ISTANBUL
CLIMATE CHANGE
ACTION PLAN
SUMMARY REPORT
2018
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# Abbreviations

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<th>Abbreviation</th>
<th>Full Form</th>
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</thead>
<tbody>
<tr>
<td>BAU</td>
<td>Business-as-usual</td>
</tr>
<tr>
<td>CO$_2$</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>COP</td>
<td>Conference of Parties</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>GPC</td>
<td>Global Protocol for Community</td>
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<tr>
<td>ICCAP</td>
<td>Istanbul Climate Change Action Plan</td>
</tr>
<tr>
<td>IMM</td>
<td>Istanbul Metropolitan Municipality</td>
</tr>
<tr>
<td>INDC</td>
<td>Intended Nationally Determined Contribution</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>ISTAC A.S.</td>
<td>Istanbul Environmental Management Industry and Trade Company</td>
</tr>
<tr>
<td>KI</td>
<td>Kaya Identity</td>
</tr>
<tr>
<td>tCO$_2$e</td>
<td>Tonnes of carbon dioxide equivalent</td>
</tr>
<tr>
<td>UAST</td>
<td>Urban Adaptation Support Tool</td>
</tr>
<tr>
<td>UCLG-MEWA</td>
<td>United Cities and Local Governments Middle East and West Asia Section</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
</tbody>
</table>
WHAT IS CLIMATE CHANGE?

Climate change is the changes observed over extended periods in mean patterns and variability of climate parameters\[^1\]. Anthropogenic activities including use of fossil fuels, deforestation, agriculture and industries increase the concentration of greenhouse gases such as carbon dioxide and methane in the atmosphere\[^2\]. As a result, the sun rays reaching the Earth which gets absorbed without being reflected by the Earth gradually increase, thus amplifying the greenhouse effect of the atmosphere\[^3\]. In December 2017, carbon dioxide concentration in the atmosphere has passed the estimated safe limit of 350 ppm to curb climate change and the upper limit of 400 ppm and has reached 407 ppm\[^4\]. The energy trapped in the atmosphere leads to an increase of average temperatures of the Earth, melting of land and sea ice, the decline in snow cover, the rise in the sea level, change in precipitation patterns, and intensification and increase in the frequency of extreme weather events such as droughts and storms. In 2017, the global average temperatures have risen 0.9°C compared to the 1951-1980 average. Besides, the years of 2015, 2016 and 2017 have been recorded as the hottest three years observed\[^5\]. All these impacts of climate change threaten both natural and anthropogenic systems.
Climate and weather are different phenomena. The main differences are time and specific location. Weather indicates short time periods and micro-climatic zones whereas climate indicates large regions (macro-climate) and extended time periods.

Climate is the atmospheric conditions which cover a large area and persist over many years. Climate characteristics are identified by both mean patterns that carry on over 300-500 years cycles and extreme conditions. Climate oscillates between these extremes. This oscillation is observed through the renewal, increase in frequency and continuity of these extreme values as mean pattern conditions change.

Weather indicates the meteorological events that occur in the atmosphere. These short-term weather conditions in the atmosphere are described through terms such as cold, hot, rainy. These refer to the present condition of the weather. Weather is the atmospheric conditions that are active over a specific location, and for a specific or short period.
Ecologic and socio-economic structure of Istanbul requires a smart and sustainable urban management approach. Istanbul is an ancient city that hosted many civilizations over its 8 thousand years long history. As a result of its strategic location between Asia and Europe, it has been an economic and cultural hub and an intersection point. Its population quickly increased after the establishment of the republic. Nearly 15 million people reside in Istanbul today, making it the most populated city in Europe and one of the megacities worldwide. Increased industrial and commercial activities, fuelled by its high population, exert ever-increasing pressures on the infrastructure, superstructure, and ecosystems. This necessitates the expansion of the smart city vision with sustainability principles.

Due to its strategic location between Europe and Asia, Istanbul has been an economic centre throughout history. The economic activities in Istanbul make up 30% of Turkey’s GDP. The city has been located on one of the most important trade routes in history, the Silk Road. The position of the Bosphorus, allowing sea trade between the Black Sea and the Mediterranean, resulted in the establishment of trade colonies by the Genovese and Venetian trade cities. In the Ottoman Period, Mehmet the Conqueror has commissioned the Grand Bazaar to promote trade. In recent history, Istanbul witnessed the construction of railroads and bridges that link Europe and Asia. With the industrialization of Turkey, factories have been established in the city, making it a commercial and industrial centre. Istanbul hosts 20% of the labour force, and one-third of the production of industrial and service sectors takes place in the city. In terms of trade, as of 2017 half of the companies that export were registered in Istanbul, which make up 52% of the export value.

Istanbul is one of the European cities most vulnerable to climate change, thus adaptation activities have priority. In 2017, Turkey experienced one of its driest years. In the summer of the same year, heavy rainfall and severe hail events have affected the transportation infrastructure and caused significant damage to homes and vehicles. According to a study that assesses the potential economic damages of extreme weather events in 15 European coastal cities, Istanbul ranks first. This study indicated that the losses resulting from sea level rise and storm surges will cost Istanbul 200 million dollars annually until 2030, and this will increase up to 10 billion dollars annually by 2100. These values are only predictions, however, the message that Turkey’s most economically significant city, Istanbul, being the most vulnerable metropolitan city in Europe and that the damages to radically increase until the end of the century is one that needs to be taken seriously. The threats imposed on municipal services and investments, and on the city’s economy, ecosystem, and social and cultural assets by climate change requires action from all actors in Istanbul. Not taking necessary precautions early on will increase in economic losses and burden existing capacities, thus challenging municipalities’ abilities to perform their expected duties defined by law.
Being the city with the highest greenhouse gas emissions in Turkey, Istanbul must lead in mitigation. According to 2015 data\textsuperscript{11}, Istanbul is responsible for approximately 10\% of greenhouse gas emissions (47.3 MtCO\textsubscript{2}e) of Turkey (475.1 MtCO\textsubscript{2}e). Although the total mitigation potential of the city is high due to its large size, the mitigation potential per capita is limited. The low value of emissions per capita, compared to similar cities, signals that Istanbul’s transition to a low carbon economy can be rather fast and easy. This transition will specifically affect the national greenhouse gas emissions. Reduction of emissions due to energy consumption in buildings and transportation aligns with IMM and its subsidiaries’ strategies and activities. Besides, awareness and interest of citizens regarding mitigation related topics such as public transportation, clean energy and energy efficiency due to the size of the city’s population, heavy traffic, and high energy costs will facilitate IMM’s activities in these areas.

