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# INTERACTIONS OF CLIMATE CHANGE, SUSTAINABLE CITIES AND URBAN PLANNING



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# INTERACTIONS OF CLIMATE CHANGE, SUSTAINABLE CITIES AND URBAN PLANNING

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# INTERACTIONS OF CLIMATE CHANGE, SUSTAINABLE CITIES AND URBAN PLANNING

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ABBREVIATIONS

EU	European Union
USA	United States of America
ASEAN	Association of Southeast Asian Nations
CDP	Carbon Disclosure Project
COP	Conference of the Parties
EEA	European Economic Area
ICLEI	Local Governments for Sustainability
IPCC	Intergovernmental Panel on Climate Change
LPAA	Lima-Paris Action Agenda
NASA	United States National Aeronautics and Space Administration
NAZCA	Non-State Actor Zone for Climate Action
NYC	New York City
OECD	Organisation for Economic Co-operation and Development
SUDS	Sustainable Urban Drainage System
UCLG	United Cities and Local Governments
UN	United Nations

## EXECUTIVE SUMMARY

The problem of “ever-changing climate”, which has a direct or indirect cause-effect relationship with the nexus of environment and “development” is among the most up-to-date debate topics in public administration. The excessive population that exceeds the capacities of cities in addition to the activities of this population are the basis of this problem, which creates negative impacts on our living environment. Now the cities started to host more than half of the world population since the end of the past century and lead to disturbance of natural balance in the atmosphere as well as the increase in greenhouse gas emissions due to the natural variability of the climate in addition to the impacts of accelerated human activities such as the excessive use of fossil fuels, land use changes and deforestation. In this respect, in order to keep the greenhouse gases leading to climate change at the level that ensures the climate system in living environment to function properly, it is required to prepare the greenhouse gas inventories of cities, and to reconstruct the management and planning of energy, agricultural and water resources in line with the mitigation targets defined. While combatting climate change, it is necessary to prepare GHG inventories in order to better analyse the current status and to provide certain targets in the best clear way. With the help of understanding and measuring carbon flows in the cities, it will be possible to provide an effective measurement for the determination of urban sustainability and to create sustainable and livable cities with urban infrastructure implementations to be determined.

On the other hand, the commitment, continuity, and compliance demonstrated by the cities of today in the implementation of their adaptation strategies, policies and measures are important. As a matter of fact, the urban administrators of the city will be able to protect their cities against the threats of climate change by means of plans and infrastructure

investments that involve standards regarding prevention, preparation, and intervention which they will prepare today, and thus they will protect their cities against the warming world. While combating the changing climate, participation of the private sector, universities, civil society organizations, and citizens, who are the real owners of the city, in all decisions taken regarding the future of the city, is also essential for implementation of good governance principles and practices as well as for assisting in decision making. It is a prerequisite for ensuring the success that these actors develop their activities and strategies towards collaboration, and initially that the powerful political decree and government policies create a will in this direction and in particular inclusion of local governments as primary practitioners in this process towards ensuring urban sustainability. In this regard, cities such as New York, San Francisco, and Copenhagen are among the good and successful practices ensuring coordination with and effective participation of all actors in the society in all processes from the identification and planning to decision making and implementation of relevant urban policy. These cities separately reviewed in this research represent examples with their different aspects for Turkish cities in combatting climate. The common characteristic of these cities is that each of them has a mitigation target, and in this direction, they construct their related infrastructures to be minimally damaged by the impacts of changing climate. While the selected initiatives are unique to themselves, it could be also seen that local governments implement similar practices.

It could be seen that urban administrations take part in some international initiatives, act in collaboration in joint platforms and create pressure groups in international meetings on climate. The most known and leading international networks in this challenge include first “Local Governments for Sustainability”, followed by “C40 Cities Climate Leadership Group”,

“Global Covenant of Mayors for Climate and Energy” and “Non-State Actor Zone for Climate Action”. These networks act as the key mechanisms to ensure the mitigation of urban carbon emission and adaptation of their cities to the impacts of climate change, and succeed. Being included in these entities facilitates the challenge as a result. As a matter of fact, the existence of such entities is important to demonstrate the power of the local has in this new era. The higher participation level of local governments in the Habitat III meeting compared to previous meetings could be the indicator of the value attributed to local.

The aim of this study is to address the issue of sustainability regarding restructuring in the modern cities within the context of cities and local governments’ combatting climate change. This study is designed based on the target of identification of the fundamental principles of how the low-carbon cities that are climate-resilient should be in the urban planning actions and strategies. In this study, firstly, the concept of urban sustainability is defined and then it focuses on its emergence, its development from past to present and the indicators developed to provide sustainable solutions to problems in urban areas or combat areas and the different impacts on the socio-economic structure within them. Thereafter, it aims to explain the best practices that succeed and the new organization models within the context of cities besides the measures and policies that could be adopted regarding internationally mitigating carbon emissions within the scope of local government’s combatting climate change for urban sustainability. By the best and successful practice examples such as New York and Stockholm, it is examined how the local governments included their determined climate policies in their sustainable development strategies, and policies in sectors such as energy, transportation, and agriculture with low emissions.







## INTRODUCTION: ON CLIMATE CHANGE AND SUSTAINABILITY PERCEPTION IN CITIES...

Although today the level of development of all countries in the world varies, it could be seen that they are affected by the urbanisation process, especially in economic, social, cultural, political and other aspects. The increasing population in cities is the major factor for this. Whereas around 11% of the global population used to live in the cities of the developed countries before the Industrial Revolution, this share increased to 26% at the beginning of the 1900s. This indicates that the urban population increased three times more than of the rural population in the same period. The same trend continued also in the following years. Whereas until the 1950s those who live in the cities of the developed world constituted more than half of the global population (55%), it was indicated that the share of those living in the cities by the end of the 1990s reached three fourths. By the end of the 20<sup>th</sup> century, more than half of the global population used to live in urban areas. Today, around 3.9 billion people live in the cities, however, it is estimated that this figure will increase over 6 billion (around 62% of the global population) by 2050. However, this growth leads to interrelated and complex problems related to the governance of cities, such as access to education, health, sheltering, infrastructure and other services. It is seen that especially the developing countries are more affected by the impacts of these problems and financial challenges as well as their lack of institutional capacities (United Nations, 2014: 26). Now the impacts of this urban growth negatively reverberate on the economy and social wealth of the country, and development in the urban areas could not meet the conditions of sustainability. In this regard, possible conflict areas between economic growth and environmental sustainability stand out among the fundamental problems that are needed to be discussed for ensuring sustainability in cities. These could be urban economic development which is frequently threatened by changes in national and

global economies; urbanisation with social and political changes; generally largely insufficient infrastructure which negatively affects natural environment and increases poverty; management/governance incompetence of institutions responsible for the implementation of sustainable urbanisation; economic, environmental and governance tensions which make it difficult to comprehend the benefits of interdependencies between rural and urban areas (UN-HABITAT & DFID, 2002: 4-5). Following the problems especially the ones related to environmental pollutions such as air, water, and soil have been discussed internationally, since the 1970s it is seen that urban sustainability has been prominent, and the issues in this field have been addressed. From this perspective, urban sustainability is the reflections of sustainable development policies in the urban area as securing a balance and integration, among economic, social and environmental policies has a positive impact on the quality of life of citizens. Today's cities hosting more than half of the global population (54%) have vital importance in combatting climate change as they are responsible for 60-80% of the global energy consumption and for more than 70% of the global greenhouse gas emissions. (United Nations, 2014: 1; UN Habitat, 2016: 16; Le Quéré et al., 2013; Intergovernmental Panel on Climate Change, 2014: 113).

Climate change is among the most emphasized problems at the local level and is one of the debate issues at the centre of the nexus of environment and development. Human activities such as excessive use of fossil fuels i.e. coal, oil and natural gas, land use changes and deforestation, cause a rapid increase in accumulation of greenhouse gases in the atmosphere, i.e. carbon dioxide and methane. This leads to a change in the energy balance of the system in the atmosphere, and to the warming of the earth's

surface and the layer of atmosphere closest to the surface. The resulting greenhouse effect is more felt in the cities and turns into an environmental problem as its impact and magnitude increase as a result of human activities. Therefore, urban heat islands are formed particularly with the impact of temperature inversion in the residential areas. The urban heat islands cause the urban areas to warm up more compared to the rural areas, especially due to unplanned urbanisation and leads to many environmental problems. These problems vary from extreme weather events such as flood and storm caused by the rising sea level, to increase of drought, decrease of water required for agriculture and food, and spread of tropical diseases. Therefore, in order to keep the greenhouse gases leading to climate change at the level that ensures the climate system in living environment to function properly, it is required to prepare the greenhouse gas inventories of cities, and to reconstruct the management and planning of energy, agricultural and water resources in line with the determined targets of mitigation and adaptation. Sustainable and livable cities will be built by urban infrastructure implementation which will be planned in this direction.

The aim of this study is to address the issue of sustainability regarding restructuring in the modern cities within the context of cities and local governments' combatting climate change. The is designed based on the target of identification of the fundamental principles of how the low-carbon cities that are climate-resilient should be in the urban planning actions and strategies. To achieve this, firstly, the concept of urban sustainability is defined and then it focuses on its emergence, its development from past to present and the indicators developed to provide sustainable solutions to problems in urban areas or combat areas and the different impacts on the socio-economic structure within them. Thereafter, it aims to explain the best practices that succeed and the new organization models within the context of cities besides the

measures and policies that could be adopted regarding internationally mitigating carbon emissions within the scope of local governments' combatting climate change for urban sustainability. By the best practice examples, it is examined how the local governments included their determined climate policies in their sustainable development strategies, and policies in sectors such as energy, transportation, and agriculture with low emissions. In addition, while selecting the cities included in this study, it was considered to ensure that they could represent examples with their solutions to the main problems of Turkish cities they face in combatting climate change. No doubt that there are many example cities in the world that actively combat other than these cities. The data for this study, are up-to-date while are based on the information obtained from some studies prepared based on author's knowledge and experiences especially in the last ten years (For some of these, see: Çolakoğlu, 2017a: 39-48; Çolakoğlu, 2016: 160-181; Çolakoğlu, 2018: 23-42; Çolakoğlu, 2017b: 71-84; Çolakoğlu, 2013; Algan & Çolakoğlu, 2017: 463-482).

## 1. CLIMATE CHANGE IN SUSTAINABLE DEVELOPMENT AND URBAN SUSTAINABILITY INDICATORS

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Rapid and uncontrolled consumption of natural resources in cities, where are densely populated, and a high level of environmental damage not only threaten the future of humanity but also significantly affect the quality of life of individuals in the living environment. Climate change is among the leading of these problems. It is important from this aspect to ensure sustainability and to keep the greenhouse gases causing climate change at the level that ensures the climate system in the living environment to function properly. For that reason, it is essential to prepare the greenhouse gas inventories of cities and to reconstruct the management and planning of energy, agricultural and water resources in line with determined targets of mitigation and adaptation. The GHG inventories will directly support both better analysing the current status and providing certain targets in the best clear way in combating climate change. Turkish cities need a powerful strategy that will immediately create a transformation in this direction.

