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URBAN CLIMATE ACTION PLANS IN THE AGE OF CRISIS: PATHWAYS TO SUSTAINABLE AND RESILIENT CITIES

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Abstract: *Cities are at the forefront of both contributing to and being affected by climate change. In order for cities to achieve sustainability and resilience, they need to develop policies against climate change. At this point, climate action plans come to the fore. This study investigates how urban climate action plans integrate risk management into spatial planning to promote sustainability and adaptive capacity. Focusing on five metropolitan cities (Bursa, Konya, Gaziantep, Copenhagen and New York), the study uses document analysis to assess mitigation targets, sectoral priorities and implementation frameworks. This study examines how local governments design and implement climate strategies within various regional and institutional frameworks. The analysis reveals a convergence around key themes such as energy transition, sustainable mobility and green infrastructure, despite administrative capacity and geographical differences. While Turkish municipalities, such as Konya and Gaziantep, have begun to emphasize climate adaptation, Bursa distinguishes itself with its relatively early strategic planning. In contrast, global cities such as Copenhagen and New York are disseminating practices against the impacts of climate change to society. By situating these examples in a comparative context, the study highlights the need for climate strategies that are both locally grounded and internationally best practice.*

Keywords: *Climate crisis, sustainable city, resilient city, climate action plan*

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1. Introduction

While climate change was once viewed primarily through an environmental lens, it is increasingly recognized as a complex challenge reshaping urban governance, spatial design, and the very fabric of social life. Increasing world temperatures, long dry spells, rising seas, and getting worse extreme weather put big dangers on the physical, economic, and social safety of cities (IPCC, 2023). Cities, so they should not be seen just as weak places but as important fields for making plans ahead of climate changes (UN-Habitat, 2024).

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The actions taken by local institutions indicate a growing awareness of the need to create sustainable and resilient urban environments. These include measures such as low-emission development, nature-based infrastructure, energy efficiency, waste management reforms, and planning that integrates climate risk (Newman & Jennings, 2012; Raven et al., 2018). The plans are obviously ones that have evolved in many municipalities as part of the practical tools, though it is now gaining prominence. This picks up more than the environmental aims of the plan and brings in social equity, economic security, and participatory governance (Bulkeley & Betsill, 2010; C40 Cities, 2023).

This study looks at climate action plans as one way institutions respond. It checks their goals, governing systems, and use in five metro areas: Bursa, Konya, Gaziantep, Copenhagen, and New York. These cities were picked because of their different geographic, climatic, and admin traits; plus they have formal climate strategies.

Bursa is a city that very well demonstrates how the process of institutionalizing climate initiatives has begun in Turkey. Through the BUSECAP initiative 2024, Bursa undertakes projects related to sustainable transport, zero-waste goals, and green corridors despite its very strong industrial legacy. In the dry conditions of Central Anatolia, Konya puts more emphasis on water resource governance and management, renewable energy expansion, and transportation reform in its Climate Change Action Plan 2021. Gaziantep faces rapid industrial growth plus urban expansion; therefore it has set under its Green City Action Plan 2023 a broad environmental vision that includes energy use, air pollution, and restoration of lost ecosystems.

At the international level, Copenhagen is known for its ambitious climate neutral targets by 2025. Long-term investment in cycling infrastructure and renewable energy support local resilience, exemplified by the Österbro Climate Zone. In contrast, social justice is an equal emphasis with technical resilience in New York's "OneNYC 2050" strategy. It emphasizes flood defenses, transport electrification, and community-based adaptation as priorities- all under multi-actor governance.

The study is based on qualitative document analysis. It uses official climate plans, urban development strategies, implementation reports, and international benchmarks to appraise how cities integrate climate resilience in spatial policy.

Theoretical framing brings together these three lenses: urban resilience, risk-sensitive planning, and multi-level governance. In this, urban resilience is defined as the ability of a city to absorb and subsequently adapt to climate pressures. Risk-sensitive planning relates to the explicit use of vulnerability data in informing spatial decisions (Meerow et al., 2016; Jabareen, 2013). Multi-level governance adds another theme- the essential coordination required between municipal, regional, and national authorities. These together offer an integrated view through which the selected cases have been evaluated.

2. Methodology

This study uses a method of qualitative comparative case analysis based on document review, which is well-established as an interpretive technique for reading textual data in relation to its socio-political and institutional settings (Bowen, 2009; Prior, 2002). The main goal is to find out how climate action plans serve as strategic tools for building urban resilience and sustainability in times of increasing climate challenges.

For spatial and place-based diversity, the research undertakes Bursa, Konya, and Gaziantep- three large cities in different climatic regions of Turkey with different administrative and developmental histories. The selection process for these cities followed certain criteria: the formal existence of a climate action plan (such as SECAP or GCAP), regional representativeness, and strategic planning that includes both mitigation and adaptation components.

For wider comparative understanding, the study also embraces Copenhagen and New York City- two global cities often mentioned for their leading roles in climate governance (Reckien et al., 2018). The primary documents forming the basis of this comparative inquiry include:

- Bursa Sustainable Energy and Climate Action Plan (BUSECAP) (Bursa Metropolitan Municipality, 2021),
- Konya Climate Change Adaptation and Mitigation Plan (SECAP) (Konya Metropolitan Municipality, 2024),
- Gaziantep Green City Action Plan (GCAP) (Gaziantep Metropolitan Municipality & EBRD, 2023),
- Copenhagen CPH 2025 Climate Plan (City of Copenhagen, 2024),
- New York City OneNYC 2050 Strategy (NYC Mayor's Office of Sustainability, 2023),
- Climate Change Adaptation Strategy and Action Plan (2024-2030)- Turkey National Document

3. Core components of action plans and risk management

Urban climate action plans serve not only as strategic roadmaps but also as governance instruments that aim to reduce systemic vulnerabilities while enhancing the adaptive and transformative capacities of cities. The effectiveness of such plans depends on how well their core components are structured and interlinked. This section outlines the principal elements common to well-designed climate action and risk management plans, with a specific emphasis on resilience and sustainability as overarching normative goals.