Climate action in Istanbul will provide guidance to other cities. Paris Agreement signed by 194 countries in 2015 has been a milestone that emphasizes the importance of political will in climate action in the international arena. Through this agreement, it is accepted that both national and local governments have an active role in mitigation and adaptation. By preparing ICCAP, IMM plans to base its activities on Turkey’s Intended Nationally Determined Contribution prepared in line with the United Nations Sustainable Development Goals, and its national plans including “Climate Change Strategy Document [12],” “Climate Change Action Plan [13]” and “Climate Change Adaptation Strategy and Action Plan [14].” Since national regulations for cities and municipalities regarding climate change are yet to be developed, ICCAP will serve as a guide and a model at the national level.
Climate Change Projections for Istanbul

As a result of its location, Istanbul has a complex climate that both carries the properties of Mediterranean climate and interacts with the surrounding climate zones. As can be seen in Figure 2.2., Istanbul is in the Mediterranean climate zone. In this climate regime, summers are hot and dry, and winters are warm and rainy. The summers are dry mainly due to the Hadley circulatory cell slipping north thus strengthening the Azor high-pressure system. During cold periods, Atlantic based low-pressure systems that carry precipitation to Turkey cannot penetrate Mediterranean basin due to the strengthened Azor high in summer, so rains decline throughout the basin. However, Istanbul gets affected by other climate zones in the surrounding areas, besides Mediterranean climate. The presence of the Bosporus as a channel and the absence of mountain ranges in north-south axis allow air flows and precipitation from Siberia and Balkans in the north, and from the Sahara Desert in the south. This report focuses only on the climate scenario studies conducted for Istanbul. It must be noted that the city may be affected in various ways from climatic changes which will be experienced in surrounding areas.

The Mediterranean region is expected to be one of the locations which will be impacted by climate change the most. IPCC’s 5th Assessment Report[1], groups the priority climate change-related risks for the European region including Turkey into three categories:

1. Increased economic losses and people affected by flooding in river basins and coasts, driven by increasing urbanization, increasing sea levels, coastal erosion, and peak river discharges,
2. Increased water restrictions (particularly in southern Europe): significant reduction in water availability from river abstraction and from groundwater resources, combined with increased water demand (e.g., for irrigation, energy, and industry, domestic use) and with reduced water drainage and runoff as a result of increased evaporative demand,
3. Increased economic losses and people affected by extreme heat events: impacts on health and well-being, labour productivity, air quality, and increased risk of wildfires in southern Europe.
Future projections suggest that Istanbul’s climate will converge to a typical Mediterranean climate, thus becoming warmer and drier. Despite some future uncertainties, scientific climate models can predict the future climate fairly well. The Mediterranean region is expected to be one of the most susceptible areas in the world to climate change. Due to its location, Istanbul has complex climate dynamics that exhibit both Mediterranean characteristics and strongly interact with surrounding regions. The emerging issues for Istanbul and surroundings are found to be the change in temperature and precipitation patterns, drought, increased sea levels, and cross-cutting themes related to urban heat island and air quality. The average temperatures in Istanbul are expected to rise until the end of the century. This increase will be higher during summer months, which will be amplified significantly by the urban heat island effect and potential heat waves. While the total precipitation is expected to decrease slightly, heavy rainfall is expected in shorter periods of time, leading to potential flash floods. The severity and frequency of extreme climatic events are expected to increase. Some examples are already experienced in recent years in Istanbul in the form of floods, drought, and hailstorm. The expected climatic changes are summarized in Table 2.1.

<table>
<thead>
<tr>
<th>Change in Heat</th>
<th>Change in Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual mean temperature increase</strong></td>
<td><strong>Total annual precipitation decrease</strong></td>
</tr>
<tr>
<td>1 - 4.5°C</td>
<td>maximum 12%</td>
</tr>
<tr>
<td><strong>The hottest day temperature</strong></td>
<td><strong>Heavy rain days to increase</strong></td>
</tr>
<tr>
<td>40+°C</td>
<td>maximum 20%</td>
</tr>
<tr>
<td><strong>The coldest day temperature</strong></td>
<td><strong>Precipitation during heavy rain days to increase</strong></td>
</tr>
<tr>
<td>0+°C</td>
<td>maximum 59%</td>
</tr>
<tr>
<td><strong>Summer temperature increase</strong></td>
<td><strong>Severity of precipitation to increase</strong></td>
</tr>
<tr>
<td>1.5 x Winter temperature increase</td>
<td>maximum 9%</td>
</tr>
<tr>
<td><strong>Number of hot days to increase</strong></td>
<td><strong>Days with frost to reduce significantly</strong></td>
</tr>
<tr>
<td><strong>Number of cool days to decrease</strong></td>
<td><strong>Number of days with frost to reduce significantly</strong></td>
</tr>
<tr>
<td><strong>Drought</strong></td>
<td><strong>Sea Level Rise</strong></td>
</tr>
<tr>
<td>Longest dry period to prolong</td>
<td><strong>45-75 cm</strong></td>
</tr>
<tr>
<td>maximum 23 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Urban Heat Island</strong></td>
</tr>
<tr>
<td>Additional mean temperature increase due to dense urbanization</td>
<td><strong>Air Quality</strong></td>
</tr>
<tr>
<td>1 - 2°C</td>
<td>Due to urbanization along East-West axis, prevalent winds along North-South axis to be affected, thus reducing air quality which exacerbates climatic threats</td>
</tr>
</tbody>
</table>
What are the Impacts of Climate Change?

Climate change is considered as a systemic shock because it affects all social and economic systems and ecosystems which are dependent on them. To understand the effects of climate change, both the impacts of the systems constructed by societies and the impacts of expected climatic changes on the existing systems need to be explored. Therefore, “EU Strategy on Adaptation to Climate Change”\(^\text{[16]}\) frequently references “system approach” for urban scale activities. System approach acknowledges that the sectors and stakeholders making up the society are related and interdependent, thus evaluates impacts not only on the basis of sectors but also with their interdependencies. For example, while sector approach for transportation evaluates a road or a bridge only through physical risks, system approach assesses its function and includes the risks its loss of function poses on other sectors and stakeholders in the evaluation. The activities which will enable Istanbul to be a climate resilient city that uses both an impact analysis and a system approach to determine action items. Critical infrastructures have been identified for selected sectors, thus risk assessments have been conducted on the assets through which these sectors are mainly linked with others.