The sustainable cities of today are transformed into centres (hub), where data are formed on all issues including access to water, wastewater, energy supply, and recycling. They use the sustainability indicators as main inputs in determining the priorities and the targets in combatting the changing climate of their area, and they create a guide by transforming the input data into a strategy. By this means, they protect their living environment, relieve the pressure on natural resources, and successfully tackle these problems. In this respect, these cities could be regarded as the first areas in combatting the negative impacts of climate change.

In this study, sustainable urbanisation is clarified by firstly explaining in detail the conceptual framework,

before presenting the urban sustainability indicators in tackling this problem.

### 1.1. What is Urban Sustainability?

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Urbanisation in the narrow sense refers only to a population movement from rural to urban areas. However, today regarding this concept as only a population movement will be deceptive. In this regard, urbanisation in a broad sense describes the change in the economic and social structure of a society that causes the population movement in it. Therefore, the concept is the increase in the number of cities and the growth of today's cities, together with industrialization and economic development. Besides, this concept also indicates the process of a population accumulation, which leads to changes unique to cities, in human behaviours and relationships as well as creates organization, division of labour and specialization in the community structure in an increasing degree (Keleş, 2015: 35). However, the unsupervised and uncontrolled growth of urbanisation has a major impact on the liveability and quality of life in urban areas today. In these cities, various problems mainly sheltering, and zoning, water and sewage infrastructure, transportation and environmental destruction, are encountered. Based on the high rate of increase in the urban population, it could be estimated that the circumstances and the trend will be worse in the following years.

On the other hand, citizens have greater expectations in terms of access to better living conditions and services in these urban areas where they choose to settle. The concept of urban sustainability emerges as a discourse that can positively impact the quality of life of individuals and meet their expectations. Because, this concept requiring global solutions, aims mainly at building social solidarity in a community, economic strengthening and increasing the opportunities, and raising the environmental awareness in the urban

areas. An urban sustainability plan, which relies on providing the generations of today and the future with equal opportunities, basically ensures the balance between nature and human development, permits the controlled use of resources without damaging them and ensures sustainable development by using environmentally friendly technologies and approaches. Thus, it will be possible to integrate social, economic and environmental policies and strategies for resolving origin of the existing problems, in addition to ensuring a livable and prosperous standard of life for all in urban areas.

The definition of urban sustainability originates mainly from sustainability or sustainable development, which is also known as "continuous and balanced development" (Keles, 1998: 112; World Commission on Environment and Development, 1987: 54). This concept was used internationally for the first time at the United Nations (UN) Conference on the Human Environment which was held in Stockholm, Sweden, in June 1972. It proposes that it is necessary to adapt the urban plans to sustainable development strategies, and adopt them by achieving the highest social, economic and environmental benefits as three fundamental pillars of sustainability for all, and by avoiding any negative impacts on the environment (United Nations Environment Programme, 2015a). The concept of urban sustainability has continued to be discussed in the following years. In 1987, when the recognition of the concept of sustainability has increased, the Our Common Future (Brundtland) Report published by the UN Environment and Development Commission. In "The Urban Challenge" chapter of the report, in line with the estimation that more than half of the global population will be living in cities by the end of the century, it is recommended that especially developing countries should implement urban sustainability due to the lack of trained staff in addition to a possible major urban crisis attributable

to the failure to locally provide adequate public services such as clean water, health care, schools, and transportation (Türkiye Çevre Sorunları Vakfı, 1989: 317-327).

In line with these recommendations, it could be seen that the international community took concrete steps in the following years through various programs developed for ensuring sustainability, particularly in the cities. Programs under the 7<sup>th</sup> chapter titled "Promoting Sustainable Human Settlement Development" of Agenda 21, which was adopted in the UN Environment and Development Conference which was organized in Rio in 1992, presents the sustainable development targets prepared for improving the social, economic and environmental quality of human settlements (United Nations Environment Programme, 2015b). These could be briefly listed as follows:

- Providing adequate sheltering for all;
- Improving management of human settlement;
- Promoting sustainable land-use planning and management;
- Providing integrated environmental infrastructure;
- Promoting sustainable energy and transport systems;
- Promoting planning and management of human settlement in disaster-prone areas;
- Promoting the sustainable construction sector activities;
- Supporting capacity building for the development of the human settlement.
- Promoting the development of human resource and capacity-building for human settlement

In fact, it could be seen that the programs, which were recommended under Agenda 21 adopted following the conference and the approach envisaged for ensuring sustainable development in the Brundtland Report, were further developed.







Four years after the Rio Conference, the UN Human Settlements Conference (Habitat II), which was organized in Istanbul between June 03<sup>th</sup> and 14<sup>th</sup>, 1996, in overall aimed at ensuring adequate sheltering for all and making human settlements safer, healthier and more livable, equitable, sustainable and productive. Under the “Sustainable Human Settlements Development in an Urbanizing World” chapter of the report adopted at the end of the Conference, it was emphasized that to effectively implement the strategies for ensuring urban sustainability, it is required to promote cooperative action between local governments and all relevant parties of the community such as the individuals, in particular, social groups and private sector. The last of the Habitat conferences (Habitat III) held at 20-years intervals, was held in Quito in 2016.

In addition, the Aalborg Charter, which was adopted at the end of the first “European Conference on Sustainable Cities and Towns” organized in Aalborg, Denmark in 1994, is one of the most influential developments in terms of urban sustainability. It is indicated in the Charter that urban sustainability is an important guide in achieving social justice, sustainable economy and environmental sustainability in accordance with the carrying capacity of nature and living conditions of individuals. For that reason, the Charter not only provides a comprehensive framework for ensuring local sustainable development but also calls to include the local governments to Local Agenda 21 processes. Today, more than 2,700 local governments in more than 40 countries signed this Charter (The European Sustainable Cities Platform, 2015a). Besides, after the first conference held in Aalborg in 1994, conferences were held in Lisbon in 1996, Hannover in 2000, Aalborg in 2004, Seville in 2007, Dunkerque in 2010 and Geneva in 2013 (The European Sustainable Cities Platform, 2015b). All these conferences and meetings, which provide an integrated framework, can be regarded as important steps towards urban sustainability.

In short, urban sustainability could be defined as a tool that addresses all aspects of environmental, social, economic and political-institutional sustainability of urban development. For that reason, the concept covers dynamic and multi-dimensional processes. Besides, this concept contains the relationship among all human settlements from small cities to metropolises, and between cities and towns and their rural areas (UN-HABITAT & DFID, 2002: 4). Nowadays, as urban areas continue to expand their boundaries, they should be considered not only as settlements within certain administrative boundaries but also with their surroundings. Central policies should be implemented in a participatory and coordinated manner.

## 1.2. Urban Sustainability Indicators for Determining the Changing Climate

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There are measurable and comprehensible economic, social and environmental indicators, which enable comparison between different geographical regions and periods, to identify whether or to what extent sustainable development were achieved in cities (Türkiye Çevre Vakfı, 1997: 95). It could be assumed that the first step towards identifying these indicators was taken with Agenda 21 adopted after the 1992 UN Conference on Environment and Development. Because, one of the fundamental objectives of this document was identified as to develop the indicators for measuring and identifying the sustainable development processes, and monitoring their performance (Joss et al., 2015: 7). In this regard, today there are dozens of indicators that address the impacts on the socio-economic structure of the settlements, and the urban nature of production and consumption, in different aspects (Aşıcı, 2012: 51-52). These indicators are mainly based on the indicators identified by “environmental responsibility”, “economic capacity” and “social solidarity” which are the sustainable development goals that provide a general framework (Mengi & Algan, 2003: 11-13). Accordingly, these

indicators could include social security and welfare, health care, individual living conditions, shelter and asylum, cultural and leisure activities, social cohesion and participation, development of cooperation, education and science, knowledge, physical security, international trade and competition, domestic marketing, employment, research and development, technology, production, consumption, mobility, hazardous materials and waste, soil, water, air, climate, land use, biodiversity, energy and forests.

The first concrete steps towards determining urban sustainability indicators were taken in Aalborg Charter in 1994. In this Charter, the need for sustainability indicators as a tool for assessing

sustainability in cities was indicated and acknowledged (Mega, 1996: 138). In the following years, indicators were developed by various international and regional institutions and organizations. The World Bank is one of these. The system, developed by the institution in 1990 with the partial financial support of the UN Centre for Human Settlements (Habitat) and previously addressing only housing indicators, was improved later (Mega, 1996: 22). Accordingly, as shown in Table 1, it was requested to calculate the 51 indicators, which are gathered and identified under six modules, within the scope of urban indicators during the preparation process for the 1996 Habitat II meeting (Yazar, 2006: 80-81).

**Table 1- Modules and Sub-groups for Urban Sustainability Indicators (Yazar, 2006: 80-81)**

Modules	Sub-groups
Poverty, Employment and Productivity	<ul style="list-style-type: none"> <li>Urban poverty</li> <li>Growth of employment opportunities</li> <li>Growth in urban productivity</li> </ul>
Infrastructure	<ul style="list-style-type: none"> <li>Increasing the accessibility and affordability of services</li> <li>Ensuring sustainability and quality of water supply systems</li> <li>Developing the provision of sewage services</li> <li>Developing the provision of electricity services</li> </ul>
Environmental management	<ul style="list-style-type: none"> <li>Improving the quality of water in the cities</li> <li>Developing solid waste collection and disposal services</li> <li>Ensuring the sustainability of resource usage</li> <li>Reducing the effects of natural and man-made disasters</li> </ul>
Social development	<ul style="list-style-type: none"> <li>Promotion of sustainable demographic growth and social development</li> <li>Provision of education and health services for all</li> <li>Promotion of social integration</li> </ul>
Transportation	<ul style="list-style-type: none"> <li>Developing the performance and sustainability of urban transport systems</li> <li>Developing road networks and reducing congestion</li> <li>Making private vehicle use sustainable</li> <li>Providing and developing public and mass transportation</li> </ul>
Local government	<ul style="list-style-type: none"> <li>Developing institutional arrangements between local governments</li> <li>Improving the financial viability of local governments</li> <li>Increasing democratic participation in the decision-making process in local governments</li> <li>Reducing their dependence on decision making</li> <li>Improving the effective use of public resources</li> </ul>

In this regard, the following indicators developed by the European Foundation for the Improvement of Living and Working Conditions in 1998, are important. These are Global climate, air quality, acidification, ecosystem toxification, urban mobility or clean transportation, waste management, energy consumption, water consumption, nuisance, social justice, housing quality, urban safety, economic urban sustainability, green, public space and heritage, citizen participation and unique sustainability indicators. For each indicator, the meaning, and what kind of sustainability in its own value could be achieved are explained (Mega & Pedersen, 1998: 11-27). The urban sustainability indicators determined by Sustainable Cities International are given in Table 2.

