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Izmir Sustainable Energy Climate Action Plan

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İZMİR BÜYÜKŞEHİR BELEDİYESİ

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List of Acronyms

Acronym	Meaning
AFAD	Disaster and Emergency Management Authority
AR5	Assessment Report 5
BAU	Business As Usual
BEI	Baseline Emission Inventory
BEP	Building Energy Performance
CH4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon dioxide equivalent
CoM	Covenant of Mayors for Climate & Energy
CoM	Covenant of Mayors
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EMRA	Energy Market Regulatory Authority
EPC	Energy Performance Certificate
ESCO	Energy Service Company
ESHOT	Electricity, Water, Coal, Gas, Bus, and Trolly bus
EU	European Union
GCAP	Green City Action Plan
GCoM	Global Covenant of Mayors for Climate & Energy
GHG	Greenhouse gas
GVA	Gross Value Added
GWP	Global Warming Potential
IBB	Izmir Metropolitan Municipality
INDC	Intended Nationally Determined Contribution
IPA	Instrument for Pre-Accession Assistance
IPCC	Intergovernmental Panel on Climate Change
IZBAN	Local railway company of IBB
IZBETON	Construction Company of IBB
IZSU	General Directorate of Izmir Water and Sewerage Administration
IZUM	Izmir Transportation Sector
KAPRA	Key Agricultural Product Risk Assessment
KwH	Killowatt Hour
Km2	Kilometres squared
LFG	Landfill Gas
LZC	Low and Zero Carbon
MoAF	Ministry of Agriculture and Forestry
MoENR	Ministry of Energy and Natural Resources of Turkey
MoEnvU	Ministry of Environment and Urbanisation
MoH	Ministry of Health
MoI	Ministry of Interior
MoIT	Ministry Industry and Technology
MoTF	Ministry of Treasury and Finance

MW	Mega Watts
N_2O	Nitrous oxide
NC	National Communications
NCCS	National Climate Change Strategy
NEEAP	National Energy Efficiency Action Plan
NREAP	National Renewable Energy Action Plan
PAD	Landscape Research Society
RCP	Representative Concentration Pathways
RVA	Risk & Vulnerability Assessment
SEAP	Sustainable Energy Action Plan
SECAP	Sustainable Energy Climate Action Plan
SLR	Sea Level Rise
SO_2	Sulphur Dioxide
TMMOB	Union of Chambers of Turkish Architects and Engineers
tCO_2e	Tonnes of Carbon Dioxide Equivalent
UNFCCC	United Nations Framework Convention on Climate Change
USD	United Stated Dollar
WEI	Water Exploitation Index
WWTP	Wastewater Treatment Plants

0. Executive Summary

1. Introduction

By joining the Covenant of Mayors (CoM) and preparing and implementing a Sustainable Energy and Climate Action Plan (SECAP), Izmir Metropolitan Municipality (IBB), has voluntarily committed to reducing greenhouse gas emissions and improving climate resilience. The CoM signatories' objectives to be achieved by 2030 are to:

- Reduce CO_2 emissions by at least 40% against the baseline year
- Increase climate resilience (i.e. develop a climate action plan); and
- Provide secure access to sustainable and affordable energy in a manner that is integrated with the mitigation and adaptation plans

Izmir's SECAP has been aligned with the development of its Green City Action Plan (GCAP) which aims to identify, prioritise and address the most pressing environmental challenges, aligning with IBB Strategic Plan Vision, enabling a future for Izmir that is more compatable with nature. The City had joined EBRD's Green Cities Framework in early 2019.

2. SECAP Process

Developed over 7 months, the SECAP process followed by Izmir is consistent with the CoM methodology used by all cities developing and implementing a SECAP. Delivered in the form of the CoM SECAP reporting template and accompanying method report, the process followed these key steps: 1) Initiate and develop a baseline review, including a baseline emissions inventory and a risk and vulnerability assessment. 2) produce practical actions in order to inform and help reduce emissions and increase resilience to climate change.

Stakeholder input has been a key feature of the SECAP process. Utilising the two governance bodies established as part of the GCAP process, multiple government departments, civil society and non-government organisations have been engaged throughout the workshop process, with over 100 attendees at the SECAP kick-off event held in Izmir in December 2019.

Municipality -wide (inter-departmental) and inter-institutional focus group meetings were also held during the SECAP preparation process to understand how to handle climate adaptation in local context and data availability for the monitoring process of adaptation indicators

3. Mitigation

The Izmir Sustainable Energy and Climate Action Plan sets out a roadmap for mitigation of emissions from energy consumption in different sectors identified with the participation of urban stakeholders. The process started with calculating the Baseline Intervention Emissions (BEI) of 2018 for the city of Izmir. GHG Emissions in the urban scale, have been prepared within the framework of the general principles and philosophy applicable to each local government of the International Local Government Greenhouse Gas Emissions Analysis Protocol (IEAP) established by the International Local Environmental Initiatives Council (ICLEI) also based on IPCC guidelines.

Mitigation actions proposed in SECAP are in line with current plans and strategies like UPI 2030 (İzmir Transportation Master Plan, 2019), Izmir Province Integrated Solid Waste Management Plan, IBB Strategic Plan 2020 – 2024. There are some bold actions like a massive roll out of PV on building planned after 2025 to reach the 40% target.

a. Key Outputs

The GHG emissions of Izmir for the baseline year of 2018 is 25,062,569 tCO_2e. Only 0,8 % of the total emissions belong to IBB. Industry has the highest share (31.4%) of all emissions while residential buildings account for 14.3 % of all emissions (including fuel combustion and electricity) and tertiary buildings account for 8,8 %. The 2nd highest emissions are transportation emissions (23%). 1 % of all emissions are from public transportation. Process emissions from klinker production accounts for 6.1 % while fuel consumption for energy generation for own use is around 3.7 %. The rest of the emissions are CH_4 and N_2O emissions related with waste, wastewater treatment, fertilize use in agriculture, irrigation and livestock and manure management.

The shares of the sectors can be found in the figure below. The mitigation actions focused on the highest emission sources like transportation, buildings.

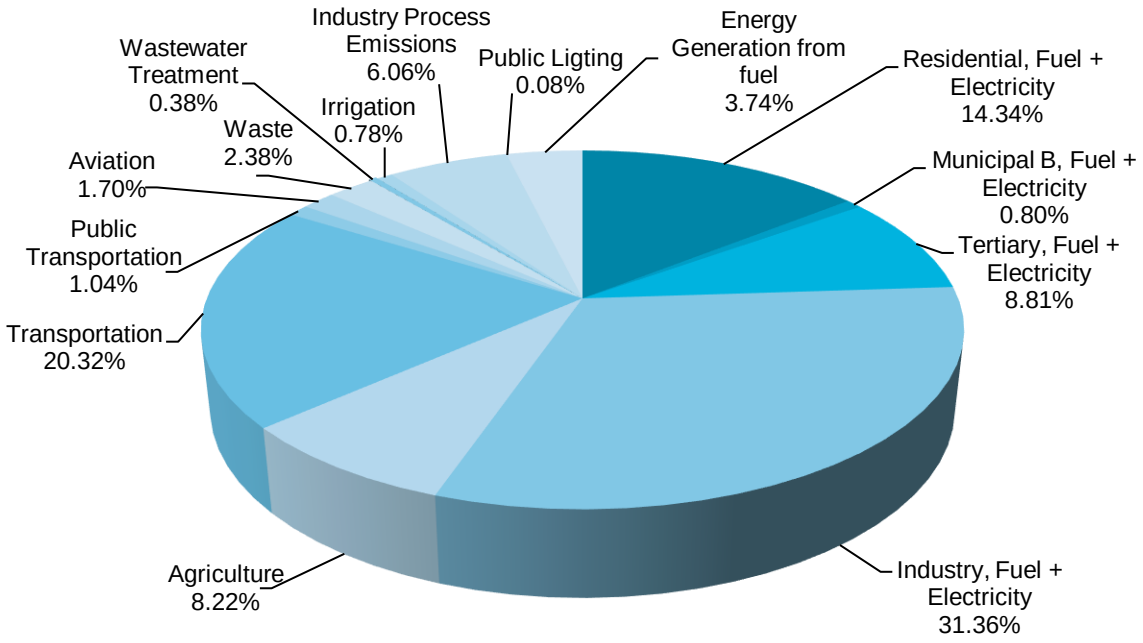

Figure A: Sector shares of BEI 2018

b. Actions

The Izmir Sustainable Energy and Climate Action Plan sets out a roadmap for mitigation of emissions from energy consumption in different sectors. Turkey's urban growth rate is similar to developing countries and there is a growth in absolute emissions the majority of sectors. According to the BAU (Business As Usual) scenario, per capita emissions increase from 3.31 tCO_2e (2018) to 3.51 (6% increase) in 2030. After the proposed mitigation actions, the GHG emissions will be 9,973,640 tCO_2e in 2030 (excluding industry and aviation) and 1,98 tCO_2e per capita. A reduction of 40% will be achieved. The energy consumption and emission reductions achieved after mitigation actions can be seen in Table A. 7.7 million tCO_2e could be saved from total 17.5 million tCO_2e GHG emissions, if measures are taken.

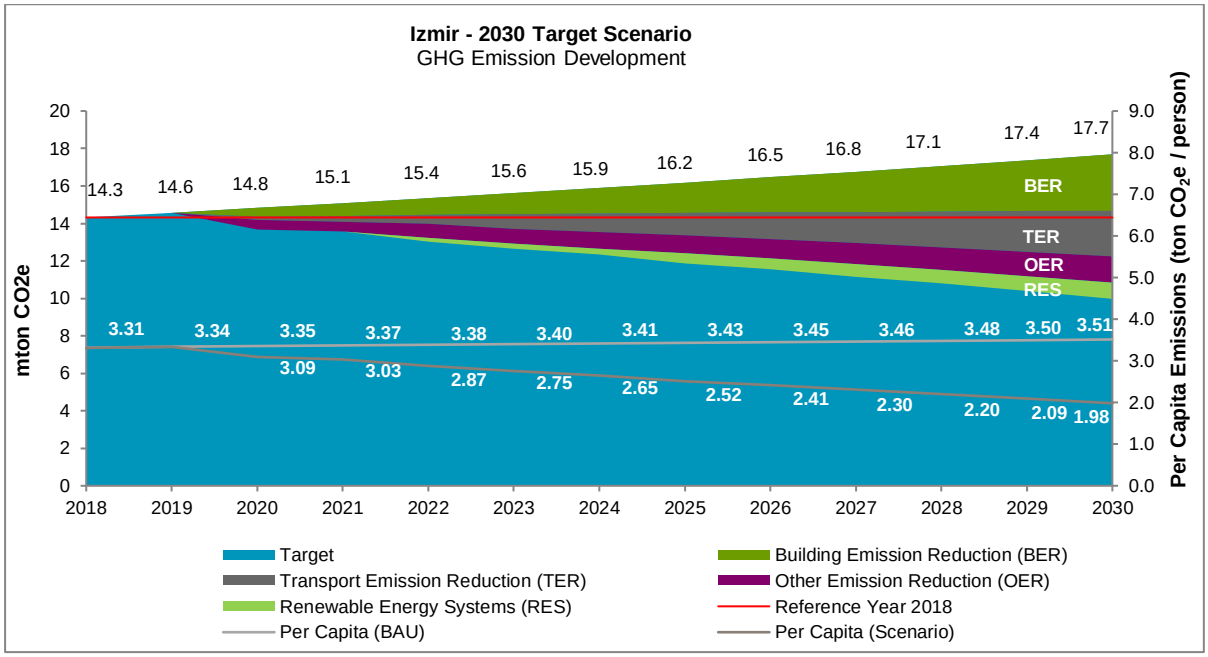

Figure B: Izmir Target Scenario, 2030

IBB have already taken significant steps in terms of transportation with the introduction of Intelligent Traffic System, expanding the mass public transportation schemes, use of e-buses for public transportation (20 e-buses).

Regarding buildings National regulations and the Urban Transformation Scheme for Risky Areas offer some opportunities for energy efficiency. It is a matter of awareness raising and setting rules for sufficient audits and schemes to provide an uptake for energy efficiency.

Izmir has a significant potential for renewable energy uptake especially small-scale solar use. After 2025 quite a high number of solar energy installations are planned throughout the city. Other actions include biogas production from landfill facilities, manure management and efficiency in irrigation.

Table A: Mitigation action results per sector

	MWH reductions in 2030	Ton CO_2e reductions in 2030
Buildings Sector Emission Reduction	7,860,496	3,019,384
Transportation Emission Reduction	14,507,438	2,432,813
Other Emission Reduction	97,592	1,390,206
Renewable energy systems	1,726,000	875,082
Total	**24,191,526**	**7,717,485**

4. Adaptation

a. Key Outputs

An assessment of climate change risks was completed for Izmir across 12 CoM defined sectors in relation to 9 key CoM defined hazards. The sectors assessed were agriculture & forestry, buildings, civil protection & emergency, economic, energy, environment & biodiversity, health, land-use planning, tourism, transport, waste and water.

The sector specific impact pathways assessed were developed by reviewing the research undertaken around Izmir's historical climate context, climate projections and indicator data around vulneraries too and impacts from climate change.

The risk assessment identified 33 impact pathways. The table below summaries those impact pathways assigned a risk score of 'High' in relation to the Global Covenant of Mayors (GCoM) risk matrix definitions. The GCoM is the global scale Covenant of Mayors for climate and energy, established in 2016 to bring together the Compact of Mayors and the European based Covenant of Mayors.

Table B: A summary of "high" level risks.

I.D	Sector	Impact	Timeframe of Occurrence
IM2	Building	Surface water and riverine flooding events causing damage to / inundation of buildings within the municipality.	Short-term
IM3	Building	Land-slides result in the damage and loss of buildings within the Municipality.	Short-term
IM8	Water	Rising temperatures and drought periods increasing water scarcity, decreasing water quality and reducing ground-water recharge rates.	Short-term
IM9	Water	Extreme weather events increasing the demand on, causing damage too and peaking the capacity of the wastewater and stormwater management infrastructure resulting in flooding and increased maintenance costs.	Short-term

IM13	Land Use Planning	Surface/ river flooding causing the inundation of urban or industrial land.	Short-term
IM14	Land Use Planning	Sea Level Rise causing the inundation of urban or industrial land.	Long-term
IM15	Land Use Planning	Rising temperatures and prolonged periods of drought will dry out landscapes, causing fuel build up that result in the occurrence of forest / wildfires.	Short-term
IM18	Agriculture & Forestry	River and surface water flooding could result in the damage too, and the inundation of low-lying agricultural land causing the destruction and loss of crops and livestock.	Short-term
IM19	Agriculture & Forestry	Sea level rise could result in the damage too, and the inundation of low-lying agricultural land causing the destruction and loss of crops and livestock, alongside the salination of ground water sources used for irrigation.	Long-term
IM20	Agriculture & Forestry	Forest fires damaging and destroying agricultural and forestry land alongside livestock.	Short-term
IM21	Environment & Biodiversity	Extreme climate events damaging and /or destroying the natural environment resulting in ecosystem degradation, habitat and biodiversity loss.	Short-term
IM23	Environment & Biodiversity	Increased periods of drought will reduce the water levels in rivers and other freshwater bodies and Gulf of Izmir, reducing the natural environments capacity to manage wastewater and run-off pollution, causing habitat and species loss and eutrophication.	Short-term
IM24	Health	Extreme heating exacerbating the urban heat island effect, resulting in an increase in heat related illness, disease and mortalities.	Short-term
IM27	Civil Protection & Emergency	The more frequent occurrence of extreme events will result in the Increased deployments and pressure on civil protection and emergency agencies.	Short-term

b. Actions

Developed by leveraging existing policy strategy and recommendations that IBB and other key stakeholders have and are currently implementing, this SECAP has identified a total of **30** actions that address key climate risks and vulnerabilities across the 11 sectors within adaptation. Overlapping with mitigation and in coordination with the GCAP, the number of adaptation actions by sector is provided below.

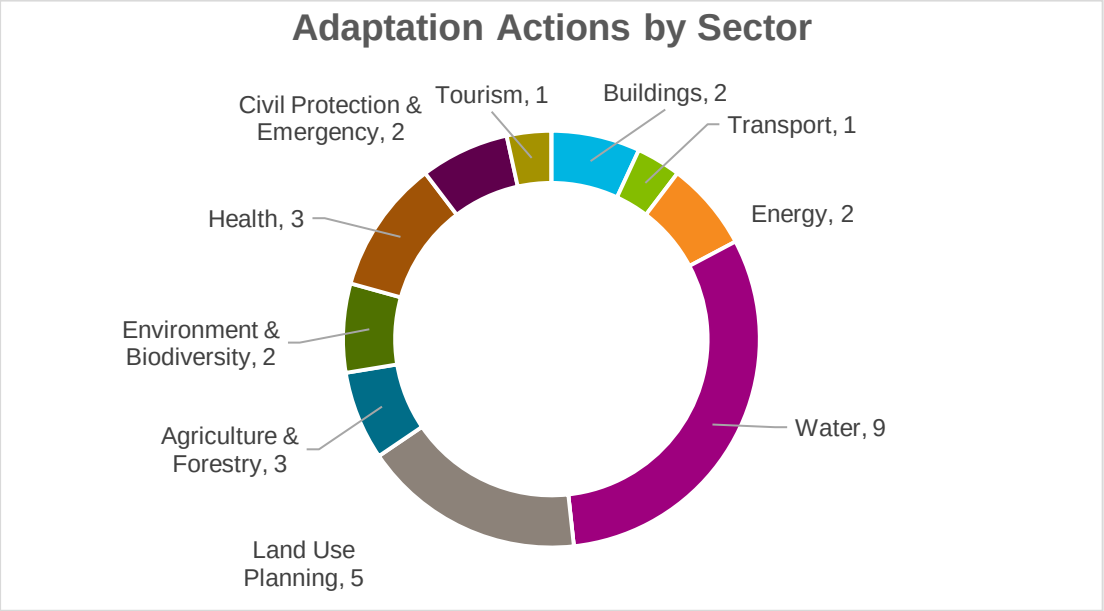

Figure C: Number of adaptation actions by sector (number on the chart indicate the number of actions).

A business case has been developed for each of the actions, with a more detailed description, assigning an appropriate action owner, relevant stakeholders, IBB Strategic Plan Objective 2020 – 2024 and the risk and vulnerabilities it will address. Where required, these business cases overlap with Izmir's GCAP.

1. Introduction

1.1 Overview and Purpose of SECAP

The Global Covenant of Mayors (GCoM) for Climate & Energy brings together thousands of local governments voluntarily committed to implementing climate and energy objectives. By joining the CoM, Izmir Metropolitan Municipality (IBB), covering the province of Izmir, has committed to:

- Reduce CO_2 emissions by at least 40% (per capita) against the 2018 baseline year by 2030
- Increase climate resilience (i.e. develop a climate action plan); and
- Provide secure access to sustainable and affordable energy in a manner that is integrated with the mitigation and adaptation plans.

Part of the obligation in joining the CoM is the preparation, delivery and maintenance of a Sustainable Energy and Climate Action Plan (SECAP). The SECAP provides the standard reporting framework for Covenant Signatories; enabling the collection and analysis of data in a structured and systematic manner, serve as a basis for good climate and energy management and for tracking progress in implementation.

This SECAP for Izmir has been funded by the European Union (EU) through the Instrument for Pre-Accession Assistance (IPA) Component 1 (Transition Assistance and Institution Building), as agreed between the European Commission (EC) and the Ministry of Energy and Natural Resources of Turkey (MoENR), and supported by the European Bank and for Reconstruction and Development (EBRD).

This report has been designed to accompany and justify the data and actions inputted within the SECAP Reporting Template, submitted to the CoM through the online portal. It incorporates input from over 100 stakeholders and proposes 34 mitigation and 30 adaptation actions that incorporate infrastructure investments, policy measures, emergency planning, capacity development and advocacy, all of which are designed to reduce Izmir's emissions and increase its resilience to climate change.

1.2 Alignment with the Izmir GCAP

This SECAP process has been carried out in alignment and parallel with the preparation of the Izmir Green City Action Plan (GCAP), also supported by the EBRD, to avoid duplicating efforts and resources. The final action plan reports have been produced separately for the SECAP and GCAP but are complementary to one another; aligned in messaging and actions where possible.

1.3 Content and Structure of this report

Part 1: SECAP Approach

- **Chapter 1: Introduction:** An introduction into the final report. This chapter outlines the purpose of the SECAP, it's alignment with the GCAPand a high-level overview of existing national and local level climate change policies and actions.
- **Chapter 2 – Methodology.** Split into two separate adaptation and mitigation sections, this chapter outlines the methodological approaches followed when completing the SECAP process. This outlines the steps taken for the Baseline Emissions Inventory (BEI), Risk and Vulnerability Assessment (RVA) and Action Development.

Part 2: Baseline conditions in Izmir

- **Chapter 3 & 4: Justification of Template Input:** An overview of the data and outputs produced from the BEI and the RVA, as inputted within the SECAP reporting template.

Part 3: Izmir's more resilient, future that is more compatable with nature.

- **Chapter 5: Actions for Izmir's SECAP:** Outlines the SECAP actions that Izmir will implement to address in order to achieve a reduction in emissions and a heightened resilience to climate risk. These actions are split into Mitigation and Adaptation and then further divided into the following sectors:
  - **Mitigation:**
    - Buildings: Municipal, Tertiary, Residential
    - Transport
    - Waste
    - Energy
    - Agriculture and Forestry
  - **Adaptation:**
    - Buildings
    - Transport
    - Energy
    - Water
    - Land Use Planning
    - Environment & Biodiversity
    - Agriculture & Forestry
    - Health
    - Civil Protection & Emergency
    - Tourism

- **Chapter 6: A Road Map for Izmir:** Describes and outlines protocols for the next steps for implementation and monitoring of the SECAP actions.

1.4 National Climate Change Policies and Actions

Turkey became a party to the United Nations Framework Convention on Climate Change (UNFCCC) in 2004. Prior to becoming a party to the UNFCCC, Turkey had established a Coordination Board on Climate Change (CBCC) in 2001. The CBCC was restructured in 2004 after Turkey became a party to the UNFCCC and in 2010 its remit was expanded to include new members.[1]

Turkey has a different position than the other countries in the Annex-I list of the Convention, and in the 7th Conference of the Parties (COP7) meeting held in Marrakech in 2001, Turkey's special conditions were recognised and it was decided that its name will remain on the Annex-I while it will be removed from the Annex-II list. This has affected and accelerated the country's political decision to be a party of the Kyoto Protocol. In February 2009, five years after becoming a part of the Convention. Turkey's entrance to the Kyoto Protocol was documented and sent to the General Secretariat of the UN. The whole ratification process of the Protocol was completed in August 2009.[2] Turkey is not included in the Protocol's Annex B list (do not have numerical obligations on greenhouse gas emission reduction).

The Climate Change Department was established in 2009 under the General Directorate of Environmental Management, which is subordinate to MoEnvU and tackles all issues concerning climate change.

In May 2010 Turkey published a "National Climate Change Strategy" in order to contribute to global efforts to reduce the impacts of climate change, taking into account its own special circumstances and capacity. The Strategy

[1] Republic of Turkey Climate Change Strategy 2010-2023, T.C. Ministry of Environment and Urbanization, 2012, Ankara
[2] Turkey's National Climate Change Adaptation Strategy and Action Plan, Ministry of Environment and Urbanization, 2011, Ankara

includes a set of objectives to be implemented in the short term (within one year), the mid-term (within 1 to 3 years), and long term (to be initiated in the next 10 years period) goals relating to transport, industry, buildings, waste and agriculture. The Strategy includes measures such as:

- Co-generation and regional heating
- Local renewables as well as local coal use
- Building efficiency improvements

Energy efficiency legislation has a longer history in the framework of EU candidature processes in Turkey, and recent legislation in Turkey has detailed approaches for energy efficiency in power production, industry and the built environment. Various new instruments and institutions have also been formed through legislation, including the Energy Market Regulatory Authority (EMRA), the Energy Efficiency Coordination Council and the National Energy Efficiency Centre.

In terms of legal duties and responsibilities, the regulations introduced by the Energy Efficiency Law cover all sectors of the economy, as well as all individuals and organizations at the national, regional and local level. They bring obligations, supports and activities for the industry, building and transportation sectors. The Energy Performance Regulation in Buildings (BEP) has also come into force, and within this framework it has become mandatory to issue an Energy Performance Certificate (EPC) for new buildings as of 2011. Within the scope of the same law, the Regulation on Increasing Efficiency in the Use of Energy Resources and Energy includes practical measures such as

- Establishing the institutional structure and certification schemes for the ESCO sector
- Training and increasing capacity for all public and private stakeholders
- Establishing the mechanisms with which to support energy efficiency projects
- Assigning energy managers in industry sector and buildings

The regulation also includes various incentives to those who voluntarily commit to reduce energy intensity with projects that increase energy efficiency. Legislative action concerning local renewable energy development has come some way, with wind and solar power installations increased multifoil in Turkey. Some of the actions for energy efficiency and using new energy sources planned are[3]:

- Construction of zero emission energy generation technologies such as renewables and nuclear with local content provisions
- Increasing the overall efficiency of existing thermal power plants,
- Lowering of energy intensities to 2004 levels
- Increasing local renewable contribution in total power production to 25%,
- Maximum utilization of energy efficiency potentials in the industrial sector,
- Capitalizing on built environment energy efficiency potentials
- 7% reduction in GHG emissions

In 2011, the National Climate Change Adaptation Strategy and Action Plan[4] was published by MoEnvU. The National Climate Change Adaptation Strategy and Action Plan focuses on five key topics, which are supported by participatory processes and technical and scientific studies in the following fields

- Water Resources Management
- Agricultural Sector and Food Security
- Ecosystem Services, Biodiversity and Forestry
- Natural Disaster Risk Management
- Public Health

The Intended Nationally Determined Contribution (INDC) proposed by Turkey to UNFCCC in 2015 indicates up to 21% reduction in GHG emissions from the BAU level. By 2030, this will enable Turkey to settle on low-carbon development pathways compatible with the long-term objective of limiting the increase in global temperature below 2°C.

Emission reductions to be achieved by these policies and plans compared to the business as-usual scenario are presented in the Figure 1 below.

[3] Regulation on Increasing Efficiency in the Use of Energy Resources and Energy No. 28097, Ministry of Energy and Natural Resources, 2011, Ankara.
[4] Turkey's National Climate Change Adaptation Strategy and Action Plan, Ministry of Environment and Urbanization, 2011, Ankara

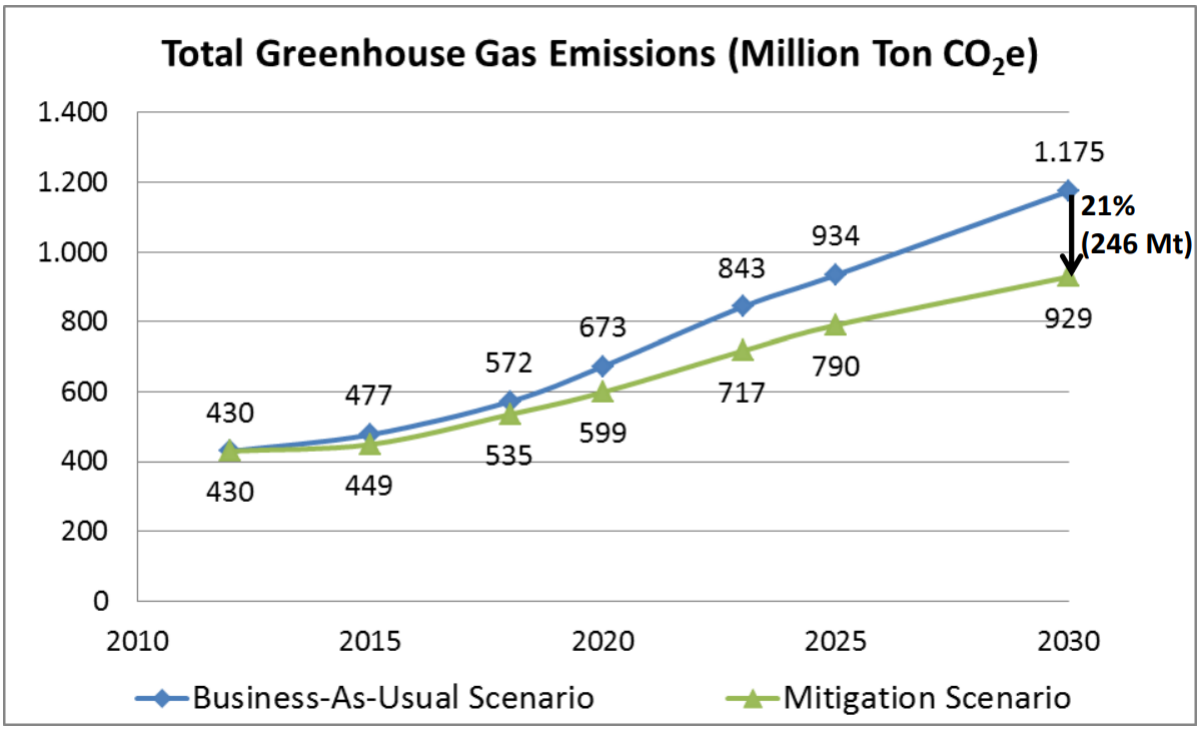

Figure 1: Turkey's INDC Target, 2015[5]

Turkey is supporting its INDC targets through a range of national climate change policies which include:

- 11th National Development Plan
- National Strategy on Climate Change (2010 – 2023)
- National Climate Change Adaptation Strategy and Action Plan (2011 – 2023)
- National Climate Change Action Plan (2011 – 2023)
- National Strategy on Industry and Technology for 2023
- Energy Efficiency Strategy Paper (2012-2023)
- National Strategy and Action Plan on Recycling (2014-2017)
- Regulation on Monitoring of GHG emissions (2014)
- National Smart Transportation Systems Strategy Document (2014- 2023) and its Action Plan (2014-2016)
- National Renewable Energy Action Plan (2014)
- National Energy Efficiency Action Plan (2017 – 2023)
- MoENR's Strategic Plan (2019 – 2023).