Climate change can impact environmental, social and economic systems in two ways: loss of function or loss of performance. All systems have a defined scale (limits of the system), relations with other systems, and (one or more) balance points. For example, if the precipitation amount and timing changes due to the changes in seasonal means, agriculture which requires irrigation and industrial facilities that have a cooling demand will be affected. This effect won’t be observed as a physical damage, but as a performance or productivity loss. On the other hand, if a heavy rainfall beyond the seasonal changes is experienced, agriculture and industrial facilities may be physically damaged. In this case, it will be a function loss. These two effect types are shown in Figure 2.3 to demonstrate the impacts of climate change. From left to right, there are three sections in the figure: (1) The three columns on the left summarizes climate change and shows the mean pattern and extreme pattern changes in temperature, precipitation and sea level; (2) these changes

![Figure 2.3. Impacts of climate change](Source: Ergin 2013\(^{17}\))

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1. EU Strategy on Adaptation to Climate Change
2. Ergin 2013
3. Climate system approach
4. Sector approach
5. System approach
6. Critical infrastructures
7. Risk assessments
8. Environment, social, and economic systems
9. Loss of function vs. loss of performance
10. Mean and extreme pattern changes
11. Climate change impacts on agriculture and industrial facilities
12. Heavy rainfall beyond seasonal changes
13. Physical vs. performance/productivity loss
14. Figure 2.3
15. Source: Ergin 2013

will first impact ecosystems; and (3) then the socio-economic systems in the section on the right. Both impact types can be seen in the figure. Changes in mean patterns can affect the performance of socio-economic systems (for example, the water to be used for cooling in industries to become warmer or less available). Increase in frequency and intensity of extreme patterns can exacerbate physical damage and cause interruptions in system functions (like how an infrastructure that gets damaged by flood or hail becomes dysfunctional). To evaluate performance loss, increased operational costs, decline in market share, brand value and productivity need to be determined. To evaluate function loss, duration of interruption, recovery costs and cascading impacts need to be assessed.

Climate change, interacting with Istanbul’s urbanization dynamics, will cause vulnerabilities in socio-economic systems of the city. Besides physically affecting public infrastructure and social services, the intensifying impacts of climate change will also burden the carrying capacities of these social systems and weaken the social protection systems of the city. The vulnerable population of Istanbul continuously grows as a result of the city’s rapid growth and urbanization dynamics. The possible socio-economic impacts which may be faced are summarized below:
Health

The most critical risk that will occur as a result of extreme weather events will be a loss of life. This will be triggered by insufficient infrastructure, unplanned urbanization and poor-quality construction, and the risk will be higher for groups with limited mobility (e.g. elderly, children and disabled). As observed in the hail event of July 28, 2017, extreme weather events can also cause injuries. Intensified heat waves and increased demand for cooling in the summer will trigger health problems, especially for groups at risk. Events such as floods and storm surges can facilitate the spread of water-borne diseases, while higher temperatures will facilitate vector-borne diseases. Contagious diseases pertaining to tropical climates might be observed. Additionally, the inability to mitigate greenhouse gases will amplify air pollution, causing respiratory system illnesses or exacerbate existing health problems. The loss of life and manpower caused by these increasing health risks will likely to have economic consequences.

Food Security

Istanbul is linked to Turkey through supply chains to sustain the food demand of its growing population. Therefore, disasters such as droughts and hail which impact agricultural production directly affect Istanbul. Interruptions in the supply chain, including food production, influence consumer prices. This jeopardizes access to food, sufficient and healthy nutrition of low-income groups. Large-scale, temporary interruptions in the food supply and sudden price increases can impact workforce performance, social security, and especially health and growth of children.

Water Security

Istanbul is dependent on surface water sources. Water that precipitates during rainy seasons are collected in dams and regulators, go through necessary treatments and distributed to the city. Temperature and precipitation regime changes induced by climate change will create difficulties to meet the increasing demand of the city’s growing population. The pressure on water resources -decreasing rains, evaporation occurring with increasing temperatures, decrease in surface water amount, increasing dam capacity demand due to extending dry periods, increasing population, increasing water demand per capita during summer- may threaten water security.

Energy Security

In Istanbul, climate change will decrease heating demand in the winter, and increase cooling demand in the summer. Thus, total energy demand is expected to increase. Energy transmission and distribution network will face high demand, especially during peak hours in the summer when cooling demand is the highest.

Physical Damage

Intensifying rains will increase flood and storm surge cases which damage buildings, offices, and vehicles in the city. Improvement of rainwater drainage network to adapt to these expected changes will reduce physical damages. Most of these damages will be covered by individuals, firms and insurance companies. This will weaken the economic resilience of stakeholders.

Income Level

As a result of unplanned development, low-income families usually reside in locations vulnerable to events such as floods. They will encounter such events more frequently due to the intensifying effect of climate change. Covering the cost of these repeating externalities will reduce the economic adaptation capacity of such families, and inhibit them from spending their already limited income on basic needs such as food, health, and education.

Life Style

Extreme weather events can interrupt access to public services (e.g. schools, hospitals, main transportation routes), so social life is expected to evolve to be intermittent and unpredictable. During summer months, as a result of the high temperatures during the daytime, work hours can be shifted earlier or later, and demand for municipal services will change in parallel to these changes.
Recent climatic events experienced in Istanbul, though not directly linked to climate change, hints to its multi-faceted impacts. On July 27, 2017, hail that lasted about 20 minutes followed by heavy rainfall impeded land, sea and air traffic in Istanbul. Hundreds of houses and offices, thousands of cars and even planes were damaged. Some pedestrians got injured. Toppling over of a crane in the Port of Haydarpasa and collapse of a cemetery wall in Sisli led to fatalities. Based on the information provided by Insurance Association of Turkey, after the hail event the car insurance reports alone reached 168 million TL, and the total economic damage of the event is estimated to pass 1 billion TL. However, because a detailed damage assessment has not been conducted, the burden on Istanbul’s socio-economic systems is not clearly determined. Extreme weather events are expected to become more frequent and intense due to climate change. Therefore, the functional and performance losses in socio-economic systems of the city will also become more frequent and increase. To enhance

<table>
<thead>
<tr>
<th>Date</th>
<th>2017</th>
<th>27 July 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event</td>
<td>Drought</td>
<td>Hail</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency</th>
<th>once every 40-50 years</th>
<th>Unknown</th>
</tr>
</thead>
</table>
| Infrastructure | Water availability of 10 dams in Istanbul dropped to 65% | Transportation disruptions:
• Roads and underpasses got flooded.
• Sea transportation stopped.
• Air transportation stopped. Planes got damaged.
• A crane toppled over in the Port of Haydarpasa and fire broke out. |

<table>
<thead>
<tr>
<th>Production</th>
<th>Decline in agricultural production</th>
<th>Decline in agricultural production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>Unknown</td>
<td>Fatalities and casualties</td>
</tr>
<tr>
<td>Social</td>
<td>Unknown</td>
<td>Window damage in residential and commercial buildings. Damage in approximately 180 thousand cars. 3,500 TL hood, 1,000 TL window damages per car.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ecosystem</th>
<th>Unknown</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>Unknown</td>
<td>Estimated as approximately 1 billion TL</td>
</tr>
</tbody>
</table>
the resilience of the city towards climatic events, it becomes critical to establish baseline data for monitoring and evaluation and detailed damage assessment systems.