3.1. Strategic objectives and risk assessment

Every robust climate action plan begins with a clearly articulated vision that integrates long-term sustainability with short- and medium-term resilience objectives. This framing goes beyond emission reduction targets and includes normative commitments to equity, environmental justice, and intergenerational responsibility (Adger et al., 2005; Romero-Lankao et al., 2016). Plans like New York's OneNYC or Copenhagen's CPH 2025 illustrate how aligning climate goals with broader social and economic development agendas fosters more coherent and durable policies. In the Turkish context, Gaziantep's GCAP explicitly links climate mitigation with post-disaster recovery, while Bursa's BUSECAP frames sustainability through energy transition and clean mobility.

Greenhouse gas (GHG) emissions data offer more than just numerical insight- they establish the empirical foundation upon which urban climate strategies are built. For local governments aiming to reduce their environmental footprint, these figures are a starting point, shaping both the urgency and direction of policy. Yet, setting emissions targets in isolation- detached from broader systemic risks- can limit the effectiveness of climate action. It is not enough to aim for lower numbers; cities must understand the complex web of vulnerabilities that threaten to undermine their goals.

As Aven (2015) emphasizes, risk is not merely a statistical measure but a lens through which uncertainty, exposure, and potential loss are evaluated. Urban climate planning, in this light, must integrate rigorous risk assessment to identify threats—be they climatic, infrastructural, or institutional—that could compromise both mitigation and adaptation efforts. Risk-informed planning supports resilience by anticipating the types of disruptions that are increasingly likely in an unstable climate future.

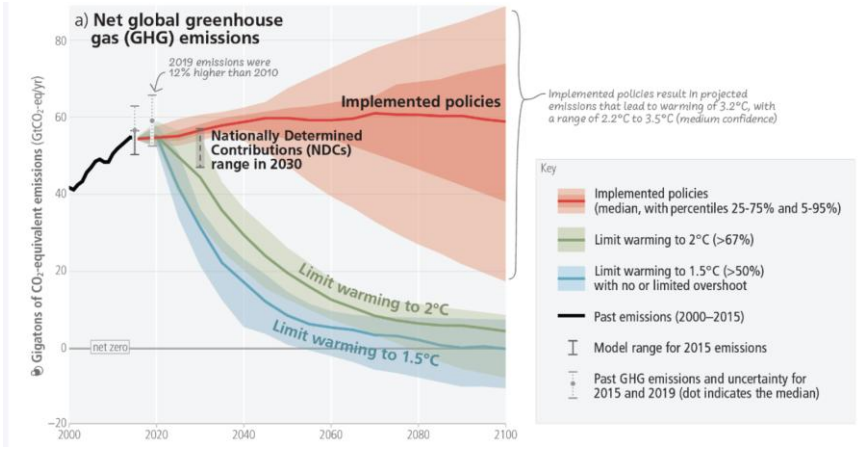

Figure 1. Net Global Greenhouse Gas Emissions[1]
Source: IPCC, 2024. IPCC AR6 Synthesis Report SPM.5 (a): Net global greenhouse gas (GHG) emissions. Palisades, New York: NASA Socioeconomic Data and Applications Center (SEDAC).

The necessity of this approach is underscored when we consider the broader global context. As illustrated in Figure 1, the trajectory of current policy implementation globally falls well short of what is needed to meet the Paris Agreement targets. Rather than limiting warming to 1.5°C or even 2°C, current trends project a rise nearing 3.2°C. This stark gap between ambition and action is a warning: minor adjustments will no longer suffice. Cities must move beyond incrementalism and embrace deeper, structural changes in the way they design and govern climate responses.

In sum, emissions targets, if pursued without a realistic appraisal of local risks and global constraints, risk becoming symbolic rather than substantive. Effective climate action depends on plans that are not only measurable and time-bound but also resilient, adaptive, and rooted in a clear understanding of the complex systems they aim to influence. Within this framework, risk assessments typically address a range of climate-related hazards—such as flooding, heatwaves, droughts, and extreme storms. These are examined in conjunction with broader economic, social, and ecological vulnerabilities, enabling a more integrated understanding of urban risk exposure and adaptive capacity (IPCC, 2021). This approach helps cities to move beyond reactive measures toward anticipatory, resilience-oriented planning.

3.2. Policies, guidelines, and risk reduction strategies

Action plans require the formulation of policies and guidelines necessary to achieve the defined objectives. As emphasized in the C40 network's action plan (2023), these policies span a range of areas including renewable energy incentives, sustainable transportation policies, and waste management strategies. The effectiveness of these policies plays a critical role in the success of the overall plan. During the policy development process, national and local regulations, standards, and incentive mechanisms are taken into account. Risk management, in turn, identifies potential issues that may arise during the implementation of these policies and supports the development of risk reduction strategies.

[1] The figure includes shaded areas indicating the 5th to 95th percentiles. The red range represents emission pathways based on policies implemented by the end of 2020 and Nationally Determined Contributions (NDCs). The green range illustrates pathways that limit global warming to 2°C with a probability greater than 67%, while the blue range shows pathways that limit warming to 1.5°C with a probability greater than 50%, with no or limited overshoot. The black line indicates historical emissions from 2000 to 2015. The error bar in 2015 represents the 5th to 95th percentile uncertainty range of unharmonized emissions across different pathways. The figure also includes a "net zero" trajectory that marks the long-term target for reducing methane emissions. All these future projections are based on the implemented policies and mitigation strategies. See: IPCC, 2024.