**Table 2-** *Urban Sustainability Indicators (Sustainable Cities International, 2012: 24-26)*

Sustainable Development Goals	Indicators	Measures
Improving the economic capacity	Unemployment rates/Jobs	<ul style="list-style-type: none"> <li>Underemployment /employment/unemployment rates</li> <li>Percentage of green jobs in the local economy</li> <li>Average professional training years of the labour force</li> </ul>
	Economic growth	<ul style="list-style-type: none"> <li>Annual Gross Domestic Product growth rate</li> <li>Annual Gross National Product growth rate</li> <li>Net export growth rates</li> <li>Direct foreign investments</li> </ul>
Developing environmental responsibility	Green areas	<ul style="list-style-type: none"> <li>Percentage of preserved areas/ reservoirs/ waterways/ parks in relation to total land area</li> <li>Percentage of trees in the city in relation to the urban area and/or size of the population</li> </ul>
	Greenhouse gas mitigation/Energy efficiency	<ul style="list-style-type: none"> <li>The total amount of greenhouse gas emissions per city and per capita</li> <li>Percentage of total energy consumed in the city coming from renewable resources</li> </ul>
	Mobility	<ul style="list-style-type: none"> <li>Percentage of each mode of transportation; i.e. private, public, bicycles, pedestrians</li> <li>Average commuting time and cost</li> </ul>
	Water quality/Availability	<ul style="list-style-type: none"> <li>The total amount of available water</li> <li>Water quality index/ score</li> <li>Rate of the population accessing adequate and safe drinking water</li> </ul>
	Air quality	<ul style="list-style-type: none"> <li>Particulate Matter levels (PM10 - mg/m<sup>3</sup>)</li> <li>Particulate Matter levels (PM2.5 - mg/m<sup>3</sup>)</li> </ul>
	Waste/Reuse/Recycling	<ul style="list-style-type: none"> <li>Recycling rate</li> <li>The volume of solid waste produced</li> </ul>
Increasing social solidarity	Compact city	<ul style="list-style-type: none"> <li>Access to local/ neighbourhood services within a short distance</li> <li>Crime rates</li> <li>The measure of income distribution and inequality</li> </ul>
	Housing	<ul style="list-style-type: none"> <li>Percentage of social/ economic/ priority housing</li> <li>Breakdown of the housing sector by type of ownership (owner occupied/rental, single occupant/couples/family/ multi-family, etc.)</li> </ul>
	Quality Public Spaces	<ul style="list-style-type: none"> <li>Percentage of roadways in good condition</li> </ul>

Sustainable Development Goals	Indicators	Measures
		<ul style="list-style-type: none"> <li>Percentage of green areas in relation to the city area and/or populations size</li> </ul>
	Education	<ul style="list-style-type: none"> <li>Number of schools with environmental education programs</li> <li>Adult literacy rate</li> </ul>
	Sanitation	<ul style="list-style-type: none"> <li>Percentage of population with access to water-based or alternative (and effective) sanitary sewage infrastructure</li> </ul>
	Health	<ul style="list-style-type: none"> <li>Mortality rate/life expectancy</li> <li>Percentage of population with access to health care services</li> </ul>

Other indicators for building sustainable cities are designed mostly based on European cities. For example; indicators developed by *City Blueprints*, *Waternet Amsterdam* and *Water Cycle Research Institute* are a tool that enables quick scanning and baseline assessment of water sustainability in a city. The overall objective is to implement integrated urban water management and to provide basic knowledge to local governments and other stakeholders in European cities in order to contribute to sustainability. The developed 24 indicators were tested in a case study conducted in three Dutch cities (Rotterdam, Maastricht and Venlo). As an indicator of urban metabolism, *European Environment Agency (EEA) Urban Metabolism Framework* was implemented in Barcelona, Freiburg and Malmö. The Framework assesses the sustainability of a city based on its metabolic flows rather than its

performance or current status. These 15 indicators provide continuous, but cost-effective monitoring of urban metabolism in European cities. In addition, a scaling framework is proposed enabling the use of these indicators in cities of different scales. However, there are also indicators that could be applied beyond European cities. The sustainability of around 200 Chinese cities was measured with the China Urban Sustainability Index financed by the *Urban China Initiative*. These indicators are developed based on the 2011 Sustainability Index of China in addition to China Urbanisation Index. It is indicated that these indicators are a highly scalable tool since they are developed for cities ranging in size from 200,000 to 2,000,000 (European Commission, 2018: 11-21). See Table 3 for other various indicators.



**Table 3** - Other Indicators for Urban Sustainability (European Commission, 2018: 11)

Indicator	Organization Developed
China Urban Sustainability Index	Urban China Initiative
City Blueprint	Waternet Amsterdam; KWR Water Cycle Research Institute
EEA Urban Metabolism Framework	European Environment Agency
European Green Capital Award	European Commission
European Green City Tool	European Union
European Green City Index	Economist Intelligence Unit; Siemens
European Green Leaf Award	European Union
Global City Indicators Program	Global City Indicators Facility
Indicators for Sustainability	Sustainable Cities International
Reference Framework for Sustainable Cities/RFSC	RFSC
STAR Community Rating System	Sustainability Tools for Assessing and Rating Communities/STAR
Urban Audit Cities Statistics	Eurostat
Urban Ecosystem Europe – Informed Cities	Local Governments for Sustainability/ICLEI; Ambiente Italia
Urban Sustainability Indicators	European Foundation for the Improvement of Living and Working Conditions
BREEAM Communities	Building Research Establishment Environmental Assessment Methodology/BREEAM
Climate+Development Program	Clinton Foundation: US Green Building Council
Covenant of Mayors	Covenant of Mayors
DGNB Certification System	Deutsche Gesellschaft für Nachhaltiges Bauen e.V./DGNB
Eco Cities Initiative	World Bank
Eurostat Sustainable Development Indicators	Eurostat
Green Cities Programme	Organisation for Economic Cooperation and Development/OECD

On the other hand, the measure of urban sustainability and the number of indicators could definitely be increased based on factors such as urban economics, use of natural resources and population, for many countries and communities to develop their own sustainable urbanisation indicator systems. However, no

consensus has been reached on the issue yet. Because, some studies that use different indicators could produce conflicting results for the same country (Aşıcı, 2012: 54-55). In addition, among these indicators, it is seen that the importance of mitigation of carbon emissions and adaptation to climate change is

increasing in ensuring sustainable urbanisation. Indicators developed regarding this are generally included as a whole and as a separate module, in other sustainability indicators.

However, it is observed that some programs or initiatives emerged as a result of changing climate in recent years have been developed in line with other sustainability policies, but examples such as Climate Positive Development Program and Global Covenant of Mayors for Climate and Energy, which are developed for measuring the results of climate change, are also developed. Information on such initiatives which include these indicators is given in the following sections to ensure the subject integrity of this study (pg. 15-18).



## 2. IMPACTS OF CLIMATE CHANGE ON TODAY'S CITIES

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Climate change, which is defined as variations emerging over time as a result of natural changes or human activities, is mostly anthropogenic in the our age and the damage negatively impacts the sustainability of the earth ecosystem and therefore the human life. In addition to increasing the extreme weather events and disasters such as flood, storm, drought, earthquake, volcano eruptions<sup>1</sup>, and heatwaves, particularly in coastal cities, it also creates severe impacts on the infrastructure of these settlements, such as the transportation networks, energy, water and sewage system, food distribution systems, and it poses several security risks. It is observed that each city in the world is affected by these security risks, even at different scales, and that the level of development of the countries remains insignificant.

In 2011, as a result of heavy rain in Copenhagen, houses are flooded; the railway, highway and subway network and drainage and sewage infrastructures of the city were severely damaged; resulting in a damage of around 894 million euros nationwide (BBC News, 2017; The Nordic Insurance Associations, 2013: 14). Hurricane Sandy in 2012 is one of the most well-known examples. It was recorded that the Hurricane caused 44 people to die in one day in the metropolitan area of New York and lead to a loss of 19 billion US dollars for New York City alone. It was also indicated that 88,700 buildings were flooded and nearly 2 million people were affected for days by the blackouts (Rosenzweig & Solecki, 2017). On the other hand, heavy rain could cause landslides in mountains and hills outside the city. This leads to interruption of roads and obstruction of transportation and communication. The distribution of emergency requirements such as

food becomes more difficult, particularly in such disaster conditions. It was reported that in the Philippines, where floods and landslides hit almost every year recently, more than 200 people died, 144 people were lost and more than 77,000 families were forced to leave their homes due to the Typhoon Tembin, tropical cyclone, in 2017. According to the initial estimations, the worth of damage to the agricultural sector is around 2.4 million USD (Reliefweb, 2018). In 2014, more than 100 landslides occurred, and more than 200 people were forced to leave their homes, in the flood disaster in the Liguria region in the vicinity of Genova, Italy (Klizista-hr, 2018). 70 people died in this disaster. It is claimed that the worth of these natural disasters, occurred between 2006-2016, is approximately 15 billion USD, while 88% of the municipalities in Italy already runs the risk of flood and landslide (DW, 2018). 2 million people were affected from the flood caused by the heavy monsoon rains in Thailand in 2011 and this led to anti-government protests. The circumstances also affected Pakistan. The number of victims of man-made disaster occurred following the flood it caused in Pakistan, reached to 20 million people. It was also recorded that approximately 2,000 people died. Every year in Bangladesh, about 64,000 to 100,000 people become homeless due to riverbank erosion (The German G7 Presidency, 2015). No doubt that it is possible to increase the number of such examples. Because, it is claimed that regardless of the average global temperatures the increasing CO<sub>2</sub> levels could lead to an increase in extreme weather and climate events despite all international efforts (Baker et al., 2018: 1-7).

Whereas it is claimed that the biggest coastal floods in the world will take place in the rapidly growing coastal cities of Asia in 2070, the total worth of these floods which will occur until 2050 is estimated to reach 1 trillion USD if the current trends continue (Munich Security Conference, 2016: 44). 43% of this

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<sup>1</sup> For earthquake and volcano eruption, see McGuire, 2012; Brandes, 2018.

cost is stated will be borne only by Miami, New York and New Orleans cities of the USA, and Guangzhou city of China. Other high-risk cities include Mumbai, Jakarta, Boston, Bangkok and Abidjan, Marseille, Naples and Athens (Nature Communications, 2017). The rise in sea level is one of the main reasons for this. The rise is expected in 70% of the world's coastline; however, its impacts considerably vary among regions. Today, 136 cities with a total population of 400 million are under this threat (Mobjörk et al., 2016: 9). By 2100, it is estimated that the sea level will rise by at least 0.36 meters if the average global temperature increases by 1.5°C, and 0.58 meters if it increases by 4°C (The German G7 Presidency, 2015: 12).

On the other hand, since urban residential areas lead to heat islands that are much warmer than rural areas, heat waves increase the air pollution and could aggravate cardiovascular and respiratory diseases, and even in some cases could result in death. Therefore, death risk increases particularly for the elderly in urban areas (European Environment Agency, 2015: 5). It is a clear example that in the summer of 2003 more than 70,000 people died in European countries alone (WHO, 2018). By the end of this century, it is predicted that on average 150,000 people could die annually in many of the European cities due to heatstroke, cardio and respiratory problems as well as floods (Griffin, 2017). In developing countries, the circumstances are more severe. For example, it was indicated that more than 1,000 people died in June of 2015 in Karachi city of Pakistan (Astor, 2018).