Istanbul is affected by climatic events that occur in different locations around Turkey because it is connected to Turkey through supply chains. For example, during the winter of 2016 heavy snowfall caused traffic disruptions in Toros Mountains, thus declined the amount of fresh fruits and vegetables entering Istanbul Wholesale Market by 60%. This resulted in increased food prices in the city. 2017 has been the driest of the last 44 years, especially in the south-east of Turkey, therefore agricultural production is affected. This decline in agricultural production is expected to influence 2018 consumer prices in Istanbul. These two examples demonstrate that to ensure climate resilience of Istanbul, the resilience of supply chains needs to be taken into consideration and collaboration needs to be developed at regional and national scales in time.

18 July 2017
Flood

once every 30-50 years
Water and sewage networks got affected. Transportation disruptions:
• Roads got flooded.
• Metro stations got flooded.

Unknown
Unknown

Residential and commercial buildings got flooded.
Cars are damaged.

Unknown
Unknown

Estimated as approximately 200 million TL

2016 Winter
Snow

Unknown
Unknown

Transportation disruptions:
• 40km truck queue on Bursa-İzmir road.
• Roads closed to traffic in Toros Mountains.

Unknown
Unknown

The food entering Istanbul Wholesale Market dropped by 60%, thus consumer prices increased.
The concept of resilience comes from system theory and holds two different meanings in engineering and ecology. In engineering, efficiency comes into the forefront in systems. Such a system is isolated from external factors as much as possible, an optimal balance point is identified, and the system is kept as close as possible to that balance point. Systems operating this way usually have a single balance point and are designed to be stable, so the concept of resilience is measured as the speed of returning back to the normal after a disruption. This approach is relevant for sectors such as infrastructure (e.g. energy and waste) and economic systems (e.g. banking and buildings) which are dependent on engineering and economics principles. In ecology, the continuity is primary in systems. Such a system interacts with external factors, may have various states, and may form balance at multiple points. The critical element in a system operating with this logic is the reactions and adaptation solutions developed to form a new balance when the system deviates from normal conditions. Therefore, resilience is measured as the intensity of disruption from which the system can overcome whilst protecting its own parameters and processes. Many institutions like United Nations combine these two approaches to define the concept of resilience is “the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management[18].” However, during implementation, the engineering definition dominates risk assessment, action suggestions, and indicators.

Istanbul, during its 8-thousand-year history, has experienced countless disasters and gained resilience against vulnerabilities. The city has been challenged especially by earthquakes and fires. The preference of wooden buildings for earthquake resistance has many times left the city vulnerable to fires. Therefore, the experience gained through disasters guided the urban authorities towards legal, institutional and technical solutions.
In order to minimize the risk of fire in the high density and high reputation areas, the city was divided into two regions: main and secondary. The construction of wooden buildings in the main regions was totally banned, while in the secondary areas fire walls were made between wooden buildings. In addition, masonry buildings have been encouraged by granting higher elevations than wooden constructions.

The 1870 Fire led to the establishment of Fire and Rescue Services in 1874, the development of fire insurance and therefore the preparation of Istanbul Fire Risk Maps.

1509 Earthquake
After the earthquake that happened on 15 September 1509, also known as “The Lesser Judgment Day”, Istanbul took great damage. It is estimated that 5-10 thousand lives were lost. Rebuilding and renovation of the city began with 3,000 craftsmen and 66,000 workers gathered, and all repairs in the city were completed within 10 months (June 1510).

1836 Plague Epidemic
Since the Byzantine period, the people of Istanbul have encountered plague epidemics many times. The last epidemic occurred in 1836, causing 25-30 thousand people to lose their lives. In this episode, the Maiden’s Tower was dedicated to isolation and treating the patients. Quarantine practices at the ports and city limits and awareness raising with the bills that were handed out and published in the newspapers prevented the casualties in the following years.

1994 Drought
Due to the drought that happened in 1994, water-saving measures had to be taken by the IMM. However, in September of 1994, Istanbul had water for 3 months, and the danger of drought was overcome thanks to the rainfall at the end of the year. Consequently, water infrastructure of the city has been strengthened with investments such as renewal of water lines and construction of new dams. (Kazandere and Sazlidere)
1870 Fire
The fire in Beyoğlu in 1870 destroyed an area of fifty hectares, demolished about 3,000 buildings and affected about thirty thousand people. In order to minimize the risk of fire in the high density and high reputation areas, the city was divided into two regions: main and secondary. The construction of wooden buildings in the main regions was totally banned, while in the secondary areas fire walls were made between wooden buildings. In addition, masonry buildings have been encouraged by granting higher elevations than wooden constructions. The 1870 Fire led to the establishment of Fire and Rescue Services in 1874, the development of fire insurance and therefore the preparation of Istanbul Fire Risk Maps.

1569 Fire
30,000 houses burnt in 1569. Thus the public was obligated to take measures against fire. Among these measures were possession of water barrels and the first response obligation of home owners and neighbors in case of a fire. Besides, Head Architect Sinan was regarded responsible for confirming that the builders were competent.

1999 Earthquake
The Marmara (Golcuk) Earthquake in August 17, 1999 was deeply involved in the memory of Istanbulites. This earthquake has been instrumental in updating the earthquake regulations for buildings in 2007 and for starting awareness activities at urban scale. In addition, urban transformation projects continue to be carried out, especially in fragile regions, for the renewal of the building infrastructure under risk.
Mitigation is the social, economic and technological measures that reduce greenhouse gasses which cause climate change and strengthen carbon sinks. The use of fossil fuels for energy, livestock farming, intense agriculture activities, the loss of forest cover to pave way for economic activities, and insufficient waste management practices lead to greenhouse gas emissions. Mitigation actions and policies aim to slow down (and ideally reduce) the accumulation of greenhouse gasses in the atmosphere and control the greenhouse effect. Increasing generation of renewable energy (e.g. solar and wind), energy efficiency programs in buildings, industries and transportation, and expanding carbon sinks such as forests are prevalent actions in this context.

Adaptation is the practices that aim to alleviate the existing and expected risks and capture opportunities caused by climate change on natural and anthropogenic systems. Even if greenhouse gas emissions causing climate change is ceased today, the concentration of greenhouse gasses in the atmosphere will not immediately go back to pre-industrial period levels, the effects of climate change will continue to be experienced. Therefore, the resilience of socio-economic systems and ecosystems need to be improved against expected climate change impacts. Climate change can bring forth both risks and opportunities. Adaptation actions and policies should not focus on eliminating risks, but on minimizing the intensity of destructive impacts of threats and properly leveraging opportunities. These practices include improving existing infrastructure investments, planning new buildings to be adapted to the climate, raising awareness and enhancing the preparedness of institutions and people.