Plans and policies to be implemented by the INDC for different sectors are summarized below.

Energy

Renewable energy investments will be supported to increase capacity of production of electricity from solar and wind power. The target is to increase the capacity for solar power to 10 GW and wind power to 16 GW until 2030. Reducing electricity transmission and distribution losses to 15 percent at 2030 and rehabilitation of public electricity generation power plants are also targeted. Tapping the full hydroelectric potential, establishment of micro-generation, co-generation systems and production on site at electricity production can be mentioned as another attempts for energy sector.

Industry

The main intervention areas for industry are energy efficiency and waste. Reducing emission intensity with the implementation of National Energy Efficiency Action Plan and Energy Efficiency Strategy Paper and increasing energy efficiency in industrial installations and providing financial support to energy efficiency projects are targeted. Making studies to increase use of waste as an alternative fuel at the appropriate sectors emerges as another matter for the industry sector towards sustainability and circularity.

[5] Republic of Turkey: Intended Nationally Determined Contribution 2015. Website: https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Turkey/1/The_INDC_of_TURKEY_v.15.19.30.pdf

Transport
The strategic aim for the transportation sector is to promote sustainable modes of transport such as walking, cycling, and use of public transportation. Targets in accordance with this aim include:

- High speed railway projects
- Increasing urban railway systems
- Promoting a shift away from road journeys towards increased use of maritime and rail transportations for both freight and passenger transport

Energy use of the transportation sector is another strategy area in the INDC. Targets include promoting alternative fuels and clean vehicles, reducing fuel consumption and emissions of road transport with National Intelligent Transport Systems Strategy Document (2014-2023) and its Action Plan (2014-2016), and achieving fuel savings by tunnel projects and the removal of older vehicles from use. To ensure energy efficiency, policies implement green port and green airport projects, as well as special consumption tax exemptions for maritime transport, buildings and urban transformation.

Buildings
The main INDC policy for the building sector is the reduction of primary energy demand in new and existing buildings. This is accomplished with design, technological equipment, building materials, and development of channels that promote the use of renewable energy sources (such as loans and tax reduction). In order to reduce energy use and its negative effects on climate, the following measures will be promoted:

- Passive energy and zero-energy house design to minimise the energy demand and ensure local production of energy
- Constructing new residential buildings and service buildings as energy efficient in accordance with the Energy Performance of Buildings Regulations
- Creating Energy Performance Certificates for new and existing buildings, to control energy consumption and greenhouse gas emissions and reduce energy consumption per square metre

Agriculture
The main national policies related to sustainability in the agriculture sector are linked to topics such as fuel savings by land consolidation in agricultural areas, the rehabilitation of grazing lands, controlling the use of fertilisers, implementing modern agricultural practices and supporting the reduced tillage methods of land management. Collectively, these will help to reduce direct and indirect emissions from agriculture and livestock, reduce negative impacts on soil, water, and air quality, and support healthier ecosystems.

Waste
To ensure circularity of the waste sector, national policies include sending solid waste to managed landfill sites and recovering secondary raw materials to utilise as energy sources while reducing waste.
Energy can be recovered from waste through an industrial symbiosis approach, by processes such as:

- material recycling
- bio-drying
- bio-methanisation
- composting
- advanced thermal processes or incineration and recovery of gas from landfill sites
- utilisation of industrial wastes as an alternative raw material or fuel in other industrial sectors

Other policies for the waste sector include conducting studies to utilise waste from breeding and poultry farms, rehabilitating unmanaged waste sites, and ensuring waste is deposited at managed landfill sites.

Forestry
The national policies for forest areas are increasing sink areas and preventing land degradation, implementing the Action Plan on Forestry Rehabilitation and National Afforestation Campaign.

1.5 Local Climate Change Policies and Actions

In 2015, IBB joined the Covenant of Mayors (CoM), which was established by the European Commission to promote and support urban mitigation plans, promote the use of renewable and clean energy resources in order to reduce GHG emissions from cities.

In accordance with the mitigation aspect of this agreement, IBB prepared a Sustainable Energy Action Plan[6] (SEAP) which was carried out under the leadership of the IBB Directorate of Environmental Protection and Control, Healthy Cities and Clean Energy Branch Directorate and in coordination with local stakeholders. The aim of the SEAP was to reduce IBB's greenhouse gas emissions of the city by at least 20% by 2020; this report, which serves as an update to the SEAP, will set out a new target of achieving a 40% reduction in per capita urban emissions by 2030.

The SEAP 2015 actions include:

- Creating an inventory of high energy use buildings or sectors and promoting energy efficiency measures in buildings
- Conducting studies on energy consumption and providing information about reducing greenhouse gas emissions to local and neighbourhood organisations
- Ensuring that public institutions, especially municipalities, develop relevant databases and adopt greenhouse gas reduction measures
- Taking measures to save energy in buildings and increasing the amount of green areas in urban transformation areas

Although IBB cannot directly affect energy demand or set local building regulations related to energy efficiency, some of the proposed mitigation measures include encouraging the uptake of public transport, facilitating the increased use of bicycles and pedestrianisation, and urban planning actions to reduce daily travel.[7] These actions are also underscored in IBB's Strategic Plan for 2020-2024, which includes targets to raise awareness of clean energy both inside the municipal administration and with the public, perform preliminary studies for renewable energy technology, and increase the municipality's own uptake of clean energy.[8]

The IBB Strategic Plan 2020-2024 (as summarised in Appendix A) contains many measures on various fields to ensure sustainable management of urban services, natural resource efficiency, sustainable use of energy resources, building sustainable environments, sustainable urban development, etc. There are several actions determined under Climate Action Strategy Area of the Strategic Plan to adapt climate change and its effects. These include:

- Agricultural forecasting and early warning systems
- Creating low-emission zones
- Implementations on vegetable waste evaluation (circularity)
- Developing a Sustainable Energy and Climate Action Plan (SECAP)
- Energy Saving and Efficiency Studies
- Studies on Reducing Water Consumption
- Increasing social awareness towards climate change to influence national policies
- Raising awareness on the impact of pollutant emissions created by industrial activities on climate change

In addition to the Strategic Plan, IBB prepared a Green Infrastructure Strategy which sets out a sustainable city target. Izmir's GI strategy has been developed to ensure sustainability and connectivity across the city, which includes the rehabilitation of, and increase in, the quantity of urban green and blue areas. It also strives to align existing strategies that have been developed for planning and governance of green infrastructure, promoting a more sustainable management approach. Other supporting reports and plans in the province are listed below.

- Basin Scale Flood Management Plans: Küçük Menderes Basin Flood Management Plan, Gediz Basin Flood Management Plan and Kuzey Ege Basin Flood Management Plan prepared by the MoAF, General Directorate of Water Management in 2019
- Küçük Menderes Basin Drought Management Plan prepared by the Ministry of Forestry and Water Affairs General Directorate of Water Management Flood and Drought Management Department in 2018

[6] IBB Sustainable Energy Action Plan, 2015
[7] IBB Sustainable Energy Action Plan, 2015
[8] IBB Strategic Plan 2020-2024, 2019

- Gediz Delta Wetland Management Plan
- Izmir Province Integrated Solid Waste Management Plan prepared by IBB in 2018
- Izmir Drinking Drinking Water Master Plan project prepared by IZSU in 2017
- Izmir Transportation Master Plan (UPI) prepared by Department of Transportation of IBB in 2019
- Foca SEPA Management Plan

To determine and implement effective greenhouse gas emission mitigation and climate adaptation actions, it is important to understand future climate conditions in in the local context by using national, regional and urban scale climate models as well as global scale models. To this end, Izmir Metropolitan Municipality (IBB) and Landscape Research Society (PAD) carried out a project titled “Green Re-vision: A Framework for Resilient Cities (2019)”.

2. Methodology

2.1 Overview of SECAP Methodology

The SECAP processes follows a consistent methodology adhered to by all cities who are signatures of the CoM. This method was established by the CoM and provides guidance to local authorities in developing an effective SECAP, covering the core steps as outlined in Figure 2 below. Steps 1 and 2 of this process are what have been undertaken by this piece of work; developing a baseline emissions inventory, risk and vulnerability assessment, and practical actions in order to inform and help reduce emissions whilst increasing resilience to climate change. This has been developed on the understanding that future implementation and monitoring sections fall under the responsibility of IBB after this assignment.

Figure 2: The SECAP process: the main steps.[9]

The core deliverable of this process is an excel-based SECAP reporting template, which constitutes the reporting framework required by the CoM initiative. This report is designed to accompany the template, providing supporting information and justification for the data inputted within the excel workbook. It should also be noted that the SECAP is meant to be regularly monitored and updated (every two years) where necessary.

The following sections are split by mitigation and adaptation and outline the detailed process taken to inform the SECAP reporting template.

2.2 Mitigation

2.2.1. Process followed

The CoM initiative allows local authorities to develop a mitigation action plan that fits their local context for new beginners and without major changes of the approaches for local governments already committed to energy and climate actions. With this principle in mind, the Covenant has developed a multi-option methodology, based on or adapted from existing standards and methods. The different options, some of which are inter-dependent, concern the choice of the baseline year, the emission inventory approach, the included GHG(s), the emission factors and the definition of the reduction target[9].

[9] Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)'. Source: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC112986/jrc112986_kj-na-29412-en-n.pdf

Baseline Year
The baseline year is the reference year against which the emissions reduction target shall be compared, to monitor the results of the proposed actions. The New Metropolitan Municipalities Law (6360) originally enacted in 2012 came into force after the local government elections of March 2014. The Law expanded the administrative boundaries of Metropolitan Municipalities to the provincial boundaries, nullifying village administrations by transforming them into city neighbourhoods and making Metropolitan Municipalities thereby responsible for the whole of the administrative area. IBB thus came to be responsible for an additional 11 district municipalities and hundreds of village administrations that were now city neighbourhoods. IBB had to significantly re-organise to be able to deliver fundamental infrastructural and other services to a hugely expanded area and number of settlements. The legislative re-adjustments are still being enacted, while the socio-economic repercussions of this change are only now being felt. The increase in commercial and economic activity in previously rural areas of Izmir spread urban energy consumption traits to much larger populations, hugely affecting urban transport and building energy intensities much larger than those otherwise expected. The reference year was changed from 2014 to 2018, as this was the most suitable year for which comprehensive and reliable data was found. In order to reach the 40% reductions target for 2030, it would be realistic to start monitoring from the latest year that would reflect the current situation of the city.

Boundary
The new border of Izmir Metropolitan Municipality (as of March 2014) marks the area of IBB's jurisdiction. The sectors in the selected boundary are building, transport, waste and wastewater facilities, and agricultural soil (fertilizers) and livestock (enteric fermentation, manure management). Due to the complexity of calculations and data requirements, agricultural crops and residue related emissions are not included in the inventory. The industrial ghg emissions are calculated but not included in the baseline emission inventory of 2018.

Methodology for calculating the BEI
Greenhouse gas direct and indirect emissions are calculated for each energy carrier by multiplying final energy consumption by the corresponding emission factor. Also, CH_4 and N_2O emissions from waste, wastewater treatment, agriculture and livestock have been calculated and converted into CO_2e.

The activity-based approach which is the most widely used by cities has been used for calculation Baseline Emission Inventory. In this approach, all the CO_{2e} (or GHG) emissions that occur due to energy consumption within the territory of Izmir, either directly (through fuel combustion) or indirectly (through consumption of electricity), are included. Most of the GHG emissions are CO_2 emissions, whereas emissions of CH_4 and N_2O are of secondary importance for the combustion processes in the residential and transport sectors. All CO_2, CH_4 and N_2O emissions are calculated for all fuel types along with global warming potentials (GWP) using IPCC emission factors of Fifth Assessment Report (AR5). One of the reasons to include the other emissions other than CO_2 is that Izmir is also calculating emissions from waste (CH_4), wastewater (CH_4, N_2O), enteric fermentation (CH_4) from livestock and chemical fertilizers (N_2O) used in agriculture.

IPCC, TIER-1 and TIER-2 methodology is taken as basis for greenhouse gas calculations within the **determined** borders of Izmir Metropolitan Municipality. Accordingly, the following formulas and variables were used in the calculations according to the types of Scope-1, Scope-2 and Scope-3 greenhouse gas resources:

$$\textbf{Emissions GHG}_{\text{, fuel}} = \textbf{Emission } CO_{2\text{, fuel}} + \textbf{Emission } CH_{4\text{, fuel}} + \textbf{Emission } N_2O_{\text{, fuel}} + \ldots$$

$$\textbf{Emission } CO_{2\text{, yakıt}} = \textbf{Consumption fuel x Emission Factor } CO_{2\text{, fuel}}$$

2.2.2. Assumptions made

Assumptions of GHG emissions for targeted 2030 are made taking into consideration of population increase rate, building and service sector growth rate, energy consumption trends in last decade and legislative changes in the administrative control of Izmir Metropolitan area. Sector based assumptions are listed below:

a. **Population growth**: The population projection was made using the arithmetic average of the population growth in the last decade. This projection coincides with the population projections in various strategy and plans[10] prepared by Izmir Metropolitan Municipality. The average annual population growth is considered as 1.3% per year. Based on this Izmir's population will reach up to 5,033,986.

b. **Building sector** emissions have been increased by the assumptions made according to the building typologies below.

[10] Izmir Province Integrated Waste Management Plan, 2018

i. Residential buildings: Energy consumption is considered to be directly proportional to population growth and the rate of increase is taken as 1.3% per year.
ii. Tertiary buildings: Energy consumption increases have been determined by taking into consideration the last 5 years trends and the development status of the service sector. Assumptions are as follows:
    1. Natural gas: %3
    2. LPG: %1 based on last 4 years average increase rate per year.
    3. Fuel-oil: %1 based on last 4 years average increase rate per year.
    4. LNG: %0 Although it has been in a downward trend in the last four years, the yearly rate of increase is assumed as 0%.
    5. Electricity: 3% The high growth rates in the service sector in the last 10 years are also reflected in the increase in energy consumption of tertiary buildings. This growth rate, which is 7% on average, has decreased in recent years to 3%. For this reason, the rate of increase in natural gas and electricity is assumed to be 3% per year.
    6. Geothermal energy: %2 increase rate per year.
iii. Municipal buildings: In the last 5 years, with the change of the metropolitan law, there have been important increase in the number of buildings and facilities of the IBB, especially the natural gas consumption has almost doubled. However, the increase in services resulting from this change has been completed and has entered a more stable state. The following assumptions have been made regarding the energy consumption of the municipal buildings:
    1. Natural gas: %3 increase rate per year
    2. Electricity: %3 increase rate per year
    3. Fuel-oil, diesel (stationary),coal, LPG:%0 increase rate per year
    4. LNG:%2 increase rate per year

c. **Transportation Sector** fuel consumptions and greenhouse gas emissions increase rates are as follows:
i. Municipal vehicle fleet:
    1. Diesel: %1 increase rate per year
    2. Gasoline: %0 increase rate per year
    3. Electricity: %2 increase rate per year
ii. Public Transport fleet
    1. Diesel:%3 increase rate per year
    2. Electricity:%3 increase rate per year
iii. Private Vehicles
    1. Diesel Personal cars: %2
    2. Diesel Logistic vehicles:%1
    3. Gasoline Personal Cars:%1
    4. LPG: %0

In addition, the total fuel consumption have been distributed to vehicle categories using IBB registered vehicles numbers. In this breakdown (Table 1), the following average km data and average fuel consumption data were used depending on the vehicle type:

Table 1: Fuel breakdown assumptions per vehicle type

	Private Cars			Minibus	Bus	Heavy Duty Veh.	Light Duty Veh.	Motorcycle
	Gasoline	**Diesel**	**LPG**	**Diesel**	**Diesel**	**Diesel**	**Diesel**	**Gasoline**
Km per year / unit	12,000	12,000	30,000	18,500	70,000	25,000	15,000	4,000
Fuel Cons. (lt/100km)	8.5	7.3	6.7	10.9	57.2	29.9	10.9	2.9

d. **Other Emissions**; waste and wastewater related emissions are increased based on the population growth rate of %1,3 as these emissions are directly link with the citizen activities. Agriculture and livestock related emissions

are increased with a rate of %1 per year whereas irrigation electricity consumption increase rate assumed as %2 per year.

BAU GHG emissions projection for 2030

As a result of above assumptions, GHG emissions of Izmir urban emissions (excluding industry) has been calculated (Figure 3) as 17,691,125 tCO_2e for 2030 and total energy consumption will be 45,593,220 MWh. Per capita emissions will raise from 3.31 tCO_2e to 3.51 tCO_2e (6% increase).

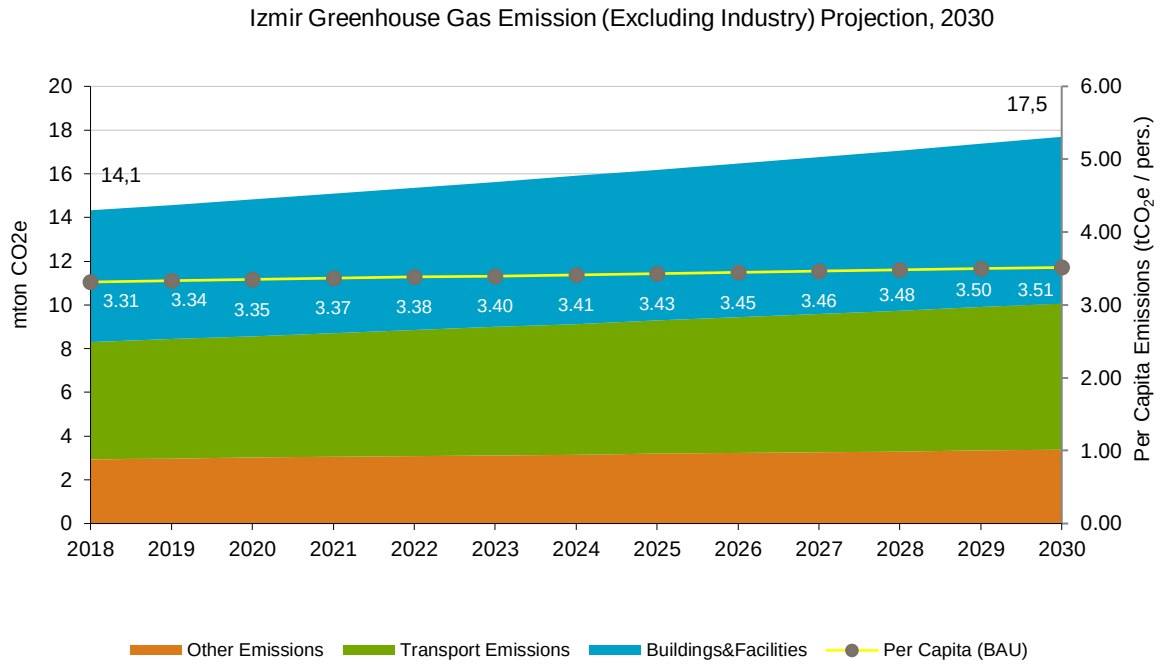

Figure 3: Izmir GHG Emission Projection, 2030

2.3 Adaptation

2.3.1 CoM Process

The CoM methodology outlines 6 key stages within the adaptation cycle, which outline the necessary processes required to help guide and inform a city's future decision making for improving climate resilience (Figure 4). Stages 2, 3 and 4 of this cycle, as highlighted, are the three aspects of the process that have been delivered as part of this assignment to develop Izmir's SECAP. The framework for the next stages of this process; implementation, monitoring and evaluation, is provided by the CoM and incorporated within the reporting template deliverable.

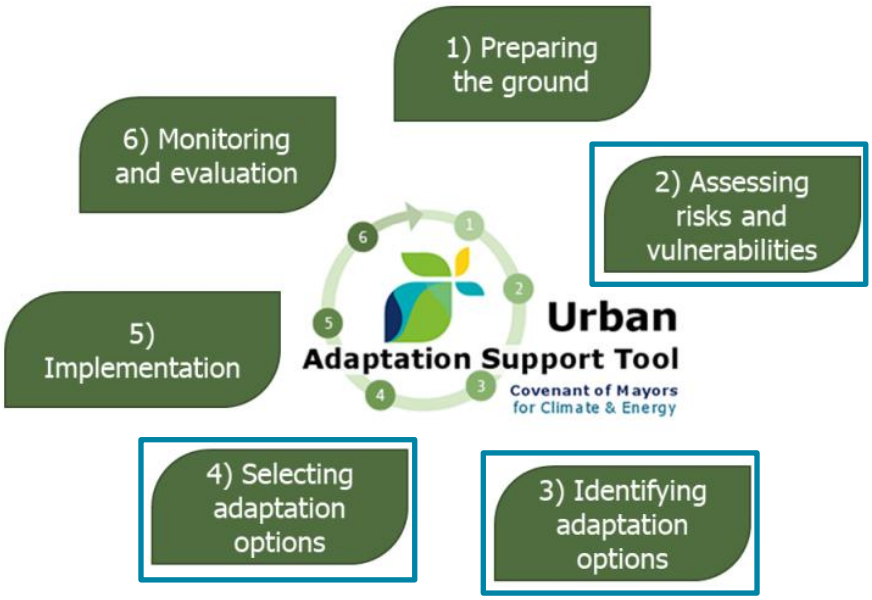

Figure 4: Adaptation cycle steps. Urban adaptation Support Tool[11]. The blue boxes demonstrate the aspects of this cycle undertaken within this report.

Assessing Izmir's risk and vulnerability to climate change forms the fundamental baseline for understanding, and then minimizing, the impacts that the Municipality faces through the identification and selection of adaptation options. In order to address stages 2, 3 and 4 of the adaptation cycle the following steps were followed:

- **Establish context and scope:** Understand the temporal scope, climate variables and risk framework.
- **Gather weather, climate and indicator data:** - consider observed weather data, including climate projections, alongside impact and vulnerability related indicator data.
- **High level RVA:** assess current risk posed by the primary climate hazards and develop potential impacts and future risk on a sectoral basis. Utilising past events information to apply current risk and climate projections to understand how risks may change over associated timeframes.
- **Adaptation options:** generate and detail a list of new adaptation measures for implementation by the Municipality, in conjunction with the Izmir GCAP and involving stakeholder engagement

2.3.2. Establish Context and Scope

A foundational step of any climate risk assessment is to define a clear set of underlying assumptions made during analysis. These are outlined in Table 2:

Table 2: Key Project Assumptions

Scope Element	Approach
Timeframes and emission scenario	The baseline climate was assessed using national and regional climate change projections, in-line with Turkey's 7th National Communication report for the United Nations Framework Convention on Climate Change. When considering the effects of modelled future climate, the timeframes for the climate projections used were adopted and defined against the SECAP reporting template input

[11] Urban Adaptation Support Tool, Covenant of Mayors. Source: https://climate-adapt.eea.europa.eu/knowledge/tools/urban-ast/step-0-1

	options; 'Current' (present day), 'Short-term' (<2040), 'Medium term' (2041 – 2070), 'Long-term' (2071-2100) and 'Not Known' (unknown). The high-emission scenario projections, 'Representative Concentration Pathway (RCP) 8.5', was used. As outlined by the UN Emissions Gap Report 2019 [12], current global population, urbanisation and emission trends demonstrate it is most likely global emissions will follow the high emission scenario pathway.
Climate Hazards	The CoM defined hazards this study considers are: • Extreme heat • Extreme cold • Extreme precipitation • Flooding (fluvial / urban) • Droughts • Storms (high winds) • Landslides • Forest Fires • Sea level rise
Key Sectors	The 12 CoM defined sectors considered in this assessment are: • Buildings • Transport • Energy • Water • Waste • Land Use Planning • Agriculture & Forestry • Environment & Biodiversity • Health • Civil Protection & Emergency • Tourism • Economic
Risk assessment framework applied	The risk assessment guidance (e.g. matrix, likelihood and consequence definitions) chosen for the RVA was that of the Global Convent of Mayors for Climate & Energy guidance note for common reporting framework[13]. This risk assessment framework was chosen to enable easier integration with the CoM SECAP methodology and reporting template, acknowledging both hazard and impact risk. The guidance is summarised in Appendix D

2.3.3. Defining Headline Hazards

The CoM methodology provides 9 key hazards to be analysed during the RVA process. For the purpose of this report and to promote the interpretation of how these 9 hazards are inter-connected, logical groupings under a headline climate hazard has been completed. These are laid out below, alongside a key definition for each of the 9 CoM hazards. This definition dictates the application of past events and climate change projection data when a deriving risk levels across all timeframes.

More frequent, longer and intense drier and hotter spells:

- **Droughts:** A period of abnormally dry weather long enough to cause a serious hydrological imbalance.
- **Extreme heat:** Temperature above the 90th percentile of the daily maximum
- **Forest Fires:** Fire burning uncontrolled on lands covered wholly or in part by timber, brush, grass, grain or other flammable vegetation.

Increased intensity and frequency of extreme rainfall events:

- **Extreme precipitation:** Rainfall events within the top 1% of all daily events.
- **Storms:** An atmospheric disturbance that can be manifested in strong winds and accompanies by rain, thunder and lightning
- **Floods:** Included river / fluvial, flash floods, sewer floods and urban / pluvial.
- **Landslides:** A movement of a mass of material downhill due to gravity, often assisted by water when material is saturated. Also associated with rockfalls.

[12] https://www.unenvironment.org/resources/emissions-gap-report-2019
[13] https://www.globalcovenantofmayors.org/wp-content/uploads/2019/04/Data-TWG_Reporting-Framework_GUIDANCE-NOTE.pdf

A rise in average global temperatures:

- **Sea Level Rise:** The average long-term rise of the ocean's surface
- **Extreme cold:** Temperature being below the 10th percentile of minimum daily temperature.

2.3.4. Gather weather, climate and indicator data

Observed Weather and Projected Climate Change

With Turkey not having an accessible national data set for climate projections, in order to effectively inform the RVA assessment, several sources were reviewed to obtain climate change projection data. Where present, Izmir specific climate projection data has been analysed, however where this was not readily available, national Turkish projections were used. Sources incorporated IBB strategies or related project documents e.g. A framework for Resilient Cities to Climate Change: Green Revision Guidebook (2019), national publications e.g. Turkey's 7th National Communication Report for UNFCCC and relevant academic papers.

Past Events

Understanding past severe weather events and the impacts caused by the primary hazards form an important tool in the climate risk screening process, as it establishes a baseline against which climate trends and projections can be applied. Information on past events in Izmir was gathered through online resources such as; academic research papers, publicly available reports or press articles.

Indicator Data

To inform the RVA, impact and vulnerability-related indicators were identified during the project kick-off meeting held in December 2019. Focus groups meetings were held with relevant stakeholders to collect the indicator data where available. The sources of this data can be found in Appendix C.