Besides, the continuous increase in the population in cities is one of the main reasons for climate change. Based on the changing climate, rural areas are defined as the places where the most vulnerable people of the society live in and tend to migrate to urban centres due to economic pressures (Vivekananda & Bhatiya, 2017: 12). Today the rural areas host 45% of the global population, however, it

is indicated that this share will decrease to 40% by 2030. (ECOSOC, 2016: 3). It is expected that the urban populations of city centres in South Asia, the Middle East, and North Africa will be doubled by 2050 due to particularly migration. This kind of urbanisation based on migration mostly occurs in low-income countries. While the share of population living in urban areas in 2014 was 39% in middle-income countries and 30% in low-income countries, it is expected that by 2050 these shares will reach to on average 57% and 48% respectively (Vivekananda & Bhatiya, 2017: 1-2). Cities such as Lahore, Hyderabad, Bogotá, Johannesburg, Bangkok, Dar Es Salaam, Ahmedabad, Luanda, Ho Chi Minh City and Chengdu in developing countries are expected to be transformed into megacities (ECOSOC, 2016: 4). It is assumed that the developing countries will constitute approximately 97% of the global population by 2050 (The German G7 Presidency, 2015: 6). However, it is likely that these cities will be exposed to at least one of the natural disasters if adequate measures are not taken today. Because the increasing trend in the rate of urbanisation leads to exceeding the threshold of nature, and to its unhealthy growing, of the settlement areas where is a large and dynamic element of the current global carbon cycle (Hutyra et al., 2014: 473). Because of this tendency, understanding and measuring the carbon flows in the cities will provide an effective measurement for determining urban sustainability.



### 3. LOCAL GOVERNMENTS' COMBATTING CLIMATE CHANGE IN CITIES

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According to NASA (the United States National Aeronautics and Space Administration) (2017), the largest 40 cities of the world are responsible for one-third of the existing CO<sub>2</sub> emissions from fossil fuels. Therefore, they are required to adapt to the changing climate of the urbanizing world. Today, it is clear that all the countries will be affected by the adverse conditions of the changing climate even if they mitigate the greenhouse gas emissions by the rates adopted internationally. These conditions, i.e. high temperatures, changes in precipitation levels and patterns, or extreme weather events, including more frequent and intense floods and droughts, are expected to impact living environment, ecosystems and national economies (European Environment Agency, 2015: 5). As the changing climate particularly disrupts the infrastructure of these living environment and the services provided by local governments, adaptation need emerges (Broto, 2017: 2). In this regard, it is obligatory for today's cities, which do not have any option other than adaptation to climate change, to immediately adopt and implement their own adaptation strategies, policies, and measures. The local administrators of the city will be able to protect their cities against the threats of climate change by means of plans and infrastructure investments that involve standards regarding prevention, preparation, and intervention which they will prepare today.

While combating changing climate, participation of the private sector, universities, civil society organizations and citizens, who are the real owners of the city, in addition to local administrators in all decisions taken regarding the future of the city, is also essential for implementation of good governance principles and practices as well as for assisting in decision making. It is important that these

actors develop their activities and strategies towards collaboration, and initially that the powerful political decree and government policies create a will in this direction and inclusion of particularly local governments as primary practitioners in this process of ensuring urban sustainability. In short, it is expected that ensuring coordination with and effective participation of all actors in the society, in all processes from the identification and planning to decision making and implementation of urban policy for combating climate change. Thus, it will be possible to ensure the adoption of all decisions in the city by the public in addition to ensuring their legitimacy and to implement them successfully.

#### 3.1. Climate Policies and Local Governments Before and After Paris Agreement

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Today it became a necessity to consider the production and consumption activities in cities in terms of climate change and to include them effectively in the rational planning and strategy determination processes for energy saving. Particularly the findings revealed by scientists increase awareness on the issue and transform into national and international strategies and policies. However, even though certain conventions have been adopted for the protection of atmosphere and climate in different years since the 1980s, it is observed that the provisions of these conventions could not be fully implemented due to the lack of common consensus caused by the differences in the level of development of the countries.

The Kyoto Protocol dated 1997, which was opened for signature within the scope of the United Nations Framework Convention on Climate Change that was opened for signature in 1992 and entered into force in 1994 is one of the most well-known international conventions. The objective of the Kyoto Protocol was to mitigate greenhouse gas emissions and their

unlimited impacts. However, it could not achieve its objectives. This is because the countries having the largest share in greenhouse gas emissions and hence are mainly responsible for climate change did not give adequate support to the Protocol, and some developing countries failed to meet their objectives set by this Protocol. Whereupon, because a new convention was failed to be adopted in the United Nations Climate Change Conference, which is also known as Copenhagen Summit (7-18 December 2009, Copenhagen); in the United Nations Climate Change Conference held in Durban between 28 November – 11 December 2011, it was resolved to complete a new climate change convention by the end of 2015 and to put it into force in 2020. To sum up, based on the rationale that the Kyoto Protocol, which is the implementation tool of the Framework Convention, will complete its commitment period and that there will be a need for a new plan, policy, and strategy; international studies carried out for a new climate agreement, which will guide the activities related to climate change in post Kyoto Protocol.

In this direction, the Paris Agreement was adopted unanimously by the EU and 196 parties to United Nations Framework Convention on Climate Change, at the end of the 21st Conference of the Parties (COP 21) held in Paris, France between 30 November – 11 December 2015. It was indicated that the main purpose of this universal agreement is to keep the average global temperature increase from pre-industrial levels below 2°C and even try to limit the increase to 1.5°C. In the text of the agreement, the importance of participation in combatting the impacts of climate change was highlighted by emphasizing the need for regional and international cooperation, in order to ensure that the parties and non-parties to the agreement, i.e. civil societies, private sector, financial institutions, cities and other sub-national authorities, local communities and local people; are taking stronger and more encouraged action in terms of climate (United Nations, 2017a: 5).

This new roadmap indicates that states should adopt mitigation and adaptation policies, which include actions that will limit the rate and magnitude of long-term changes in climate. Besides, it was acknowledged that this adaptation is a global effort with its local, national, regional and international dimensions and is a significant contribution in the long run in combatting changing climate and its outcomes for the protection of all living and inanimate beings. This agreement entered into force as of 4 November 2016. With this agreement, a new era and climate regime will start in combating climate change as of 2020. Therefore, the fulfilment of new commitments will ensure important achievements.

In this regard, it is clear that the local governments will be an important driving force in the cities. Their political commitment to combating changing climate is one of the main issues that are frequently raised. It could be thought that the impact of the local level could be insufficient since it is a global problem. However, every effort and initiative at the local level for the solution, make the contribution of local governments valuable in the combat in the settlements where urbanisation and industrialization grow constantly. Therefore, despite very successful best practices and studies on the issue, it could be seen that the contribution of the local remains limited until today due to this presumption. The basic reasons that created this situation, despite the exceptions, are the failure to see the existing problem as a whole and lack of a political commitment and a joint action. Now, instead of preventing climate change, the discussion is on how we could adapt the “cities lived in” and how we can protect ourselves from the negative impacts. Scientists also verify this presumption. As a matter of fact, it could be observed that the efforts and achievements so far are mostly at the local level.

On the other hand, the “Climate Summit for Local Leaders”, chaired by Turkey and organized within

the scope of the UN Climate Change Conference of Parties on 4 December 2015, is remarkable. This summit gathered more than a thousand mayors, governors, business leaders and civil society representatives from around the world to provide a decisive contribution to the conference and to emphasize the roles of cities and regions in combatting climate change. At the end of the Summit, the leaders representing more than 600 million citizens presented their commitments to the UN with a stronger determination based on the resolutions they adopted. The declaration which includes these commitments is important as it demonstrates the power of cities in combatting climate change. The following characteristics of the cities were emphasized in the Summit (Bloomberg Professional, 2017):

- Being places where there are investment, innovation and climate change action and the communities could become more resilient and socially inclusive when facing the change;
- Ability to act more decisive and faster compared to national authorities for stronger climate policies;
- Ability to test new approaches which include innovative and sustainable measures; that could be implemented at the national level in case of success;
- Ability to create solutions as they are responsible for a wide range of services that could significantly reduce emissions such as transportation, infrastructure, water use, and waste management;
- Ability to provide growth opportunities by helping to the standard of living of citizens and to attract businesses within the scope of their combatting climate change;
- Ability to build a strong partnership for globally developing solutions for the climate with public and private actors to share ideas, best practices and pooling resources in combatting climate change.

This summit created a strong global coalition at the local level which promises to mitigate local

greenhouse gas emissions, increase resilience against climate change and monitor the progress transparently. More than 80 cities that host more than 280 million people declared that they take responsibility for combatting climate change (C40 Cities, 2017b). In the same year, Sustainable Development Goals were adopted in the UN Summit titled "Transforming Our World: The 2030 Agenda for Sustainable Development" which was organized in New York on 25-27 September in the same year. The 11<sup>th</sup> of the 17 Sustainable Development Goals, which were adopted to be achieved by 2030 by UN member states including Turkey, was defined as "Make cities and human settlements inclusive, safe, resilient and sustainable". In line with this goal, the following decisions were taken for the coming 15 years;

- ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums;
- provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons;
- enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management in all countries;
- strengthen efforts to protect and safeguard the world's cultural and natural heritage;
- significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to the global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations;
- reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management;

- provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities;
- support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.

Besides, it was also targeted by 2020 (i) to substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels and (ii) to support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials (United Nations, 2017c).

The 13<sup>th</sup> Sustainable Development Goal adopted in the Summit is to “Take urgent action to combat climate change and its impacts” (United Nations, 2017b). In this regard, it was targeted to:

- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries;
- Integrate climate change measures into national policies, strategies, and planning;
- Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning;
- Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully

operationalize the Green Climate Fund through its capitalization as soon as possible;

- Promote mechanisms for raising capacity for effective climate change-related planning and management in the least developed countries and Small Island Developing States, including focusing on women, youth and local and marginalized communities (United Nations, 2017c).

Therefore, it is seen that by the UN 2030 Sustainable Development Goals, the countries and in particular the local governments are imposed with an international obligation to take measures to combat climate and to ensure sustainable urban development.

Finally, immediately following the 21<sup>st</sup> Conference of Parties of the United Nations Framework Convention on Climate Change, one year after, Habitat III Conference was organized in Quito, the capital of Ecuador, between October 17<sup>th</sup> and 20<sup>th</sup>, 2016. Habitat III, which is also known as the 3<sup>rd</sup> United Nations Conference on Housing and Sustainable Urban Development, took place in a period when the impacts of the adoption of the Paris Agreement are still alive, thus the discourse of the Agreement was reflected. Habitat III is important and decisive as ensuring that the decisions taken in the Paris Agreement are implemented. This conference provides an opportunity of shaping the implementation of the new targets on global development and climate change in cities, which are the driving force of sustainable development (Republic of Turkey, Ministry of Environment and Urbanisation, 2017). Whereas the party states accepted the obligation to mitigate greenhouse gas emissions and to respond to climate change, they emphasized that the local governments should act together with all actors of the community and the importance of this political commitment (United Nations, 2017a).