With ICCAP, the carbon footprint of the city is calculated, future climate scenarios are established, sectoral vulnerabilities are determined, and mitigation and adaptation measures are defined. To identify hotspots for emissions, IMM has calculated greenhouse gas inventories for 2010 and 2015 in transportation, waste, buildings and production categories. For these years, carbon footprint per capita is between 3 - 3.5 tCO2e, well below Turkey and global averages. Afterward, different scientific climate change models are used to generate scenarios regarding how Istanbul’s climate will change until the end of this century. These scenarios are then utilized to identify climate-induced threats to critical infrastructures in different sectors. According to similar breakdowns in local and national strategies, 10 sectors are selected for this analysis. In light of meetings with IMM’s departments, subsidiary institutions, and expert opinions, a total of 70 mitigation and adaptation measures were determined for 10 sectors, and 208 technically feasible activities were defined. Out of these 208 activities, 41 were prioritized. On this basis, IMM will continue to prioritize climate change in its investments and services, support local initiatives, and mobilize its resources.
Purpose
Istanbul Climate Change Action Plan aims to:
Enhance resilience of the city’s ecosystem, social structure and economy against climate change and reduce greenhouse gas emissions, while supporting IMM’s vision and objectives, taking into consideration the historical heritage and current megacity dynamics, and improving the city’s attractiveness and living conditions.

Objectives

Mitigation Objective:
Together with all its stakeholders, Istanbul aims to reduce the increase in its greenhouse gas emissions by 33% percent in 2030 compared to the business-as-usual scenario taking into account national climate change strategies, socio-economic dynamics of the city and global impacts of climate change impacts.

Adaptation Objective:
To improve its climate resilience, Istanbul aims to reduce disaster risks and recovery periods especially ecosystems, infrastructures and socio-economic systems, and strengthen the most vulnerable elements of these identified systems.
Principles

ICCAP is developed on the basis of 5 principles.

**Flexible** Knowledge, experience, and practices related to climate change are being developed continuously. Thus, ICCAP is prepared with the flexibility to adapt to updated scientific findings, developments in international negotiations, changes in national regulations (e.g. requirement for cities to manage mitigation and adaptation activities), and to new technological practices (e.g. mainstreaming of electric cars).

**Holistic** Climate action needs to be aligned with IMM’s strategies. Therefore, the strategic plans of IMM and its subsidiaries were taken into account while developing ICCAP. Besides, it is important that ICCAP is coherent with the strategic documents that IMM will produce in the future.

**Action-oriented** ICCAP is prepared primarily as an operational document. Those actions are prioritized that are readily planned, or technically and capacity-wise feasible for IMM and its subsidiaries and has high impact potential for mitigation or adaptation. This enables ICCAP to be action-oriented, and its impacts easy to monitor and evaluate.

**Multiple benefits** Some climate change actions can influence both mitigation and adaptation. Furthermore, these actions can have co-benefits besides reducing greenhouse gas emissions or climate vulnerabilities. For example, a public transportation project can reduce greenhouse gas emissions, while enhancing the quality of life by improving air quality. In terms of cost-benefits, activities that enable multiple benefits support local authorities to use their financial and institutional resources more efficiently. Therefore, while the actions are being prioritized for ICCAP, multiple benefits were taken into consideration.

**Change leading** The success of ICCAP’s implementation will depend on collaboration with all of the stakeholders of the city. Thus, in ICCAP especially the actions of sectoral stakeholders were included as much as possible, and it was developed to facilitate its adoption by stakeholders. ICCAP is the first local action plan in Turkey that gives mitigation and adaptation equal importance. Since no national level regulations are available for local authorities regarding climate change, ICCAP will be a guiding document at a national scale.
Process and Stakeholder Participation

ICCAP’s development process is divided into 7 sequential work packages.

1. Development of the roadmap
2. Preparation of the greenhouse gas inventory
3. Analysis of climate scenarios
4. Identification of risks, opportunities, and vulnerabilities
5. Conducting stakeholder meetings
6. Development of Istanbul Climate Change Action Plan
7. Awareness raising and capacity building activities

ICCAP was prepared with the active participation of and inputs from IMM and its stakeholders. While ICCAP was being prepared, opinions and suggestions of climate change and sector experts, IMM’s units and subsidiaries, non-governmental organizations in Istanbul, academicians and private sector stakeholders were used. Besides the activities listed in the timeline, over thirty meetings were conducted with IMM’s subsidiaries and stakeholders to collect view of units within the institution, deliver presentations and gather information on their activities. Below is the detailed timeline illustrating IMM’s activities regarding climate change.

2015

November

December

**UCLG-MEWA Committee on Environment**
IMM was selected as the chair for, UCLG-MEWA (United Cities and Local Governments Middle East and West Asia Section) Committee on Environment.

**21st Conference of Parties – Paris**
To observe and conduct evaluations, IMM has attended 21. United Nations Climate Change Conference of Parties.

**Membership to Compact of Mayors**
IMM has signed onto the global urban network Compact of Mayors.

**Climate Change Status Report**
IMM’s existing and planned projects were assessed in light of the role of cities in combatting climate change.

**Activities to determine the scope of Istanbul Climate Change Action Plan (ICCAP)**
For the preparation of ICCAP, work packages, and processes, goals, methods, resources, and responsibilities of work packages were structured in detail. Thus, coherence among work packages, goals for deliverables, scopes, and approaches were ensured.
Malatya Agreement
Istanbul Declaration
Under IMM’s leadership, member municipalities of UCLG-MEWA Committee on Environment have published a declaration presenting their commitment to climate change action.

Istanbul’s Greenhouse Gas Inventory Report
The greenhouse gas inventory study, which provides the foundation for mitigation actions, was conducted for 2015 with GPC Basic methodology, and buildings and land transportation-related energy consumption were identified as the main greenhouse gas emission sources. Meanwhile, through this exercise, an inventory dataset was established to easily update in the future and to provide a baseline for comparison.

Climate Change Risk, Opportunities and Vulnerabilities Assessment Report
Based on the future projections from climate scenarios, experts have explored expected climate change impacts on different socio-economic and environmental features, and vulnerabilities and opportunities related to critical infrastructures.

ICCAP Stakeholder Structure Report
In order to monitor the implementation of ICCAP and ensure its sustainability different management models that promote stakeholder engagement were reviewed.

23rd Conference of Parties – Bonn
IMM’s subsidiary, ISTAC A.S., has attended COP23.

Stakeholder Survey
The actions proposed by experts during the stakeholder workshop in July 2017 were structured and elaborated through meetings with IMM units and subsidiaries. A survey was prepared and sent to sectoral experts to prioritize these actions: A total of 128 experts survey from IMM subsidiaries, academia, and non-governmental organizations responded to the survey.
22nd Conference of Parties – Marrakech

IMM has attended COP22. Within the scope of the conference, in the Cities and Climate Change panel taking place at Turkey’s booth, the Directorate of Environmental Protection presented “Istanbul Metropolitan Municipality’s Climate Change Combatting and Adaptation Activities,” the Directorate of Disaster Coordination Center presented “Disaster Preparedness Activities in Istanbul for Climate Change Adaptation,” and ISTAC Inc. presented “Istanbul’s Waste Management Strategies, and Climate Change Mitigating Impacts, Istanbul’s Greenhouse Gas Inventory.”