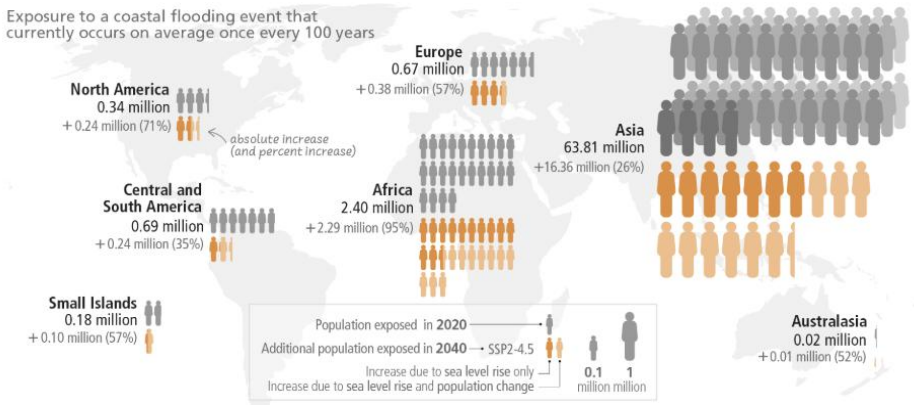

Figure 2. Regional Gradients of Climate Risks
Source: Kaynak: IPCC, 2023, AR6 Synthesis Report: Climate Change 2023.

When identifying potential issues related to climate risks, projections can be made based on existing data. For example, the figure above identifies flood events as a major risk. It illustrates the projected short-term increase, between 2020 and 2040, in the population exposed to 100-year flood events, based on greenhouse gas emission scenarios and current adaptation measures, largely due to sea level rise and demographic changes. In the scenario, coastal flooding is shown to impact many densely populated regions of the world, affecting a significant portion of the population. Additional risk projections may also be derived from the current scenario. For instance, a city facing the risk of rising sea levels may construct barrier systems to prevent coastal inundation and enhance green spaces to strengthen natural drainage pathways.

3.3. Implementation, monitoring, and reflexive capacity

It is essential to identify the resources and mechanisms required to implement action plans. This includes securing funding sources, establishing collaboration between relevant institutions and managing the implementation of projects (UN HABITAT, 2024). Risk management contributes to the creation of crisis management plans to ensure rapid and effective responses in emergencies. Action plans are often criticized for remaining in writing unless they are combined with good practice and adaptive governance mechanisms. Best-practice cities have monitoring dashboards and institutionalized feedback loops in their policies to assess progress and recalibrate strategies. For example, in Copenhagen, emissions are monitored annually and interventions are revised accordingly. The inclusion of monitoring policies in Gaziantep's plans is a notable example.

According to Davoudi et al. (2012), climate resilience is not a static goal but a dynamic process that requires iterative learning and governance flexibility. Indeed, reflexivity (i.e. the ability to question assumptions and revise trajectories) is increasingly seen as a key feature of successful urban climate management. All of these are important elements in making cities resilient. These elements expand the scope of cities' crisis management.

Crisis management focuses on helping communities respond quickly and effectively when unexpected events occur. It includes preparing emergency response plans, figuring out how to communicate clearly during crises, and creating recovery strategies in the aftermath of disasters. As an important part of broader risk management efforts, crisis management plays a proactive role in addressing the types of disasters that are becoming more common due to climate change (Tierney, 2020). Therefore, action plans go a long way in ensuring the resilience of cities.

4. Implementation practices in climate action plans: global and local case studies

The role that cities play in combating climate change is becoming more evident every day. This fight is not only a reflection of global efforts at a local scale; it is also the product of the unique strategies developed by cities in recognition of their own vulnerabilities. Cities shape their climate action plans in line with local environmental pressures, socioeconomic conditions and administrative capacities. In this context, focusing on the diversified experiences of cities is vital to understanding which interventions produce sustainable results.

For example, New York has developed an integrated vision under the title of "OneNYC" by considering climate action together with social equality and economic development. With transparent data sharing and a multi-stakeholder governance structure, this approach aims to increase urban resilience. Copenhagen, on the other hand, approaches the goal of carbon neutrality not only as a technical issue but as a holistic transformation project that permeates all areas of urban life. It transforms urban residents into direct actors of the process with tools such as bicycle transportation systems, green roofs and energy cooperatives.

In Turkey, different cities are seeking to produce solutions suitable for their own geographical and climatic conditions. While Bursa maintains its industrial city identity and invests in energy efficiency and public transportation infrastructure, cities like Konya, which are facing the threat of drought, stand out with their agricultural irrigation technologies and water management policies. Gaziantep, on the other hand, is following a unique path by integrating climate resilience principles into the post-disaster reconstruction process after the 2023 earthquakes. Each of these cities is redefining climate-related planning within their own historical and physical contexts.

These examples show that the success of climate action plans depends not only on the capacity to produce technical solutions, but also on the ability to integrate these solutions with the social fabric. Inter-institutional coordination, encouragement of social participation, and a data-based management culture in decision-making processes stand out as indispensable components of sustainable climate action.

As a result, this diversity, extending from New York to Konya, from Copenhagen to Gaziantep, reveals that a single recipe does not work; on the contrary, flexible and participatory planning approaches that take local specificities into account make success possible. For cities in Turkey, these examples are not only something to learn; they should also be considered as experiences to be transformed and localized.