Different from the previous Habitat I (Vancouver, 1976) and Habitat II (Istanbul, 1996) conferences, approximately 36,000 people from 167 countries member to the UN, participated in the Habitat III, which hosted local and regional governments. Whereas they were not allowed to participate in Habitat I, they could participate in Habitat II with permission (ICLEI, 2016). On the contrary, more than 120 local leaders including 59 mayors and deputy mayors from more than 40 countries participated in Habitat III (ICLEI, 2017). The main reason for this is that until the beginning of the 21<sup>st</sup> century to exclude local governments from the policies related to climate change carried out at the local level; however, this perception has changed due to the strong impacts of the existing problem on the local level.

In the New Urban Agenda – Quito Declaration on Sustainable Cities and Human Settlements for All that was adopted as an outcome of the Conference, it was emphasized that the requirement to construct a climate-resilient infrastructure to ensure sustainable development of cities. In this regard, the document is considered as a first step towards integrating the sustainable development at global, regional, national, sub-national and local levels. The declaration aiming at the promotion of climate actions in cities basically should be considered together with the Paris Agreement. Decisions were taken for making cities and other settlements more inclusive, safer, ecologically qualified and resilient, in terms of sustainability, and supporting them. One of the basic principles adopted in this regard is to increase the resilience of urban infrastructure against adverse physical, economic and social impacts and pressure; and to adapt to and to mitigate the impacts of climate change, which is one of the important negative impacts of cities on the environment. In this framework, it was resolved to consider the appropriate land use and urban planning, implementation of zoning rules, early warning systems, business continuity plans, and emergency

planning for the critical infrastructure. Besides, it is indicated that priority should be given to low risk regions in future urban development actions and expansions in order to provide the most effective protection against rising sea levels, floods, tsunamis, earthquakes and other natural disasters (earthquakes, extreme weather events, sand and dust storms, heatwaves, water scarcity, droughts, water and air pollution, epidemic diseases). In addition, it is emphasized that the requirement of cooperation with national/international institutions, in addition to the need of funds – Green Climate Fund, Global Environment Fund, Adaptation Fund and Climate Investment Funds – for reducing the capital costs including the risk transfer mechanisms, and for taking the measures that will encourage private sector and households to participate in efforts towards increasing resilience and in urban resilient programs (United Nations General Assembly, 2017; Republic of Turkey, Ministry of Environment and Urbanisation, 2016).

### **3.2. Joint Initiatives and Platforms of Local Governments for Cooperation in Combatting Climate Change Internationally**

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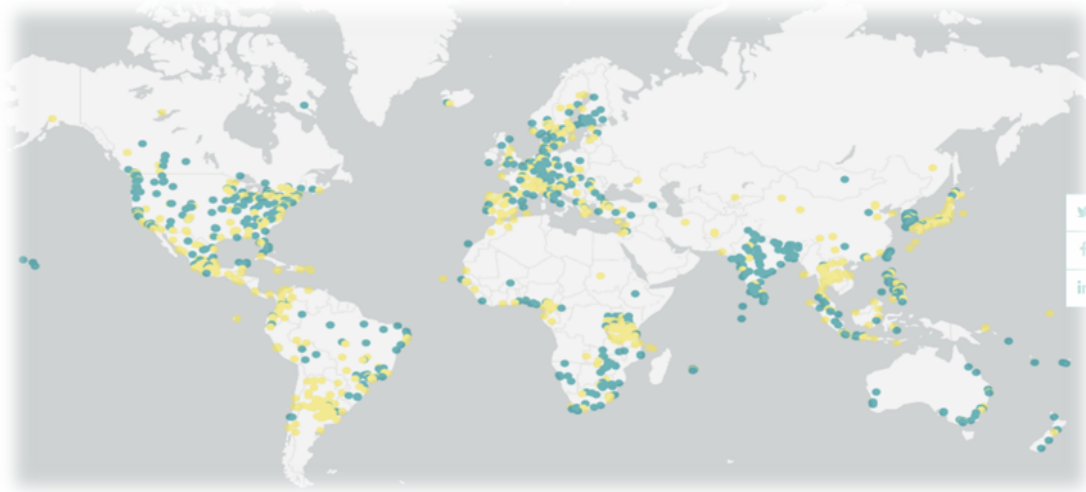
It could be seen that urban administrations take part in some international initiatives and act in collaboration in joint platforms, to mitigate urban carbon emission and ensuring the adaptation, of their cities against the impacts of climate change. These networks act as key mechanisms by making the cities' impact more visible on transnational climate change policies (Broto, 2017: 2). The most known and leading international networks in this challenge include first "Local Governments for Sustainability", followed by "C40 Cities Climate Leadership Group", "Global Covenant of Mayors for Climate and Energy" and "Non-State Actor Zone for Climate Action".

### 3.2.1. Local Governments for Sustainability

This Union (ICLEI) is a global network of more than 1,700 governments of cities, towns, and regions, where more than 25% of the world's urban population lives in. It provides local governments with technical consultancy such as capacity building, knowledge sharing, and financial support as well as training, information services and exchange, to ensure they accomplish their sustainability targets at the local level. Thus, as a global network, ICLEI supports local actions to ensure sustainability through results-oriented campaigns and programs, based on international performance. In line with the Integrated Environmental Management principles of modern environmental management, ICLEI helps cities develop a green urban economy with smart infrastructure and sustainable urban transportation, and become sustainable, low-carbon, resilient, biodiverse, resource-efficient and productive.

ICLEI, which is a non-profit non-governmental organization, was established in 1990 in the World Congress of Local Governments for a Sustainable Future that was held in New York and gathered more than 200 local governments from 43 countries (ICLEI - Local Governments for Sustainability, 2018a). The last Turkish local municipality that participated in this Union, which is centred in Bonn, is Eskisehir Tepebaşı Municipality (REMOURBAN, 2018). Thus, the total number of Turkish municipalities became a member of the Union reached to 7. Other municipalities are Gaziantep Metropolitan Municipality (Gaziantep), Kadıköy Municipality (İstanbul), Kartal Municipality (İstanbul), Konya Metropolitan Municipality (Konya), Seferihisar Municipality (İzmir) and Şişli Municipality (İstanbul). The rapid increase in the number of members recently clearly demonstrates the enthusiasm at the local level for combatting climate change.

**Figure 1.** ICLEI Cities (ICLEI - Local Governments for Sustainability, 2018ç)



ICLEI held the last (ICLEI World Congress 2018) of the meetings, which is organized every three years, in the second biggest city of Canada, Montreal, on 19- 22 June 2018. Two documents were adopted at the end of this Congress: ICLEI Montréal Commitment and Strategic Vision, and ICLEI Montreal Action Plan. They cover the important strategies and policies which guide the cities' combatting changing climate in line with the local governments' perception on urban sustainable development and outline the new vision of the ICLEI network on how to promote global sustainable urban development. In the first of these documents, Montreal Commitment and Strategic Vision, local governments committed to following five interconnected pathways towards a transformation based on a low-emission, nature-based, circular, resilient, equitable and people-centred development by 2024. Accordingly, to ensure a low-emission development, local governments committed to significantly reduce all hazardous pollutants resulting from heating, cooling, illumination and food systems, and emissions

(particularly from transportation, waste and construction sectors), in addition to the noise in cities. It was clearly indicated in this document that the target of keeping the increase in the global average temperature below 2°C, which was adopted in the 2015 Paris Agreement, was adopted. They also indicated that they agree that a full transition to renewable energy utilization should be ensured in this process. In this direction, a commitment was given towards promoting sustainable load and passenger transportation, as well as giving priority to pedestrian, bicycle, mass transportation and shared mobility as part of people-centred solutions, in addition to electric-vehicles in case clean fuel policies and renewable energy are available (ICLEI - Local Governments for Sustainability, 2018b: 9). The projects, partnerships, and initiatives identified within this framework are included in the ICLEI Montreal Action Plan (2018-2021). It is committed in this Action Plan that 130 certain actions and initiatives covering 3,572 cities and regions, will be launched as of June of 2018 (ICLEI - Local Governments for Sustainability, 2018c).

### 3.2.2. C40 Large Cities Climate Leadership Group

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The C40 Large Cities Climate Leadership Group, which also includes Istanbul, is a network of megacities of the world committed to combatting climate change. Approximately 100 megacities, where more than 600 million people live and which represent more than one-fourth of the global economy, are members of this network. See Table 4

for these cities. This initiative, which is also known as C40 Cities, acts in coordination with The Clinton Climate Initiative which helped megacities in mitigating greenhouse gas emissions since 2006. It provides its members with technical assistance and information services similar to ICLEI. In this framework, it carries out joint initiatives with Bloomberg Philanthropies, World Bank, The Carbon Disclosure Project (CDP) and Arup in addition to ICLEI (C40 Cities, 2017a).





**Table 4.** C40 Cities (C40 Cities, 2018a)

Region	Country	City	Region	Country	City
Africa	Cote d'Ivoire	Abidjan	Latin America	Argentina	Buenos Aires
	Ethiopia	Addis Ababa		Brazil	Curitiba
	Ghana	Accra			Rio de Janeiro
	Nigeria	Lagos			Sao Paulo
	Senegal	Dakar			Salvador
	South Africa	Cape Town		Chile	Santiago
		Durban		Colombia	Bogota
		Johannesburg			Medellin
		Tshwane		Ecuador	Quito
	Tanzania	Dar es Salaam		Mexico	Guadalajara
Mexico City					
Central Eastern Asia	China	Beijing	North America	Canada	Montreal
		Chengdu			Toronto
		Dalian			Vancouver
		Fuzhou		USA	Austin
		Guangzhou			Boston
		Nanjing			Chicago
		Qingdao			Houston
		Shanghai			Los Angeles
		Shenzhen			New Orleans
		Wuhan			New York City
		Hong Kong			Philadelphia
		Zhenjiang			Portland
					San Francisco
					Seattle
					Washington
East, South East Asia and Oceania	New Zealand	Auckland	South and West Asia	Jordan	Amman
	Thailand	Bangkok		India	Bengaluru
	Vietnam	Hanoi			Chennai
		Ho Chi Minh City			Jaipur
	Indonesia	Jakarta			Calcutta
	Malaysia	Kuala Lumpur		Bangladesh	Dhaka
	Australia	Melbourne		United Arab Emirates	Dubai
		Sydney		Pakistan	Karachi
	Philippines	Quezon City			
	South Korea	Seoul			
	Singapore	Singapore			
	Japan	Tokyo			
		Yokohama			

Region	Country	City	Region	Country	City
Europe	Denmark	Copenhagen	Countries with temporary inactive membership		
	France	Paris	Egypt	Cairo	
	Germany	Berlin	Venezuela	Caracas	
	Greece	Athens	South Korea	Changwon	
	Italy	Venice	India	New Delhi	
		Rome		Mumbai	
		Milano	Germany	Heidelberg	
	Holland	Amsterdam	Kenya	Nairobi	
		Rotterdam	Total: 99 countries Grand Total: 106 countries		
	Norway	Oslo			
	Poland	Warsaw			
	Russia	Moscow			
	Spain	Barcelona			
	Sweden	Stockholm			
	Spain	Madrid			
	Switzerland	Basel			
	Turkey	İstanbul			
	United Kingdom	London			
	Israel	Tel Aviv-Yafo			

C40 Cities provides megacities with opportunities to work together in seven key areas i.e. energy, finance and economic development, measurement and planning, sustainable communities, transportation, solid waste management, adaptation and water. It also directs them to urban actions, which mitigate greenhouse gas emissions and reduce climate risks. In this way, megacities are able to take climate actions with a lower cost but more effective and faster to mitigate greenhouse gas emissions and reduce climate risks (C40 Cities, 2018a). For that reason, C40 Cities comprise 17 networks covering mitigation, adaptation and sustainability issues with the highest priority. It is possible to promote, improve and accelerate the climate actions in the cities with the help of these networks. Furthermore, the local administrators of the cities from all over the world interactively communicate and learn from each other about their combatting climate through these networks. They also help the cities collaborate with technical experts and participate in collective actions demonstrating the strength of cities working jointly (C40 Cities, 2018b).