2.3.5. High Level RVA

Current and future risk:

As required by the CoM and by drawing on outputs from previous elements of this method, a climate change risk and vulnerability assessment was conducted across 12policy sectors. The following steps were undertaken:

- For each of the primary hazards identified within Izmir, the current level of risk was scored and justified with a rationale in accordance with the CoM risk rating matrix, which is a function of:
    - Consequence of each hazard (regardless of the likelihood)
    - The current (present day) likelihood of each hazard occurring. Using professional judgement, the likelihood level assigned took into account the following information:
        - Observed and projected climate data.
        - Past events information
        - Indicator data
- For each of the 12 CoM defined sectors, a list of impact pathways was identified utilising past events information and known vulnerability indicators to inform professional judgement in portraying a high-level interpretation of how the sectors could be affected, positively or negatively, by the climate hazards.
- A level of risk was then scored and justified with a rationale against each of the individual impact pathway. Using the GCoM risk rating matrix, a consequence and likelihood rating were applied in association with a timeframe of occurrence, as defined in Table 2; current-day, short-term, medium-term, long-term or unknown).
- Impact related indicators were also applied against each impact statement, in order to help inform the future monitoring of the impacts.

- The preliminary findings of the risk assessment were presented and validated during the kick-off meeting held in December 2019. Further amendments and alterations were undertaken in-light of new indicator database when this was received.

Vulnerability Statements

The vulnerability of Izmir to climate change risks was broken down into two categories; socio-economic and physical & environmental. Vulnerability descriptions were developed based on relevant indicator data and baseline condition research undertaken during the GCAP Technical Assessment and Political Framework reports. Examples of Izmir's vulnerabilities include:

- **Socio—economic**: population density and composition, economic prosperity.
- **Physical & Environmental**: geographical location, topography, spatial planning, physical conditions.

As per the impact statements, each vulnerability description was associated with relevant indicators to help inform the future monitoring of these vulnerabilities.

2.4. Action Development

Undertaken in coordination with Izmir's GCAP, actions were developed for both aspect of the SECAP, mitigation and adaptation simultaneously. The objective of these actions is to reduce the greenhouse gas emissions and improve its resilience to climate change impacts, addressing high risks and key vulnerabilities.

In alignment with the GCAP process, actions were developed through the following steps:

- A review of Izmir's existing actions within strategy and policy documents was completed.
- Internal workshops with sector experts to develop long list of potential future actions headlines for both SECAP and GCAP, acknowledging that actions can address both projects respectively.
- A higher-level of detail was then added to the action headlines, including; action type, key GCAP challenge addressed, SECAP sector addressed, link to Izmir's Strategic Plan, existing actions it leverages.
- A multi-criteria analysis was applied to prioritise the actions into groups of 'high', 'medium' and 'low' priority using numerous environmental, social and economic criteria that were validated by IBB stakeholders.
- This initial prioritisation was then subject to extensive stakeholder engagement with the city's GCAP Steering Group and Technical Committee during a workshop held within Izmir week beginning 17th February 2020. A renewed list of prioritised actions was produced as a result of this.
- IBB and EBRD then reviewed the prioritised long list of actions
- A short-list of actions was produced, focusing only on the 'high' priority actions to come out of the MCA, stakeholder and review process.
- IBB further reviewed the short-list of 'high' priority actions.
- High priority actions were then 'basketed' into synergistic groupings that reflect the comparable skill sets / approaches required in their implementation / delivery e.g. awareness raising
- Priority individual actions within the basket list were then identified for detailed business case development.

2.5. Stakeholder Engagement in Izmir

Stakeholder input has been a key feature of the SECAP process. Utilising the two governance bodies established as part of the GCAP processes for identifying and mapping stakeholders, the SECAP's stakeholder engagement workshops aligned with those of the GCAP in order to increase efficiency and promote a co-ordinated effort between the two projects.

The first of the two governance bodies established was the Technical Committee (TC). The TC's purpose being to provide technical advice spanning the various sectors covered by the GCAP process, and later SECAP, comprising of numerous technical municipality staff and advisors. The second was the Steering Committee (SC), the purpose of which was to provide guidance and oversight, ultimately giving IBB approval of the GCAP and SECAP. The members of the SC's are Senior IBB official who hold decision-making powers.

Civil society and non-government organisations were also engaged throughout the SECAP / GCAP workshop process, including at the kick-off event and the action prioritisation workshop. IBB thanks these stakeholders for their invaluable input around SECAP actions for Izmir.

Municipality-wide (inter-departmental) and inter-institutional focus group meetings were also held during the SECAP preparation process to understand how to handle climate adaptation in local context and data availability for the monitoring process of adaptation indicators. Vulnerability and impact-related indicators of CoM SECAP were examined together with IBB relevant departments and city authorities such as meteorology, disaster and emergency management, water, national parks, agriculture and forestry.

3. Justification of Input: Adaptation

This section provides the context around the information on past events, climate projections and vulnerability indicators that informs the basis of the assessment of current and future risk to the 11 policy sectors. A summary of the outcomes of the RVA is also provided.

3.1. Historical context, climate change projections and physical & social characteristics.

An understanding of what climate related events have occurred previously, and the social and environmental characteristics of Izmir is required to help inform and direct the risk and vulnerability assessment. Broken down by the headline hazard defined in section 2.3.3 of this report, the following sections will provide a summary of the historical context of the hazards in Izmir, how climate projections are expected to influence this and the physical and social, characteristics of Izmir that could exacerbate the impacts of these hazards.

3.1.1. More frequent, longer and intense drier and hotter spells

The core hazard of longer, intense and more frequent drier and hotter spells promotes the occurrence of climate related hazards such as extreme temperatures, drought and forest fires, which are often inter-connected. Extended periods of extreme temperatures are known to result in drought, which in turn can lead to forest fires.

Historical Context

Izmir's current and historical climate is one very typical of the Mediterranean region hot, dry summers and mild, rainy winters, demonstrating strong variability of inter-annual or seasonal variability. The General Directorate of Meteorology for Turkey collates baseline figures for temperature within Izmir on a monthly basis as seen in Table 3. The highest recorded temperature recorded in Izmir for the period of 1938 to 2019 is 43 °C, occurring within the month of August. This data also that on average, temperatures remain in excess of 25°C from June through to the end of August.

Table 3: Baseline climate for Izmir (°C) 1938-2019.[14]

	Jan	Feb	Ma	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Average Temperature (°C)	8.7	9.5	11.6	15.8	20.7	25.3	27.8	27.6	23.6	18.8	14.2	10.4	17.8
Average Maximum Temperature (°C)	12.3	13.5	16.2	20.8	26.0	30.7	33.1	32.9	29.1	23.9	18.5	14.0	22.6
Highest Recorded Temperature (°C)	22.4	27.0	30.5	32.5	37.6	41.3	42.6	43.0	40.1	36.0	30.3	25.2	43.0

Due to these climate conditions, extreme heat, forest fires and particularly water scarcity/periods of drought are long-recognised hazards. Research shows that Izmir is believed to experience an annual frequency of < 3 drought events per year[15]. In 2018, a study of water potential per basin was undertaken, incorporating the three water basins located within Izmir province – Küçük Menderes, Kuzey Ege and Gediz.

[14] https://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?m=IZMIR
[15] Baglee, A, Connell, R, Haworth, A, Rabb, B and Bugler, A. (2013). Climate Risk Study: Pilot Climate Change Adaptation Market Study: Turkey. EBRD. International Finance Corporation.

As shown in Figure 5, this demonstrates that at the time of the study, Küçük Menderes was experiencing an absolute water shortage, with Gediz basin showing Water distress with Kuzey Ege being the only one not showing water shortages.

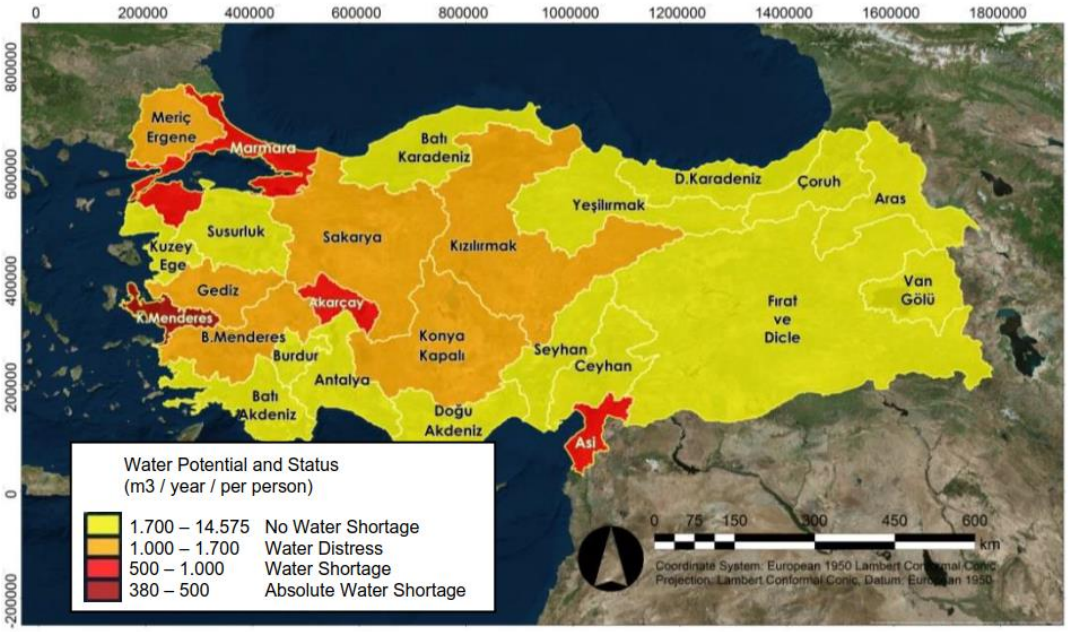

Figure 5: Turkey's water potential per Basin (m^3/year/person)[16].

This water scarcity is confirmed by the water exploitation index (WEI). Defined as the mean annual total abstraction of fresh water divided by the long-term average freshwater sources, this index describes how the total water abstraction puts pressures on water resources. Izmir's WEI is 72.9%. Severe water stress can occur when an area has a WEI of >40%, demonstrating that the city is very highly water constrained[16].

Extended periods of drought and water scarcity, driven by prolonged dry periods and heat waves have had cross-sector impacts within Izmir. Examples include:

- A recent heatwave, lasting from 17th and 27th of June 2017 and exacerbated by the urban heat island effect, saw a consistent air temperature of 27.8ºC ± 1.9 ºC, compared to the average for that time of year of 24.5 ºC ± 1.9 ºC. An academic study undertaken in 2018 demonstrates that during this heat wave, hospital mortality rates in Izmir increased by nearly 1% - up from 320 ± 20 per day vs 269 ±27/day.[17]
- Throughout 2007 – 2008, Turkey's Aegean region experienced an 'extreme' drought that saw a reduction in average precipitation rates by 43%. This brought about direct and indirect effects, particularly impacting water dependent industry such as agriculture and the growth of some of Izmir's key crops. An academic paper from 2013 shows that, compared to 2006, plant production during drought hit 2007 reduced by 14% for cereal production, 12.7% in field crops, 2.7% for vegetables and 3.9% for fruit. In total, the Turkey Ministry of Agriculture and Forestry estimated the direct economic cost of this drought for the whole country was €1.83 billion[18].
- Wildfires in August 2019 saw the destruction of 500 ha / 1,200 acres of land within the Urla region of Izmir. This fire was brought under control after 2 days thanks to 24 helicopters, 280 tankers of water and 35 bulldozers battling the flames. Villages had to be evacuated and a number of settlements were destroyed by the flames[19].

[16] European Environment Agency 2017: https://www.eea.europa.eu/data-and-maps/indicators/use-of-freshwater-resources-2/assessment-3
[17] Oray, N.C. et al., (2018) The Impact of a heat wave on mortality In the emergency department
[18] Engindeniz, S et al., (2013). Effects and Adaptation Measures of Drought in Turkish Agriculture: A Case Study of Tomato Farmers in Izmir, Turkey.
[19] Daily Sabah (August 19th,2019) "Wildfires destroy over 1,200 acres of land in western Turkey's Izmir". (https://www.dailysabah.com/turkey/2019/08/19/wildfires-destroy-over-1500-acres-of-land-in-western-turkeys-izmir)

Climate Change Projections:

National level temperature trends for Turkey have been developed as part of their National Communications (NC) to the UNFCCC. Up until 2100 and demonstrating the general direction of trend, these are:

- Average and maximum temperatures increase significantly while average precipitation decreases, particularly during summer months
- Increase in consecutive dry days and a decrease in frost days
- Increase in number of warm days and nights.

These trends are demonstrated by the seasonal breakdown of RCP4.5 and RCP8.5 emission scenario temperature change for Izmir (Figure 6), which reveals that average temperatures in the coldest months is expected to increase by more than 2°C by 2100, and by more than 3°C in the warmer months. Spring demonstrates a more significant increase in temperatures under both scenarios, with the greatest increase seen in Dikili, Konak, Ceşme and Ödemiş districts. In Autumn, the RCP 4.5 demonstrates an average change in temperature between -0.75 to 0.88°C, whereas RCP8.5 portrays an average change of 0.70 to 1.60°C.

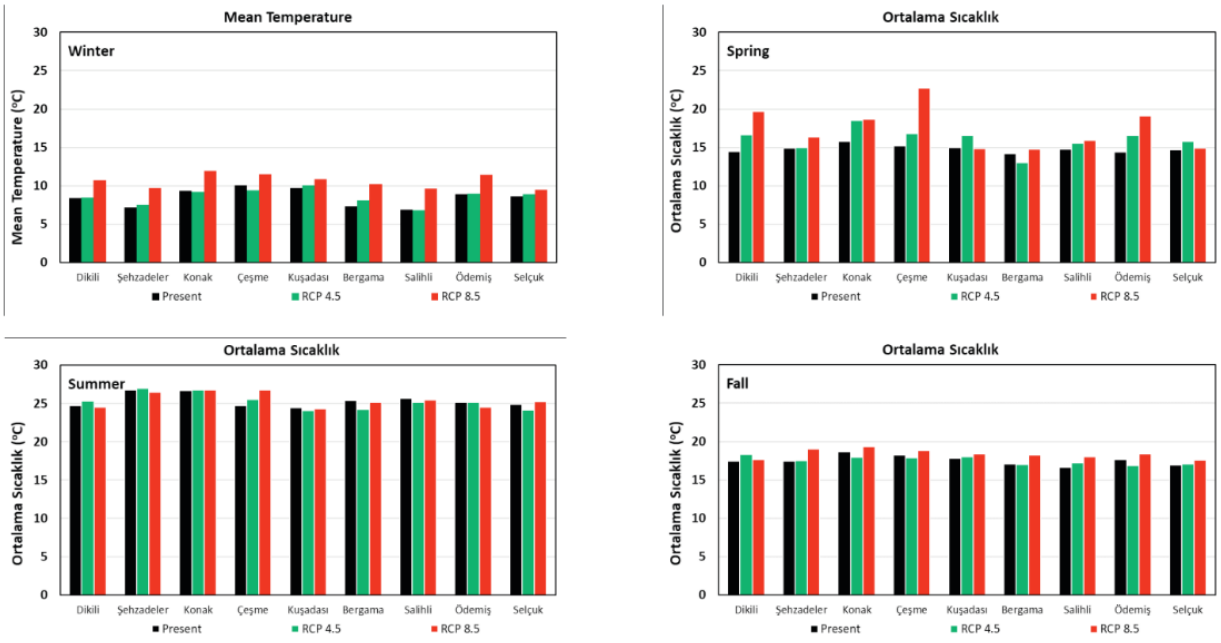

Figure 6: Seasonal average temperature data of the current (1971 – 2000) and future (2050-2100) period of Izmir climate stations[20]

[20] A Framework for Resilient Cities to Climate Change: Green Revision Guidebook;

The Climate Data Factory[21] also has maximum temperature projections for Izmir.

Figure 7 shows the average maximum daily increase in comparison to historic baseline up until 2100 from RCP 8.5, irrespective of mitigation policies. It shows that without significant intervention the average maximum temperature is projected to increase by between 2.4°C and 7.3°C.

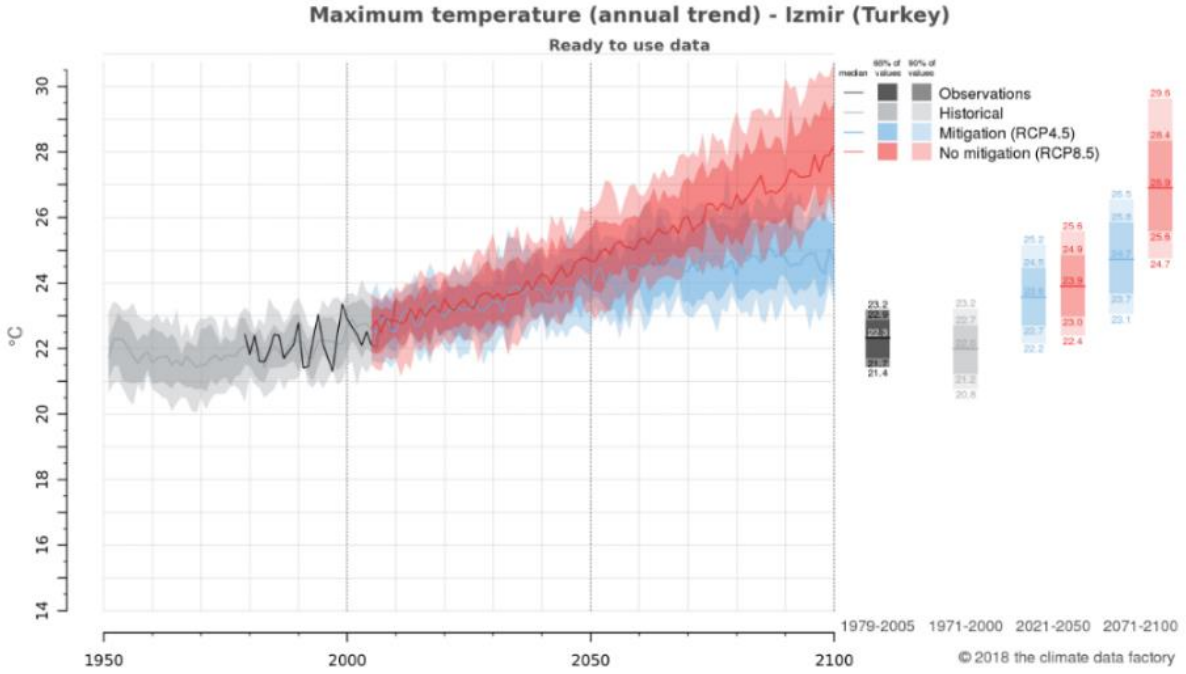

Figure 7: Maximum temperature (annual trend) for Izmir. RCP8.5 scenario is in red, with the blue demonstrating RCP4.5 with mitigating action[21].

A Framework for Resilient Cities to Climate Change: Green Revision Guidebook details climate projections for Izmir for 2050-2100 for the high emission scenario RCP 8.5, not considering mitigation actions, are demonstrated in Table 4 against a current day baseline. Its findings largely align with the projections from the Climate Data Factory in

Figure 7 and Turkey's 7th NC.

Table 4: Climate change projections for Izmir province, building on baseline / current day conditions. RCP 8.5 high emission scenario[21].

Variables	Current Day	2021-2050	2051 - 2100
Change in annual mean temperature (°C)	16.6	+ 1.7	+ 4.6
Change in annual maximum temperature (°C)	22.3	+ 1.6	+ 3.6

[21] Climate Data Factory (2018).(https://theclimatedatafactory.com)

A Framework for Resilient Cities to Climate Change: Green Revision Guidebook also analysed the number of consecutive dry days (in which rainfall is less than 1mm) for multiple districts within Izmir (Figure 8). The Arid days index was calculated for 25 yearly periods; 1971-200, 2050-2074, 2075-2099 using RCP.5 and RCP8.5 climate change scenarios. This analysis shows that the number of dry days in the regions of Dikili, Konak, Cesme, Kusadasi increase under both climate scenarios whereas Bergama, Seferihisar, Ödemiş and Selçuk regions see a decrease in umber of dry days under RCP8.5.

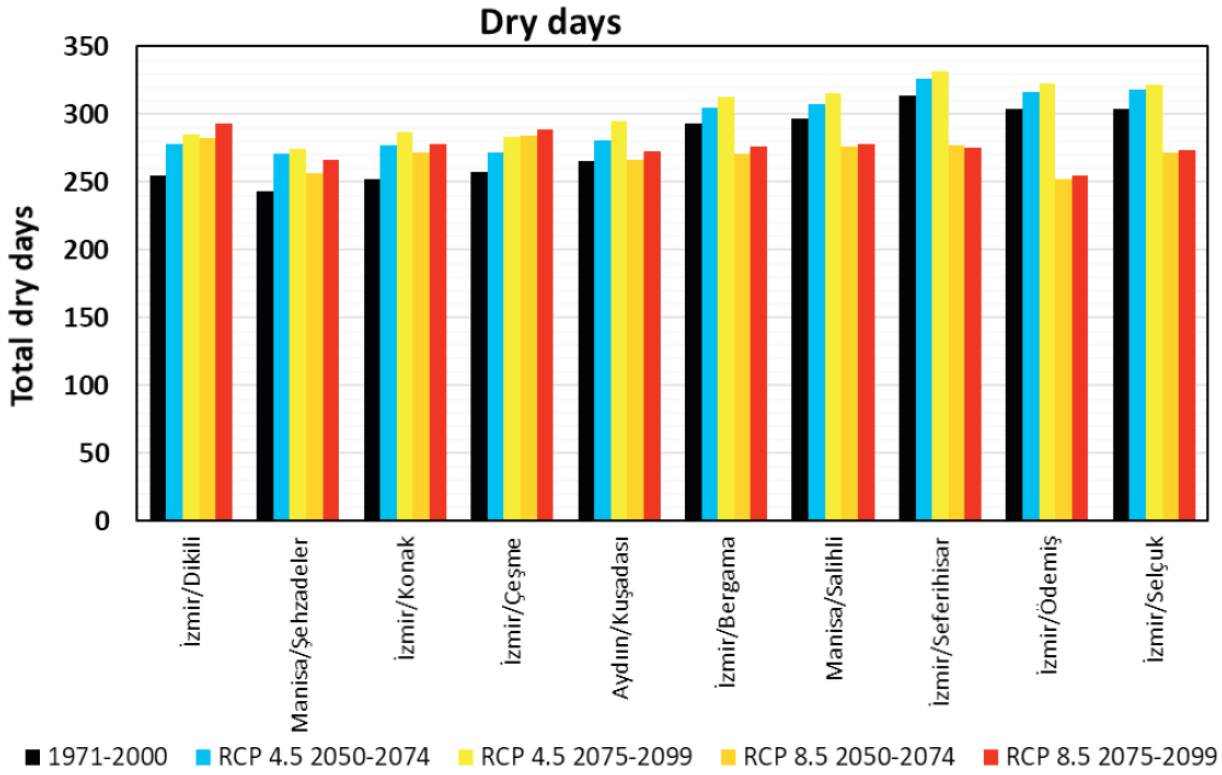

Figure 8 long term total consecutive dry days in Izmir region under RCP4.5 and RCP8.5 climate change scenarios.[22]

[22] A Framework for Resilient Cities to Climate Change: Green Revision Guidebook; 19.

Physical and Social Characteristics

As a rapidly growing population centre, Izmir has become one of the most densely populated cities in Turkey with an estimated 360 inhabitants per km^2 in 2019. This is reflected in the 2020 population statistics, which shows that Izmir is currently home to ~4.4 million people with the expectation that this will rise ~6.9 million by 2050[23]

A 2017 spatiotemporal study of the impact of the temperature trends of the urban heat island effect in Izmir, produced the map portrayed in Figure 9, which demonstrates the extent of artificial surfaces across the province[24].

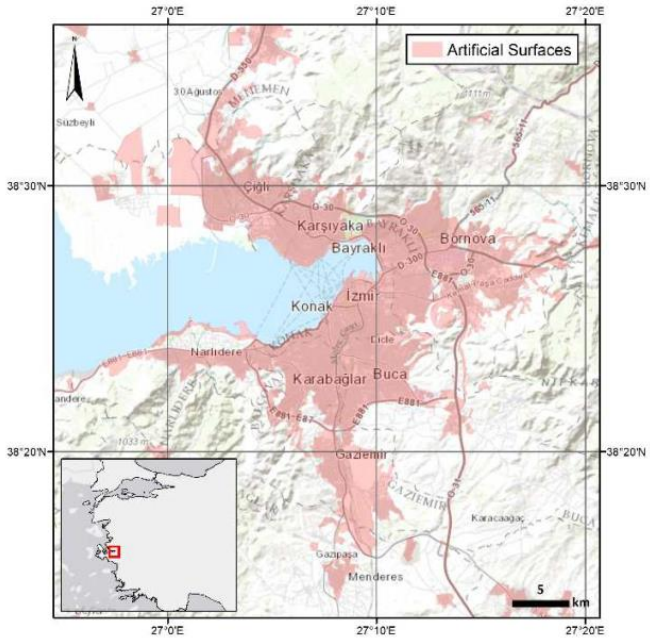

Figure 9: The artificial surface area of Izmir. 2017[24].

The city also has relatively little green infrastructure, especially within the central districts, with a low number of open spaces and limited vegetation for shading and passive natural cooling. In combination with the large areas of hard artificial surfaces, this contributes significantly to the urban heat island effect as materials such as asphalt and concrete store heat longer, gradually releasing it back into the air at night causing higher than average night-time temperatures.

This is also exacerbated by Izmir's current building stock, nearly 50% of which was constructed before 1990 with poor energy performance and low levels of insulation, alongside a number of informal settlements with limited connectivity to basic infrastructure. In order to maintain an adequate ambient temperature, cooling is required within the buildings in the form air conditioning units. Feeding warm air into the urban streets, air conditioning creates a feedback loop of rising heat which can result in serious health implications for Izmir's vulnerable population groups.

Izmir's population is made up of a number of different vulnerable groups, such as; the elderly, infirm, informal settlement residents, migrants and the homeless. As demonstrated in Table 5, the number of people above the age 65 has risen by 1.6% in just over 4 years, from 9.7% of the total population to 10.9%.

Table 5: Demographic breakdown of Izmir's population[25].

Year	Total Population	Age Groups			
		0-14	15-24	25-64	65+
2014	4,113,072	786,917	596,171	1,383,088	399,294
2015	4,168,415	792,879	595,101	1,387,980	419,031
2016	4,223,545	799,921	591,821	1,391,742	432,681
2017	4,279,677	808,490	589,597	1,398,087	450,925
2018	4,320,519	814,280	581,396	1,395,676	470,098

[23] http://www.tuik.gov.tr/PreTablo.do?alt_id=1059
[24] Doğukan Doğu Yavaşlı. Spatio-Temporal Trends of Urban Heat Island and Surface Temperature in Izmir, Turkey. American Journal of Remote Sensing. Vol. 5, No. 3, 2017, pp. 24-29. doi: 10.11648/j.ajrs.20170503.11
[25] http://www.tuik.gov.tr/PreTablo.do?alt_id=1059

Up untill 2019 it was reported that nearly 4 million refugees had entered Turkey, over 98% of whom are believed to be living in urban or semi-urban areas in informal or temporary settlements. Over 1.4 million of these refugees are believed to be under the age of 15[26]. With Izmir being a predominant location for people from Syria, Iraq and Afghanistan, both as a place of residence but also as a stopping point for their journey into Europe, they form a key aspect of the city's most vulnerable people.

As highlighted in the 2015 data from the Izmir Potable Water Master Plan[27], 66% of the provinces water supply comes from groundwater resources such as the alluvial aquifers, with 34% from surface water – predominantly the Gediz Basin, Kuzey Ege Basin and Küçük Menderes Basin[28] The alluvial aquifers of the Gediz river are an important groundwater resource for the centre of the province, however they face increasing threats from pollution from chemicals, bacteriological and heavy metals as the river drains surrounding agricultural and urban areas.

Izmir province also has 6 surface water storage facilities with a total capacity of 156 hm^3.year in order to supply the province. Izmir's water distribution network extends around 201,525 m in length, supplying 98% of its population with potable water[29]. Water quality is monitored through monthly measures at 80 locations throughout the network by the Provincial Directorate of Public Health and IZSU, with 100% of all water samples a year complying with national potable water quality standards.