4.1. Copenhagen (Denmark) Climate Action Plan

Copenhagen is one of the most ambitious cities in Europe when it comes to climate policies. Launched in 2009 and updated in 2021, the CPH2025 Climate Plan stands out as a holistic strategy that aims to make the city carbon neutral by 2025. This goal does not propose a transformation based solely on technical solutions; it also reflects an approach that aims to transform urban lifestyles, governance processes and citizen participation (Copenhagen Municipality, 2024).

In addition, the integration of smart technologies into the city's management systems has made a noticeable difference. By enabling real-time monitoring, improving infrastructure coordination, and streamlining public services, these digital tools have significantly supported Copenhagen's efforts to meet its environmental objectives. For example, a substantial portion of the city's energy needs is now met through renewable energy initiatives. Additionally, facing increasing flood risks, Denmark's capital has created the world's first climate-resilient

neighborhood—Österbro Climate District—through green infrastructure measures. This concept is not only more cost-effective than expanding sewer systems but also easier to maintain and helps mitigate the financial impacts of extreme weather events (Cities100, 2015a).

To finance its stormwater management strategy, Copenhagen adopted an innovative public-private funding model for its Cloudburst Management Plan. The main stormwater infrastructure (underground storage and drainage systems) is funded through water service fees collected by public utilities under local government regulation. Meanwhile, the green infrastructure components related to the improvement of public spaces are financed primarily through local tax revenues (C40 Good Practice Guides, 2016). The city's climate action plan can be assessed through the following framework.

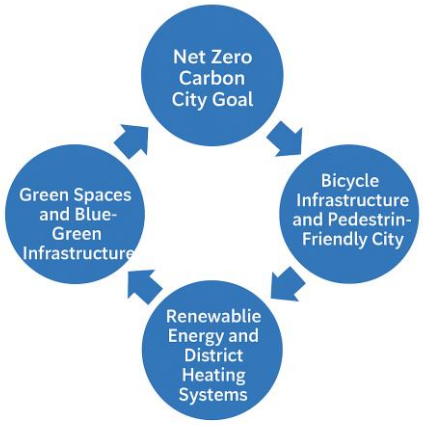

Figure 3. Copenhagen Climate Action Plan and Urban Planning Approach

Carbon-Neutral City Target

According to the city's climate plan, Copenhagen aims to become the world's first carbon-neutral capital by 2025 (CPH 2025 Climate Plan, 2024).

Bicycle Infrastructure and Pedestrian-Friendly City

Recognized as the best city for cycling in the world, Copenhagen places significant emphasis on bicycle transportation. A comprehensive network of bike lanes and pedestrian-friendly areas promotes sustainable mobility throughout the city (Urban Development, 2024). As emphasized by Gössling (2013), in line with the 2025 targets, it is envisaged that 75% of urban transportation will be provided by walking, cycling and public transport. Currently, approximately 500,000 people go to work or school by bicycle every day. The transportation sector is being tried to be decarbonized with tools such as new metro lines, electric bus fleets and pricing of urban carbon emissions.

Renewable Energy

One of the most critical areas in Copenhagen's journey to carbon neutrality is its energy system. The city has largely eliminated fossil fuels from its central heating system and expanded biomass and waste-based energy production. Wind energy has increased its capacity with both onshore and offshore investments; the transition to renewable resources in urban planning has become the norm (Lund et al., 2011).

Green Spaces and Blue-Green Infrastructure

To address water management and climate change adaptation, Copenhagen develops blue-green infrastructure solutions. Parks, canals, and green roofs are integral elements of the city's urban planning strategy (C40 Good Practice Guides, 2016).

The key components and implementation strategies of Copenhagen's climate action plan have positioned the city as one of the global leaders in sustainable urbanism. Frequently cited in academic literature, this plan serves as a prominent example demonstrating the effectiveness of sustainable urban development and climate action planning.

4.2. New York (USA) Climate Action Plan

New York City's Climate Action Plan is a comprehensive strategic framework that reflects the city's commitment to sustainability and the fight against climate change. The plan sets goals across various domains such as energy efficiency, use of renewable energy, sustainable transportation, waste management, and green infrastructure (New York City Municipality, 2024). Similar to Copenhagen, public-private partnerships are a key feature of New York's strategy. In this context, the Retrofit Accelerator program offers financial incentives to improve the energy efficiency of buildings, thereby accelerating the implementation of renewable energy projects and enhancing overall energy performance (NYC Accelerator, 2024).

Raising public awareness has contributed to the adoption of sustainable lifestyles. Initiatives like the GreenThumb program have played a significant role in enhancing community engagement (C40 Cities, 2024b). Through GreenThumb, elderly residents of the city participate in urban beautification and environmental maintenance activities such as raking leaves, mowing lawns, and cleaning up litter, thus contributing to a cleaner and more pleasant urban environment (GreenThumb, 2024).

Figure 4. An Image from the GreenThumb Program
Source: GreenThumb, https://nygreenthumb.org/ (12/12/2024).

A similar initiative, GreeNYC, encourages all New Yorkers to reduce waste and adopt more sustainable habits. Measured through consumer behavior and environmental impact data, the campaign is driven by positive messaging and local engagement to promote environmentally responsible behavior. The initiative delivers environmental, social, and economic benefits (Cities100, 2015b).

In New York, climate change risks are integrated into existing planning activities to enhance the city's resilience. The city faces challenges such as sea level rise, storm surges, heatwaves, extremely hot days, and heavy rainfall. Urban planning, building and infrastructure design are carried out with these factors in mind (C40 Cities, 2017). At the same time, efforts have been made to increase the city's resilience along the coastline through physical infrastructure and

public realm improvements. These community-based initiatives include the development of a flood protection system composed of vegetated berms and deployable barriers along the waterfront, which also aims to enhance open spaces as part of urban planning (Cities100, 2015b).