In this framework, a viable program is being implemented, which is developed by C40 Cities towards sustainability measurements. Accordingly, The Climate Positive Development Programme or Climate+ Development Programme was launched in May of 2009 in the partnership with the Clinton Climate Initiative and the U.S. Green Building Council. This program including a series of actions and activities that mitigate emissions and promote carbon-positive buildings and communities brings together the leading district-scale new construction and renovation projects making efforts to achieve "Climate Positive" - or "net carbon negative" - outcomes in certain cities around the world. As part of the C40 Sustainable Communities Initiative, it aims to establish a model for large urban communities and support projects which serve as urban laboratories for cities that effort to grow environmentally sustainable, resilient to climate change, and economically viable. Started with a competitive application process, the Program is currently being implemented with 18 projects that will collectively reduce the emission impact of more than one million people, as seen in see Figure 2.

Cities, where these projects are being implemented, locally support the implementation process and globally share the best practices, as participating in C40 Climate Positive Network. Though being at different stages of development, the projects share fundamental characteristics such as high densities, highly efficient buildings, mixed-use zoning, and transportation accessibility. These projects which are

implemented by public and private sector, help establish important corporations for integrated planning and development which improve local environmental conditions, create employment and improve local life quality (C40 Cities, 2018c; European Commission, 2018: 21; Climate +, 2009; Lorinc, 2009; USGBC Update, 2009).

**Figure 2- Climate Positive Cities (C<sub>40</sub> Cities, 2018c)**



### 3.2.3. Global Covenant of Mayors for Climate & Energy

Global Covenant of Mayors for Climate and Energy entered into force as an outcome of joint work of ICLEI and C40 together with United Cities and Local Governments (UCLG), United Nations Habitat, European Commission, EU Regions Committee, Climate Alliance, Council of European Municipalities and Regions, Eurocities and Energy Cities. This covenant creates a single global coalition by bringing together the two main city initiatives working on climate change, namely the Compact of Mayors entered into force in 2014, and the EU Covenant of Mayors entered into force in 2008. This

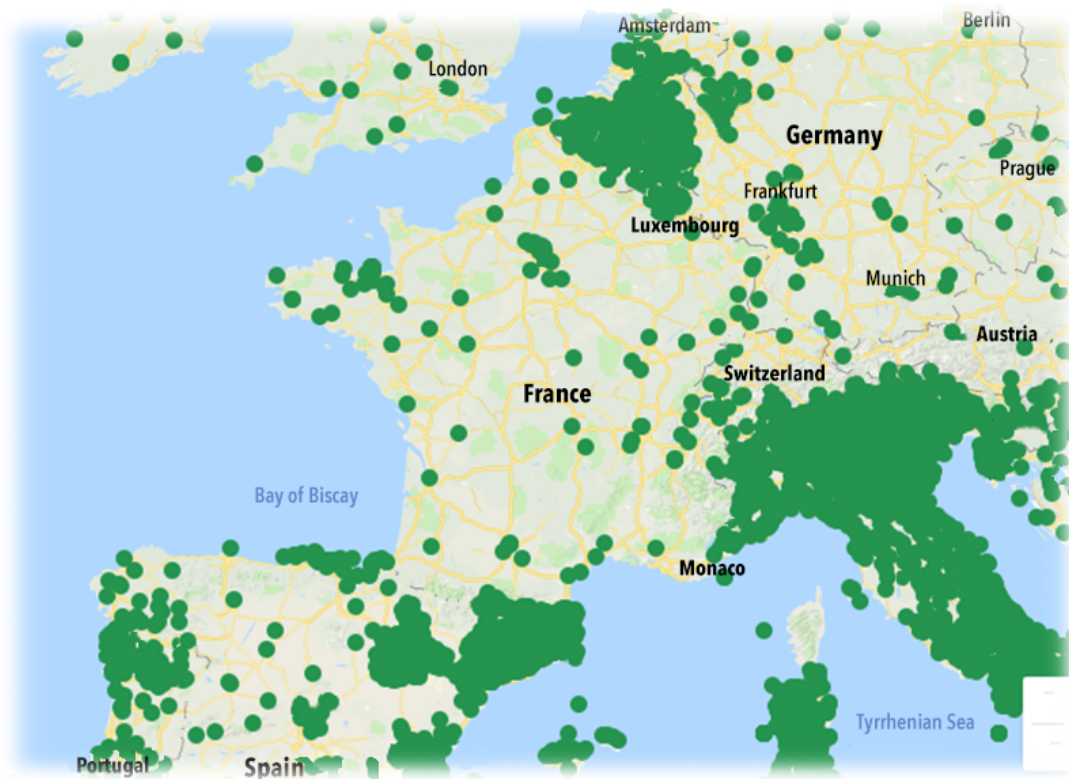
climate covenant, which uses a newly standardized measurement system that follows international practices, is an agreement signed by mayors and other city governors who publicly commit to mitigating greenhouse gas emission. 7,441 cities, which signed this Covenant dated 22 June 2016, committed to mitigate the CO<sub>2</sub> emissions at least by 40% by 2030 and to adopt an integrated approach for adaptation to climate change. These cities share a long-term vision for providing carbon-free and resilient zones that provide sustainable and cost-effective energy for all. To mitigate the greenhouse gas emissions, these cities committed to establish energy-efficient lighting; to develop and implement building codes that involve energy-efficient designs; to invest in programs for public transportation,



vehicle and bicycle use, to shift to solid waste management programs that use less energy, to recover by storing the gas; and to establish programs by developing an efficient action plan, and preparing an inventory for emissions for combatting climate change (Mayors Climate Protection Center, 2017; Engel & Orbach, 2008: 122-123). These cities which signed the convention

for this purpose also prepare the Climate and Energy Action plans which are subject also to the monitoring processes. This covenant, which is the most comprehensive urban climate and energy initiative of the world, is financed by the European Commission (The Global Covenant of Mayors for Climate and Energy, 2017a).

**Figure 3-** *Cities that signed the Global Covenant of Mayors for Climate & Energy, 2018*



#### 3.2.4. Non-State Actor Zone for Climate Action

Non-State Actor Zone for Climate Action (NAZCA), which became an official portal as an outcome of the 21<sup>st</sup> Conference of Parties when the Paris Agreement was adopted, is a global platform where the role of the business in combatting climate change is reflected. This platform bringing together the

investors and the companies in addition to local governments and civil society organizations (5,649 stakeholders) was established in order to monitor and record the targets declared and efforts for emission mitigation. NAZCA was launched in 2014 by the COP20 Peru Presidency together with Lima-Paris Action Agenda (LPAA) (Global Climate Action, 2017b). In this context, 2,138 companies committed to combat climate change while 105 of them set an emission mitigation target and 49 declared that all of

the energy demand will be met by renewable resources (Numanoğlu & Sabuncu, 2016: 33). For this purpose, 32.5 trillion USD was collected from the companies so far (Global Climate Action, 2017a). Thus, NAZCA includes the commitments of companies, cities, sub-national structures, regions, investors and civil society organizations towards climate action. Also, within this scope:

- 20 investors were committed to 600 billion USD for decarbonization;
- More than 70 initiatives were launched with the contribution from 180 countries;
- More than 1500 companies, cities, regions, and investors committed to taking action before 2020;
- 15 of the world's largest 20 banks representing around 2 trillion USD in market capitalization took climate action;
- 194 companies and investors committed to adopting scientific targets for greenhouse gas mitigation;
- More than 800 companies and regions committed to using carbon pricing;
- 118 investors committed to calculating the emissions in their portfolios;
- More than 400 companies, cities, regions, and investors committed to taking climate action in the long term;
- More than 600 companies, cities, regions, and investors in Asia committed to acting by the year 2020;
- More than 300 companies, cities, regions, and investors in Latin America and the Caribbean committed to climate action;
- More than 4,000 companies, cities, taking, and investors committed to set targets for greenhouse gas emission mitigation;
- More than 100 cities and regions in North America set emission mitigation targets for the year 2020 and afterwards;

- 73 companies, investors and regions committed to ending forest loss worldwide by the year 2030 (Global Climate Action, 2018).

For this purpose, NAZCA, with the Carbon Disclosure Project (CDP) that it started, records the annual environmental data of its member cities, to manage the greenhouse gas emissions, increasing the resilience of buildings and protecting them from the negative impacts of climate change. Globally, 533 cities report their climate actions to CDP (CDP Driving Sustainable Economies, 2017). Since the Paris Agreement, there is an increasing participation in the studies, especially by the cities which are the most affected by the negative impacts of climate change, and greenhouse gas emission inventory is being held by the cities. In the 2016 global report, the emission data of 1,089 companies representing 12% of the total greenhouse gas emissions is provided. Through this project, a significant amount was reached with the available climate data (CDP Turkey, 2017).

### 3.3. Good and Successful Practices Developed in the Context of Climate-Resilient National Adaptation Strategies

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With the rapid increase of urban population, it is among the most important problems of all countries to plan urban sustainability to protect environmental assets, improve service quality and quality of life. New York and Copenhagen are among the example cities that successfully implement the policies of energy efficiency, adaptation to climate change and reduction of the impacts of climate change. The efforts of these cities definitely will not be sufficient in tackling this problem; however, these initiatives are important in terms of protecting the living environment and their sustainability. Cities reviewed in this study represent examples with their different aspects for Turkish cities in combatting climate.