Assessment Report for Climate Change Scenarios

Without knowing the future climate of Istanbul, effective adaptation measures could not be taken. Thus, how Istanbul’s climate will be affected from different climate scenarios until 2100 was analysed.

Stakeholder Debriefing Meeting

Activities and finding for ICCAP’s preparation were shared with stakeholders. Views and suggestions were collected from 46 stakeholder representatives from various institutions.

IMM’s “Development of Climate change Awareness and Activities in Istanbul” project was found qualified to benefit from EU’s Capacity Building in the Field of Climate Change in Turkey Grant Scheme.

Stakeholder Workshop

In light of Istanbul’s future climate, sectoral vulnerabilities and opportunities, mitigation and adaptation actions for Istanbul were identified by 140 experts from different sectors and institutions.

Istanbul’s Greenhouse Gas Inventory Report

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Istanbul Climate Change Action Plan

In light of the greenhouse gas inventory (2nd Work Package) and future projections (3rd Work Package), vulnerabilities were identified (4th Work Package) and goals were shaped based on stakeholder inputs (5th Work Package). Thus, an action plan was developed which addresses both mitigation and adaptation, aligned with international methodologies, and adaptable to future regulations, strategies and technical methodologies.

Case Studies

In collaboration with TUBITAK-MAM, detailed scenario assessments will be conducted for selected sectors. A closer look will be presented for waste management, transportation, and buildings sectors, and foundations will be established for ICCAP’s update in the upcoming years.

Awareness Raising and Capacity Development Activities

In order for ICCAP’s goals, methodology and deliverables provide guidance to the public, municipalities and other stakeholders, promotion of ICCAP, mainstreaming of awareness and interest will enable the project to deliver long-term and sustainable contributions.

www.iklim.istanbul website was established.
FRAMEWORK
International Framework

International climate change negotiations, which Turkey is a party, is a process that began in the 1990s. Local governments have established partnerships with the international community in order to act on climate change. While the first city networks emerged on the basis of volunteerism, common platforms based on strategic bases were formed over time.
Ministry of Environment and Urbanization is responsible for structuring regulations on climate change in Turkey and there are three strategic documents which frame national policy on climate change. The following strategies and action plans, which establish the framework of Turkey’s climate policy, are critical both for national and local actors to produce their political will, visions, and goals.

- National Climate Change Strategy (2010–2020) [10]

National strategies and action plans are supported by the strategic plans of ministries, and by the thematic strategies, action plans and programs developed by ministries.

**Istanbul Framework**

Preparation of ICCAP is among the actions identified in IMM’s 2015-2019 Strategic Plan. In this strategic plan IMM’s mission is: “to provide services to meet unmet needs, in line with the local governance approaches of the 21st century, and to perfect the municipal services with an institutional understanding while keeping the cultural identity of the city,” and its vision is: “the local governance of the city that produces global value in the name of urbanism and civilization, facilitating life with sustainable and innovative solutions.” The Strategic Plan encompasses direct and indirect mitigation and adaptation activities, and preparation of ICCAP is defined as the indicator for “Mainstreaming Environmental Protection Practices” strategic goal.

Custom strategies for the city, developed by IMM and subsidiaries, shape ICCAP. ICCAP was prepared in alignment with activities shared in IMM’s activity reports. In addition, parallels with the strategic plans and activities of IMM’s subsidiaries were taken into consideration.
2015 - 2030 - 2050

Population

2015 Population: 17,890,479
GHG emission: 84,731,024 tCO2e

2030 Population: 21,206,933
GHG emission: 117,923,638 tCO2e

Greenhouse Gas Emissions (tCO2e)
Istanbul will reduce its emissions by 33% by 2030 compared to its business as usual (BAU) scenario. Istanbul’s greenhouse gas inventory for 2015, calculated with GPC, amounts to 47.3 million tCO\(_2\)e. The calculations suggest that Istanbul’s continued growth, especially the number of its inhabitants, does not permit its emissions to reach its peak until 2050. The results indicate that the BAU scenario emissions of the city will reach 84.7 million tCO\(_2\)e by 2030 and 117.9 million tCO\(_2\)e by 2050. The measures proposed in ICCAP will decrease emissions, so that 2030 emissions are expected to be 57.1 million tCO\(_2\)e and 2050 emissions 76.1 million tCO\(_2\)e, suggesting a reduction of 27.6 million tCO\(_2\)e (33%) for 2030 compared to the BAU scenario. This “reduction from increase” approach corresponds to Turkey’s INDC of 21% reduction for 2030 and is an ambitious reduction target considering Istanbul’s rapid economic and population growth expectations. This target will be reached with efforts in energy efficiency in buildings and the industry, renewable energy, waste management and 1,100 km long metro lines. In addition to IMM, the contribution of local and national actors is vital in attaining these goals.

Figure 5.1. Istanbul’s greenhouse gas projections for 2015-2050
TOTAL GREENHOUSE GAS EMISSION OF ISTANBUL

47,340,725 t\(\text{CO}_2\)e

EMISSION PER CAPITA

3.23 t\(\text{CO}_2\)e

37%

28%

25%

6%

4%

ELECTRICITY

TRANSPORTATION

NATURAL GAS

WASTE

OTHER FUELS
MITIGATION ACTIONS

Greenhouse gas emission reduction effect of actions identified by experts in the stakeholder workshop for waste, buildings, transportation, energy and industry sectors as well as health, infrastructure, water resources management, and culture and tourism were evaluated, overlapping actions or those yet to be planned were excluded from mitigation calculations. Assessments based on this framework, waste management, transportation, stationary sources (buildings and renewable energy generation options which will be developed by the municipality), and industry found to be the categories with the highest implementation and direct greenhouse gas mitigation potential. In this regard, if suggested actions are implemented, 27.6 million tCO$_2$e can be achieved in 2030 compared to the business-as-usual scenario.

**Building:** Houses, commercial buildings and public buildings constitute 58.8% of Istanbul’s greenhouse gas reduction potential foreseen for 2030. This reduction will be based on energy efficiency-oriented improvements in line with national targets. Elimination of leakages and losses in electricity distribution will also contribute to this reduction.

**Industry and Construction:** Greenhouse gas emission reductions will be achieved through renewable energy sources and widespread energy efficiency applications.

**Transportation:** Projects of IMM to increase the 100 km of railway system lines gradually to 1.100 km total line length have a reduction potential of 1.9 million tCO$_2$e in 2030. In addition, if a vehicle taxation system based on CO2 emissions and improved emissions tests are implemented, the reduction in road transport activities will account for 29.9 percent of the 2030 reduction potential.