Under the Green Infrastructure Plan, additional solutions such as green roofs and rain gardens have been implemented for stormwater management (NYC Environment Protection, 2024).

Another notable program addressing the climate crisis is Cool Roofs, launched in 2009, which focuses on cooling rooftops. By covering more than 530,000 m² of rooftops2‡with white, reflective coating, the urban heat island effect has been mitigated, resulting in a cooler city environment (C40 Cities, 2016).

The OneNYC 2050 plan can also be examined in the context of this study. It integrates sustainability and resilience goals into urban planning. The plan outlines long-term strategies that include climate crisis responses in the fields of economic growth, social equity, and environmental sustainability (NYC Mayor's Office of Climate & Environment Justice, 2024). This indicates that New York has adopted an integrated urban planning approach that aligns with climate crisis priorities.

In conclusion, New York's climate action plan and urban planning strategy are presented in the following framework.

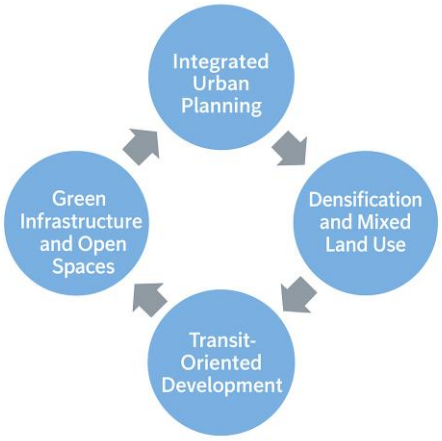

Figure 5. New York Climate Action Plan and Its Implementation Practices.

Integrated Urban Planning: Carbon Neutrality and Clean Energy Transition

An effective clean energy transition in New York cannot be separated from the city's broader spatial and planning frameworks. In this sense, carbon neutrality targets are tightly interwoven with how the city organizes its land use, density, and mobility networks. The OneNYC 2050 plan emphasizes the co-location of energy infrastructure, housing, and transit corridors to optimize energy efficiency and reduce embedded emissions in urban form. Urban planning, therefore, becomes not merely a logistical task, but a core mechanism of climate governance. As Rosenzweig et al. (2011) underline in their study on urban climate adaptation, spatial integration is a critical pathway to both energy transition and climate resilience, especially in dense metropolitan settings like New York.

Densification and Mixed-Use Development:

[2] Equivalent to approximately 626 buildings.

New York City prioritizes high-density and mixed-use development models in line with its sustainable urbanization goals. In particular, old industrial areas close to the city center are being transformed to accommodate both residential and commercial areas; thus, both urban efficiency is increased and transportation needs are reduced. Such areas support life at the neighborhood level and indirectly contribute to the reduction of carbon emissions. Projects such as Hudson Yards and the Brooklyn Navy Yard are among the concrete examples of this approach (New York City Transit, 2018). Although urban density is sometimes associated with negative environmental impacts, it can offer environmental advantages if planned well. Glaeser's (2011) study on urban economies reveals that high-density cities can reduce per capita energy use and limit carbon emissions. According to this perspective, density in metropolises with developed transportation infrastructures such as New York should not be considered a threat to environmental sustainability, but rather an opportunity.

Transit-Oriented Development (TOD):

New York City is one of the most developed cities in the United States based on public transportation. This infrastructure is also a key component of the city's carbon neutrality goals. The OneNYC 2050 plan aims to reduce reliance on private vehicles and reduce emissions by encouraging residential areas where public transportation is at the center. Within the scope of the TOD approach, residential and business areas within walking distance of subway and bus lines are encouraged; thus, transportation times are shortened and the urban carbon footprint is reduced. Especially with rezoning, new housing projects integrated with public transportation have been implemented in areas such as Queens, the Bronx and Brooklyn. The "Mandatory Inclusionary Housing" policy, which went into effect in 2017, made it mandatory to produce affordable housing in TOD areas, ensuring the intersection of social justice and environmental goals (Schuetz, 2019). Thus, TOD has become not only a transportation policy, but also a tool for social interaction and spatial justice.

Green Infrastructure and Open Spaces: The city supports water management and biodiversity through green infrastructure projects (NYC, 2024). In conclusion, New York's climate action plans aim to foster a resilient and sustainable urban planning framework while simultaneously enhancing public awareness regarding the climate crisis. In this regard, New York's approach shows parallels with that of Copenhagen. The following section of the study will examine the city of Bursa in Turkey as part of the analysis.

4.3. A look at Turkey

The 1982 Constitution, Development Plans, Environmental Law, Zoning Law, National Climate Change Action Plan, National Climate Change Adaptation Strategy constitute the legal basis for combating climate change in Turkey (Sezik and Dokuyucu, 2024: 555). Turkey, as a party to the Paris Agreement, has aligned itself with international climate goals and integrated climate policies at the national level. The Turkey Climate Change Mitigation Strategy and Action Plan (2024-2030) serves as the primary document outlining the country's climate objectives and the necessary steps to achieve them. Turkey's Climate Action Plan includes targets for sustainability and greenhouse gas emissions reduction across various sectors (Ministry of Environment, Urbanization and Climate Change, 2024).

