural wetlands, lagoons, and plantations (including the establishment of natural ecosystems).	1	Preserving, safeguarding, and improving the current biodiversity and ecological habitats by restoring natural wetlands, lagoons, and plantations (including the establishment of natural ecosystems)

Table 28: (cont.)

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
3. Supporting afforestation projects.	1	Advancement of initiatives for the further development of environmentally friendly infrastructure and water-based infrastructure	1	Advancement of initiatives for the further development of environmentally friendly infrastructure and water-based infrastructure
4. Carrying out urbanization and renewal projects using nature-based solutions.	1	Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles	1	Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles
5. Determining actions for emission reduction at sectoral level	0	-	1	Reducing emissions and pollution in industrial areas

Both plans include various actions such as increasing urban green areas, supporting green infrastructure projects to protect natural ecosystems, supporting afforestation projects and using nature-friendly solutions in urbanization and renewal projects.

Both plans include similar actions to support environmentally friendly projects and protect natural resources. However, one action specified in GCAP was not included in SECAP: identifying actions for emission reduction at the sectoral level. This shows that GCAP includes more specific strategies on sectoral emissions reduction and focuses on reducing emissions and pollution in specific industrial areas.

In particular, while the action to reduce emissions and pollution in industrial areas is mentioned in GCAP, there is no mention of this issue in SECAP.

The action of afforestation, which is frequently encountered in harmony as mentioned by Grafakos et. al. has found a response in both plans<sup>56</sup>.

In Ciambra's Madrid study, the issue of nature-based solutions was addressed in both plans with the action "Integrating stormwater management techniques into the city's green spaces, for example applying sponge city principles"<sup>49</sup>. The completed Sponge City project is a strong example of nature-based solutions and contributes to İzmir reaching its climate neutrality target.

There are actions in both plans regarding green infrastructure works, which we frequently encounter in the studies conducted by Panagiotopoulou et. al. and Grafakos et. al.<sup>55,56</sup>.

While the action regarding the sectoral discrimination of greenhouse gas emissions found in the study<sup>57</sup> and taking relevant measures is not included in SECAP, GCAP responds to this measure.

Table 29: Evaluation of action plans of İzmir with actions in the field of finance

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
1. Applying to national and international sources for financing large-scale projects.	0	-	0	-
2. Establishing special funds to support adaptation projects.	1	Establishing funds to support the renovation of housing to a higher and more environmentally friendly energy standard	1	Establishing funds to support the renovation of housing to a higher and more environmentally friendly energy standard
3. Providing incentives for projects that promote the green economy	1	Conducting circular economic (recycling-based) evaluations in all renovation and demolition projects of the municipality and encouraging updates in special projects.	1	Conducting circular economic (recycling-based) evaluations in all renovation and demolition projects of the municipality and encouraging updates in special projects.

Table 29: (cont.)

<b>ACTIONS</b>	<b>SECAP SCORE</b>	<b>SECAP ACTIONS</b>	<b>GCAP SCORE</b>	<b>GCAP ACTIONS</b>
4. Integrating appropriate financing solutions into city-scale action planning.	1	Creation of İzmir bioeconomy strategy and action plan	1	Creation of İzmir bioeconomy strategy and action plan
5. Presentation of budgets in detail	1	Budgets are stated in detail in the report.	1	Budgets are stated in detail in the report.

Both plans include various financing and incentive measures. Both plans include 4 out of 5 proposed actions, indicating that both plans propose a similar degree of financing and incentive measures.

Actions generally cover issues such as seeking financing for large-scale projects, establishing special funds to support adaptation projects, providing incentives for projects that promote the green economy, integrating financing solutions suitable for city-scale action planning, and presenting budgets in detail.

Both plans show that İzmir has adopted various financing and incentive mechanisms to achieve climate neutrality. This shows that the city aims to receive support from various sources and encourage projects to combat climate change and achieve sustainability goals.

The issue of the importance of national and international sources for financing large-scale projects, which<sup>57,46</sup> put forward by evaluating many action plans, is not included in the action list of both plans.