A study in 2018 by the World Bank demonstrates the distribution of groundwater and surface water use across activities within Izmir province for 2013. Portrayed in Figure 10, this shows that 558 million m^3 of water is used in total, 57% of which was used for agriculture, with drinking water consuming only 16%.

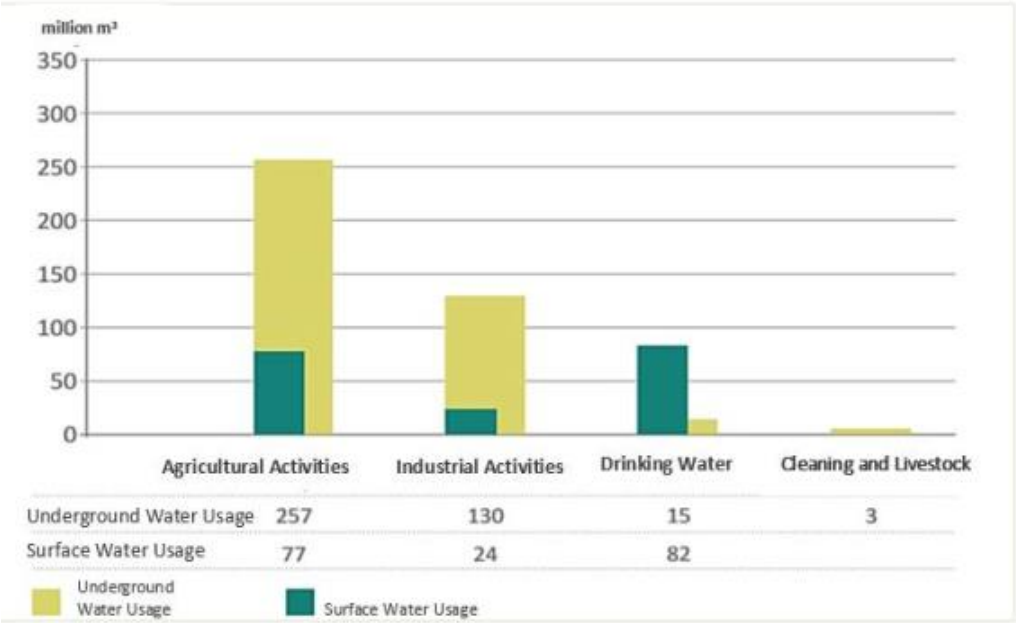

Figure 10: Distribution and annual use of groundwater and surface water in Izmir province (million m^3/year)[30]

[26] https://reliefweb.int/report/turkey/unhcr-turkey-fact-sheet-july-2019
[27] https://www.izsu.gov.tr/YuklenenDosyalar/Yayinlar/IzmirdeSuyunSeruveniEN/IzmirdeSuyunSeruveniEN.pdf
[28] Kucuksezgin, F. (2011) The Water Quality of Izmir Bay: A Case Study.
[29] IZSU Potable Water Master Plan
[30] Izmir Current Situation of Analysis IZKA. 2013. https://www.izka.org.tr/docs/strateji-analiz/mevcutdurumanalizi.pdf

3.1.2. Increased intensity, magnitude and frequency of extreme rainfall and storm events:

The occurrence of intense, high magnitude extreme rainfall events, including storms, can be observed to act as a catalyst for other cascading hazards such as flooding and landslides. By understanding Izmir's historical context, the impacts of climate change projections and its physical and social characteristics, it enables the analysis of how the hazards associated with extreme rainfall and storm events will evolve in the future

Historical Context:

The General Directorate of Meteorology for Turkey collates baseline historical data for rainfall within Izmir as portrayed in Table 6. This shows an annual average of 711mm over 78 rainy days for the period of 1938 – 2019. During this time, the highest daily total rainfall recorded was 145.33mm, occurring in September 2006.

Table 6: Monthly baseline climate for Izmir for a measurement period of 1938-2019.[31]

	Jan	Feb	Ma	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Average Rainy Days	12.7	10.8	9.2	7.9	5.3	2.2	0.5	0.5	2.0	5.4	8.8	12.8	78.1
Average of Total Monthly Rainfall Amount (MM)	136.1	102.3	75.6	46.0	31.3	11.6	4.1	5.7	15.8	44.6	93.7	144.3	711.1

Over the past 70 years, Izmir's extreme rainfall events have damaged approximately 250,000 residential in Izmir due to flooding[32], which is only second to earthquakes in terms of hazard impact. Some of the most recent example of flooding in Izmir include:

- A flash flooding in May 2017 which resulted in up to 1-meter deep water flowing through the streets of the Municipality, inundating houses, damaging infrastructure and sweeping away cars[33].
- Coastal flooding due to storm surges caused by 100km / hr winds was also occurred in January 2018[34], disrupting marine transport and damaging coastal properties.
- One of the biggest events in recent history in Izmir was the flash floods in 1995. This event was a result of a heavy and intense rainstorm over the Aegean cost, this flooding from which caused 61 fatalities and approximately $50 million worth of damage[35]. A large proportion of these impacts were focused within the Karsiyaka district.

Figure 11 below demonstrates 22 different locations of known flood events across Izmir, as well as portraying those areas perceived to be currently at risk from flooding.

[31] https://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?m=IZMIR
[32] Kutluca,A.K (N.D) The Izmir City and Natural Hazards Risk: Department of City and Regional Planning.
[33] https://watchers.news/2017/05/31/severe-flash-flood-izmir-turkey/
[34] https://www.dailysabah.com/turkey/2018/01/18/floods-hit-izmir-coastline-as-storm-causes-seas-to-surge-canceling-ferries-in-istanbul
[35] Kömüşçü, Ali Ümran. (1998). Analysis of Meteorological and Terrain Features Leading to the Izmir Flash Flood, 3–4 November 1995. Natural Hazards. 18. 1-25. 10.1023/A:1008078920113.

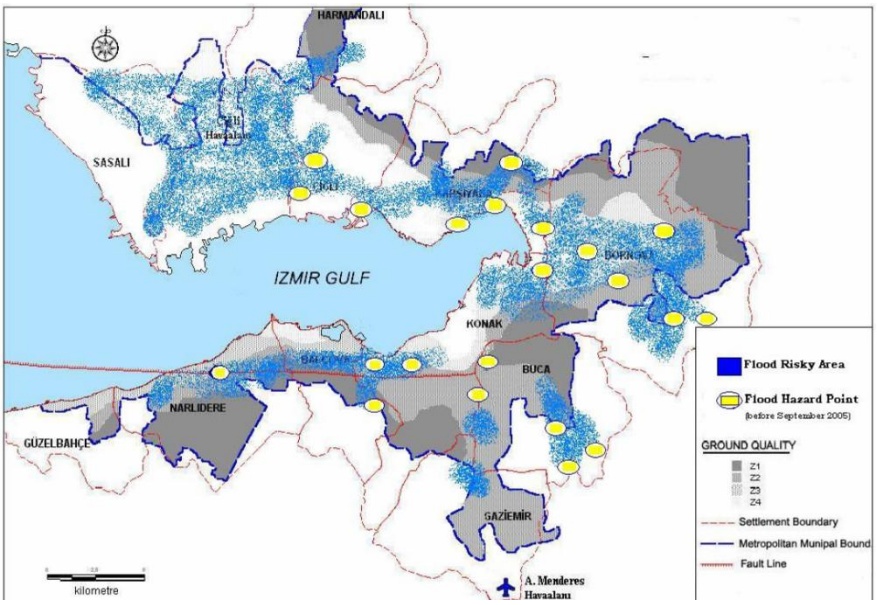

Figure 11: The left map demonstrates locations within the area of Izmir Gulf that are at risk to surface water flooding (blue areas) and the locaiton of known events (yellow squares).[36]

Unlike flooding, landslides often result in a more localized impact on buildings, the transport network and infrastructure and Table 7 below demonstrates the latest accessible figures of buildings known to have been damaged by landslide per district in Izmir.

Table 7: Major landslide areas in Izmir City (2008)[36]

Region	Damaged Buildings
Cigli - Guzeltepe	440
Konak – Gurcesme	10
Kadifekale	3162
Altindag – Merkez / Kuyu Camdibi	86
Hakimiyeti Milliye	64
Narlidere - Narkent	800

Figure 12 demonstrates the 11 areas across Izmir where landslides and / or rockfalls have been known to occur, showing a predominant North / South focus around the Gulf of Izmir.

[36] Kutluca,A.K (N.D) The Izmir City and Natural Hazards Risk: Department of City and Regional Planning.

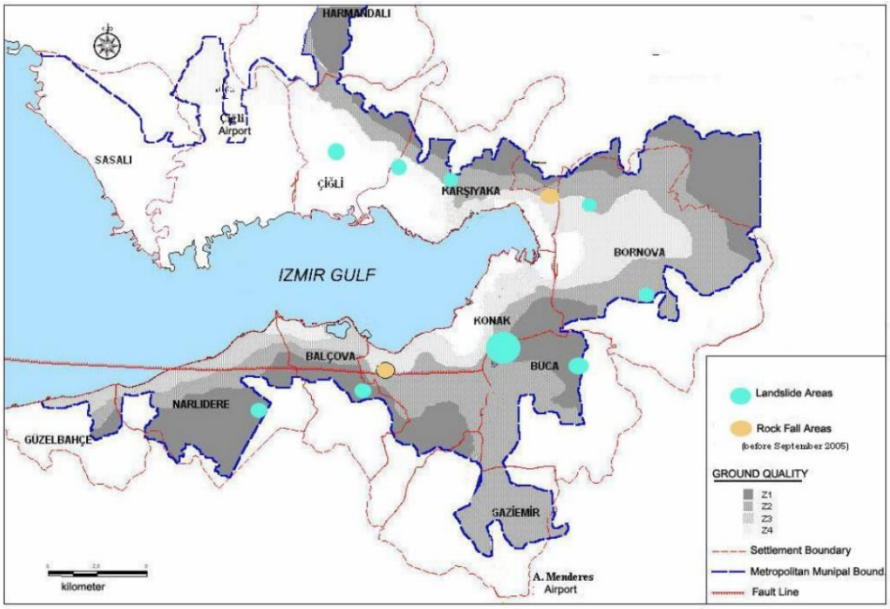

Figure 12: A map of known landslide and rockfall areas within Izmir.[37].

Climate Change Projections

The occurrence of flooding and landslides in Izmir is expected to only become more frequent and intense. Climate projection trends, such as those developed in Turkey's National Communications (NC) to the UNFCCC up until 2100 (i.e. general direction of change only), demonstrate an increase in the number of days that experience maximum precipitation events as well as a predicated increase in intensity, magnitude and frequency of storm events, and a predicted decrease in total annual rainfall.

This is demonstrated in Figure 13, which shows that despite an expected increase in extreme precipitation events, in spring summer and autumn periods it is expected that precipitation will decrease by 50% between 2050-2100 compared to the baseline[38] for both RCP4.5 an RCP8.5 scenarios. For winter, an overall increase in total annual precipitation aniticpated for RCP4.5, whereas RCP8.5 demonstrates a decrease, in-line with the other seasons

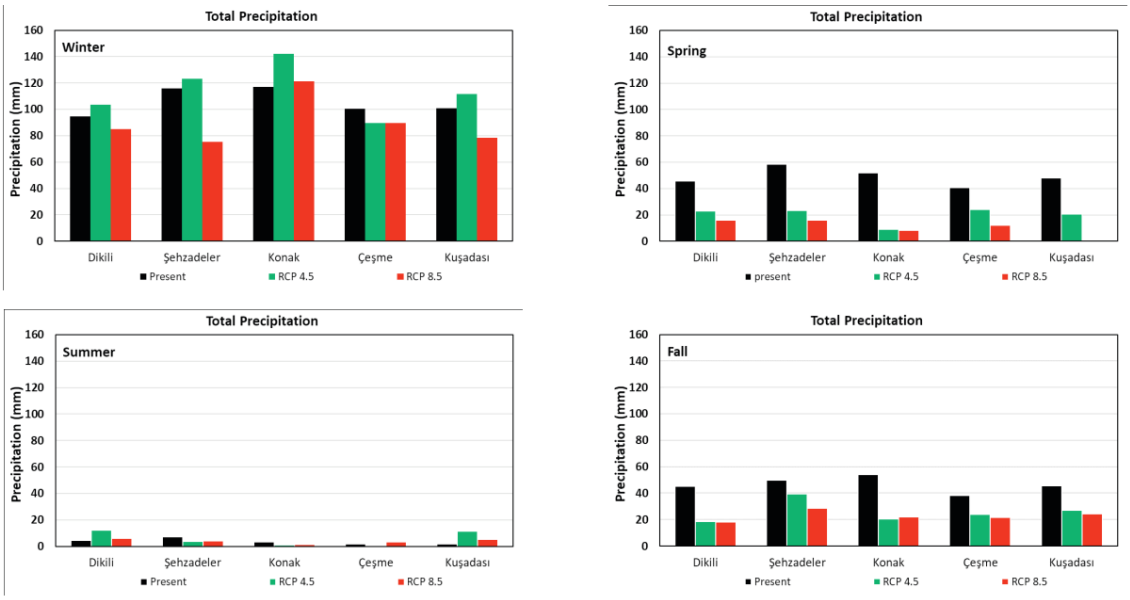

Figure 13: Total annual rainfall in Izmir climate stations for current (1971-2000) and future (2050-2100) period considering seasonality. [38]

Coupled with the expected increase in extreme rainfall events and storms, this demonstrates how rainfall will become more sporadic, with longer drier periods intersected by times of intense, high magnitude rainfall events.

[37] Kutluca,A.K (N.D) The Izmir City and Natural Hazards Risk: Department of City and Regional Planning.
[38] A Framework for Resilient Cities to Climate Change: Green Revision Guidebook, 2019.

This is demonstrated by the seasonal precipitation projections for Turkey, which shows the range of variation that is expected to occur as a result of climate change (Table 8).

Table 8: A summary of precipitation projections for Turkey, rainfall change (%) per season[39].

Model	Periods	RCP 8.5			
		Winter	Spring	Summer	Autumn
HadGEM2-ES	2016 - 2040	-20,+30	-30,+30	-40,+50	-40,+40
	2041 - 2070	-20,+30	-40,+40	-60,+60	-40,+40
	2071 - 2099	-30,+40	-40,+40	-60,+60	-50,+40
MPI-ESM-MR	2016 - 2040	-30,+30	-40,+40 -	-60,+50	-40,+40
	2041 - 2070	-30,+30	-40,+30	-60,+50	-40,+40
	2071 - 2099	-40,+50	-50,+30	-60,+30	-40,+40
GFDL-ESM2M	2016 - 2040	-40,+40	-30,+20	-30,+40	-40,+30
	2041 - 2070	40,+30 -	-30,+40	-40,+30	-40,+20
	2071 - 2099	-40,+40	-40,+40	-50,+30	-40,+40

This is also demonstrated by the prediction in the change the number of consecutive wet days (greater than or equal to 1mm of precipitation) for Izmir, as seen in Figure 14. This shows a decrease under RCP4.5, but an increase under RCP8.5 for all districts except Dikili, Konak, Çeşme and Kuşadası. Data is included for Manisa and Aydin is due to meteorological stations being located there.

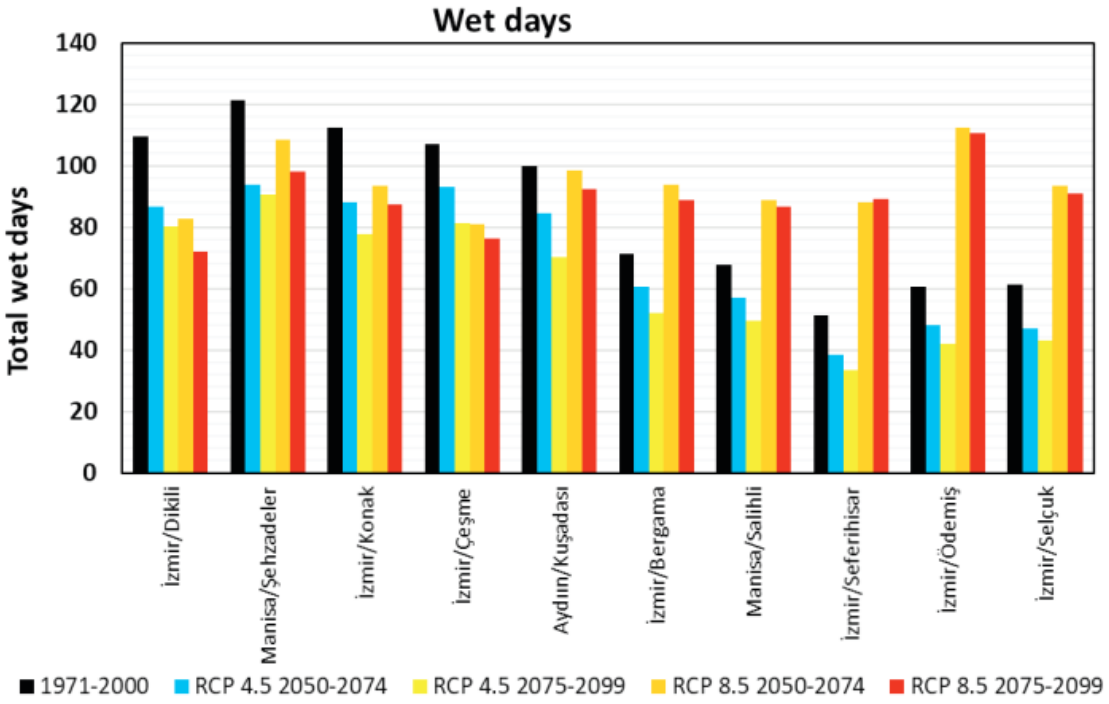

Figure 14: Long term total consecutive wet days for Izmir region under climate change.[40]

The predicted change in mean total rainfall for Izmir is also demonstrated in the below figure on a monthly basis, under the high emission scenario RCP8.5 for 2050 – 2100. This demonstrates the extremes that will be experienced annually within Izmir, peaking at 105mm of rainfall during the winter months; October through to January, with prolonged periods of minimal to zero rainfall between February and September.

[39] Demircan et al., (N.D) Climate Change Projections for Turkey: here Models and Two Scenarios.
[40] A Framework for Resilient Cities to Climate Change: Green Revision Guidebook, 2019.

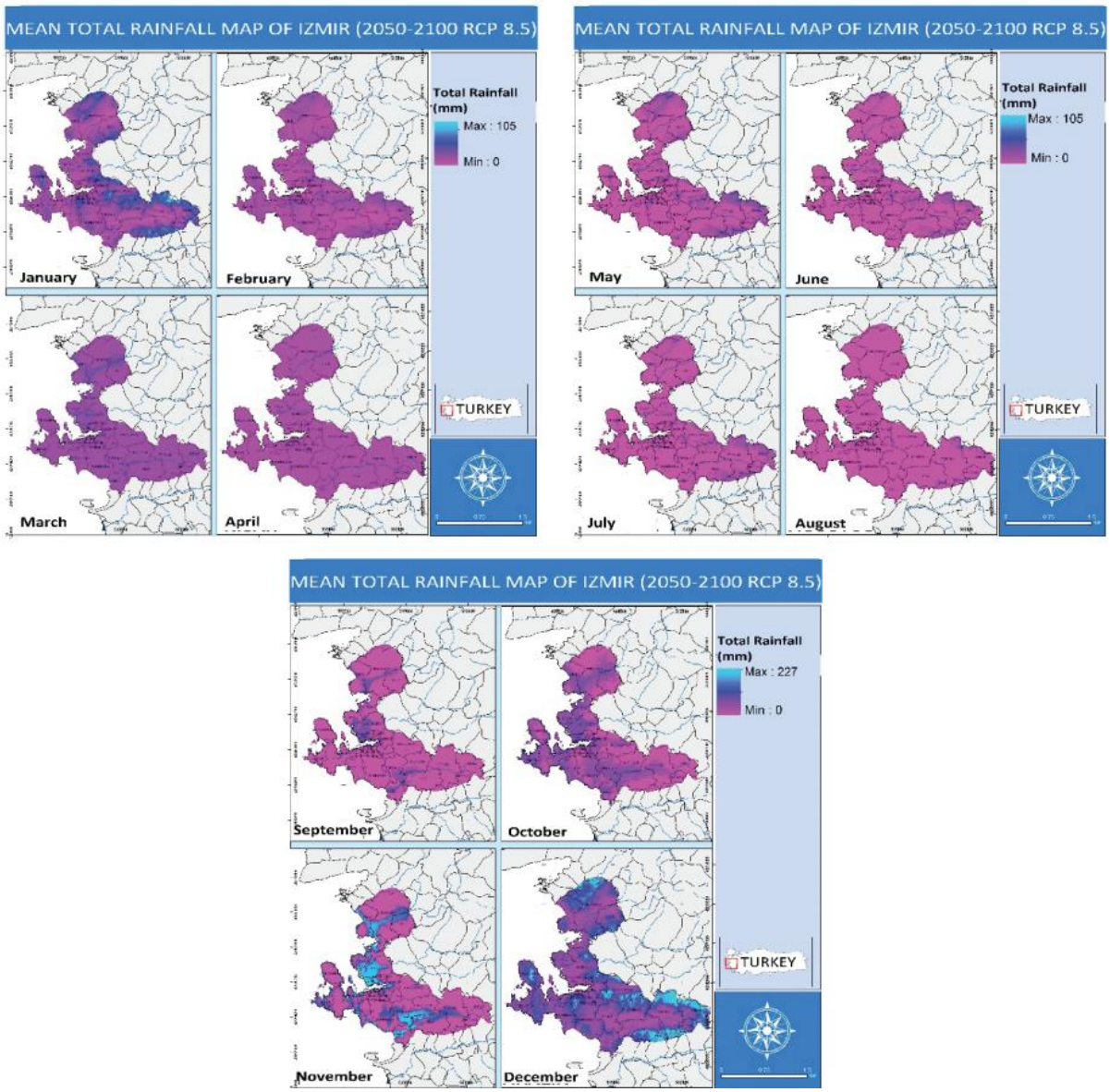

Figure 15: Long term (2050 - 2100) total precipitation maps of Izmir province using HadGEM-ES model and RCP8.5 Scenario[41].

Physical and Social Characteristics

Izmir's topographic and geological characteristics of steep and urbanised slopes bordering low-lying coastal and deltaic plans, located upon a major fault system that runs beneath the City, lends itself to be sensitive to both landslides and flooding.

The influence of extreme rainfall events on landslides is enhanced through the destabilisation of already vulnerable slopes, a characteristic of Izmir's geology due to the rock containing microfractures and existing faults lines, which leads to plains of weakness within the rock strength. When extreme rainfall events occur, increased erosions rates and saturated ground reduces soil strength, removes soil particles or other materials and lubricates the existing points of weakness.[42].

As well as the steep sloped topography, Izmir has over 60km of coastline along deltaic plains and wetlands which is predominantly urbanized and home to growing industrial activity, residential buildings and a growing number of informal settlements. The city's geography and continuously developing urbanised form will continue exposed Izmir to three key types of flooding; fluvial, surface/urban and coastal.

[41] A Framework for Resilient Cities to Climate Change: Green Revision Guidebook, 2019
[42] British Geological Society (https://www.bgs.ac.uk/research/engineeringGeology/shallowGeohazardsAndRisks/landslides/How_does_BGS_classify_landslides.html).

Izmir's current stormwater management infrastructure has limited capacity, with it being designed to collected both stormwater and wastewater simultaneously. IZSU reports an average of 1146 stormwater or sewerage overflow events per year along the 100km network.

In regard to fluvial flooding in Izmir, there is a particular focus on three key river basins'; Küçük Menderes Basin, Gediz Basin and Kuzey Ege Basin. Academic research undertaken in 2018 demonstrates the number inhabitants at risk to fluvial flooding in these key areas consist of nearly 6% of the total population of Izmir (Table 9).

Table 9: Number of inhabitants at risk to flooding within province of Izmir in 2018[434445].

River Basin,	Number of Inhabitants at Risk - 2018
KÜÇÜK MENDERES BASIN	195,841
GEDIZ BASIN	45,034
KUZEY EGE BASIN	12,927
Total population of the Basins:	253,802
Izmir Province Population	4,320,519
% of Population At Risk	**5.87%**

The Flood Management plans for these basins also demonstrates the economic loss that could be associated with flood events of various recurrence intervals (Q50, Q100 and Q500) across the relevant sectors. It is estimated that in present day condition due the occurrence of a 1 in 500-year flood event, Küçük Menderes Basin could suffer an economic loss of nearly €8 million, Gediz Basin nearly €9 million and Kuzey Ege just over €3 million. Sector specific information can be found in Table 10.

Table 10: Estimated economic loss (Euros) due to flooding across key sectors within the Küçük Menderes, Gediz and Kuzey Ege basins. Q50 = 1 in 50-yr, Q100 = 1 in 100-yr. and Q500 = 1 in 500-yr. recurrence intervals.

	Küçük Menderes Basin[43]			Gediz Basin[44]			Kuzey Ege Basin[45]		
	Q50	Q100	Q500	Q50	Q100	Q500	Q50	Q100	Q500
Agriculture	93,434,221	104,689,225	-	30,558,388	31,370,457	-	113,277,045	114,872,155	-
Buildings	41,146,022	65,919,695	136,823,409	36,104,290	52,394,574	79,089,441	5,244,699	6,583,399	10,936,475
Infrastructure (road)	42,872,220	57,636,671	112,306,692	16,640,076	20,838,930	31,168,803	5,746,587	7,820,950	15,785,982
Vehicle	46,261,364	63,184,091	168,782,576	21,572,727	27,750,000	38,529,545	2,413,636	3,436,364	6,484,091
Total	**223,713,827**	**1,429,682**	**7,912,676**	**104,875,48**	**2,353,961**	**8,787,789**	**6,681,968**	**2,712,868**	**3,206,548**

[43] Küçük Menderes Basin Flood Management Plan, T.C. Ministry of Agriculture and Forestry, General Directorate of Water Management, 2019, Ankara
[44] Gediz Basin Flood Management Plan, T.C. Ministry of Agriculture and Forestry, General Directorate of Water Management, 2019, Ankara
[45] Kuzey Ege Basin Flood Management Plan, T.C. Ministry of Agriculture and Forestry, General Directorate of Water Management, 2019, Ankara

3.1.3. A rise in average global temperatures:

With global emissions currently demonstrating an upward trend despite current mitigation measures, global temperatures are expected to continue to rise. Impacting both land and ocean temperatures, the historical increase in accumulated heat of nearly 0.95ºC[46] (as per 2019 comparative to the twentieth-century average) is already reducing snow cover and sea ice. This is stimulating some hazards to increase in prominence on a global scale, such as sea level rise, but also driving other hazards to diminish, such as the occurrence of extreme cold events in Mediterranean regions like Izmir.

Historical Context

The baseline climatic data for Izmir collated by the General Directorate of Meteorology for Turkey, demonstrates that monthly average minimum temperatures have not dropped below 5°C between 1938 - 2019. As seen in Table 11, the lowest ever temperature recorded throughout the period of 1938 to 2018 in Izmir was -8.2°C.

Table 11: Monthly baseline climate for Izmir for a measurement perid of 1938 – 2019.[47]

Climate Variable	Jan	Feb	Ma	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Average Temperature (°C)	8.7	9.5	11.6	15.8	20.7	25.3	27.8	27.6	23.6	18.8	14.2	10.4	17.8
Average Lowest Temperature (°C)	5.7	6.1	7.6	11.1	15.4	19.8	22.4	22.3	18.6	14.5	10.6	7.4	13.5
Lowest recorded Temperature (°C)	-8.2	-5.2	-3.8	0.6	4.3	9.5	15.4	11.5	10.0	3.6	-2.9	-4.7	-8.2

The most recent publicly available Tidal gauge data from Bodrum for a 19-year period of 1983 - 2002, demonstrate a rise in relative mean sea level of 6.8±0.9mm/year.[48]. This is consistent with global sea level rise estimates (although more recent reports have suggested these estimates are conservative).