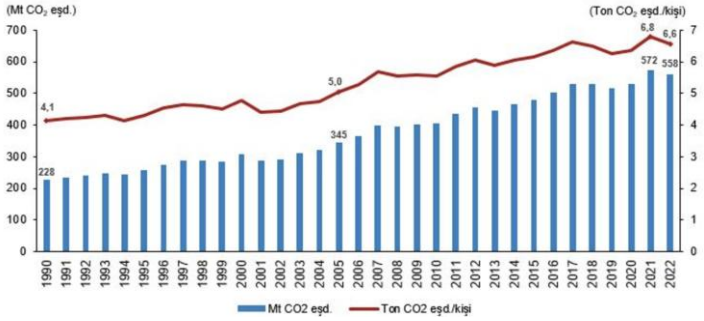

Figure 6. Turkey's Total and Per Capita Greenhouse Gas Emissions (1990–2022)
Source: TUİK (2024), Greenhouse Gas Emissions Statistics, 1990–2022

Turkey's total and per capita greenhouse gas emissions are presented in the figure above. According to the graph, there has not been a consistent or steady increase in emissions from 1990 to 2022; however, a cumulative rise of approximately 330 Mt CO_2 has occurred during this period. This trend highlights the critical necessity of urban planning efforts in response to the climate crisis.

The country's climate action plan has established strategic targets in key sectors such as energy, transportation, industry, agriculture, waste management, and forestry, accompanied by specific policies designed to achieve these§goals.3 Turkey's objectives to improve energy efficiency and expand the use of renewable energy are of strategic importance in reducing the national carbon footprint and ensuring energy independence. In the transportation sector, the promotion of sustainability and green infrastructure has made notable contributions to urban planning practices. Under the framework of the Energy Efficiency Law, various projects have significantly reduced energy consumption in public buildings (Ministry of Environment, Urbanization and Climate Change, 2024). In recent years, Turkey has also increased the share of renewables in energy production by establishing a substantial number of renewable energy power plants. For instance, wind energy projects have been rapidly implemented (Ministry of Energy and Natural Resources, 2024a-b).

Table 1. Turkey's Urban Greenhouse Gas Emissions by Sector (1990–2022)

Year	1990	1995	2000	2005	2010	2015	2020	2021	2022	1990–2022 Change (%)	2021–2022 Change (%)
Total emissions	228.0	256.5	306.4	344.8	405.3	480.1	530.2	572.0	558.3	144.9%	-2.4%
Energy	143.1	170.0	219.8	247.7	290.9	344.0	369.5	406.5	400.6	179.8%	-1.4%
Industrial processes and product use	22.7	25.4	26.1	34.0	48.6	59.2	67.2	74.7	69.9	208.1%	-6.4%
Agriculture	51.8	49.0	46.0	46.3	47.7	59.2	76.4	75.4	71.5	37.9%	-5.1%
Waste	10.3	12.1	14.5	16.9	18.1	17.7	17.0	15.4	16.3	57.7%	5.5%

Source: TUİK (2024), Greenhouse Gas Emission Statistics, 1990-2022

One of the reasons Turkey has sought to enhance its climate resilience through the energy sector is that, based on an analysis of sectoral greenhouse gas emissions in urban areas, the energy sector accounts for a significant portion of these emissions. However, according to the

[3] Türkiye's previous climate action plan also included sustainability and emission reduction targets across various sectors. The plan identified strategic goals in key sectors such as energy, transportation, industry, agriculture, and waste management, and emphasized that policies would be developed to achieve these objectives. See: Republic of Türkiye Ministry of Environment and Urbanization, 2011.

table, a decrease in emission levels is observed between 2021 and 2022, which can be attributed to the country's renewable energy incentives during that period.

Table 2. Impacts of Climate Change and Vulnerable Sectors/Regions in Turkey

Impacts	Severity	Potentially Affected Regions	Affected Sectors / Themes
Change in river/basin regimes	Low	All regions	Ecosystem services and biodiversity
Decrease in surface water	Medium	Western Anatolia Region	Agriculture, water distribution network infrastructure
Increasing water scarcity due to consumption	High	Istanbul, Ankara, Aydın, Nevşehir, Bursa	Urban areas
	Medium	Afyonkarahisar, İzmir, Kayseri, Muğla, Manisa	Agriculture, industry, energy
Flooding	Medium	Black Sea and Southeastern Anatolia Regions	Continuity of agricultural livelihoods, human health
Loss of soil / salinization	Low	Mediterranean, Black Sea, Aegean Regions, Southeastern Anatolia	Tourism, ecosystem services, biodiversity, agricultural productivity
Desertification / Soil degradation	Medium	Southwestern Anatolia	Agricultural livelihoods, water security, wetlands
Coastal erosion	Low	Black Sea Region	Coastal areas, infrastructure, unemployment
Degradation of marine ecosystems	Low	Mediterranean, Aegean, Black Sea Regions	Ecosystem services and biodiversity
Forest fires	Medium	Western Anatolia	Tourism, agriculture
Species migration to other regions	Low	Mediterranean Region	Tourism, agriculture, food security
Decline in agricultural productivity	Medium	Mediterranean and Aegean Coasts	Agriculture (employment), food security
Decrease in hydropower potential	Medium	Eastern Anatolia Region	Energy, industry
Decline in marine product yield	Low	Mediterranean Region	Agriculture, food security, water distribution network

Source: BUSECAP. (2024). Bursa Metropolitan Municipality Sustainable Energy and Climate Change Adaptation Plan.

The table presents the regions and sectors in Turkey that are vulnerable to the adverse impacts of climate change, categorized by severity of risk. Among the themes with high vulnerability intensity, urban areas stand out. The regions identified as highly vulnerable include İstanbul, Ankara, Aydın, Nevşehir, and Bursa. The first step toward local climate adaptation planning in Turkey was taken under the coordination of the Ministry of Environment and Urbanization through the pilot project titled Capacity Development for Preparing Flexible Urban Strategies and Action Plans for Climate Change Adaptation (2013–2014), which was implemented in Bursa. For this reason, the city of Bursa was selected as a case study in this research. Apart from this, Gaziantep and Konya examples were also selected due to the up-to-dateness of the action plans.