**Waste:** IMM plans to commission two waste incineration plants, a rotary kiln plant and a 70 MW landfill gas plant with a total greenhouse gas reduction potential of 3 million tCO$_2$e in 2030.

![Greenhouse Gas Emissions](image-url)
Land Use, Forestry, Biodiversity and Agriculture

- Protection of fragile ecosystems

Waste Management

- Proper location selection for disposal facilities

Energy Generation and Distribution

- Energy efficiency activities at urban scale
- Incentivizing cogeneration and renewable energy generation in buildings
- Increasing electricity generation from solar energy
- Increasing electricity generation from wind energy
- Increasing hydroelectric, landfill gas and biogas generation

Transportation and Logistics

- Adaptation of existing roads to bicycles
- Formation of a new bicycle infrastructure for transportation
- Reduction of road emissions by incentivizing pedestrian transportation
- Increasing amount and efficient use of car parking areas in the city
- Improving quality and efficient use of roads

Public Infrastructure

- Improving natural gas use and efficiency

Buildings

- Enhancing capacity for building energy efficiency
Reducing forest fire risks induced by increased temperatures

Use of recreation areas in forests based on protection-use balance and management of forest areas with less damaging methods

Locating buildings such as transfer centres, new storage facilities, biological treatment and recycling facilities away from residential areas, with low environmental vulnerabilities and costs, and where the fuel consumptions of waste transfer vehicles can be minimal

Providing training and publications to various selected stakeholder groups (e.g. commerce, residential, SME) for raising awareness about energy efficiency

Developing energy management systems within IMM

Operationalizing Hasdal 5 MW solar energy power plant in 2021

Installing solar energy power plants to water supply stations and dam lakes and reducing energy consumption

Operationalizing Terkos wind energy power plant by the end of 2021

Operationalizing Melen hydroelectric power plant project by the end of 2019

Drawing bicycle lanes and placing Is-Bike (Bicycle Sharing System) units within university campuses (e.g. YTU, ITU)

Developing Bicycle Master Plan to plan the necessary activities needed to increase bicycles’ share in transportation to 2% by the end of 2019

Increasing the existing 114 km bicycle lanes under IMM responsibility to 1053 km by 2023

Organizing an annual Istanbul-wide bicycle event with non-governmental organizations for biking to be accepted as a safe transportation vehicle by pedestrians and drivers (e.g. during Europe Mobility Week)

Congestion pricing for the complete or periodic closure of traffic in areas which experience heavy pedestrian traffic, are highly touristic, have heavy traffic load or air pollution (e.g. historical peninsula, Uskudar square, Besiktas market)

Pedestrianizing of selected areas by eliminating vehicle traffic in phases

Having activities in schools towards parking culture (e.g. theatre plays, posters)

Producing car parking spots designed according to the Design Guidelines prepared for parking areas

Developing the parkmeter system

Completing Logistics Master Plan by the end of 2019 and organizing logistics activities under this framework

Extending the natural gas network to 100% of Istanbul and reducing losses

Developing an easy to use, geographic information system based, technical design and planning software tool for those aiming to install solar panels on their buildings
Climate change related risks are projected to affect Istanbul’s sustainable development plans. As a systemic shock, climate change impacts a city’s environmental, social and economic dynamics. Events such as floods, storms, and snowfall experienced in the recent year clearly affect daily life and many sectors. However, the entirety of the impact of these extreme weather events and others which don’t get news coverage is not well known, because detailed damage assessments and status evaluation studies are not conducted. Therefore, impact assessments are developed based on similar events which occurred in Europe and on some assumptions. Another aspect of damage assessments is the evaluation of cascading effects. Impacts experienced in cities with high economic and social value like Istanbul can have consequences at regional, national scales or beyond national borders. However, data to assess such impacts are limited.

Based on scientific predictions, Istanbul is the most vulnerable coastal city in Europe. According to a 2016 study conducted by Basque Center for Climate Change in Spain which ranks coastal cities in Europe based on their risks, Istanbul ranks first and Izmir third\(^1\). In order to adapt to climate change, local authorities need to integrate a risk-based approach, conduct sector-specific assessments and analyse dependencies between sectors, and develop solutions in accordance with the urban metabolism. If measures are not taken, even if the processes seem complicated, cities will encounter risks that are impossible to overcome. Therefore, many cities similar to Istanbul such assessments have begun to be conducted. Some of these are:

- ‘Pitt Report’ developed after 2007 floods in the UK\(^2\)
- ‘Resilient Industry’ report developed after 2012 Hurricane Sandy in New York,\(^3\)
- OECD Report developed after 2014 floods in Paris\(^4\).

There are some initiatives and research available in Istanbul on this topic. Besides Istanbul Climate Research Center’s reports, sector-based studies exist such as the ongoing “Business Continuity for Industrial Infrastructures” research by Istanbul Chamber of Industry.
Istanbul will manage its disaster risks and reduce its recovery period to better adapt to a changing climate. Climate change adaptation is a matter of risk management and good governance. It is local, and specific to the needs. ICCAP’s adaptation strategy is based on sectoral risk and vulnerability analyses. To strengthen the most vulnerable elements of the city’s ecosystems, infrastructure and socio-economic systems an assessment was conducted on critical infrastructures. For the 10 sectors evaluated for Istanbul 75 critical infrastructures were identified. Considerations in the exercise to determine critical infrastructures were:

- Impacts of damages in critical infrastructures on services and potential interruptions,
- Overall estimation of losses and interruptions in important services and economic impacts,
- The geographical scope of impacts (regional, national and international impacts),
- Chain and “cascading effects” of damages in critical infrastructures and experienced interruptions, whether they caused indirect impacts or not.

Critical Infrastructure is defined as “networks, assets, systems and buildings or a combination of these which, as a result of the negative effects of potential partial or complete functional losses in environment, social order and public services, can have severe impacts on the health, security, and economy of citizens.”
Resilient cities are not only defined by their resilient infrastructure. They also require the institutional capacity of relevant actors, the improved resilience of commercial and industrial assets and awareness of citizens. Vulnerabilities can be reduced with correctly planned and managed procedures. As Turkey’s economic heart and largest city located at an ecologically sensitive region, Istanbul will transform itself into a structure that is not only less susceptible to extreme weather events, but also ready for quick and effective recovery.