In regard to past impacts experienced, sea level rise has yet to have a detrimental effect on Izmir. Coastal flooding during storm events have been known to disrupt transport activity and cause some damage to buildings as outlined in section 3.1.2. of this report. However, the Aegean Sea experiences a low amplitude tidal range. as a result of the Mediterranean's Sea's narrow outlet / inlet with the Atlantic Ocean. This low tidal range also reduces the extent and therefore impact from spring or king tides, which are known to cause significant disruption in other parts of the world with higher amplitude tidal ranges.

Extreme cold events are a rare occurrence in Izmir but have historically manifested in the form of cold waves, frosts, snowfall or hailstorms. Less common than in other areas of Turkey, cold air masses do arrive over the city, causing temperatures to drop as low as -8ºC[49] as demonstrated in Table 11 resulting in night frosts.

Snowfall is rare within Izmir but has been known to occur, from light snowfall to blizzards. In 2004, one blizzard event shut down schools and several roads across Izmir[50], with a snow fall observed in Izmir in February 2012, reportedly the first snow falls to occur in the city for 21 years[51]. Incidents of heavy snowfall are known to be more common in other areas across Turkey such as Istanbul, Ankara and the wider Aegean region, disrupting the regional and national transport network due to cancelled or delayed flights and traffic incidents.

Climate Change Projections:

As shown in section 3.1.2, regional projections for rising temperature demonstrate a near 5ºC rise by 2100 against current day baseline period, as see in Table 12.

[46] Lindsey, R & Dahlman, L (2020). Climate Change: Global Temperature. Climate.gov (https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature)
[47] https://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?m=IZMIR
[48] Kuleli, T. (2010). City-Based Risk Assessment of Sea Level Rise Using Topographic and Census Data for the Turkish Coastal Zone.
[49] https://www.climatestotravel.com/climate/turkey/izmir
[50] https://www.terradaily.com/2004/040123103147.s7b3sh7u.html
[51] http://turkishlifecafe.com/turkish-living/returned-from-dikili-izmir/

Table 12: Climate change projections for Izmir province, building on baseline / current day conditions. RCP 8.5 high emission scenario[52].

Variables	Current Day	2021-2050	2051 - 2100
Change in annual mean temperature (°C)	16.6	+ 1.7	+ 4.6

This rise is further portrayed within Izmir's annual temperature trend from 1950 – 2100 in Figure 16 with the red curve demonstrating the RCP8.5 projection pathway, with no consideration for mitigation measures.

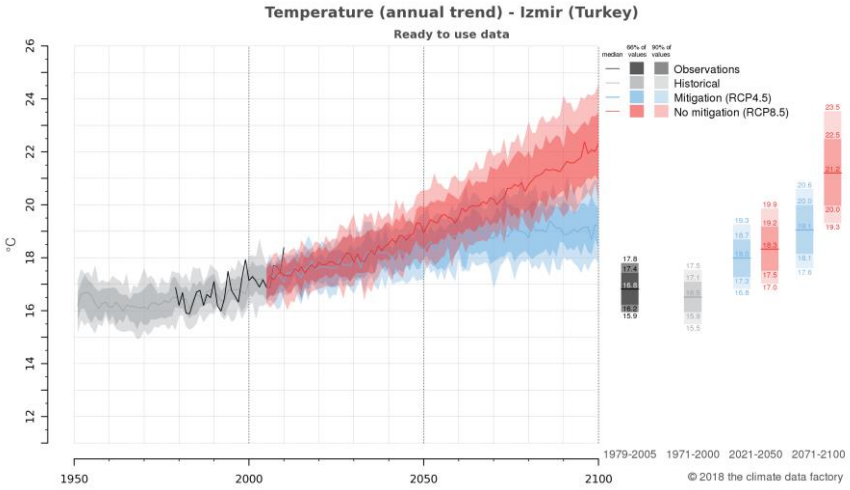

Figure 16: Temperature (annual trend) for Izmir Turkey. Incorporating high emission scenarios RCP8.5.[53]

This anticipated rise in annual average temperatures for Izmir province can be reflected in the below map, which demonstrates the shift between the historical baseline and future temperature projections under the high emission scenario RCP8.5.

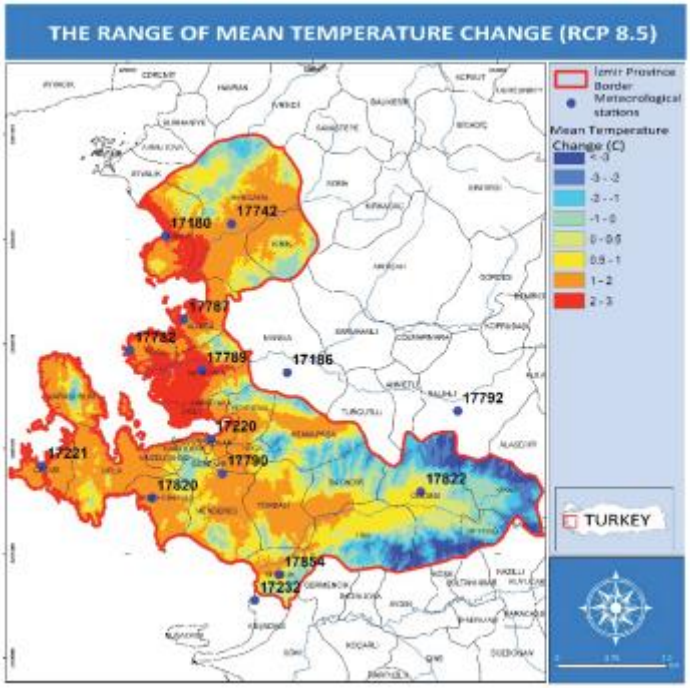

Figure 17 Change in annual temperature for Izmir province between current (1971 - 2000) and future (2050-2100) RCP8.5 scenarios.[52]

[52] A Framework for Resilient Cities to Climate Change: Green Revision Guidebook, 2019
[53] Climate Data Factory (2018).(https://theclimatedatafactory.com/).

In line with average temperature rise, Table 13 contains IPPC's AR5[54] predicted range for global sea level rise until 2100 under the RCP8.5 high emission scenario.

Table 13: Historical and projected sea level rise (SLR)[54].

Variable	< 2100
Total SLR (mm)	520 – 980mm

Physical and Social Characteristic

As a coastal city and province, Izmir has approximately 60km of coastline within 10m elevation of sea level. A 2010 study shows that coastline contains 21 settlements housing a population of 116,147 covering a land area of 754.96km^2.

This low-lying coastal land also houses a large quantity of Izmir's economic activity, placing it within a "more" vulnerable category for coastal cities in Turkey as demonstrated in Figure 14. The 2010 study[55] ranked Izmir as the second most at risk province only behind Antalya. The risk scoring account for location, population rate, income from national budget, agricultural production rate, settlements built, and population housed in low elevation zones.

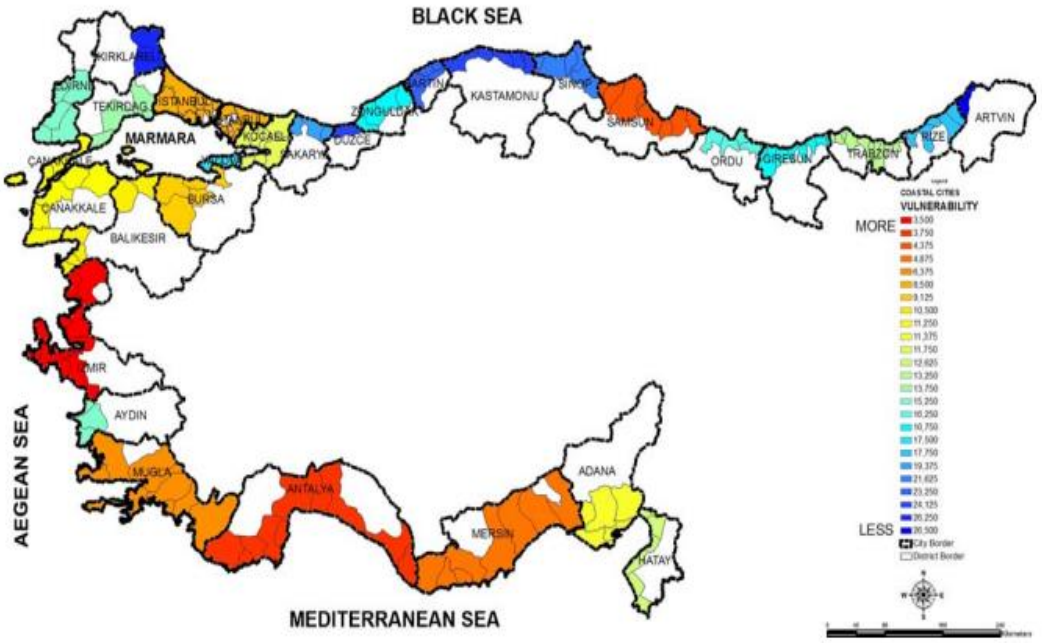

Figure 18: A vulnerability map of coastal cities in Turkey[55].

With Izmir's economic activity concentrated in low-lying coastal areas, the loss of this land due to sea level rise could have a catastrophic impact on both the region's and Turkey's GDP. **Error! Reference source not found.**[55] demonstrates the potential land loss along Izmir's coastline due to projected sea level rise.

[54] Church, J,A., Clark, P.U. (2018). Sea Level Rise. IPCC AR5 Chapter 13.
[55] Kuleli, T (2010) City Based Assessment of SLR

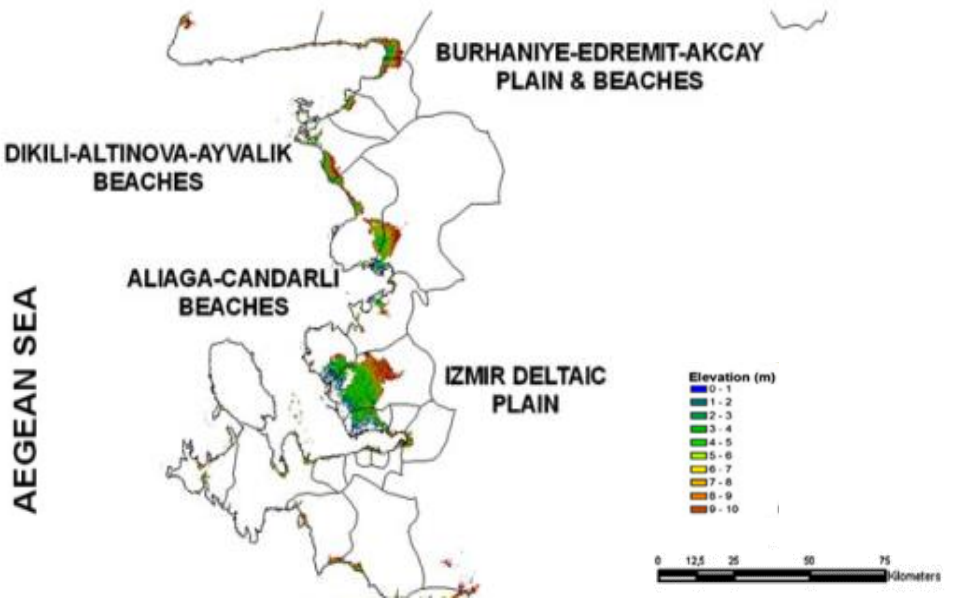

Figure 19: Potential land loss on the Aegean cost around Izmir[55].

The agricultural utilization of these low-lying, vulnerable areas within Izmir is as follows (Table 14):

Table 14: Utilisation of Agricultural Areas in Izmir[56]

Land use Type	Area of land (Decare [10 Acres])		
	1996	2006	2016
Cereals and Other Cultivated Crops	810,150	1,744,829	1,346,383
Fruits, Plants for Drink and Spices Area	1,342,410	1,329,945	1,485,156
Vegetable Gardens Area	435,970	434,757	393,090
Fallow Land	6,470	29,795	30,420
Ornamental Plant Area	-	30,420	16,181
Total Area	3,595,000	3,569,746	3,271,230

Izmir's agricultural production is ranked third an both livestock and vegetative production in Turkey. The provincial agricultural sector of the wider Aegean Region is 22.4%, which accounts for 4% of Turkey's agricultural Gross Value Added (GVA). As a major livestock producer, the meat produced in Izmir accounts for 9.5% of the Turkey's total production. Turkey's agricultural exports were calculated at a value of USD 9.2bn in 2017[57].

[56] Turk Stat 2017.
[57] Key Agricultural Product Risk Assessment (KAPRA). Report on the Financial Resilience of Key Agricultural products to Climate Change. The World Bank. 2018.

3.2 Risk Assessment

The following section summarises the key current and future risks, as well as opportunities, relating to the 12 key sectors outlined within the CoM methodology. The risks that are outlined in detail within tables throughout this section are only those where a score of 'high' against the GCoM defined risk matrix (as laid out in Appendix D) assigned in relation to the timeframe of occurrence for the impact outlined. The detailed breakdown of all aspects of the risk and vulnerability assessment can be found in the associated CoM Reporting template excel workbook and Appendix E.

3.2.1. Hazards

The first step of this risk assessment process was to apply an overarching current day risk rating to the 9 primary hazards presented by the CoM methodology based on the historical context of Izmir's climate events. As a result of this analysis, 6 of the 9 hazards identified came out as having a 'high' risk level, 2 as 'moderate; and 1 as 'low'. These are outlined in Table 15 below.

Table 15: Primary Climate Hazards and current risk level allocated.

Climate Hazards	Current Risk Level
Extreme Heat	**High**
Extreme Cold	**Low**
Extreme Precipitation	**High**
Floods (Fluvial and Urban)	**High**
Sea Level Rise	Moderate
Droughts	**High**
Storms (high winds)	Moderate
Landslides	**High**
Forest Fires	**High**

3.2.2. Impact Pathways

The second step in this risk assessment process was to identify and develop sector specific impact pathways (i.e. possible ways they could be affected by climate hazards) associated with the 9 CoM defined hazards. A risk rating was then applied against the predicted timeframe of this impact occurring. This assessment identified 33 impact pathways across the 12 sectors. In summary:

- Of these 33 impact pathways across all timeframes, 14 were identified as 'high' risk, 17 as 'moderate' risk and 2 as 'low' risk against the GCoM defined risk matrix.
- Of the 12 sectors analysed, 7 are were associated with impact pathways that were identified as having a 'high' risk rating. The other 5 sectors contain impact pathways identified as having 'medium' and 'low' risk ratings only.
- A single impact pathway associated with 'current day' and was assigned a risk rating of 'moderate'. Specifically, this impact was in relation to the exacerbation of extreme event impacts by the occurrence of Earthquakes.
- In the short-term timeframe (<2040), 1 impact pathway was assigned a 'low' risk score and 9 as 'moderate' 12 were scored as 'high', specifically related too:
    - Damage to and loss of buildings from extreme weather events
    - Inundation of urban and industrial areas due to flooding.
    - Rising water scarcity, reduced water quality and ground-water recharge rates.

- Increased maintenance costs of infrastructure.
- Fuel build up resulting in forest fires,
- Loss and damage to livestock, forestry land and crops from extreme weather events
- Ecosystem degradation, habitat and species loss.
- Illness, injury or loss of live.
- Pressure on civil protection and emergency agencies

- In the medium-term (2041 – 2070), 1 impact pathway was assigned a 'low' risk score and 7 as 'moderate', with no impacts being given a risk rating of 'high'.
- Two impact pathways were assigned to the long-term timeframe (2071-2100), both of which were assigned a risk rating of 'high' and related to sea level rise.

Agriculture and Forestry

Three 'high' rated risks were identified for agriculture & forestry sector, in relation to flooding, sea level rise and forest fires. Anticipated to be influenced by climate change in the short-term, both flooding and forest fires have the potential have a catastrophic impact on agricultural crops, livestock and natural forest – damaging yields, causing fatalities amongst the animals and destroying forest cover. In the longer-term, due to Izmir's coastal location, sea level rise will begin to inundate low-lying agricultural land, salinizing groundwater sources which Izmir's industry rely upon.

Table 16: High rated risk impact pathways for the Agriculture & Forestry sector.

I.D	Sector	Primary Hazard(s)	Impact Pathway	Timeframe of Occurrence	Risk Rating
IM18	Agriculture & Forestry	Flooding	River and surface water flooding could result in the damage too, and the inundation of low-lying agricultural land causing the destruction and loss of crops and livestock.	Short-term	**High**
IM19	Agriculture & Forestry	Sea Level Rise	Sea level rise could result in the damage too, and the inundation of low-lying agricultural land causing the destruction and loss of crops and livestock, alongside the salination of ground water sources used for irrigation.	Long-term	**High**
IM20	Agriculture & Forestry	Forest Fires	Forest fires damaging and destroying agricultural and forestry land alongside livestock.	Short-term	**High**

Building

Two impact pathways were rated as 'high' for buildings, with a focus on damage from landslides and flooding. Known as hazards that have severely impacted buildings in the past, albeit localised, a rise in extreme precipitation events as well as longer dry spells due to climate change result in these hazards being anticipated to become more prominent in the short-term.

Table 17: High rated risk impact pathways for the Building sector.

I.D	Sector	Primary Hazard(s)	Impact Pathway	Timeframe of Occurrence	Risk Rating
IM2	Building	Flooding	Surface water and riverine flooding events causing damage to / inundation of buildings within the municipality.	Short-term	**High**
IM3	Building	Landslides	Land-slides result in the damage and loss of buildings within the Municipality.	Short-term	**High**

Civil Protection and Emergency

The single impact pathway within the sector of civil protection and emergency that was assigned a risk rating of 'high' is in relation to the potential strain on civil protection and emergency agencies from climate hazards. With Izmir being exposed to numerous cross-cutting hazards, all of which are predicted to build in intensity and frequency over the short to longer term timeframes due to climate change, this impact will begin to be experienced in the short-term, in some cases with fatal consequences.

Table 18: High rated risk impact pathways for the Civil Protection and Emergency sector.

I.D	Sector	Primary Hazard(s)	Impact Pathway	Timeframe of Occurrence	Risk Rating
IM27	Civil Protection & Emergency	Extreme Heat Extreme Precipitation Floods Storms Landslides Forest Fires	The more frequent occurrence of extreme events will result in the Increased deployments and pressure on civil protection and emergency agencies.	Short-term	**High**

Environment & Biodiversity

Of the three impact pathways associated with Environment & Biodiversity sector, two were allocated a risk rating of 'high'. Both of these impact pathways demonstrate either anticipated ecosystem degradation or habitat and biodiversity loss due extreme events and their cascading impacts – whether drought forest fires of extreme temperatures. Climate change projections demonstrate that these climate hazards will become more prominent in the short term.

Table 19: High rated risk impact pathways for the Environment & biodiversity sector.

I.D	Sector	Primary Hazard(s)	Impact Pathway	Timeframe of Occurrence	Risk Rating
IM21	Environment & Biodiversity	Extreme Heat Droughts Forestry Fires	Extreme climate events damaging and /or destroying the natural environment resulting in ecosystem degradation, habitat and biodiversity loss.	Short-term	**High**
IM23	Environment & Biodiversity	Drought	Increased periods of drought will reduce the water levels in rivers and other fresh-water bodies and Gulf of Izmir, reducing the natural environments capacity to manage wastewater and run-off pollution, causing habitat and species loss and eutrophication.	Short-term	**High**

Health

One impact pathway for the health sector was allocated a risk rating of 'high'. This impact pathway is in relation to, illness or loss of human life as a result of a climatic event. With climate change expected to increase the frequency, magnitude and intensity of climate events, it is anticipated that a greater risk to human health and life will be posed over the short-term.

Table 20: High rated risk impact pathways for the Health sector

I.D	Sector	Primary Hazard(s)	Impact Pathway	Timeframe of Occurrence	Risk Rating
IM24	Health	Extreme Heat	Extreme heating exacerbating the urban heat island effect, resulting in an increase in heat related illness, disease and mortalities.	Short-term	**High**

Land-Use Planning

Of the five impact pathways identified for land-use planning, three were allocated a risk rating of 'high'. Land-use planning in Izmir has the potential to be impacted by and also exacerbate all high-risk hazards identified the current day hazard assessment. In the short-term, floods, forest fires and droughts can damage, inundated and destroy

urban and industrial / agricultural lands, with climate projections demonstrating a rise in intensity, magnitude and frequency of the climate hazards that cause these impacts. In the longer-terms, due to Izmir's predominantly low-lying, coastal nature, large areas of land are exposed too; climate change projections for sea level rise will mean large areas are at a high risk from being inundated.

Table 21: High rated impact pathways for the Land-use Planning sector.

I.D	Sector	Primary Hazard(s)	Impact Pathway	Timeframe of Occurrence	Risk Rating
IM13	Land Use Planning	Floods	Surface/ river flooding causing the inundation of urban or industrial land.	Short-term	**High**
IM14	Land Use Planning	Sea Level Rise	Sea Level Rise causing the inundation of urban or industrial land.	Long-term	**High**
IM15	Land Use Planning	Forest Fires Extreme Heat Drought	Rising temperatures and prolonged periods of drought will dry out landscapes, causing fuel build up that result in the occurrence of forest / wildfires.	Short-term	**High**

Water

This assessment revealed two impact pathways identified as having a 'high' risk for Izmir, the prominent of these being a risk associated with an increase in water scarcity, decrease in water quality and a reduction in ground-water recharge rates due to extreme heat conditions and prolonged periods of drought. This could result in numerous cross-cutting impacts for key water-dependent industries and environments, having a detrimental impact on human health. The second in relation to Izmir's water management capacity and infrastructure, with an expected increase in the magnitude of extreme precipitation events and the associated flooding increase maintenance costs across the network.

Table 22: High rated impact pathways for the Water sector

I.D	Sector	Primary Hazard(s)	Impact Pathway	Timeframe of Occurrence	Risk Rating
IM8	Water	Extreme Heat Droughts	Rising temperatures and drought periods increasing water scarcity, decreasing water quality and reducing ground-water recharge rates.	Short-term	**High**
IM9	Water	Extreme Precipitation Floods Storms	Extreme weather events increasing the demand on, causing damage too and peaking the capacity of the wastewater and stormwater management infrastructure resulting in flooding and increased maintenance costs.	Short-term	**High**

Other Sectors

It is important to acknowledge that all other impact pathways and potential opportunities assessed during this RVA, including those for the remaining sectors: Energy, Tourism, Transport and Waste can be found in in the associated CoM Reporting template excel workbook. Only sectors that contained examples of 'high' risk impact pathways has been incorporated within the body of this report.

3.3. Vulnerabilities

In order to gain a high-level understanding of Izmir's vulnerabilities, descriptions were developed and split into socio-economic and physical and environmental. In total thirteen vulnerability descriptions were developed, with each one being allocated with indicators to help inform and monitor how these evolve with time. The full matrix for vulnerability descriptions can be found in associated CoM Reporting template excel workbook.

Table 23: Socio-Economic vulnerability descriptions.

I.D	Vulnerability Descriptions
SE-A	Izmir's major tourist hubs and large areas of highly productive agricultural land, and other key industries, are located in Izmir's low lying deltaic plain and wetlands. Areas include the Gediz Basin and the Küçük Menderes Basin.
SE-B	Many of Izmir's key industries (agricultural, automotive, chemical, food and tourism) rely heavily on water availability and climatic conditions. Izmir has over 300 companies operating in the chemical sector and its food industry exports 11% of Turkey's food and beverage (e.g. pine nuts). Employment and local GDP is heavily influenced by these industries.
SE-C	Many of Izmir's industries rely on local, regional and international supply chains and trade routes, which can be disrupted to climatic events.
SE-D	Izmir's population demographic consists of a number of vulnerable communities, such as; the elderly, informal settlement residents, migrants, homeless, infirm.
SE-E	Izmir has a high and rising population density with roughly 3m residents living in dense urban environments.

Table 24: Physical & Environmental Vulnerability descriptions.

I.D	Vulnerability Descriptions
PE-A	Izmir is located on the coast of the Aegean, with 60km of low-lying (within 10m of sea level) coastline and riverine flood plains, which are exposed to riverine and coastal flooding. This includes areas such as the Gediz Basin and the Küçük Menderes Basin.
PE-B	Izmir's topographic characteristics include steeply sloped terrain which borders the low-lying coastal and deltaic plains, exposed to landslides and flash flooding.
PE-C	The city of Izmir is surrounded by significant natural land cover, primarily made up for forests and grasslands / meadows which are under pressure for urbanization.
PE-D	Izmir's urban form predominantly consists of artificial, impermeable urban surfaces with a limited stormwater water management capacity
PE-E	Izmir contains multiple informal settlements, predominantly built in low-lying areas to a poor standard with minimal consideration for accessibility and limited infrastructure support (energy, water, sewage) which, if present, are connected illegally
PE-F	Izmir's current building stock has limited consideration for earthquake design standards
PE-G	Fresh water and marine environments are exposed to high levels of water pollution due to the proximity and activity of existing land-use practices such as dense urban areas and key industry (e.g. agriculture, port, tourism), being located in low-lying coastal areas and deltaic planes
PE-H	Izmir's Mediterranean climate with mild winters and hot dry summers promotes water scarcity issues. It's location on the coast also exposes the ground-water sources (e.g. aquifers) to saline intrusion.

4. Justification of Input: Mitigation

4.1. A summary of SEAP inventory

As part of IBB's commitment to the Covenant of Mayors in 2016, a Baseline Emission Inventory (BEI) was prepared using data from 2014. The BEI 2014 included the building, transportation, and waste and wastewater treatment sectors. At the time, a decision was made to exclude the industrial, agriculture and aviation sectors on the basis that these are out of IBB's ability to control through policy mechanisms. This is in line with The International Local Government GHG Emissions Analysis Protocol (IEAP) by ICLEI and Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' by European Commission Joint Research Centre. The development of the SEAP accounted for IBB's short to long term strategic plans, and incorporated suggestions from stakeholder workshops, academics, the regional development agency, industrial and commercial associations as well as other public institutions, professional organizations and NGOs.

The BEI 2014 GHG emissions inventory calculated for the SEAP is shown in the Table 25 below. Note that, although excluded from the 2014 SEAP, emissions from the agricultural sector have added to enable comparison with 2018 figures (presented in Section 4.2). The same methodology has been used to calculate enteric fermentation, manure management and irrigation emissions.

Table 25: Izmir GHG Emissions 2014

Sector	MWh	tCO_2e	%
Total for Izmir	**62,591,032**	**21,869,346**	**100%**
Building, Equipment/Site	**43,591,022**	**13,698,579**	**62.6%**
Municipality Buildings/Sites	178,364	74,691	0.3%
Tertiary Buildings/Sites other than Municipality	3,632,902	1,612,035	7.4%
Residential	7,670,683	2,725,513	12.5%
Public Lighting	199,645	98,744	0.5%
Industry	31,909,428	9,187,597	42.0%
Transport	**16,268,206**	**4,309,141**	**19.7%**
Municipality Vehicle Fleet	82,758	22,445	0.1%
Public Transportation (Municipality Buses)	597,525	162,260	0.7%
Public Transportation (Electricity Systems)	116,379	57,561	0.3%
Other Vehicles	13,243,752	3,484,648	15.9%
Transit – Bus Station	205,980	55,935	0.3%
Aviation	2,021,811	526,292	2.4%
Other Emissions	**335,744**	**3,376,848**	**15.4%**
Solid Waste Disposal	-	506,704	2.3%
Wastewater Treatment	-	112,021	0.5%
Wastewater Treatment Process CH_4	-	*22,463*	0.1%
Wastewater Treatment Process CO_2	-	*56,884*	0.3%
Wastewater Treatment Process N_2O	-	*9,462*	0.0%
Wastewater Treatment Process Without Nit./Denit.	-	*164*	0.0%
Wastewater Discharge N_2O	-	*23,048*	0.1%
Fugitive Emissions		468	0.0%
Process Emissions of Industry		1,355,049	6.2%
Livestock, manure management	-	1,236,548	5.7%
Irrigation	335,744	166,058	0.8%
Energy Generation	**2,396,060**	**484,778**	**2.2%**
Fuel Consumption for energy generation	2.396.060	484.778	2.2%

As shown in Table 25, total greenhouse gases emissions of Izmir were calculated as **21,869,346 tCO_2e** for 2014. According to the table, building sector emissions account for around 62.6% of the total emissions, while transportation is 19.7%. Process emissions of industry is 6.2%, solid waste disposal and wastewater treatment is 2.8%, while agriculture and livestock related emissions are almost 5.7%.