4.3.1. Bursa Climate Action Plan

Bursa's climate action plan has been structured around transportation, renewable energy, and waste management (Bursa Metropolitan Municipality, 2015). In alignment with its

commitment to reduce per capita greenhouse gas emissions by 2030, Bursa Metropolitan Municipality prepared the Bursa Sustainable Energy and Climate Change Adaptation Plan. The plan includes actions related to the Urban Heat Island Effect, Inner-City Water Bodies and Streams, Green Spaces and Corridors, Public Health, Administrative Structuring, and Urban Planning (BUSECAP, 2024). In this context, measures have been defined for areas such as physical urban development and the built environment, industry and services, renewable energy, transportation, waste and wastewater management, as well as agriculture, livestock, and forestry (Zero Waste and Climate Change Services, 2024). Bursa's urban planning efforts under the framework of its climate action plans are illustrated in the figure below.

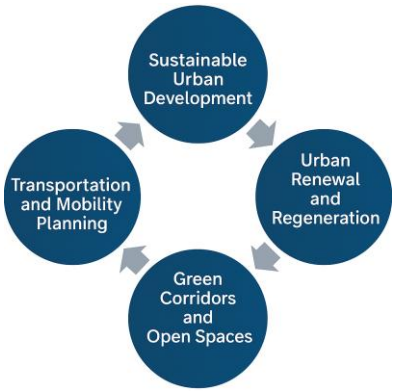

Figure 7. Bursa Climate Action Plan and Implementation Strategies

Sustainable Urban Development

Through the Bursa 2020–2030 Strategic Plan, the city of Bursa prioritizes sustainability in urban planning. The plan aims to ensure balanced urban development while preserving the city's natural and cultural heritage (Bursa Metropolitan Municipality, 2020). In line with these goals, the implementation of the Zero Waste Program supports the creation of a clean urban environment by promoting waste recycling (Provincial Directorate of Environment, Urbanization and Climate Change, 2024).

Urban Renewal and Transformation

The renewal of outdated and inefficient structures contributes to improved quality of life. Urban transformation projects are considered essential for enhancing resilience against disaster risks (BURKENT, 2023).

Green Corridors and Open Spaces

Bursa aims to strengthen ecological connectivity within the city by establishing green corridors. This approach improves air quality and supports biodiversity (Bursa Metropolitan Municipality, 2022). The expansion of green corridors in Bursa has also been highlighted in local media, with expert opinions emphasizing their positive impact on public health (Öztürk, 2024).

Transportation and Mobility Planning

Efforts to develop public transportation systems and expand bicycle lanes are intended to reduce transportation-related emissions. In this context, the Bursa Urban Transportation Master Plan was developed (Bursa Transportation Master Plan 2030, 2024).

Bursa's climate agenda is shaped by early institutionalization through its BUSECAP, which combines sustainable mobility, energy efficiency, and waste reduction measures. Its strategy

reflects a proactive model of urban resilience that integrates risk-sensitive planning with practical adaptation and mitigation policies.

4.3.2. Konya Climate Action Plan

Konya, as a metropolitan city developed in the Central Anatolia Region of Turkey on the axis of agriculture and industry, has a geographical and economic structure that is quite vulnerable to the effects of climate change. In particular, drought, depletion of water resources and temperature increases stand out as the main risks that threaten both the natural and urban systems of the city. In this context, Konya Metropolitan Municipality has developed a comprehensive strategy to both reduce greenhouse gas emissions and harmonize urban systems with the Climate Change Adaptation and Mitigation Action Plan (Konya Metropolitan Municipality, 2024), prepared in line with the European Union SECAP approach. As a starting point of the plan, the emission value for 2022 was calculated as 11,957,157 tCO_2e; it is aimed to reduce this value by 40% by 2030 to 7,477,281 tCO_2e. In line with this goal, a total of 30 reduction and 120 adaptation actions have been defined (Konya Metropolitan Municipality, 2024). The actions have been grouped in a way that is sensitive to the sectoral dynamics and spatial structure of the city and supported by performance indicators. The Konya example is remarkable in that it is one of the rare examples where local governments have mobilized their planning capacity against the climate crisis. The prominent elements in the plan are evaluated below.

Renewable Energy and Energy Efficiency

According to the plan, reducing energy consumption in the city and increasing renewable energy production are one of the basic components of the plan. Projects based on the use of solar energy have been developed especially for the expansion of photovoltaic panels in public buildings and for meeting the energy needs of agricultural enterprises on site. In addition, applications such as thermal insulation in buildings, passive cooling techniques and energy-efficient lighting systems constitute the energy pillar of the plan.

Sustainable Transportation Policies

The transportation sector has a significant share in Konya's total carbon emissions. For this reason, increasing rail system investments, encouraging the use of electric vehicles, expanding bicycle transportation infrastructure and transforming public transportation fleets are among the priorities of the plan. These strategies, which are based on demand management in transportation, also aim to create positive effects on air quality and comfort of life.

Water Management and Agricultural Adaptation

Drought and the decrease in water resources have made Konya one of the cities most vulnerable to climate change. In this context, actions such as expanding drip irrigation and sensor-supported automation systems in agricultural irrigation, developing infrastructure for rainwater harvesting and gray water use come to the fore. In addition, encouraging climate-resistant product patterns in agricultural production has been determined as one of the priority areas within the scope of the plan.