<table>
<thead>
<tr>
<th><strong>Sector</strong></th>
<th><strong>Critical Infrastructure</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Health</td>
<td>Children, sick, pregnant and elderly</td>
</tr>
<tr>
<td>Land Use, Forestry, Biodiversity and Agriculture</td>
<td>Flora (Terkos-Kasatura coasts, Sahilkoy-Sile coasts, Kilyos-Agacli-Sile dunes, Omerli basin, northern Bogazici ve Alibeykoy pastures) Fauna (Terkos, Buyukcekmece and Kucukcekmece lakes, Omerli dam and basins, Belgrad, Beykoz and Sile forests, pastures in Alibeykoy and Omerli basins, Black Sea coasts between Cilingoz and Sile)</td>
</tr>
<tr>
<td>Energy Generation and Distribution</td>
<td>Ambarli natural gas combined cycle plant Power transmission and distribution grid Odayeri and Komurcuoda landfill gas plants</td>
</tr>
<tr>
<td>Transportation and Logistics</td>
<td>Roads, bridges and tunnels Railway systems Harbor structures</td>
</tr>
<tr>
<td>Water Resources Management</td>
<td>Omerli, Darlik, Terkos, Alibeykoy, Buyukcekmece, Sazlidere, Pabucdere, Kazandere, Elmali dams, Yesilcay and Buyuk Melen regulators</td>
</tr>
<tr>
<td>Public Infrastructure</td>
<td>Wastewater network Rainwater drainage systems</td>
</tr>
<tr>
<td>Buildings</td>
<td>Buildings along the coast</td>
</tr>
<tr>
<td>Tourism, Commerce and Socio-cultural Structure</td>
<td>Open air events, cultural activities Historical heritage elements</td>
</tr>
</tbody>
</table>
ADAPTATION ACTIONS

Public Health
- Enhancing climate resilience of health care services
- Activities to increase public awareness

Land Use, Forestry, Biodiversity and Agriculture
- Enhancing climate resilience of agricultural practices
- Enhancing climate resilience of urban green spaces
- Expanding urban green spaces

Waste Management
- Proper disposal and management of wastewater sludge, industrial and sea waste
- Reducing evaporation from dam lakes and rehabilitation of dams
- Modelling raw water

Water Resources Management
- Developing demand management in water use and risk mitigating measures
- Protection and improvement of forests and wetlands in watersheds
- Taking measures against floods
- Rehabilitation of rainwater drainage systems
- Increasing capacities of wastewater treatment facilities

Public Infrastructure
- Reduction of water consumption and losses
- Enhancing climate resilience of electric, natural gas, and telecommunication networks

Buildings
- Enhancing climate resilience of buildings

Tourism, Commerce and Socio-Cultural Structure
- Adapting tourism, commerce and socio-cultural regulations to changing climate
Below is a list of readily planned and prioritized actions.

- Strengthening health services at homes: identification of personnel and vehicle demand to provide health care at home for patients who are at risk from coming to the hospital during situations such as heavy rains, heat and cold waves
- Raising awareness about the relationship between climate change and health through training modules and publications on the environment among pre-school and primary school children
- Mainstreaming water efficiency systems in agricultural areas, wind breaks next to farm areas, irrigation lake, and channel construction
- Reducing water consumption in urban green spaces
- Irrigating urban green spaces with treated wastewater and rainwater
- Shifting to natural earth surfaces in parks and gardens or constructing surfaces according to “Permeable Concrete Technical Specification” to reduce flash floods; supporting afforestation activities in university campuses; designating vacant urban land to forest status and their afforestation
- Prioritizing drought-resistant trees with shade properties in the landscaping of squares and carpark roofs
- Proper disposal of wastewater sludge: Continuing the drying the wastewater sludge and sending to cement factories and operationalizing the combustion plant by 2024 as a definitive solution
- Taking measures to prevent the rate of evaporation in dam lakes
- Water supply network modelling and performing scientific raw water modelling according to the structures of water resources
- Taking necessary precautions to reduce the amount of water given free of charge and W loss rate in transmission lines
- Conservation of water yield and quality by preventing tree cutting, industrialization, and building in dam basins
- Rehabilitation of streams
- Separating rainwater drainage system from the sewage network
- Enabling additional capacity in wastewater treatment facilities in cases such as the impossibility of completely splitting rainwater drainage system or rapid population increase
- Lowering the water loss in water transmission network to 18% by 2020 through rehabilitation and improvement measures
- Managing water transmission and potable water network through smart systems
- Protecting of natural gas network and boxes from climate threats which are expected to get more frequently, such as floods
- Conducting risk-focused assessments in 52 critical points of Istanbul to prevent flash flood intrusion to buildings
- Including carbon footprint information on natural gas and water bills, using paper with seeds for museum tickets
IMPLEMENTATION

Institutional Capacity

IMM will further develop its institutional capacity for climate change. The role of local governments is becoming more prominent in the face of climate change. For this purpose, it will continue integrating climate change into its strategic planning and internal procedures, and strengthening its institutional capacity. When cities which resemble Istanbul in terms of climate, size, and vulnerabilities are assessed, they have sought solutions for similar questions, and these had four main foci: administration and legislation, inter-institution space, intra-institutional space, and human resources. Based on this assessment for Istanbul, concrete steps for improving capacity were identified. It will enhance climate change-oriented dialogue and long-term cooperation with local and national actors. IMM will mainstream its sustainable and smart city vision in its investments and municipal services. To ensure high-level ownership of climate change within IMM, strategic decisions will be taken, and the necessary technical and financial resources will be developed. Training will be conducted for IMM units and subsidiaries, and events will be organized to strengthen technical coordination with other municipalities in Marmara Region. Awareness raising activities for the general public will also be organized.
Awareness Raising

Awareness raising activities will establish the foundations for dialogue and cooperation with stakeholders which will be vital to activate ICCAP’s implementation. Climate change is not a challenge IMM can take on its own. Improving urban resilience, besides increasing the resilience of municipal infrastructure, requires public and stakeholder engagement. Therefore, IMM aims to strengthen its activities by supporting collective efforts. Awareness raising activities will be realized in three axes by taking into account different stakeholder groups in Istanbul (e.g. public, sectoral stakeholders, universities and non-governmental organizations):

• **Awareness about the impacts of climate change on Istanbul:** Citizens and various stakeholder groups in Istanbul will be affected by climate change in different ways. Information regarding this will be relayed to the stakeholders through different tools and messages. Publications and events which raise the awareness of stakeholder will improve overall support and willingness and mobilize local knowledge and resources.

• **Awareness about IMM’s climate change related activities:** By informing the citizens and stakeholders about IMM’s activities regarding climate change a positive influence that triggers their action as well. Therefore, IMM will use different media channels to update citizens and stakeholders about its climate change activities.

• **Awareness for stakeholders about actions they can take:** The integration of mitigation and adaptation measures to daily lives, work programs and decision mechanisms of citizens and stakeholders will strengthen IMM’s climate change actions. Therefore, IMM will develop action-oriented information tools for target audiences about potential climate change measures they can take.

Monitoring and Evaluation

Monitoring and Evaluation activities will be conducted to monitor the implementation and ensure sustainability of ICCAP. Monitoring and Evaluation will enable tracking of results from mitigation and adaptation activities implemented under ICCAP according to specific performance indicators, and comparison of these results with conditions before the action plan. The coordination between stakeholders will be improved by biannual reportings and updating ICCAP every 4 years.