While the emission per capita including industry, aviation and energy generation is **5.32** tCO_2e, the emission per capita excluding industry, aviation and energy generation is **2.17 tCO_2e.**

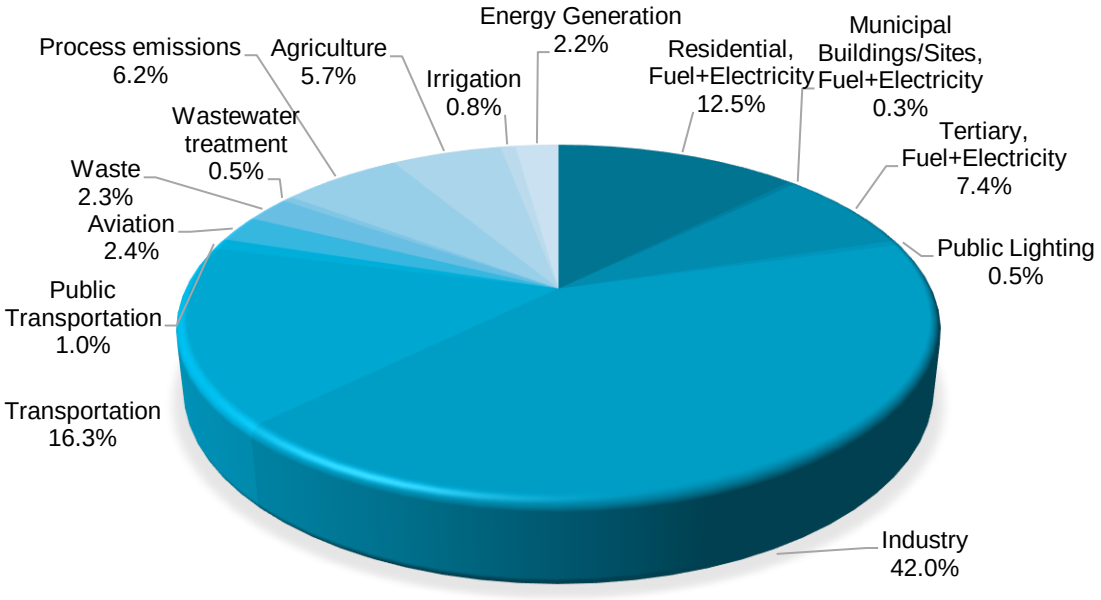

Figure 20: Izmir BEI 2014

According to the Figure 20, the highest greenhouse gas emissions are industry-sourced with 42% in 2014. Other greenhouse gas emission emission sources are followed by transportation with 16.3% and residential with 12.5%. The Sustainable Energy Action Plan, which was based on this baseline emissions inventory, set a target of reducing total urban emissions by 20%, primarily through intervention measures aimed at the building and transportation sectors.

4.2. Baseline Emissions Inventory SECAP Update

City scale GHG emissions including all energy carriers and emissions sources in the geographical and administrative boundaries of the local government was calculated as **25,062,569 tCO_2e** for 2018. The detailed breakdown can be seen in Table 26. Information has been disaggregated into sub-sectors in line with CoM guidelines, which helps to identify key intervention areas and therefore facilitates decision-making processes when developing an action plan.

This analysis indicates that fuel consumption in buildings and industry accounts for the largest source of emissions, representing nearly 55.4% of the total (Table 26). This sector is dominated by industrial buildings with a share of 56.7%, residential properties following second which account for 25.9% of emissions from buildings (or 31.4% and 14.3% of total emissions respectively). Transport is the second biggest emitter with a share of 23.1%. Waste and wastewater emissions account for around 2.8% of the total, while agriculture and livestock represent roughly 8.2% (excluding irrigation). Energy generation from fuel for own use account for 3.7% of total emissions and irrigation account for 0.8% of the total.

Table 26: Izmir GHG Emissions-2018

Sector	MWh	tCO_2e	%
Total for Izmir	**66,726,400**	**25,062,569**	100%
Building, Equipment/Site	**40,067,386**	**13,879,952**	**55.4%**
Municipality Buildings/Sites	403,894	181,289	0.7%
Tertiary Buildings/Sites other than Municipality	4,808,950	2,128,887	8.5%
Residential	10,722,856	3,592,798	14.3%
Public Lighting	230,094	116,658	0.5%
Industry	23,901,592	7,860,319	31.4%
Transport	**21,659,891**	**5,780,293**	**23.1%**
Municipality Vehicle Fleet	193,836	52,492	0.2%
Public Transportation (Municipality Buses)	683,162	185,137	0.7%
Public Transportation (Electricity Systems)	150,716	76,413	0.3%
Other vehicles (private, other public etc)	18,819,286	4,992,974	19.9%
Transit – Bus Station	175,066	47,443	0.2%
Aviation	1,637,825	425,835	1.7%
Other Emissions	**384,752**	**4,465,606**	**17.8%**
Waste Disposal	-	595,316	2.4%
Wastewater Treatment	-	96,141	0.4%
Wastewater Treatment Process CH_4	-	*19,558*	0.1%
Wastewater Treatment Process CO_2	-	*47,128*	0.2%
Wastewater Treatment Process N_2O	-	*8,555*	0.0%
Wastewater Treatment Process Without Nit./Denit.	-	*134*	0.0%
Wastewater Discharge N_2O	-	*20,766*	0.1%
Process Emissions of Industry		1,519,992	6.1%
Livestock, manure management	-	2,059,089	8.2%
Irrigation	384,752	195,069	0.8%
Energy Generation	**4,614,371**	**936,717**	**3.7%**
Fuel Consumption for energy generation	4,614,371	936,717	3.7%

When calculating industry emissions national statistics have been taken into account for fuel consumptions and electricity. For process emissions only fugitive emissions of clinker production is calculated since there was not

information for calculating other process or fugitive emissions from other industrial sectors. Fuel consumption for energy generation is related with only electricity generation for own use (autoproducers).

Izmir is the hub for the Aegean region, concentrating not only the industrial and commercial activities of the Province of Izmir but also naturally attracting neighbouring provinces such as Manisa, Uşak and Denizli. The long-term promotion of road transport by national policies and the neglect of rail in passenger as well as commercial transport has exploded automobile use both within the Izmir Province, among towns and prominently in and out of Izmir, but also to and from neighbouring Provinces mentioned above. Private car ownerships for instance has increased by 25% during the past four years, much higher than population growth (Figure 21).

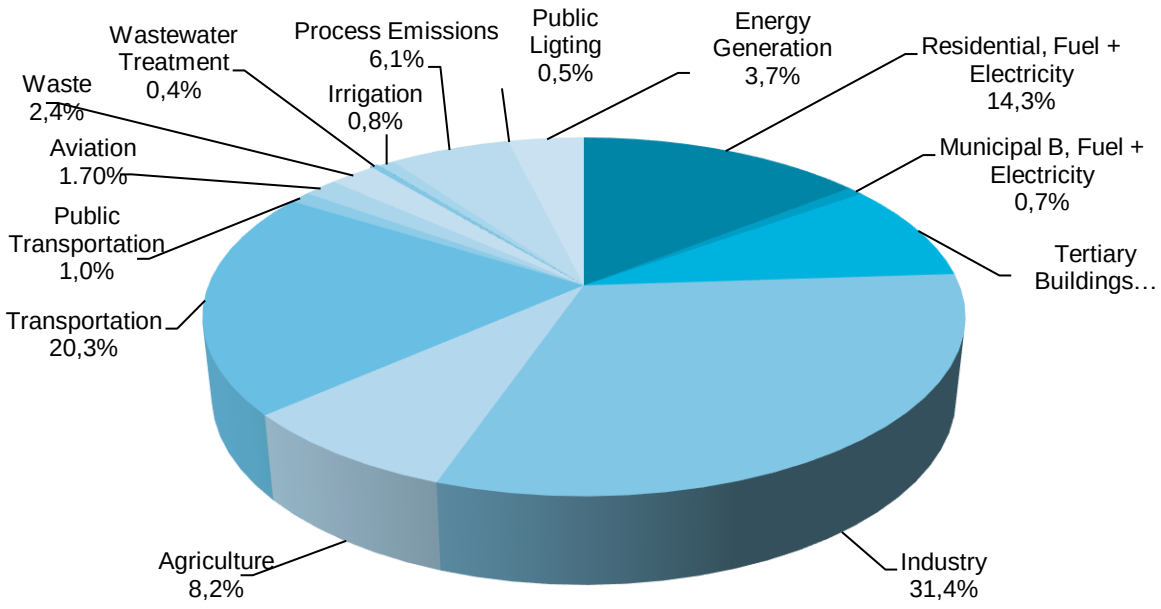

Figure 21: Izmir Emissions Inventory

According to Figure 19, the highest greenhouse gas emissions in 2018 are industry with 31.4%. Other most greenhouse gas emission sources are transportation with 23%, residential with 14.3% and agriculture with 8.2%.

In Table 27, municipal greenhouse gas emission sources are detailed. According to the table, the most source of municipal greenhouse gas emission emissions is transportation with 61%. Approximately 50.7% of the municipal greenhouse gas inventory is from public transportation. Municipal buildings and facilities are the second largest source of greenhouse gas emissions with 35.2%. Electricity consumption of IBB and its subsidiaries account for 32% of GHG emissions. Of this, it should also be noted that 60% of the electricity consumption is due to the water pumping stations, drinking and wastewater facilities, the rest is consumed by buildings/facilities.

The remaining is divided between GHG emissions of the Municipality vehicle fleet (largely diesel), park and streetlights and fuel combustion for heating in buildings/facilities. The corporate GHG emissions of the Municipality are detailed in Figure 22.

Table 27: IBB Corporate Greenhouse Gases Emissions, 2018

Corporate GHG Emissions	MWH	CO_2e	%
Buildings & Facilities	**403,894**	**181,289**	**35.2%**
Municipal	**67,341**	**29,467**	**5.7%**
Stationary	*16,214*	*3,546*	*0.7%*
Electricity	*51,128*	*25,922*	*5%*
Subsidiary	**336,553**	**151,822**	**29.5%**
Stationary	*62,898*	*13,079*	*2.5%*
Electricity	*273,655*	*138,743*	*27%*
Park and Street Lighting	**37,973**	**19,252**	**3.7%**
Transportation	**1,027,714**	**314,042**	**61%**

Municipal	**92,655**	**25,098**	**4.9%**
Fuel-oil	*1,127*	*294*	*0.1%*
Diesel	*91,528*	*24,804*	*4.8%*
Subsidiary	**102,133**	**27,877**	**5.4%**
Fuel-oil	*2,612*	*682*	*0.1%*
Diesel	*98,569*	*26,712*	*5.2%*
Electricity	953	483	*0.1%*
Public Transportation	**832,926**	**261,067**	**50.7%**
Diesel	*683,162*	*185,137*	*36%*
Electricity	*149,764*	*75,930*	*14.8%*
TOTAL	**1,469,580**	**514,583**	**100%**

Izmir Metropolitan Municipality is responsible to serve to over 4 million residents. IBB has many departments as well as more than 10 legal entities that are responsible for specific services (subsidiaries). For public transportation buses there is ESHOT, for water, wastewater facilities there is IZSU, for tram and metro lines there is Izmir Metro.

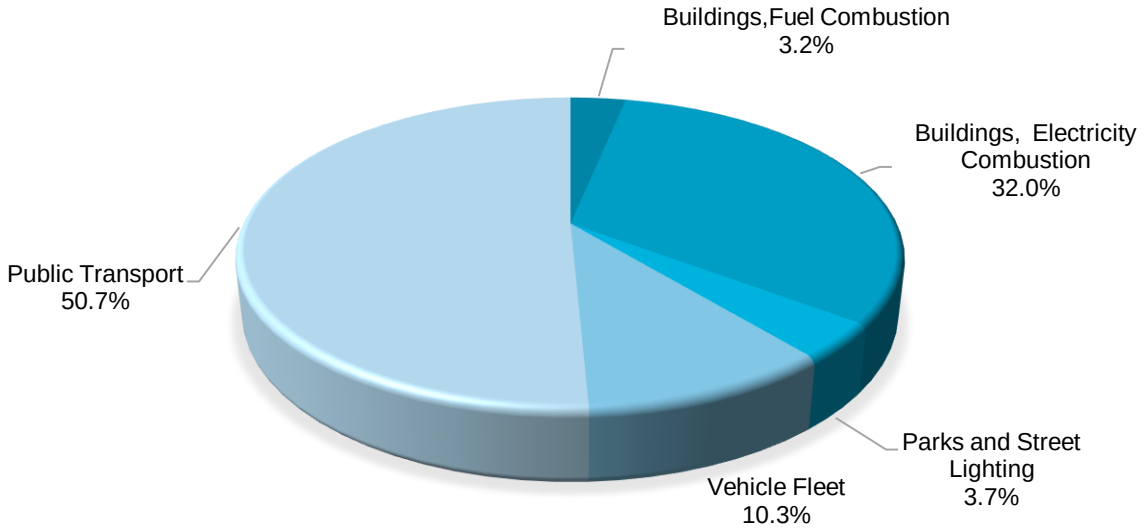

Figure 22: IBB Corporate Emissions Inventory (IBB + Subsidiaries)

In Figure 22, the corporate greenhouse gas inventory of İzmir Metropolitan Municipality is detailed. According to İzmir's corporate inventory, the most emission source is public transport with 50.7%. Electricity consumption is the second most emitting greenhouse gas with 32%. Vehicle Fleet emissions are 10.3% of total emissions. Parks and street lighting are 3.7%, while fuel combustion is 3.2%.

The emissions of Izmir urban area have increased 15% in 2018 compared to 2014. The highest increase is seen in fuel consumption for energy genenration (93%), 2nd increase is in agriculture, livestock and manure management sector (67%) and 3rd increase is in transportation (34%). Private vehicles which include private cars as well as logistic sector and other vehicles' consumptions increased 43%. Some of the increase in total emissions can be explained by the increase of electricity Emission Factor which is calculated yearly bases using national energy portfolio (increased by 15% in 2018 compared to 2014) and others change in the GWP (global warming potential based on IPPC 5th assesment report) which impacted significantly in the agriculture, livestock and manure management emissions more than %10.

Table 28: Comparion of 2014 and 2018 emissions

Sector / tCO_2e	2014	2018	% Change
Buildings	4.510.983	6.019.632	33.44%
Industry	9,187,597	7,860,319	-14.45%
Transportation	4,309,141	5,780,293	34.14%
Solid Waste	506.704	595.316	17,49%
Wastewater	112.021	96.141	-14,18%
Process Emissions of Industry+Fugitive	1,355,517	1,519,992	12.13%
Agriculture, Livestock and manure mng	1.236.548	2.059.089	66,52%
Irrigation	166.058	195.069	17,47%
Fuel Consumption for energy generation	484,778	936,717	93.23%
Total	**21,869,346**	**25,062,569**	**14.60%**

The mitigation commitment of the Covenant signatories is related mainly to the emissions associated with energy consumption in sectors which can be influenced by the local authority (housing, services and urban transport) leaving out other emitters such as industry and transport outside the mandate of the local authority (e.g. highways). Including these sources/sectors is generally not recommended, as this would jeopardize the achievement of the reduction target. With this approach IBB decided to exclude industry and aviation related emissions from its baseline calculations.

Moreover, some specific sources/sectors shall be explicitly excluded in order to ensure the overall consistency of the CoM approach and avoiding double counting. City scale GHG emissions including all energy carriers and emissions sources in the geographical and administrative boundaries of the local government – (excluding industry and aviation) was calculated as 14,319,706 tCO_2e for 2018. The detailed breakdown can be seen in Table 29. Information has been disaggregated into sub-sectors in line with CoM guidelines, which helps to identify key intervention areas and therefore facilitates decision-making processes when developing an action plan.

This fCMcalculation indicates that fuel consumption in buildings accounts for the largest source of emissions, representing nearly 42% of the total (Table 29). This sector is dominated by residential properties which account for 60% of emissions from buildings (or 25% of total emissions). Transport is the second biggest emitter with a share of 37%. Waste and wastewater emissions account for around 5% of the total, while agriculture and livestock represent roughly 16%.

Table 29: Izmir GHG Emissions-2018 (Industry and aviation excluded)

Sector	MWh	tCO_2e	%
Total for Izmir	**36,572,611**	**14,319,706**	100%
Building, Equipment/Site	**16,165,794**	**6,019,632**	**42.0%**
Municipality Buildings/Sites	403,894	181,289	1.3%
Tertiary Buildings/Sites other than Municipality	4,808,950	2,128,887	14.9%
Residential	10,722,856	3,592,798	25.1%
Public Lighting	230,094	116,658	0.8%
Transport	**20,022,065**	**5,354,459**	**37.4%**
Municipality Vehicle Fleet	193,836	52,492	0.4%
Public Transportation (Municipality Buses)	683,162	185,137	1.3%
Public Transportation (Electricity Systems)	150,716	76,413	0.5%
Other vehicles (private, other public etc)	18,819,286	4,992,974	34.9%
Transit – Bus Station	175,066	47,443	0.3%
Other Emissions	**384,752**	**2,945,615**	**20.6%**
Solid Waste Disposal	-	595,316	4.2%

Wastewater Treatment	-	96,141	0.7%
Wastewater Treatment Process CH_4	-	*19,558*	0.1%
Wastewater Treatment Process CO_2	-	*47,128*	0.3%
Wastewater Treatment Process N_2O	-	*8,555*	0.1%
Wastewater Treatment Process Without Nit./Denit.	-	*134*	0.0%
Wastewater Discharge N_2O	-	*20,766*	0.1%
Livestock, manure management	-	2,059,089	14.4%
Irrigation	384,752	195,069	1.4%

The share of the dominant sectors of buildings and transportation are 42% and 37% respectively. Notably, the population increased by only 5% during the same period, which indicates there are other factors contributing to this change. The increase of the jurisdiction area of the Municipality required to provide more municipal services throughout the metropolitan area which also has an important impact on the increase of the IBB corporate emissions. As previously pointed out, the changes brought about by the Metropolitan Municipalities Law, has not only increased the administrative space for IBB (by increasing the number of districts to 30 and adding over ~500 villages that have now become city neighbourhoods) but also urbanized the rural towns and villages, a change whose impacts will be felt into the future.

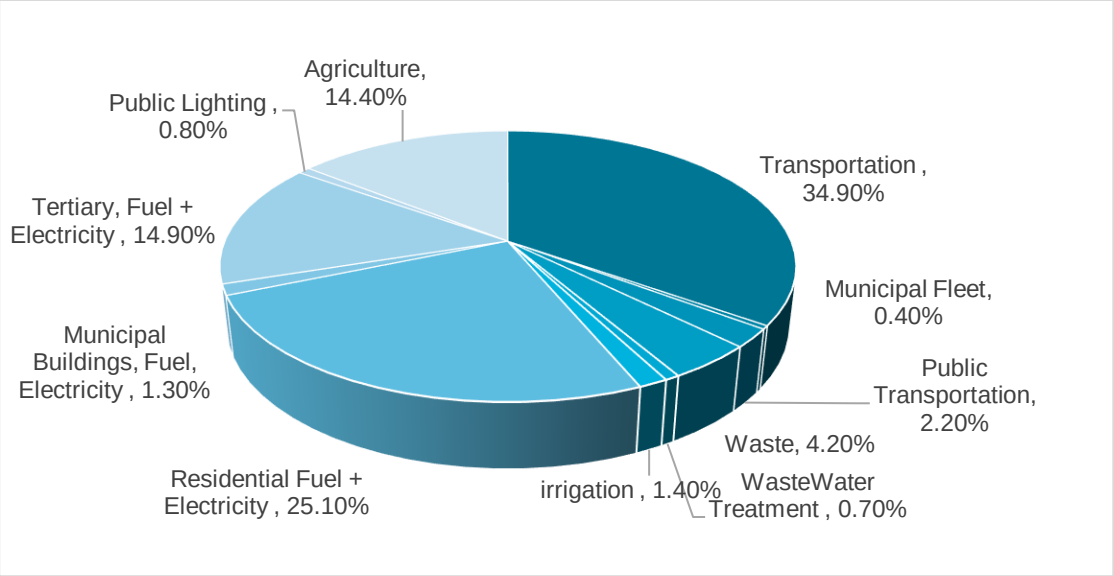

Figure 23: Izmir Emissions Inventory (industry and aviation excluded)

4.3. Target

In order to achieve a 40% per capita reduction against the 2018 baseline, Izmirs SECAP sets out a pathway of emission reduction for the City, derived from energy consumption data across different sectors and validated through stakeholder engagement.

As of 2018, Izmir's GHG emissions total 14,319,706 tCO_2e per year. According to the business-as-usual (BAU) scenario, by 2030 Izmirs GHG emissions will be 17,691,125 tCO_2e (Figure 24). The projections are made using different assumptions, which are explained in section 2.2.

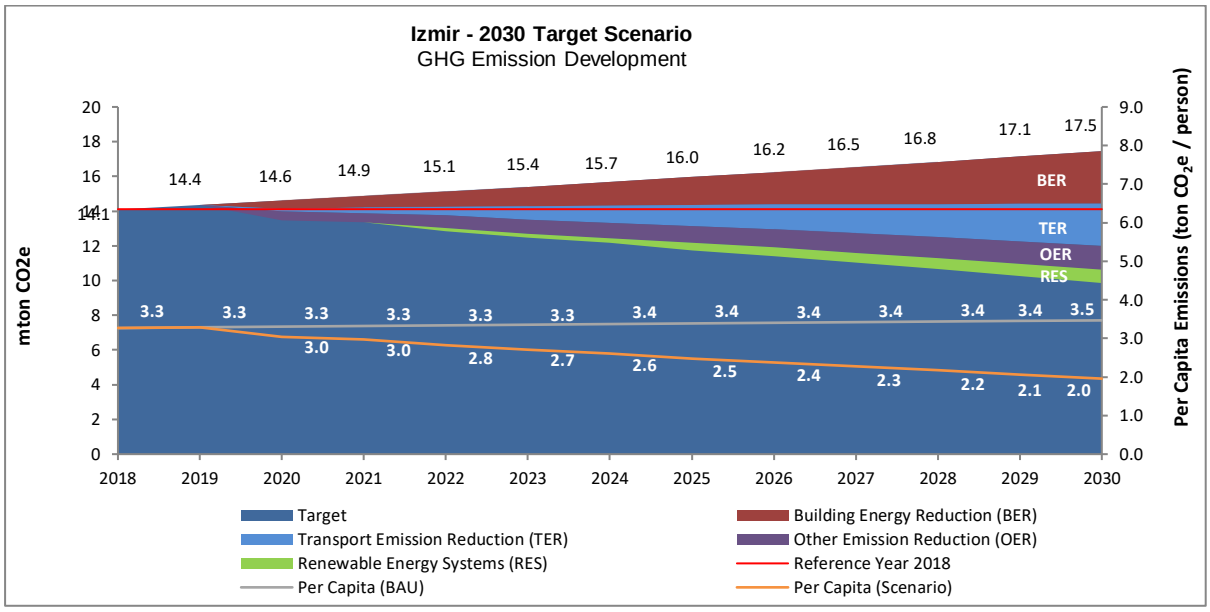

Figure 24: Izmir Target Scenario, 2030

Turkey's urban growth rate is similar to developing countries rather than industrialized countries in terms of quality and quantity. Since it is not possible to make reference to absolute emission reductions at these growth rates, it would be appropriate to express emission reduction targets as per-capita emissions. According to the BAU scenario, per capita emissions increase from 3.31 tCO_2e to 3.51 (6% increase) in 2030. After the proposed mitigation actions, the GHG emissions will be 9,973,640 tons CO_2e in 2030 (excluding industry and aviation) and 1,96 tCO_2e per capita. A reduction of 40% will be achieved.

Current plans and strategies such as İzmir Transportation Master Plan 2019, Izmir Province Integrated Solid Waste Management Plan and IBB Strategic Plan is all in line with the mitigation actions proposed in SECAP. There are some bold actions like a massive roll out of PV on building planned after 2025 to reach the 40% target.

Table 30: Mitigation action results per sector

Sector	MWh savings in 2030	Ton CO_2e reductions in 2030
Buildings Sector Emission Reduction	7,860,497	3,019,384
Transportation Emission Reduction	14,507,438	2,432,813
Other Emission Reduction	97,592	1,390,206
Renewable energy systems	1,726,000	875,082
Total	**24,191,526**	**7,717,485**

The energy consumption and emission reductions achieved after mitigation actions can be seen in Table 30 above. 7.7 million tCO_2e could be saved from 17.7 million tCO_2e GHG emissions.

5. Actions for Izmir SECAP

Chapter 5 of the SECAP transitions from an analysis of baseline information to how action can be taken in order to reduce emissions and improve resilience across the different sections.

This section comprises of two categories of actions – mitigation and adaptation each of which are split into the relevant sectors. A detailed business case has been developed for each of the mitigation and adaptation actions separately, containing information required by the CoM reporting template. Each action has also been aligned with an appropriate IBB Strategic Plan Objective 2020 – 2024 that articulate the municipality's specific aims for the coming years.

A full list of actions the specific to the SECAP and the full list of GCAP basketed actions can be found in Appendix F, G, H and I respectively. The number of actions in this SECAP across adaptation and mitigation totals **58.** Of these, **14** are SECAP specific with the other **44** also included in the GCAP, of which **25** have a detailed business case shared between the SECAP and GCAP.

All detailed business cases that overlap with the GCAP have been coloured **green.** Those actions that are unique to the SECAP, are coloured in **blue.**

Actions for the SECAP have been developed collaboratively with IBB and a range of stakeholders, in coordination with the Izmir GCAP and EBRD; however; they remain to be proposals only at this stage. **While some can be implemented quickly, most will require additional detailed feasibility studies, funding or statutory approvals before implementation could commence.**

Types of actions

The actions included within the SECAP fall under the following categories:

- **Capital projects:** infrastructure investments that IBB will undertake either using municipal funds or with support from donor agencies.
- **Policy measures**: new legislation or policy enacted to drive more environmentally friendly activities.
- **Plans and strategies**: provide a more detailed roadmap for improving performance in a specific sector or area (e.g. a Climate Action Plan).
- **Behavioural:** measures specifically seeking to shift behaviour of a cohort in a targeted direction (e.g. towards more public transport use). While policy measures may also have a behavioural component, actions in this category focus specifically on behaviour-change, such as awareness campaigns.
- **Training:** actions seeking are those that seek to increase capacity through knowledge exchange.
- **Enforcement:** measures seeking to improve compliance with policies and regulations, typically through monitoring and potential penalties.

Action I.D

Each action produced for the SECAP and GCAP projects were allocated an I.D based on the sector that they address. For actions that are SECAP specific, the I.D breakdown is as follows:

Table 31: SECAP specific action I.D

SECAP Secto	Abbreviation for I.D
Mitigation	
Buildings	**SECAP B**
Adaptation	
Agriculture & Forestry	**SECAP AF**
Health	**SECAP H**

For the actions that cover both GCAP and SECAP, this is as follows:

Table 32: Action I.D per sector for GCAP and SECAP actions.

GCAP Sector	Abbreviation for I.D
Buildings	B
Energy Supply	ES
Industries	I
Land use	LU
Solid Waste	SW
Transport	T
Water cycle management	WCM
Public Health	PH
Administrative Organisational Structure	AOS

The action I.D's were assigned when the initial long list of actions was developed and were retained throughout the prioritisation and stakeholder engagement process. As a result, the actions I.Ds presented in this final report are not numbered consecutively, with I.D's not having been re-organised post prioritisation for administrative purposes and to enable the tracking of actions through the prioritisation process if required.

Business Case Development

There are three different types of business cases developed for the actions throughout this report, reflecting the different contributing aspects; Adaptation, Mitigation and Izmir's GCAP.

For the 25 actions that are also within the GCAP, the business cases follow the detail laid out in sections 'i' through to 'iii' below. For adaptation and mitigation specific actions, the business cases provide the detail required of the CoM reporting methodology respectively. For adaption this includes; action description, rationale / purpose, action type, timeframe, risk and vulnerabilities addressed, responsible body, stakeholders and financing option. For mitigation, it covers; rationale / purpose, steps for implementation, timeframe, potential emission reduction, potential barriers, action owner, stakeholders and financing options.

GCAP Overlap:

There are 25 actions in the SECAP that overlap with the **28** actions selected by IBB to have a detailed business case developed in the GCAP, as laid out within Appendix H and I. These 25 actions have been aligned with the GCAP and therefore displayed within a busiess case template to those actions only detailed in the SECAP, containing additional GCAP related information.

i. Environmental Value Logos

Each business case developed for a GCAP action includes a symbol that depicts the environmental values that have been positively affected. These are portrayed in Table 33 below.