Adaptation and Green Infrastructure in Urban Spaces

Spatial interventions such as reducing the heat island effect in the city center of Konya, increasing green areas, permeable ground applications and expanding shaded area systems are among the adaptation strategies of the plan. In addition, it is aimed to plan new construction areas in line with risk analyses and to encourage disaster-resistant building typologies. In this respect, Konya adopts a strategy that directly links spatial planning to climate risks.

Digitalization and Smart City Integration

One of the distinguishing aspects of the Konya Climate Action Plan is its integration with smart city applications that support urban resilience with digital systems. Applications such as remote monitoring, digital mapping, carbon footprint measurement and the collection and analysis of water usage data in central systems enable decision-making processes to be data-based. This structure allows climate action plans to be used not only as a document but also as a management tool.

In summary, Konya's climate strategy emphasizes water security, agricultural adaptation, and low-emission urban infrastructure through a regionally grounded and digitally integrated action framework. Building on this example of drought-oriented adaptation, the case of Gaziantep offers insights into managing climate risks in a densely industrialized metropolitan context.

4.3.3. Gaziantep Action Plan

Gaziantep, located in the Southeastern Anatolia Region of Turkey and standing out in terms of both population and industrial density, is one of the cities with a high level of risk against climate change. Its industrial production structure, high energy consumption and environmental burdens make the city vulnerable in terms of both carbon emissions and air pollution. In this context, Gaziantep Metropolitan Municipality has created a multi-sectoral climate action strategy in line with the net zero carbon target by 2050 with the Green City Action Plan (GCAP), prepared with the support of the European Bank for Reconstruction and Development (EBRD) (Gaziantep Green City Action Plan, 2023). The plan progresses through sectoral priorities developed based on vulnerability analyses. Low-carbon and adaptation-oriented interventions are envisaged, especially in the areas of transportation, energy, water and waste management. In addition, the governance dimension of the plan includes mechanisms to be carried out in cooperation with both the private sector and national/international actors. The prominent elements in the plan are evaluated below:

Transportation and Carbon Reduction

With the Gaziray railway project, electric bus infrastructure, micro mobility (bicycle, scooter) and active pedestrian planning, an annual reduction of 668,000 tons of CO2 equivalent is targeted.

Transformation in Energy Systems and Green Infrastructure

Investments such as wind power plant feasibility studies, energy efficiency applications in buildings and disaster-resistant energy storage systems aim to make energy infrastructure resilient. Applications such as green roofs and walls, green streets, urban gardens and rain-harvesting surfaces contribute to the strengthening of green infrastructure in urban areas.

Water and Waste Management

Net zero wastewater treatment plant, reduction of water loss-leakage and actions to take precautions against flood risk with nature-based solutions are drawing attention. Pilot application of domestic waste separation systems, evaluation of organic waste and energy facilities are expected to provide economic contribution as well as environmental benefit.

Post-Earthquake Resilience and Management

Following the February 6 earthquakes, the GCAP aimed to create a digital inventory of buildings, create green areas (“resilience parks”) for disaster areas, and strengthen the energy infrastructure with redundant systems. The plan envisages the establishment of a “GCAP

Coordination Unit" for the monitoring and evaluation process and a regular reporting system through units called "Green Champions." This structure enables a multi-actor climate management with the simultaneous participation of the public, private sector, and civil society. Gaziantep GCAP responds to the city's climatic, demographic, and economic challenges with a multi-faceted approach. The plan prioritizes not only physical infrastructure but also social inclusiveness, disaster resilience, and digital management capacity. With these aspects, Gaziantep is moving towards a city model that will set an example both nationally and internationally.

6. Conclusion

This study aimed to analyze strategic interventions developed at the city level against climate change by comparatively examining the climate action plans of five different cities. Selected cities from Turkey, such as Gaziantep, Bursa and Konya, were evaluated together with prominent examples on a global scale, such as Copenhagen and New York. Qualitative document analysis was used as the method; each city's publicly available strategy documents, policy documents and implementation plans were interpreted by taking into account the spatial and administrative context. The findings show that both scalable and institutional differences are decisive in the approach of cities to the concepts of sustainability and resilience. Copenhagen presents a holistic vision that combines climate-compatible urban infrastructure, green space management and low carbon targets; it is an exemplary city in Europe with its 2025 carbon neutrality target. New York, on the other hand, offers a complex but progressive governance model that integrates climate action with social justice and economic development, and aims to eliminate urban inequalities beyond carbon neutrality. Three cities selected from Turkey have structured their climate action plans mostly through technical solutions and sectoral interventions. While Gaziantep stands out with its efforts to integrate climate adaptation into post-disaster reconstruction processes; Bursa is taking steps towards energy efficiency and decarbonization of transportation systems. Konya, on the other hand, draws attention with its agricultural resilience strategies focusing on water scarcity.

In this context, some basic suggestions can be made for local governments:

- Strengthening participatory processes: A more active role for civil society, academia and citizens in planning and implementation processes will increase the legitimacy and impact of action plans.
- Data-based monitoring and evaluation: Monitoring progress with performance indicators, especially in Turkish cities, is critical for increasing adaptation capacity.
- Integration of spatial strategy and climate policies: Addressing climate targets together with land use, transportation and housing policies can structurally reduce carbon emissions.
- Redefining the concept of resilience: Resilience should be considered not only as protection from risk but also as the ability to restructure in the face of uncertainty; this concept should be integrated into plans in a holistic manner.

The findings of this study also offer various openings for further research. First of all, cities' climate strategies should be evaluated not only at the document level, but also in terms of actual implementation and governance practices. In addition, issues such as social inequalities, spatial justice and local financing capacity are dimensions that directly affect the success of climate plans but are often overlooked. These topics offer important research areas for local governments.

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