### 3.3.1. New York Dream, Combat and Achievement of Bloomberg

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New York, which is located in the northeast of the USA, today became a city where the impacts of climate change are largely felt and extreme weather events damaging particularly the economic infrastructure are experienced more frequently and intensely. The city is constantly developing plans and determining new policies and strategies to adapt and increase resilience against frequent precipitation, rising sea levels, and increasing temperatures. The average annual temperature and precipitation in the city increased by 4.4 degrees and by 7.7 mm since the 1990s. The sea level raised by about 34 cm, resulting in making the city unable to defend itself against hurricanes with its existing infrastructure. In this regard, Hurricane Sandy which occurred in 2012 could be an important milestone in this combat. The Hurricane which occurred in the Atlantic Ocean was one of the most deadly and destructive hurricanes recorded in the history of the country. A total of 24 states, including the entire eastern seaboard from Florida to Maine, and west across the Appalachian Mountains to Michigan and Wisconsin, were affected while it caused severe damage particularly in New Jersey and New York and led to the death of hundreds of people. The storm surge affected the streets, tunnels and subway lines in New York, lead to power cut-offs in and around the city. It led to a high loss of more than 50 billion USD. It is assumed that bigger changes will occur in New York's climate during this century.

However, in the period of the former mayor of New York, Michael Bloomberg (2002-2013), and afterwards, this city emerges as a leading city and a driving power, in combatting climate change and sustainable urban planning. New York has been combatting climate change since 2002. Within the framework of PlaNYC (New York City), which is a sustainable urban plan, various local initiatives were launched that will mitigate the emission level of the

city by more than 30% by 2030. Accordingly, the Bloomberg administration implemented 132 innovative initiatives such as the Greener, Greater Buildings Plan, The Clean Heat Program and The Climate Resilience Initiatives. Whereas New York became more energy-efficient compared to the past with the help of these initiatives, it made its infrastructure investments in line with the mitigation and adaptation targets. For example, it is expected that more than 10% mitigation of greenhouse gas emissions by 2030 with full implementation of the Greener, Greater Buildings Plan. Because around 75% of the carbon emissions of this city caused by the buildings that use energy the most, causing an annual cost of 15 million USD. The cleanest heating resources including natural gas and biodiesel were started to be used with the Clean Heat Program. NYC Clean Roof Program aims at cooling down the city, reducing the costs, decreasing energy use and mitigating the emissions. More than 750,000 trees were planted so far with the Million Trees NYC, which is another initiative. Such initiatives which are considered as the best practices at the local level transform New York into a more resilient city against the impacts of climate change.

Despite the end of Bloomberg's mayor position in 2013, these best practices that are still implemented in the city continue to transform the city in terms of sustainability. An initiative was launched in order to transform the large old buildings into energy-efficient structures: One City, Built to Last Transforming New York City's Buildings for a Low-Carbon Future. It is anticipated that this initiative will ensure that the owners of existing buildings with an area of larger than 25,000 m<sup>2</sup> will make investments in the coming years in more efficient heating and cooling systems, provision of insulation and hot water systems. By this means, it is indicated that this initiative will be implemented to 14,500 buildings, which constitute almost one-fourth of the greenhouse gas emissions of New York City. It is stated that most of these buildings were required to

comply with the new efficiency targets by 2030, that otherwise the building owners would be penalised. This initiative will lead to a mitigation of 10% in the greenhouse gas emissions caused by buildings and enable energy savings of worth of 8.5 billion USD which would create around 3,500 new jobs in the construction and energy sectors in the coming decade. They demonstrated this ambition with the 80x50 Roadmap Plan published in the same year. In this plan, they committed to mitigating the emissions of the city by 80% by 2050 compared to 2005 levels. They also adopted the 2015 Paris Agreement with an administrative decision confirming their commitment, even though it is not adopted at the federal level (Rucker & Johnson, 2017; The NYC Mayor's Office of Sustainability, 2017a; Dennis & Epstein, 2017; Rollings, 2017).

Bloomberg, who served as the mayor of New York for three periods, launched an initiative in June 2017, named The Bloomberg American Cities Initiative, worth more than 200 million USD. Within the scope of this initiative covering a period of three years, it was tried to reveal the existing problems by

asking questions related to sustainable urbanisation in a survey conducted targeting the mayors of cities (city managers) with a population of 30,000 and more. It is believed that the findings of this survey will help them to play a leading role, to produce critical policies, to implement relevant legislation and to strengthen citizens, in the solution of the existing problems (Philanthropy News Digest, 2017). Accordingly, it was revealed that 8 out of every 10 mayors, who participated in the survey of which details are given in the following tables, agree that it is important to address climate change. It was emphasized that the national political discussions on this issue are highly polarized despite the mayors clearly declared that they accept the reality of changing climate and the urgent need to act. Besides, these mayors were asked a question on what the barriers are to take effective action in cities for combatting climate change. It was stated that financing is the most major problem in combatting climate change and that it is even more important than the political barrier and the public support that should be at a sufficient level (Bloomberg Philanthropies, 2018).



**Table 5** - Question: How important is it for your city to address climate change? (%) (Bloomberg Philanthropies, 2018: 6)

Cities	Very Important	Somewhat Important	Not Important
Democrats	<b>69</b>	22	3
Republicans	19	<b>50</b>	25
Midwest	46	34	17
Northeast	<b>63</b>	21	4
South	40	40	12
West	42	33	18
Large	<b>78</b>	11	0
Medium	44	37	12
Small	43	35	15
<b>Total</b>	<b>46</b>	34	13

**Table 6** - Question: What are the key barriers to effective city action on climate change? (%) (ibid)

Cities	State Policy Barriers	Federal Policy Barriers	City Hall Capacity	Financing	Private Sector Engagement	Understanding Project Benefits	Public Support
Midwest	20	37	34	57	3	31	29
Northeast	8	21	25	67	0	33	13
South	23	25	25	35	0	29	17
West	13	18	29	44	4	18	31
Large	33	44	33	44	0	11	0
Medium	22	22	32	46	5	20	27
Small	14	25	26	48	1	31	24
<b>Total</b>	17	25	28	47	2	27	23



**Table 7** - Question: *How city halls are tackling climate change? (%) (ibid, pg. 7)*

Approach adopted	Significant Experience	Some Experience	A Little Experience	No Experience
Encouraging sustainable modes of transportation (walking, cycling, buses)	37	42	14	0
Promoting low-carbon new buildings	15	21	27	31
Shifting to electric vehicles	8	33	28	25
Developing or procuring renewable energy	24	31	27	12
Engaging in public-private partnerships around local climate adaptation	15	22	24	33
Promoting low carbon districts or regeneration projects	8	15	15	55

Finally, the mayors indicated that they lack required experience on climate adaptation strategies despite they have the ambition and adopted or promoted various approaches for addressing this issue in their cities (such as sustainable transportation - walking, bicycle, bus - construction of new or transformation to low-carbon buildings, shifting to electrical vehicles, developing or procuring renewable energy, engaging in public-private partnerships around local climate adaptation, promoting low carbon districts or regeneration projects) (Bloomberg Philanthropies, 2018).

### 3.3.2. One of the First Cities to Combat Climate Change: San Francisco

The city of San Francisco is one of the cities adopting and implementing the Global Covenant of Mayors for Climate & Energy. In line with this Convention, San Francisco committed to mitigating its carbon emissions by minimum of 80% by 2050 (The Global Covenant of Mayors for Climate & Energy, 2017b). In fact, this city's combatting climate change started in the past. Hurricanes such as Katrina and Sandy, and tsunamis, threatening the country security has a great impact on this. In addition, rising sea level, melting snowpack on Sierra Nevada Mountains and extreme and severe weather events such as the increasing fires, heat waves and heavy rainstorms that create floods, affect the life and economy of the

whole Bay. One of the most concrete examples in the city is the Rim Fire that started in 2013. In this disaster, which was the third largest fire in the history of California, more than 250,000 acres were burned, and it caused a damage costing of more than 70 million of USD, in addition to other financial losses of local governments (City and County of San Francisco, 2017: 33). According to the latest studies, it is assumed that, in line with the current tendencies, the sea level will rise by between 11 and 19 cm by 2050 and between 30 and 55 cm by 2100. This threatens especially the runways in San Francisco International Airport, as well as main transportation arteries such as the Highway-101, shorelines, and parks. According to another scenario, the rising sea level could cause a damage to the infrastructure of the city with an amount of 62 billion USD. Whereas, it is indicated that it is possible to overcome the flood risk in case of a possible rise of 55 cm with an adjustment amounting of 5.3 billion USD (NRDC, 2017). Besides, by the midst of this century, San Francisco might be exposed to the negative impacts of heatwaves, three or four times, which would result in deaths (San Francisco Department of Environment, 2013: 1).

On the other hand, San Francisco's combatting climate change, in fact, started much earlier than New York City. Climate change and adaptation activities are being inspected by the Department of

Environment of the city which cooperates with the Public Utilities Commission and Planning Department. San Francisco Climate Adaptation Working Group includes the representatives from the City Administrators Office, the Port, San Francisco International Airport, the Department of Public Works (water, energy, and wastewater), the Municipal Transportation Association, the Department of Public Health and the Department of Recreation and Parks. The Department of Environment operates under the responsibility of the Environment Commission which provides advisory service to the Mayor and Inspection Board on environmental programs and policies. Seven members of the Commission are assigned by the Mayor (Environment and Energy Division City of Toronto, 2017: 6-7). In addition to these states and federal boards, the households, enterprises and civil society organizations are included in the process of creating innovative programs and policies in the city.

Up to now, emissions arising from buildings, transportation, and waste sectors were mitigated by 14.5% (a total of 5.3 million tons) by the city administration in the period between 1990 and 2010. Despite the increase of 11% in the overall electricity consumption in San Francisco between 1990 and 2010, together with the increasing urban population, net mitigation of greenhouse gas emission of the grid was achieved. Among other USA cities, San Francisco accomplished an important success in recycling with a rate of 80% in 2010. The success of recycling and composting programs of the city means that the greenhouse gas emissions arising from the waste sent to landfills were almost decreased by half compared to the 1990s. Emissions of privately owned vehicles increased by up to 4% as the citizens travelled more and worked at longer distances since the 1990s. Developments in fuel economy show a positive trend – from 18 miles per gallon twenty years ago, to 25 miles per gallon in 2010 – however, this served to slow down the growth in emissions caused by

transportation (San Francisco Department of Environment, 2013). Despite this, the Municipal Code of San Francisco demands significant reductions in greenhouse gas emissions. It is foreseen that emissions will be decreased by 25% by 2017, 40% by 2025 and 80% by 2050, below 1990 levels (Energy.Gov., 2018).