Table 33: Legend for "Environmental Values" used in action business case development.

State indicators		GCAP sectors	
Air quality		Buildings	
Biodiversity		Energy supply	
Climate risk and adaptation		Industries	
Greenhouse Gases (GHG)		Land use	
Green spaces		Solid waste	
Soil quality		Transport	

Water quality/availability 	**Water cycle-management** 
Marine Biology 	

ii. Benefits Assessment

In order to provide a greater level of detail around the potential benefits that could be achieved by the actions, criteria were developed which outlines descriptions for the following benefit categories:

- **Health & Wellbeing:** This covers public health improvement from more active lifestyles, reduced pollution and workplace safety.
- **Social Inclusion:** This covers access to basic services, skills development, social equity and social fabric.
- **Economic Development:** This addresses economic growth, employment creation, economic efficiency, revenue saving / generation and avoided damages.
- **Environmental:** Focusing on reduced air, water and ground pollution and a reduction in GHG emissions, alongside the prevention and enhancement of ecological value and biodiversity within Izmir.

Each business case developed across the suite of actions provides reference to the criteria that is has the ability to directly influence. The full matrix of criteria for the benefits assessment can be found in Appendix D.

iii. Economic Costing

Indicative economic costing has only been calculated for the 28 actions that have been selected for business case development by IBB. Calculated in Euros, the relevant assumptions made for the cost ranges calculated can be found in Appendix F in the Izmir GCAP report. The costs estimated cover the following aspects where applicable to each action:

- **CAPEX:** Capital expenditure
- **OPEX:** Operation expenditure
- **Design / Development:** Other costs such as scoping / feasibility study.

5.1. Cross-cutting Mitigation & Adaptation

This section contains the 6 actions that can apply to both mitigation and adaptation sectors.

5.1.1. Buildings

Sector Objective & Target: See section 5.2.1.

Number of actions: 2

Developed to address both mitigation and adaptation aspects, these actions recognise current building stock quality and the existing characteristics of Izmir's urban environment alongside leveraging the existing work undertaken by IBB such as the Energy Efficiency Study in Municipality Buildings 2016 – present and the Building Inventory Study undertaken as part of the Izmir Earthquake Scenario and Earthquake Master Plan. There is also an acknowledgement that IBB can influence building design and performance.

There are also several national strategic plans and regulations for the building sector led by the MoEnvU, including the Energy Efficiency Strategy Paper (2012 – 2023) and the National Energy Efficiency Action Plan (2017-2023), with the Turkish Energy Efficiency law and the EU Energy Performance Regulation in Buildings.

When developing and implementing these actions it is also important to consider maladaptive practices in regard to adaptation. This is where the anticipated impacts of climate change could be exacerbated by ineffective climate change adaptation and mitigation considerations in future management and technical practices. In buildings a key aspect of this is to avoid displacing the pressures or impacts of climate risk onto other environments (e.g. neighbouring areas). An example of this is the use of air conditioning units to mitigate against overheating, which may cool inside the buildings but as the waste heat is expelled into the urban environment it exacerbates the urban heat island effect.

Table 34 below demonstrates the IBB strategic plan objective that aligns with actions presented for the building sector.

Table 34: IBB Strategic Plan 2020 - 2024 objectives addressed.

Strategic Heading	Strategic Goal	Strategic Objective(s)
Infrastructure – Urban Infrastructure	**1.** Building a Sustainable Infrastructure Available to Everyone	**1.1:** A Sustainable Urban Infrastructure Will Be Built to Contribute to the Urban Economy
Infrastructure - Sustainable Living Areas	**1.** Building a Sustainable Infrastructure Available to Everyone	**1.2:** Planned, Safe and Sound Settlement Areas Will be Developed or Regenerated.

The SECAP mitigation and adaptation actions for buildings are summarised below in Table 35 and further developed into a business case.

Table 35: Summary of the building sector actions.

Action ID	Action Headline	Responsible Body	Cross-sector benefits	Link to Mitigation
B1.3	Review and update the local-level policies, planning regulations and guidelines for future and new municipality development around energy efficiency.	IBB	Public Health	Yes
B1.11	Explore ways to support residential retrofits being undertaken to a higher and greener energy performance standard.	IBB	Public Health	Yes

B1.3 Review and update the local-level policies, planning regulations and guidelines for future and new municipality development around energy efficiency.	
SP Objectives:	1.2 Planned, Safe and Sound Settlement Areas Will be Developed or Regenerated.
Description	Establish a source of funding / subsidy for retrofitting existing privately-owned residential properties so that they become more energy efficient. Eligible retrofitting works could include, for instance, upgrading the building fabric (e.g. wall and roof insulation, windows, airtightness, etc.) or services (e.g. heating systems and water/sanitary fittings). This action will include the formation of associated administrative and oversight bodies as required to target and deliver any funding. It should be coordinated with Action B1.11, which includes research and surveys aimed at assessing the existing energy performance of the building stock, in order to target areas currently exhibiting poor performance.
Rationale / Purpose	Planning regulations and building performance standards dictate the energy efficiency of buildings, which can help to reduce emissions (i.e. climate mitigation), as well as ensuring that buildings are better able to adapt to climate change. Given that buildings represent a key source of emissions in Izmir (roughly 42% as of 2018), and also have a significant impact on climate resilience (for instance, due to their impact on overheating, urban heat islands and flood risk), it is important to ensure that best practices are implemented wherever possible through strong policies and guidance. This has cross-cutting impacts on public health, quality of life and cost of living and would follow the identification of 'high-risk buildings' under Law No 6306.
Steps for Implementation	1. Establish a working group to review local-level policies 2. Conduct a study on energy efficiency design and materials to use taking into consideration future climatic conditions changing climate conditions and flexibility and adaptability in future use 3. Engage District Municipalities that are important partners as they are the authority to grant licence to new buildings 4. Develop new planning regulations and guidelines for more energy efficient areas 5. Cooperate with relevant stakeholders to implement the proposed actions
Project Type	Policy / Guidance
Timeframe	2022 – 2030
Risk and/or vulnerabilities addressed	**Risks:** IM1, IM11, IM24 **Vulnerabilities:** PE-D
Potential Emission Reductions	The new buildings are planned to be 50% more energy efficient then existing buildings 85,806 tCO_2e in 2030
Potential Barriers	Distrust of the technologies Lack of awareness Resistance to proposed regulations and guidelines due to cost concerns Higher costs
Action Owner	IBB
Stakeholders	MoEnvU Provincial Directorate of Environment and Urbanisation Ministry. District Municipalities Izmir Chamber of Commerce, the Chamber of Architects and Engineers. Contractors procured for the Urban Transformation Areas
Financing Options	Munucipal Budget

B1.11: Explore ways to support residential retrofits being undertaken to a higher and greener energy performance standard.		
Strategic Plan Objectives:	**1.2** Planned, Safe and Sound Settlement Areas Will Be Developed or Regenerated	
Description	Explore the options that are available to support retrofitting of existing privately-owned residential properties so that they become more sustainable. Retrofitting practices could include, but are not limited to. • upgrading the building fabric (e.g. wall and roof insulation, windows, airtightness, etc.) • services (e.g. heating systems and water/sanitary fittings), • green roofs • Water efficiency, rainwater/greywater collection for reuse and rehabilitation. Options to support retrofitting could include: • Adjusting permitting requirements for buildings that meet high standards of energy and water efficiency (e.g. fast-tracking permits, allowing greater floor area, etc.) • Developing public awareness campaigns and information schemes to promote uptake in residential retrofitting. This action should be coordinated with Action B1.3, which includes research and surveys aimed at assessing the existing energy performance of the building stock, in order to target areas currently exhibiting poor performance. It should be aligned with SECAP B4, B5 and ES1.5.	
Rationale	Due to the age of the building stock of Izmir (46% having been built prior to 1990 and therefore prior to the introduction of thermal standards) there is likely to be poor building performance across the City, although there is currently no reliable data about the existing building stock in regards to age, household composition, heating systems, energy performance, etc. The energy efficiency and quality of housing stock not only dictates the emissions and cost associated with space heating and cooling, but if poor, it can expose the residents to a higher level of risk to extreme temperatures due to its heightened sensitivity to overheating. Furthermore, opportunities for improving the efficiency of water fixtures and fittings will help to reduce water demands and help remove dated plumbing (often cited as a reason for residents not drinking from the potable water network with dependency on bottled water). By retrofitting residential building, operational energy costs can be reduced, decreasing the resident's vulnerability to overheating, improve water efficiency and quality to reduce water stress and help to reduce GHG emissions.	
Steps for Implementation	1. Undertake analysis of housing stock to identify those areas that are poor performing, not set for urban transformation and where improvement would reduce energy poverty. 2. Create a suite of home energy retrofit options that target the most cost-effective carbon reduction and water efficiency opportunities. 3. Conduct Life Cycle analysis for green energy standards proposed to further investigate how buildings should be designed, constructed/retrofitted and operated. 4. Establish guidelines that addresses the definitions, technical standards, economic analysis, building envelope recommendations, and building mechanical and electrical systems. 5. Developing public awareness campaigns or incentive methods to contribute to household budgets, through tax reductions such as Energy Performance Regulation in Buildings (05.12.2008) on energy gains to be achieved and environmental protection	
Type of action	Policy / Behavioural / Training	
Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	**Risks:** IM1, IM11, IM24 **Vulnerabilities:** PE-D	
Potential Emission Savings	The emissions savings depend on the nature of the incentive that is established. For context, if this was delivered for 50% of residential buildings in Izmir, achieving a 10% reduction in electricity demand and a 40% reduction in heat demand.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	MoEnvU, MoENR, IFI's, Izmir citizens, Businesses such as architects and designers, contractors / construction companies, manufacturers e.g. as insulation, heating systems, etc. Vulnerable groups: infirm, elderly.

	Financing options	Municipal budget, IFIs, Ilbank, Private banks
	Revenue/savings opportunities	Savings opportunities will come from reduced energy costs, decreased pressure on energy networks, and public health benefits from more comfortable homes.
	Timeline	2020-2030
Impact measures	• Electricity consumption in residential buildings. • Heating / cooling consumption in residential buildings	
Estimated cost	**CAPEX:** **OPEX:** €2,081,250 **Design/development costs:** €312,188	
Estimated benefits	**Health impacts:** Public health – more active lifestyles **Economic Development:** increased economic efficiency; economic growth **Environment:** Mitigation of GHG Emissions	
Existing Work Leveraged:	Izmir SEAP 2016	
1/25,000 scaled IBB Environmental Plan Alignment	Not spatially dependent.	

5.1.2. Transport

Sector Objective & Target: See section 5.2.2

Number of actions 1

Developed to address both adaptation and mitigation aspects, these actions recognise and leverage the existing work undertaken by IBB such as UPI 2030 (the Izmir Transportation Master Plan 2017 – 2030), with projects such as the modernisation of commuter ferries, improving traffic control and the on-going expansion of the metro (which is supported by EBRD).

National level strategies in the sector include the Transport Strategic Plan (2017-2021) and the National Transport Master Plan (2018) which, led by the Ministry of Transportation and Infrastructure, both identify direction and priorities around improving railroad infrastructure, increase environmental awareness, improving energy efficiency and reducing pollution and greenhouse gas emission levels.

It is necessary to acknowledge the cross-sector linkages of the transport sector. Transport is a key enabler of economic growth and trade, providing the networks and services on which economies depend – facilitating individual mobility, movement of goods and equal access to employment and services such as health and education. From an adaptation perspective, Transport infrastructure is also critical in regard to the response and recovery aspect of emergency management strategies, facilitating elements such as access for emergency services, evacuation routes and the deployment of humanitarian goods and relief packages for victims. When developing actions, these cross-sector linkages need to be incorporated, interacting with other strategies, approaches and policies including but not limited to; energy, industry, tourism, green economy transitions, emergency management, the promotion of gender equality and economic inclusion.

Table 36 below demonstrates the IBB strategic plan objective that aligns with actions presented for the transport sector.

Table 36: IBB Strategic Plan 2020 – 2024 objectives Addressed

Strategic Heading	Strategic Goal	Strategic Objective(s)
Quality of Life - Public Transport	**2.** Making Izmir a Smart City with A high Level of Quality of Life and A Well-Developed Transport Network	**2.1:** Public Transport Will Be Affordable, Energy Efficient, Fair, Comfortable, Available to and Accessible for all residents
Quality of Life - . Urban Transportation	**2.** Making Izmir a Smart City with A high Level of Quality of Life and A Well-Developed Transport Network	**2.2:** A Sustainable Transport System Will be Created with a Harmonious Interaction Created With A Harmonious Interaction Between Different Modes of Transport, Offering Different Options

The SECAP mitigation and adaptation actions for transport are summarised below in Table 37 and further developed into a business case.

Table 37: Summary of Transport Sector Actions

Action ID	Action Headline	Responsible Body	Cross-sector benefits	Link to Mitigation
T1.7	More sustainable urban mobility: mass transit and local mobility.	IBB	N/A	Yes

T1.7: More sustainable urban mobility: mass transit and local mobility.	
Strategic Plan Objectives:	**2.1** Public Transport Will Be Affordable, Energy Efficient, Fair, Comfortable, Available to and Accessible for all residents **2.2** A Sustainable Transport System Will Be Created With a Harmonious Interaction Between Different Modes of Transport, Offering Different Options
Description	Develop and enhance the Municipalities urban mobility to enable the implementation of more diverse modes of low carbon transportation alternatives whilst reducing traffic congestions, by: <u>Mass transit schemes</u> By 2030, the rail system network will total 664.1 km including tramway, metro and IZBAN line • It is targeted to complete 312.1km rail system network. The line between F. Altay and Narlıdere will be finalized in 2021. Buca metro line has been planned and will be finalized by 2025. The tram line to Çigli is planned to be finalized in 2021. • Expanding the existing metro lines with Buca metro project which includes the construction of 13.3 km metro line and 11 underground stations • Introduce more park-and-ride systems in-line with the transportation master plan. Park-and-ride systems are located in 8 main transportation hubs, 21 transportation hubs and 23 transfer points totalling 52 points. • Additional 8 ferry and passenger ships will be purchased. • Implementation of park-and-ride systems to integrate private car using with public transportation system <u>Local mobility schemes</u> • Assess feasibility of scaling up existing local mobility options E.g. scooter schemes and share-bike incentives. • Pedestrianisation of central city streets. 145 km length of street pedestrianization will be implemented in some of the districts such as Narlıdere, Balçova, Konak, Bornova, Buca, Karşıyaka, Çiğli until 2030 • Improve and expand the cycling infrastructure e.g. cycle lanes. The length of cycling route will be increased from 67km to 402 km until 2030.
Rationale	As Izmir has grown, so has the number of private vehicles on the roads from 477,773 in 2008 to 765,657 in 2018. This has led to reduced air quality and congestions. This action will help reduce dependence of fossil fuel private vehicles by offering a range of local and longer distance, low carbon, mobility options. Damage and disruption to transport infrastructure is also a key factor in amplifying the impact of a climate related event, especially in densely populated cities such as Izmir. By diversifying and improving the transport infrastructure within the City it will create an overarching transport infrastructure that can provide more effective protection and support recovery
Steps for Implementation	<u>Mass-transit schemes</u> In line with the Transportation Master Plan of Izmir 2030, this action is already being progressed including: 1. Procurement of construction works of Buca metro 2. Construction of metro line including civil and E&M works 3. Procurement of metro vehicles 4. Handing over to Izmir Metro AŞ for operation 5. Development plans to be updated considering planned main transportations hubs, transportation hubs, transfer points and P&R locations 6. Metro station designs to take into account planned P&R areas 7. Construction and operation of park-and-ride systems <u>Local mobility schemes</u> 1. Feasibility studies to be prepared for scaling up existing scooter schemes and share-bike incentives. 2. Development plans to be updated considering planned pedestrianization projects 3. Preparation of hardscaping and landscaping design of pedestrianization projects 4. Construction of pedestrianization projects 5. Development plans to be updated considering planned cycling routes 6. Preparation of cycling infrastructure design 7. Construction of cycling infrastructure 8. Undertake and implement awareness raising campaigns on road safety.
Type of action	Capital project

Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	**Risks:** IM4	
Potential Emission Savings	**Mass transit schemes**: 805.216 tCO_2e reduction in 2030. 12% reduction targeted of all transportation except logistic emissions and additional 5% for intercity speed train investments. **Local mobility schemes:** 410.473 tCO_2e reduction in 2030. 5% reduction targeted for cycling and 5% for pedestrian of all transportation except logistic emissions	
Plan for delivery	**Action owner**	• IBB:
	Stakeholders	• ESHOT • IZBAN • Izmir Metro AŞ • TCDD • 2nd Regional Directorate of Highways. • Professional chambers • District municipalities • Headman's and Citizens
	Financing options	Municipal budget, IFIs, Ilbank, PPP, private operators
	Revenue/savings opportunities	Greater uptake of public transportation will result in higher revenues for the city.
	Timeline	2021 - 2030
Impact measures	• All air quality indicators • Concentration of heavy metals in soils (zinc, cadmium) • Annual CO_2 equivalent emissions per capita • Annual CO_2 emissions per unit of GDP • Transport modal share in total trips (Public Transport) • Transport modal share in total trips (Walking) • Transport modal share in total trips (Bicycle) • Kilometres of road dedicated exclusively to public transit per 100,000 population • Kilometres bicycle path per 100,000 population • Share of population having access to public transport within 15 min by foot • Interruption of public transport systems in case of disaster • Efficiency of transport emergency systems in case of disaster	
Estimated cost	**CAPEX: -** Pedestrianisation: €172,405,000 for 145km of 15m width pavement. - Cycling Infrastructure: €69,498,000 for 351km 5m wide infrastructure. **OPEX:** N/A **Design/development costs:** N/A	
Estimated benefits	**Health impacts:** Public health – more active lifestyles and reduced pollution. Public safety - particularly for more vulnerable people such as children and elderly **Economic Development:** Increased economic efficiency; economic growth; employment creation; avoided damages **Social Inclusion:** Access to basic services; social equity **Environment:** reduced pollution, mitigation of GHG emissions.	
Existing Work Leveraged:	Izmir SEAP 2016	
1/25,000 scaled IBB Environmental Plan Alignment	1. Gulf of Izmir 2. Central City 3. Urban / Rural Periphery	

5.1.3. Energy

Sector Objective & Target: See section 5.2.3

Number of actions: 2

Developed in co-ordination with the mitigation actions for energy in section 5.1.3 of this report, these actions recognise and leverage the existing work undertaken by IBB whilst acknowledging Izmir's extremely high potential to generate renewable energy. This includes Izmir's Sustainable Energy Acton Plan (2016).

At a national level, due to economic and population growth the demand for energy is rising rapidly in Turkey, the government has set a target to increase the share of renewable energy supply to at least 30% by 2023. This is supported by several national strategic plans and regulations, including the National Renewable Energy Action Plan (2011 – 2023).

When developing an adaptation dynamic for these actions, it is important to consider the cross-sector influences that have the potential to impact or be impacted by the energy sector. Increasing the resilience of energy infrastructure to climate change risks needs to incorporate a broader landscape of factors that currently impact or have the potential to impact the sector in the future. This includes a transition to a green economy, socio-economic aspects, the local demographic context and anticipated technological advancements. Actions also need to recognise the energy markets and supply-chain structure, finding the balance between accommodating the economic objectives, adaptation needs and capacities of the various supply-chain actors and end users, whilst also evolving into an affordable, secure, low-carbon, flexible and diverse resilient network.

Table 38 below demonstrates the IBB strategic plan objective that aligns with actions presented for the energy sector.

Table 38: IBB Strategic Plan 2020 - 2024 objectives addressed.

Strategic Heading	Strategic Goal	Strategic Objective(s)
Quality of Life – Accessible and Clean Energy	**2.** Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network.	**2.4:** Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted
Nature – Climate Action	**5.** Making Izmir a Global Mode for its Harmony with Nature `	**5.2:** In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy

The SECAP mitigation and adaptation actions for energy are summarised below in Table 39 and further developed into a business case.

Table 39: Summary of Energy sector actions.

Action ID	Action Headline	Responsible Body	Cross-sector benefits	Link to Mitigation
ES1.4	Localised micro-grids renewable energy options study	IBB	N/A	Yes
ES1.5	Mass role out of photovoltaic cells for municipality owned assets and land e.g. municipality buildings, road reserves, bus stops.	IBB	Buildings	Yes

ES1.4: Local renewable energy options study		
Strategic Plan Objectives:	**2.4** Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted	
Description	Undertake an options study to understand the feasibility of deploying local renewable energy technologies and expanding the use of renewable electricity. This should be done across Izmir but particular opportunities may exist in areas in the city that are close to high energy users (for example, heat networks near universities, hospitals or industrial zones and / or cooling networks for offices) and in informal settlement areas where there is limited access to grid electricity.	
Rationale	This action is a first step to rolling out renewable electricity technologies across the province, which would improve the security and reliability of Izmir's energy supply and reduce the carbon intensity of electricity use.	
Steps for Implementation	1. Appoint a project team to conduct the analysis (e.g. consultants and/or different IBB departments) 2. Project team to investigate feasibility of technologies such as wind, solar PV / solar hot water, heat pumps, batteries, district heating, micro CHPs and fuel cells, identifying suitable pilot projects 3. Search for financing options for different actions (ESCOs or similar financing mechanisms can also be considered as an option) 4. IBB to review and sign off on suitable locations for pilot project(s), if any 5. Conduct pilot projects, monitor and publicise results, and assess whether to pursue additional projects	
Type of action	Plan / Strategy leading to Capital project	
Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	**Risks:** IM5, IM6 **Opportunity:** IM7	
Potential Emission Savings	In cooperation with SECAP action SECAP ES1.14, greenhouse gas reduction will be achieved by installing 850 MW solar PV in buildings and using 45 MW solar energy in agricultural irrigation.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	District Municipalities and MoENR – General Directorate of Energy Affairs Academics, consultancy firms and other knowledge institutions that can inform or conduct the study
	Financing options	IBB would likely need to provide funding for the initial study but there may be potential to collaborate with an industrial or academic partner organisation. ESCOs or similar financing mechanisms can also be considered as an option for project delivery.
	Revenue/savings opportunities	If a micro grid is implemented, this could offer reduced exposure to energy price hikes, reduced exposure to damage from blackouts, etc. along with potential revenue from the sale of surplus power.
	Timeline	2022 – 2030
Impact measures	• Proportion of total energy demand derived from RES as a share of total city energy consumption • Share of population with an authorised connection to electricity • Average share of population undergoing prolonged power outage in case of climatic extremes over the past 5 years	
Estimated cost	**CAPEX:** €105,000,000 **OPEX:** N/A **Design/development costs:** N/A	
Estimated benefits	**Health impacts:** Improved air quality through use of local renewable energy sources, potential reductions in fuel poverty. **Economic development:** This action can create jobs if projects are implemented. **Environment:** reduced pollution, mitigation of GHG emissions. **Other:** Improved resilience of the energy system.	
Existing Work Leveraged:	Izmir SEAP 2016	

1/25,000 scaled IBB Environmental Plan Alignment	1. Gulf of Izmir 2. Central City 3. Urban / Rural Periphery

ES1.5: Mass role out of photovoltaic cells: municipality owned assets and land e.g. municipality buildings, road reserves, bus stops.	
SP Objectives:	2.4 Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted
Description	Investments for 15 MW solar energy in buildings owned by municipalities and their subsidiaries by 2030.
Rationale / Purpose	Izmir already had plans to invest in solar energy with the motivation to be a good example for its citizens. Increasing energy prices is another motivation for IBB to save and use the excess resources to promote other types of low carbon technologies in the city, especially technologies related to its own operations. With the rapid increase of exchange rates, the prices have inflated significantly in the previous years. Within the IBB strategic plan (2020-2024) there are 10 solar energy plants planned until the end of 2024. There are 4 different solar energy investments planned with a total of 0.2 MW capacity within the short term. We can easily assume that IBB will develop more projects after the year 2024. By increasing the municipality's renewable energy generation capacity, it diversifies the energy supply, reducing the exposure of the municipality buildings and key infrastructure to the risk of power shortages and blackouts as a result of a climate hazard.
Steps for Implementation	Most of the implementation steps mentioned below are in progress especially on the agenda of Directorate of Climate Change and Clean Energy Department. 1. Analysis of legislations and potential of buildings, lands, bus stops etc 2. Analysis of possible financing methods; revenue sharing, unlicensed energy production rights of municipalities, public and private collaboration 3. Start implementations according to Strategic Plan 4. Expand the plans for the next Strategic Plan period.
Project Type	Capital Project
Timeframe	2020 – 2030
Risk and/or vulnerabilities addressed	**Risks:** IM5, IM6 **Opportunity:** IM7:
Potential Emission Reductions	12,168 tCO_2e in 2030 with 15 MW installation
Potential Barriers	Frequently changing legislation Complex permission processes from DSOs DSOs doubts about sufficient infrastructure for additional RE sources High initial costs Lack of cooperation between institutions
Action Owner	IBB
Stakeholders	District Municipalities Manufacturers Finance institutions
Financing Options	Municipal Budget, PPP, IFI's, IIIBank

5.1.4. Agriculture and Livestock

Sector Objective: Support sustainable agriculture through low carbon farming and climate smart techniques

Number of actions: 1

Sector Target against 2018 baseline: 31 % CO_2e emission reduction by 2030.

With a total of 8.1 billion TL production value, agriculture is one of the key sectors of Izmir. The province is one of the most important centres for agricultural production in the country; its agricultural, food and livestock industry exports amounted to 2.43 billion TL (over 300 million €) in 2018 and has a share of nearly 14% in total agriculture, food and livestock exports of Turkey. Over 28 % of the land area of the province is used for agriculture.

As discussed previously, GHG emissions from the agricultural sector are primarily attributed to methane (CH_4) from livestock, which accounts for 11% of total emissions (1,690,940 tCO_2e), while chemical fertilizer related N_2O emissions account for 1.2% and energy consumption for irrigation accounts for roughly 1.4%. (For more information, see Section 4.2.) For this reason and recognising that rural development has been a key priority area for IBB since the villages were incorporated into the province in 2014, improving the sustainability of the agricultural sector is an important goal.

The establishment of the Agricultural Services Directorate has helped to accelerate efforts to promote healthy, environmentally friendly and sustainable agricultural production in rural areas of Izmir. A series of projects have been prepared and implemented to maintain the young population living in rural areas, to support / activate existing producer cooperatives, and to deliver healthy local produce to the people of Izmir. The actions presented in this section align with these wider efforts, and also link to goals and objectives from the İBB Strategic Plan, as outlined in Table 40 below.

Table 40: Summary of İBB Strategic Plan goals and objectives that are relevant to the agriculture and livestock sector.

Heading	Goal	Objective (s)
Economy – Access to food	**3.** Creating an Innovative and Entrepreneurial Local Ecosystem Capitalizing on Geographical Characteristics of the City.	**3.4** Food Safety Will Be Provided, Nutrition Will Be Improved, and Sustainable Agriculture Will Be Supported.
Nature – Climate Action	**5.** Making İzmir A Global Model City for Its Harmony With Nature	**5.2** In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy

The SECAP mitigation and adaptation actions for agriculture and livestock are summarised below in Table 41 and further developed into a business case.