Table 30: Evaluation of action plans of İzmir with actions in the field of governance and planning

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
1. Ensuring the participation of stakeholders in the planning process	1	Identification and collaboration of stakeholders to lobby for "Risky Areas". Working with infrastructure companies to understand the current renewable energy capacity and ensure the transition to a renewable energy-based electricity system.	1	Identification and collaboration of stakeholders to lobby for "Risky Areas". Working with infrastructure companies to understand the current renewable energy capacity and ensure the transition to a renewable energy-based electricity system.
2. Include a monitoring and evaluation framework in the plan to monitor progress and result	1	Reviewing and updating local level policies, planning regulations and guidelines The necessary tools and mechanisms to implement climate change adaptation strategies determination	1	Reviewing and updating local level policies, planning regulations and guidelines The necessary tools and mechanisms to implement climate change adaptation strategies determination
3. Defining the local government coordination structure	1	Developing an administrative institutional structure for the implementation and monitoring of GCAP and SECAP actions	1	Developing an administrative institutional structure for the implementation and monitoring of GCAP and SECAP actions

Table 30: (cont.)

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
4. Creating a disaster management plan against risks	1	Establishing access to safe clean water in emergencies such as disasters Creating flood management plans for high-risk areas such as industrial areas and residential areas Creating a drought action plan Establishing a management strategy for forest fires	0	-
5. Leveraging an integrated framework that is compatible with globally accepted standards and benchmarks	1	The plan was prepared within the international framework by signing the Covenant of Mayors (CoM).	1	The plan was prepared within the international framework by signing the Covenant of Mayors (CoM).
6. Ensuring cooperation between local governments in climate action planning.	1	Partnership and/or cooperation with relevant institutions that can act together in accordance with the Zero Waste Regulation to invest in the necessary recycling infrastructures (garbage bins, trucks, routes, etc.).	1	Partnership and/or cooperation with relevant institutions that can act together in accordance with the Zero Waste Regulation to invest in the necessary recycling infrastructures (garbage bins, trucks, routes, etc.).
7. Regular publication of reports evaluating the results of adaptation studies	0	-	0	-

Table 30: (cont.)

ACTIONS	SECAP SCORE	SECAP ACTIONS	GCAP SCORE	GCAP ACTIONS
8. Setting targets to reduce greenhouse gas emissions over a specific period of time.	1	The municipality is committed to net zero energy consumption in all new municipality-controlled buildings by 2030.	0	-

Both plans involve participants in the planning process, include a monitoring and evaluation framework, define the local government coordination structure, create disaster management plans in climate action plans, and set greenhouse gas emissions reduction targets over a specific time period. These actions are in line with studies and recommended standards<sup>46,49,51,57,58</sup>.

However, some actions are not specified for both plans. For example, there is no mention in GCAP for creating disaster management plans. Similarly, there appears to be no mention in SECAP for setting targets for reducing greenhouse gas emissions over a specific time period.

In general, both plans contain a variety of measures, and these measures are based on standards and methods recommended by researchers. However, there are some shortcomings that need to be addressed in future plan updates.



## CHAPTER 6

### CONCLUSION

This research evaluates the efforts of the İzmir Metropolitan Municipality to achieve climate neutrality, while also examining how suitable the local action plans are for achieving climate neutrality goals. Focusing on İzmir's commitment to combating climate change and its integration of this commitment into local action plans, the study provides a significant contribution to understanding the role of local governments in achieving climate neutrality.

İzmir has taken on a leadership role in the fight against climate change by actively participating in national and international platforms. Its participation in initiatives such as the "Nature-Based Solutions" project under HORIZON 2020 and the European Union's "Cities Race to Zero" program underscores İzmir's determination and innovation in addressing climate change. Particularly noteworthy is İzmir's involvement in significant initiatives like the European Union's "Climate Neutral and Smart Cities Mission," which demonstrates its intention to lead in combating climate change.

The action plans prepared by İzmir propose various strategies to achieve climate neutrality. Plans such as SECAP and GCAP include a range of actions recommended for achieving climate neutrality goals in areas such as energy, transportation, building management, and others. However, both plans have some deficiencies, with critical actions missing from GCAP but present in SECAP, indicating areas for improvement in both plans.

Overall, İzmir's efforts to achieve climate neutrality are progressing positively. However, there is a need for the development and implementation of more effective and comprehensive strategies, particularly in addressing critical issues like emergency preparedness and response, which should be given greater consideration and inclusion in action plans.

Future research can provide guidance for further developing and effectively implementing strategies to achieve climate neutrality at the local level. Additionally,

sharing the experiences of pioneering cities like İzmir can serve as inspiration for other local governments.

In conclusion, İzmir's efforts to achieve climate neutrality make a significant contribution to regional and global efforts to combat climate change. However, continuous efforts are needed to strengthen and make these efforts more effective. This study could serve as a milestone in İzmir's journey towards climate neutrality and shed light on the development of future strategies.

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