### 3.3.3. Copenhagen, Floods and Climate Adaptation Plan

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Considered as one of the most sustainable and green cities of the world, Copenhagen has been working on adaptation to climate change for many years. The existing measures regarding climate, mostly rely on the incidents in the past. Together with this, rapid changes in climate in recent years required a new strategy based on climate projections. This is also due to the financial loss of millions of dollars caused by the floods in 2011 and 2014. The flood in 2011 caused a loss of 1.04 billion USD in the city (Gerdes, 2012; The Local, 2017). It is claimed that the existing estimations of the Intergovernmental Panel on Climate Change (IPCC) for the following 30 or 40 years became inadequate. It was indicated that the ongoing projects show the same tendencies. In this regard, the city determined and adopted a new strategy for itself. Accordingly, the Copenhagen Climate Adaptation Plan was adopted with a decision taken in 2011.

Based on the strategy adopted in this Plan, a resilience mechanism was adopted wherein, upon the occurrence of any problem related to climate, the new information is urgently combined with the technology developed, thus able to fight against the uncertainties. Accordingly, if the damaging risk is high in case of a flood, it was indicated the requirement of immediately taking the actions of establishing embankments, constructing buildings higher than the sea level, and expanding the capacities for the disposal of sewage and wastewater. If it is not possible to prevent the



damage, it was indicated that it is important to minimize it, i.e. establishing early warning systems for rain, and constructing waterproof cellars and stormwater storage. In addition, it is indicated that the resilience of the city should be improved. Measures to overcome the floods are mentioned such as the cellars being fully equipped and providing ready to use pumps (Gerdes, 2012). In line with this Plan, the local governments took a series of precautions to protect the city. It was discussed to urgently separate the sewage system from stormwater in the city, or to establish a Sustainable Urban Drainage System (SUDS), or as Plan B, to carry the excess storm waters to places where no or less damage would occur. As a matter of fact, the flood in 2017 was overcome with less damage compared to previous years (Davies, 2017). Following the flood cases, the city management took also the decision of making the asphalt areas and parks adaptive to climate (Cathcart-Keays, 2017). By establishing a new heating system in the city, they aim at a saving of 70% compared to conventional methods. To protect the city from the heat island effect, it is desired to protect the existing green structures and construct new ones, by good planning (Miljø Metropolen, 2011). Thus, it is targeted to become the first carbon-neutral capital of the world in 2025.

This plan was started on St. Kjeld Square of Copenhagen. With this project launched, steps were taken for making the neighbourhood climate change sensitive area and producing creative and effective solutions, since 2012. It was thereafter implemented at Tasinge Square and Bryggervangen in the city. While 20% of the existing built environment in the St. Kjeld Square in the city was planned to be transformed into green areas, it was also aimed to use 30% of stormwater before it reaches to sewage. Within this framework, it is planned to replace the asphalt coated roads at the square with walking paths including partly grass areas, and also transforming the small parks in the neighbourhood into water basins such that the

streets around could turn into canals that will carry stormwater from the squares to the ports, in case of flood and excessive storm (Klimakvarter.dk, 2015). With the Copenhagen Municipality's ambitious project, which covers an area of 105 hectares, it is also aimed to reduce the area for road traffic by 20% (Mezzi, 2015). This project won the Guangzhou Award in 2016. Following 2014, the Tasinge Square in Copenhagen was transformed. On the one hand, a dynamic and recreational urban area was created, and on the other hand, the green spaces were successfully used to solve the city's problem of stormwater caused by floods (State of Green, 2018).

### **3.3.4. The Success of Political Commitment and the Case of Stockholm in Combatting Climate**

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Another city that combats the negative impacts of climate change is the Stockholm city of Sweden. The political commitment of the country where Stockholm is located lies at the bottom of its success. Because Sweden signed the Kyoto Protocol dated 1997 immediately the next year and ratified in 2002. Another characteristic of this country is that it is one of the countries which were able to grow together with sustainable development. This country is among the member countries to both EU and OECD (Organisation for Economic Co-operation and Development), with the lowest greenhouse gas emissions. It has also been implementing carbon tax since 1995 (The Swedish Institute, 2017).

The capital, Stockholm started its combat with Hammarby, which is an old industrial zone. In this area, which was intended to be transformed into a new settlement developing with zero fossil fuel emission, successful means of sustainable city management from smart electric grids to public transportation were implemented (The Swedish Institute, 2017). The project of Hammarby Lake City (Hammarby Sjöstad) was launched in the 1990s to meet the housing and infrastructure of the growing

urban population. With this project, which is about to be completed, it was targeted to provide a settlement area of around 12,000 (Ország, 2018). It is planned to construct 140,000 new houses overall the city by 2030 (Stockholm – The Capital of Scandinavia, 2017). This project creates environmental solutions for waste, energy, water and wastewater: Examples include transformation of abandoned industrial zones, creating green spaces, promoting public transportation and carpool, enhancing of bicycle roads, utilization of environmentally friendly materials in the buildings, utilization of renewable energy sources, utilization of biogas, reusing of waste, creating energy-efficient buildings, reusing the drainage water (GlashusEtt, 2017). It is indicated that the approximate total cost of the project is around 4.5 billion EUR (Freudenthal, 2017). Besides, the Stockholm bypass, which is one of the largest infrastructure projects of Europe (Förbifart Stockholm) is still at the construction stage in the city. It is said that this will be one of the longest highway tunnels of the World, with a construction cost of 3.1 billion Euros (Stockholm – The Capital of Scandinavia, 2017). Stockholm, which is the first to win the European Green Capital Award of the European Commission in 2010, aims at becoming a carbon-neutral city by 2050 (C40 Cities, 2017c).

Accordingly, Stockholm, which is a prominent member of C40 Cities, contributes to this network as one of the pilot cities for the Global Protocol for Community Scale GHG Inventories. Besides, by signing the EU Covenant of Mayors the mayor of the city committed to mitigate greenhouse gas emission in the city and to provide the EU with regular information on the issue (Jones, 2018: 141-142). In addition, she indicated that she would stop the use of coal, oil and all other fossil fuels by 2040 (Goering, 2017). This city is one of the most livable cities and is already among the top five green cities of Europe in terms of energy and carbon emissions, transportation, water, air quality, land use and

buildings, waste, sanitation and environmental governance (Jones, 2018: 142).

### 3.3.5. The Case of Singapore As a Tropical Island (City) State

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Singapore, which is one of the few city-states of the world, is one of the most sustainable cities in Asia. Singapore is one of the countries which ratified the UN Framework Convention on Climate Change in 1997, participated in Kyoto Protocol in 2006, and ratified the amendments in the Protocol in its second commitment period in 2014 (between 2012 -2020). Singapore recently ratified the 2015 Paris Agreement with 30 other countries in New York on 21 September 2016. Although Singapore is responsible for less than 0.2% of the global carbon emissions, it makes significant efforts in decreasing these emissions (Ministry of Foreign Affairs Singapore, 2017). According to the 2016 Environmental Performance Index, Singapore ranks 14<sup>th</sup> among 180 countries and is at the top among Asian countries. Singapore was the first among 22 large cities in the 2013 Asian Green City Index (National Climate Change Secretariat Prime Minister's Office, Singapore, 2016: 5). Besides, Singapore, which participated as the observer city in C40 Cities in 2012, launched its Climate Action Plan in 2016 (NCCS, 2017a).

Singapore explains the Climate Action Plan in two documents. The first document titled Take Action Today: For a Carbon-Efficient Singapore, explains the basic strategies which it will adopt to comply with the commitment it gave in line with Paris Agreement and to mitigate the greenhouse gas emissions (National Climate Change Secretariat Prime Minister's Office, Singapore, 2016). This city set the target of reducing greenhouse gas emission intensity by 36% compared to 2005 levels by 2030. In particular, it is determined that increasing energy efficiency will continue to be the greenhouse gas emissions mitigation strategy of the city and it is

planned to extend the scope of all existing sectors such as electricity generation, industry, buildings, transportation, household, waste and water sectors.

The second document titled A Climate – Resilient Singapore: For a Sustainable Future, explains how this city is affected by climate change and which strategy the administration should follow in tackling these problems (Ministry of the Environment and Water Resources, 2016; NCCS, 2017b).

Finally, Singapore announced the year 2018 as the Year of Climate Action. It is also indicated that the carbon tax will be introduced in 2019 as a fixed-price credit-based system. It is specified that the entities within the scope of this system should purchase allowance from the regulator and surrender an amount equal to their relevant emissions during the compliance period. In addition, Singapore, as the 2018 Chairman of the Association of Southeast Asian Nations (ASEAN) declares that it will act in cooperation with other members and international partners to expand capacity-building and technical exchanges and implement existing work programmes (Low, 2018).

## CONCLUSION

Cities of today, which have different dynamics based on their level of development, are considered as a part of sustainability. Minimizing environmental pollution, more efficient use of resources, and creating sustainable cities that minimizes urban mobility are among the fundamental goals of sustainable development. In this regard, it is expected to keep the greenhouse gases leading to climate change at the level that ensures the climate system, particularly in cities to function properly. Nowadays, the greenhouse effect is felt more in cities due to the increasing human activities and this becomes a security problem while its intensity increases. Therefore, urban administrations' combatting climate change becomes important and it is required to determine the measures and policies of each settlement to mitigate their carbon emissions.

However, the commitment that a country has in combatting the outcomes of the changing climate significantly impacts the success of urban administrations. Copenhagen, Singapore, and Stockholm, which are the cities addressed in this study, are among the best examples that could be given in this context. On the other hand, there are cities such as New York and San Francisco which are successful, though they are not politically supported at the national level. It is known that despite New York has fallen back compared to other successful USA cities in combatting climate change, it became as successful as they are. As a result of comprehensive actions taken after 2002, it is seen that the city achieved success today. Moreover, following the Sandy Hurricane (2012), the New Yorkers supported the current mayor for the sustainability of climate adaptive policies (Çolakoğlu, 2013). On the other hand, all these cities could act jointly in the platforms they initiated such as C40, ICLEI, UN Habitat, NAZCA, and Climate Alliance, and could create pressure groups in the meetings related to climate. The existence of such entities is important to demonstrate the power of

local has in this new era. Higher participation levels of local governments in the Habitat III meeting compared to previous meetings could be the indicator of the value attributed to local.

Briefly, local governments in cities could achieve success in climate change if they intend to. It is clear that the example practices of these cities are guiding for other cities. To reach the sustainable development goals in the living environment by their energy-saving and recycling practices, in particular, all these successful cities explain to us how the energy, which is not only important for all development activities but also responsible for a large share of greenhouse gas emissions, should be used. These cities prove that they could grow while ensuring sustainable development at the same time.

As climate change is already happening and will continue in the coming years, Turkey should be ready for the impacts that will arise despite all measures taken today. It is apparent that adaptation and mitigation specific to the country should be addressed immediately today within the context of climate change. Considering the existing climatic and topographic structure, Turkey is among the hot point countries that could be most affected by the situation. We currently experience the impacts of climate such as decrease of water required for agriculture and food, and loss of biodiversity, in addition to fires, heat, drought, extremely decreased or increased rainfalls leading to floods. As Turkey is a country with a rapidly growing market economy, it is inevitable that the local governments in the country could succeed in mitigating the greenhouse gas emissions in the cities in particular with energy-efficient practices which are explained as best practices in this study. It is clear that it will help the country achieve its sustainable development goals on a larger scale.



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