Table 41: Agriculture and Livestock sector actions

Action ID	Action Headline	Responsible Body	Cross-sector benefits	Link to Mitigation
I1.1 & I1.2	Support the implementation of low carbon farming techniques and climate-smart agriculture across the province.	IBB	Environment & Biodiversity Land Use Planning Water	Yes

I1.1 & I1.2: Support the implementation of low carbon farming techniques and climate-smart agriculture across the province.	
Strategic Plan Objectives:	**3.4** Food Safety Will Be Provided, Nutrition Will Be Improved, and Sustainable Agriculture Will Be Supported. **5.2** In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy
Description	Development of resources and training scheme for farmers to support the transition to more sustainable agriculture that is more resilient to climate change, reduces greenhouse gas emissions and increase carbon sequestration rates. This would include the consideration of techniques that help address the "four pillars" of carbon farming. These are: - **Nutrient Management**: which looks at ways to improve storage and application of fertilisers and manures, which would increase efficiency and decrease emissions. - **Livestock Management:** A focus on animal health and welfare to reduce fatalities and stimulate healthy gut activity, exploring different grass types and supplements. - **Soil and Grassland Management:** Looking at soil biology including micro-organisms and Earthworks. Avoiding soil disturbance as much as possible and adopted practices such as injection fertilisers, and extended leys. - **Renewable Energy:** opportunity to diversify and consider using solar power and other renewable energies to generate electricity and sell the surplus back to the grid. - **Ancient Production Basins:** Agricultural production basins where low-carbona and rain-based production takes place, biodiversity is rich, and production is mostly based on pure (ancestry) seed crops.
Rationale	In order to improve food security while also reducing food waste globally and to mitigate against negative climate change impacts. CO_2e emissions from livestock is one of the highest emissions of the city. According to the 2018 baseline emissions inventory undertaken by Izmir's SECAP, there are nearly 750 thousand livestock within the city of Izmir accounting for 90% of the CH4 emissions from enteric fermentation. 937 thousand sheep and goats account for 7% of the enteric fermentation. The use of chemical fertilisers are 8% of the total agriculture related emissions (2.06 million tCO_2e), which equates to 1.2% of all emissions within the province.
Steps for Implementation	1. Undertaken more in-depth analysis of agricultural sector and product pattern, including an examination of the key biophysical, economic, and social components of the agricultural system to understand the characteristics of the sector. 2. Draw on analysis to determine possible practices that are most at risk and/or contribute the greatest CO_2e, and eliminate them gradually. 3. Engage with farming community and cooperatives to understand most effective training formats and support required for transition to more sustainable practices. 4. Supporting more sustainable agricultural practices at the basin scale, which could include, but are not limited a. Giving purchase guarantee to low carbon strategic products, b. Supporting rain-basedagricultural and ancient production basin products, c. Supporting the production of goats and sheep grazing in natural pastures, preparing and implementing pasture plans for small cattle, establishing a private dairy network for small cattle, d. Organic farming practices, e. Energy efficient and low carbon irrigation system, f. Low-cost monitoring, g. Supporting the development of watermeadow and buffalo breeding, h. Promoting pasture instead of forage plants that consumes a lot of water, i. Farming practices with high biodiversity, changeing the agricultural crop pattern, j. Providing water management suitable for climate change in agricultural production, and reducing agricultural irrigation, k. Supporting heirloom and native breeds, l. Providing active support for the branding, patenting, packaging and export of climate-friendly products. 5. Undertake appropriate training workshops across the agricultural basins. 6. Establishment of the agriculture high school. 7. Track progress of implementation and evaluate impact
Type of action	Capacity-building, Capital and implementation projects
Environmental values positively affected	

Climate Change risks and / or vulnerabilities addressed.	**Risks:** IM2, IM8, IM9, IM16, IM17, IM18 **Vulnerabilities:** SE-A, PE-A, PE-B, PE-C, PE-G, PE-H	
Potential Emission Savings	Savings from irrigation (20% Efficiency): 49,479 tCO_2e by 2030 Savings from chemical fertilizers 55,609 tCO_2e by 2030 (20% decrease) Savings from manure management 173,260 tCO_2e by 2030 Savings from transforming the animal stock 438,456 tCO_2e by 2030 *It is estimated there will be an addition of 10 sheep for each cow removed from the herd	
Plan for delivery	**Action owner**	IBB
	Stakeholders	Izmir International Agricultural Research and Training Centre, Izmir Provincial Directorate of Agriculture and Forestry, District Municipalities (especially rural Districts), Farmers and cooperatives
	Financing options	Municipal budget, private banks, funding sources as identified by the Climate Smart Agriculture guide[58]
	Revenue/savings opportunities	Savings opportunities will come from public health benefits from food safety and reduced GHG emissions.
	Timeline	2020-2030
Impact measures	• Quality of Environmental assets – water bodies and soil. • Emissions associated with agriculture. • Economic cost of climate event impacts	
Estimated cost	**CAPEX:** N/A **OPEX:** N/A **Design/development costs:** €19,000 - €25,000	
Estimated benefits	**Economic Development:** increased economic efficiency; economic growth **Environment:** Mitigation of GHG emissions, enhanced ecological value.	
Existing Work Leveraged:	EBRD Turkey Adaptation Study	
1/25,000 scaled IBB Environmental Plan Alignment	4. Agricultural Basins	

[58] https://csa.guide/csa/funding-opportunities

5.2. Mitigation

This section contains the 28 actions that are specific to Mitigation.

5.2.1. Buildings: Municipal, tertiary, residential

The following section outlines the actions developed to help mitigate the impacts of Izmir's building sector on global climate change, primarily through measures aimed at reducing GHG emissions and resource consumption. In line with the SECAP inventory presented in Section 4.2, these actions will address municipal, tertiary and residential buildings.

Sector Objective: To improve energy efficiency of existing and future buildings, promoting the widespread adoption of sustainable building techniques

Number of Actions: 8

Sector Target against 2018 baseline:

Municipal Buildings: ~ 20% emission reduction by 2030

Tertiary Buildings: ~ 40% emission reduction by 2030

Residential Buildings: ~ 40 % emission reduction by 2030

Energy consumption in buildings accounts for 44% of the total energy consumption of the city (excluding industry and aviation) and 43% of CO_2e emissions. Because buildings represent such a significant portion of total emissions, achieving the mitigation target depends heavily on interventions in this sector.

There are several national strategic plans and regulations regarding energy efficiency, which are outlined in section 1.3. Regulations for building energy efficiency standards are set at a national level. The Regional Plan 2014-2023 prepared by the Development Agency of Izmir includes a strategy titled "Sustainable Environment"; one of the targets is "to advance the use of the renewable / clean energy while promoting energy efficiency in household heating".

As stated in Section 1.3, although all new buildings have been required to obtain Energy Performance Certificates since 2011, the building stock as a whole is likely to have relatively poor energy performance, reflecting the rapid urbanisation dynamics of the past several decades. Therefore, in broad terms, these actions will aim to set high standards for new buildings while also taking steps to upgrade existing buildings.

Although sector targets are listed above, it should be noted that the state of the building stock is probably the most important factor in developing appropriate targets for urban emission reductions, however, there is limited data on the subject which makes it difficult to estimate the scale of improvement that can be achieved. The last detailed study undertaken on the building stock was back in 2000 which is now significantly out of date, particularly considering changes that have taken place as a result of the urban transformation initiatives implemented by the Ministry of in response to the disastrous earthquake of 1999 in Gölcük (see "Law No 6306 Transformation of Areas under Disaster Risk"). The past 20 years have seen considerable new construction (and demolition) work in Turkish cities, and the process is still ongoing. On one hand, this could provide some opportunities for large scale energy efficiency gains to be achieved, particularly where properties are being demolished and rebuilt. At the same time, it will be important to reduce the impacts of the construction process itself by considering topics such as circular economy and embodied carbon.

The actions developed to address and reduce emissions associated with the building sector for the SECAP aligns with the following goals and associated objectives of IBB Strategic Plan, as listed in Table 42.

Table 42: Summary of IBB Strategic Plan goals and objectives that relate to the building sector.

Heading	Goal	Objective(s)
Infrastructure – Urban Infrastructure	**1.** Building Sustainable Infrastructure Available to Everyone	**1.1** A Sustainable Urban Infrastructure Will Be Built to Contribute to the Urban Economy
Infrastructure – Sustainable Living Areas	**1.** Building Sustainable Infrastructure Available to Everyone	**1.2** Planned, Safe and Sound Settlement Areas will be Developed or Regenerated

Nature – Climate Action	**5.** To make Izmir one of the exemplary cities of which is harmonious with nature	**5.2** In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy
Experimental Learning, Institutional Capacity - Enterprise Resource Management	**6.** Making Izmir one of the leading points of learning by living in the world and creating an urban climate where innovative ideas emerge.	**6.2** Institutional Capacity and Functioning Will Be Made More Effective, Economic and Efficient

The SECAP mitigation actions for buildings are summarised below in Table 43 and further developed into a business case.

Table 43: Building sector actions

Action ID	Action Headline	Intervention Area	Policy Instrument	Responsible Body
B1.5	Revise planning regulations and guidelines to ensure efficient water fittings in all new municipality buildings.	-	Planing Policy	IBB
B1.6	Municipality to develop policy that commits to net zero in all new municipality buildings by 2030.	-	Public Procurement	IBB
B1.9	Undertake circular economy assessments on all Municipality refurbishment and demolition projects, encouraging uptake in private projects.	-	Awareness raising/training	IBB
SECAP B1	Insulation of Tertiary Buildings	Building Envelope	-	IBB
SECAP B2	Energy Efficiency in Municipal Buildings	Building Envelope, Lighting, Energy Systems	-	IBB
SECAP B3	Energy Efficient Light Bulb change in Tertiary Buildings	Lighting	-	IBB
SECAP B4	Encourage and incentivise thermal insulating in existing residential buildings.	Building Envelope	-	IBB
SECAP B5	Encourage and incentivise energy efficient lighting systems in existing residential buildings (LED etc.)	Lighting	-	IBB

B1.5: Revise planning regulations and guidelines to ensure efficient water fittings in all new municipality buildings	
SP Objectives:	**1.1**. A Sustainable Urban Infrastructure Will Be Built to Contribute to the Urban Economy
Rationale / Purpose	As per LU1.16 this action would involve collaboration with relevant bodies to review and update the appropriate planning regulation and guidelines to ensure that water efficient fixtures and fittings are considered in all new public buildings. This would involve considering the following water-consuming components: WC's, Urinals, Taps (wash-hand basins and, where specified kitchen taps and waste disposal unit), showers, baths, dishwashers and washing machines.

Steps for Implementation	1. Establish a working group to review local-level policies 2. Conduct a study on energy efficiency design and materials to use taking into consideration future climatic conditions changing climate conditions and flexibility and adaptability in future use 3. District Municipalities are important partners as they are the authority to grant licence to new buildings 4. Develop new planning regulations and guidelines for more energy efficient areas 5. Cooperate with relevant stakeholders to implement the proposed actions
Timeframe	2020 – 2030.
Potential Emission Reductions	This will have an indirect impact on emission reductions, by reducing water consumption and therefore the energy consumed in the water purification, transportation and disposal.
Potential Barriers	The agenda and priorities change rapidly in line with the country and local context Lack of financing Lack of human resources to conduct studies
Action Owner	IBB
Stakeholders	District Municipalities under Metropolitan Area IZSU Other public institutions NGOs and TMMOB – for consultancy Manufacturers, implementers – cooperation Finance institutions – financing the investments
Financing Options	Municipal Budget

B1.6: Municipality to commit to net zero energy in all new municipality-controlled buildings by 2030.	
Strategic Plan Objectives:	**5.2** In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy
Description	In order to adapt to climate change and its impacts, IBB will commit to net zero in all new municipality-controlled buildings and encourage other organisations, businesses and institutions to do the same.
Rationale	Rising national energy dependency on foreign fuels and market prices volatiles are a big challenge facing the world. IBB would like to showcase some of the projects within the urban transformation programme by delivering net zero buildings and thus also developing financial and technical feasibilities for similar projects to copy and to study the possibilities and feasibility of delivering net zero buildings in the city of Izmir. The EU Energy Performance of Buildings Directive (consolidated version) requires all new buildings to be nearly zero-energy by the end of 2020. Considering that Turkey is a candidate country, Izmir would be a template for the rest of the country. Note: There are 8 buildings planned within the 2020-2024 Strategic Plan of IBB. IBB is encouraged to adopt this target for all future buildings, including those in the 2020-2024 IBB Strategic Plan where feasible.
Steps for Implementation	1. Establish a working group to study the design, implementation and additional cost for net zero buildings which particularly emphasis on water efficiency which has high carbon impacts. 2. Review municipality construction and refurbishment programme 3. Conduct feasibility studies for priority buildings 4. Set programme for committing to zero carbon 5. Develop and implement projects 6. Target to be met by implementing projects in stages. With sustainable low energy to be achieved between 2020-2025; nearly zero buildings between 2025-2030 and then net zero energy buildings from 2030 onwards.
Type of action	Plan / strategy plus capital investment for future building investment
Environmental values positively affected	

Climate Change risks and / or vulnerabilities addressed.	N/A	
Potential Emission Savings	By committing to net zero in all new municipality buildings, this will not reduce the current baseline of emissions, but will help avoid potential future emissions that these buildings would have been produced if built to existing standards. Because there is currently no information about the proposed future buildings it is not possible to calculate emissions savings at this time.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	Academics Consultancy companies for Green Buildings Finance institutions
	Financing options	Municipal budget, IFIs, Ilbank, private banks, Green Bonds,
	Revenue/savings opportunities	Savings opportunities will come from reduced energy costs, decreased pressure on energy networks and public health benefits
	Timeline	2021-2030
Impact measures	Annual emissions associated with new public sector buildings	
Estimated cost	**CAPEX:** N/A **OPEX:** N/A **Design/development costs:** €21,000 - €31,000	
Estimated benefits	**Health impacts:** Public health – reduced pollution **Economic Development:** Increased economic efficiency, revenue/savings generating activities **Social Inclusion:** Skills development **Environment:** Mitigation of GHG Emissions	
Existing Work Leveraged:	Izmir SEAP 2016 EBRD Turkey Adaptation Study Izmir Green Infrastructure Strategy	
1/25,000 scaled IBB Environmental Plan Alignment	Not spatially dependent	

B1.9: Undertake circular economy assessments on Municipality refurbishment and demolition projects and encourage their uptake in private projects

Strategic Plan Objectives:	**1.1** A Sustainable Urban Infrastructure Will Be Built to Contribute to the Urban Economy
Description	IBB will commit to undertaking circular economy (CE) Assessments on all public building, refurbishment and demolition projects, and (where practicable) ensuring that the findings or recommendations are implemented. The aims of a CE assessment will be to identify opportunities to retain and reuse materials of buildings and develop a design and management strategy for ensuring that the building is easy to maintain, adapt and deconstruct in future. IBB should determine the content and scope of such studies, but key outputs are likely to include: • A pre-demolition audit (if applicable) highlighting reuse opportunities • An estimate of construction, demolition and excavation waste arisings, with specific commitments (e.g. design strategies) for how these will be minimised and monitored • Specific design measures aimed at facilitating deconstruction and reuse IBB will also develop a PR strategy (e.g. press releases and guidance) to promote CE assessments as a best practice measure that should be adopted by private businesses.
Rationale	Building construction, retrofit and demolition creates significant volumes of waste and in addition results in significant emissions from the manufacturing and construction process. Undertaking CE assessments will help to identify opportunities for reusing and recycling building materials, reducing the volume of waste to landfill and the need for virgin materials with associated extraction and processing impacts. IBB has greatest control over their own building stock, and the IBB Strategic Plan identifies several new buildings and retrofit plan. With significant private sector development, particularly within the allocated 'Urban Transformation Areas', this action will also encourage the private sector to also undertake CE assessments.
Steps for Implementation	1. IBB must define the scope and process for carrying out CE assessments. This will include defining standards and design evidence requirements for pre-demolition audits, the method for estimating and monitoring waste arising, and the level of detail required for any design for deconstruction strategy.

	2. Based on the outputs of (1), develop and disseminate guidance on how to carry out a CE assessment, both internally within IBB and externally so that private companies can develop their own targets as appropriate. 3. Allocate the individual(s) or department(s) responsible for ensuring they are carried out on IBB projects, e.g. ensuring that design teams have engaged with contractors to identify CE measures and ensure these are written into specifications or contracts in collaboration with IBB project decision makers 4. Publicise positive outcomes (e.g. waste reduction and cost savings) through press releases and social media to promote uptake by private businesses	
Type of action	Plan / Strategy	
Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	N/A	
Potential Emission Savings	This action should result in a reduction in emissions associated with material efficiency, less demand for raw materials (higher use of recycled materials) and therefore less demand for manufacturing and transport of those materials. The emissions figures have not been calculated at this time.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	District Municipalities Design teams, engineers, contractors Waste and recycling facilities Industries / organisations that can use the waste
	Financing options	Municipal budget.
	Revenue/savings opportunities	Circular Economy Assessments aim to maximise overall resource efficiency, helping to avoid costs of construction, demolition and refurbishment. Although some 'circular' solutions may cost more in the short term, these costs can often be recouped because of the ease of deconstruction, higher resale value, etc.
	Timeline	2021-2030
Impact measures	Waste diverted from landfill	
Estimated cost	**CAPEX:** N/A **OPEX:** N/A **Design/development costs:** €40,000 - €50,000	
Estimated benefits	**Health impacts:** Reduced waste to landfill, reduced air pollution and less dust due to lower rates of demolition, more efficient logistics during construction, and lower levels of waste production **Economic development:** Opportunities to develop new industries related to (de)construction, innovative design and construction techniques, and greater need to reclaim, reuse and recycle materials **Social Inclusion:** Wider, global positive impacts result from lowering the demand for raw materials which have a high social, economic and environmental cost due to the extraction and processing involved	
Existing Work Leveraged:	N/A	
1/25,000 scaled IBB Environmental Plan Alignment	Not spatially dependent	

SECAP B1 Insulation of Tertiary Buildings **SECAP B3 Install Energy Efficient Light Bulbs in Tertiary Buildings**	
SP Objectives:	1.1 A Sustainable Urban Infrastructure Will Be Built to Contribute to the Urban Economy
Rationale / Purpose	Electricity consumption accounts for more than 90% of the total energy consumption of the tertiary sector, and therefore represents a major source of emissions. Insulation and energy efficient lighting installations will help to reduce these emissions, as well as offering co-benefits such as lower fuel costs for businesses and other tertiary organisations. Mechanical and HVAC systems need to be considered for the efficiency of the systems.

Steps for Implementation	1. Develop a working group with sector representatives, NGOs, financial institutions 2. Cooperate with relevant stakeholders 3. Study on incentive alternatives within the jurisdiction of the local governments 4. Examine the awareness level of SMEs, owners of tertiary buildings 5. Build a communication strategy to increase awareness of energy efficiency, highly efficient appliance use and behavioural change of the business owners Note: Tertiary buildings tend to have higher energy demands as well as higher energy prices when compared with the residential or industrial sectors. This means that energy efficiency measures in tertiary buildings may have a shorter payback period which may help to promote uptake of these measures.
Timeframe	2021 – 2030
Potential Emission Reductions	Due to the difficulty in determining the number and size It is not easy to make assumptions about the number or size of the tertiary buildings pool, several assumptions based on as in separate residential units. The assumptions are made taking into account the total energy consumptions of the sector. It is assumed that 40% reduction in all fuel and 35% reduction in electricity consumption. 1.066.962 tCO_2e reductions in 2030 378.126 tCO_2e reductions in 2030 by awareness campaigns.
Potential Barriers	Lack of awareness Unwilling to change habits High initial costs Potential mismatch in knowledge, influence and incentives between tenants and landlords Lack of cooperation between institutions
Action Owner	IBB in conjunction with tertiary building owners / managers
Stakeholders	MoEnvU District Municipalities NGO's (IZODER, ENVERDER etc) Manufacturers Finance institutions
Financing Options	Municipal Budget, IFIs, PPP, IIBank, Private Developers,

SECAP B2: Energy Efficiency in Municipal Buildings	
SP Objectives:	1.1 A Sustainable Urban Infrastructure Will Be Built to Contribute to the Urban Economy
Rationale / Purpose	A Presidential Circular to achieve energy efficiency of 15% in all public buildings by 2023 have been published recently. The regulations also enforce to make energy audits and assignment of energy managers to buildings with a conditioned area of over 10.000 m^2. Compared to the energy consumption of the buildings in the city, the municipal consumptions are relatively low with a 1.4% of all emissions. Taking measures for efficiency would have an environmental impact as well as financial for the Municipality. Financial savings would also help to finance other low carbon actions. When analysed more than 60% of the electricity emissions are from water pumps, wastewater treatment and drinking water treatment facilities. There are ongoing efforts to save energy by IZSU. Still IBB has more than 150 buildings/facilities for different purposes of use and with different sizes. When the facilities of affiliates are included the number is much higher.
Steps for Implementation	1. Create an interdisciplinary project team and establish rules for investment decisions 2. Prepare feasibility studies for energy efficiency measures prioritizing buildings/facilities with high consumptions 3. Search for financing options for different actions (ESCOs or similar financing mechanisms can also be considered as an option) 4. Conduct pilot projects
Timeframe	2021 – 2030
Potential Emission Reductions	The reduction assumptions are made taking into account the total energy consumption of Municipal Buildings. It is assumed that 40% of energy consumption in 50 % of the buildings will be reduced. When the efficiency of the municipal water pumping stations is ensured, a total reduction of 67.884 tCO2e will be achieved in 2030. (The reduction amount of 6123 tCO_2e is related to the actions WCM1.11 - WCM1.9 - WCM1.4 - WCM1.5 - WCM1.6 - WCM1.10.)

Potential Barriers	The agenda and priorities change rapidly in line with the country and local context Lack of financing Lack of human resources to conduct studies
Action Owner	IBB All subsidiary companies
Stakeholders	District Municipalities under Metropolitan Area Being a good showcase IBB can share its experience with district municipalities and lead them take action for their buildings Other public institutions NGOs and TMMOB – for consultancy Manufacturers, implementers – cooperation Finance institutions – financing the investments
Financing Options	Municipal Budget, ESCOs, IFIs.

SECAP B4: Encourage and incentivise thermal insulation in existing residential buildings **SECAP B5: Encourage and incentivise energy efficient lighting systems in existing residential buildings (LED etc.)**	
SP Objectives:	1.1 A Sustainable Urban Infrastructure Will Be Built to Contribute to the Urban Economy
Rationale / Purpose	The total fuel consumption in residential buildings account for 60% of the emissions in the building sector. Any change will have an important impact on the CO_{2e} emissions of the city. Due to geographical and climate conditions of Izmir, cooling requirements of buildings are as significant as heating requirements. Thermal insulation will reduce cooling consumption as well as heating need. Natural gas is the most common heating source for the city and is used within almost half of households. The remainder of households still predominantly use either fuel-oil, coal, LPG or electricity for heating.
Steps for Implementation	1. Establish a team with sector representatives, NGOs, financial institutions 2. Cooperate with relevant stakeholders 3. Study on incentive alternatives within the jurisdiction of the local governments 4. Examine the awareness level of citizens 5. Build a communication strategy to increase awareness and inform about the incentives
Timeframe	2021 – 2030
Potential Emission Reductions	It is assumed that 40% reduction in fuel consumption and 10% reduction in electricity consumption in residential buildings. Insulation: 693.974 tCO_2e in 2030 Lighting: 124.610 tCO_2e in 2030 Awareness: 402.733 tCO_2e in 2030 will be achieved by 12% reduction of 80% of the residential buildings.
Potential Barriers	Lack of cooperation between institutions Lack of support from central government Lack of awareness Unwilling to change behaviour High initial costs (for most of the households)
Action Owner	IBB
Stakeholders	Building Owners MoEnvU – for regulatory support Izmir Metropolitan Municipality - can have a catalyser role for bringing different parties to develop business schemes, subsidies by different parties, etc. District Municipalities under Metropolitan Area - to take action to control and promote the actions NGO's (IZODER, ENVERDER etc) – increase public awareness and bring together the industry players Manufacturers, implementers Finance institutions – develop business models and financial solutions to promote activities
Financing Options	Municipal Budget, IFIs, PPP, IIBank, Private Developers,

Transportation

The following section outlines the actions developed to help mitigate the impacts of Izmir's transportation sector on global climate change. In broad terms, this involves promoting uptake of sustainable modes of transport, and reducing emissions from existing modes of transport.

Sector Objective: To increase sustainable modes of urban transportation systems while improving efficiency of current modes to increase the quality of life for all citizens

Number of actions: 5

Sector Target against 2018 baseline: 36% reduction by 2030

The transportation sector represents the second largest source of emissions in Izmir, at around 37%. The municipal vehicle fleet and public transportation services (including railways and marine transport) account for 6% of transportation emissions (2.2% of total emissions), while the remainder is dominated by other (i.e. private) vehicles. This reflects the fact that Izmir is a commercial hub and port of significant importance.

UPİ 2030 (The Izmir Transportation Master Plan) was published in January 2019. It aims to regulate the transportation and traffic problems of Izmir through 2030 and to outline future projects related to improving the transportation infrastructure. A survey conducted for UPİ 2030, indicates that 21% of journeys are made by private car while 35% use public transportation. It should also be noted that 33% of transportation is by pedestrian and 11% by service buses which businesses and schools provide buses or minibuses for commuting of students and workers. This is illustrated in Figure 25 below.

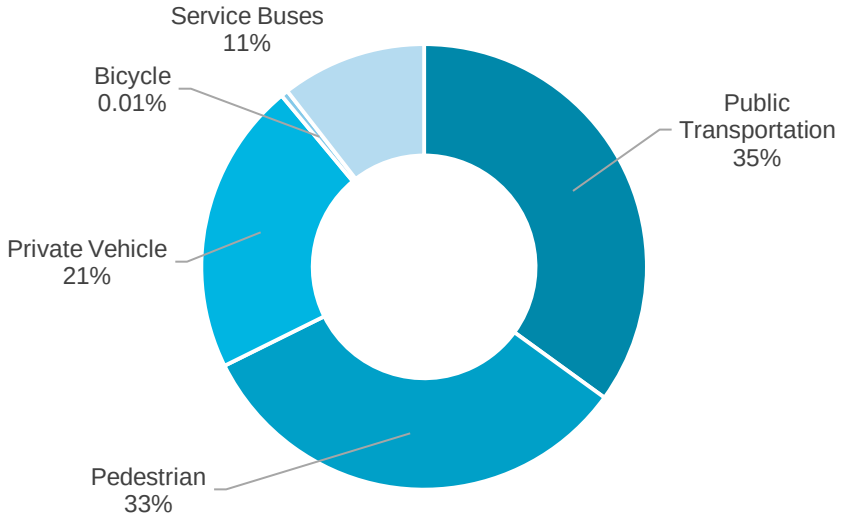

Figure 25: Shares of transportation modes, UPİ 2030

The recent UPİ 2030, published in January 2019, has strategies and targets similar to those laid out in the IBB Strategic Plan 2020-2024 in regard to sustainable transport. The actions developed to address and reduce emissions associated with the transportation sector for the SECAP align with the following goals and associated objectives within IBB Strategic Plan.

Table 44: Summary of the IBB Strategic Plan goals and objectives that relate to the building sector.

Heading	Goal	Objective(s)
Quality of Life - Public Transport	**2.** Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network	**2.1** Public Transport Will Be Affordable, Energy Efficient, Fair, Comfortable, Available to and Accessible for all residents
Quality of Life - Urban Transportation	**2.** Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network	**2.2** A Sustainable Transport System Will Be Created With a Harmonious Interaction Between Different Modes of Transport, Offering Different Options

Quality of Life - Health and Sports	**2.** Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network	**2.3** Health of Human and All Creatures will be Promoted
Quality of Life - Accessible and Clean Energy	**2.** Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network	**2.4** Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted

The SECAP mitigation actions for transportation are summarised below in Table 45 and further developed into a business case.

Table 45: Transportation sector actions

Action ID	Action Headline	Intervention Area	Policy Instrument	Responsible Body
SECAP T1.3	Apply smart traffic management, e.g. a command centre	Transport	Public Procurement	IBB
SECAP T1.4	Eco driving training (driving more economically) for IBB employees (As per SEAP Action - in lieu of EV / hybrid vehicles)	Transport	Awareness raising and training	IBB
T1.5	Municipal Fleet and Service Vehicles: electric and Low-carbon vehicles.	Transport	Public Procurement	IBB
T.1.1.3	Promote a step change in the uptake of privately / Municipality owned low emission vehicles:	Transport	Grants and subsidies	IBB
I: B	More sustainable logistical practices.	Transport/Industry	Transport and mobility planning	IBB

SECAP T1.3: Apply smart traffic management, e.g. introducing a command centre	
SP Objectives:	2.2 A Sustainable Transport System Will Be Created With a Harmonious Interaction Between Different Modes of Transport, Offering Different Options
Rationale / Purpose	The primary purpose of a smart city is to improve the quality and performance of public services, including transportation, by incorporating information and communication technologies. Traffic management systems, which help monitor, control, optimize, and operate traffic in urban areas. The streamed live data into the Transportation Management Centers allow transport officials and citizens to receive real-time updates about the city's transport conditions and availability. In Izmir, traffic flow and density can be monitored by the online platform of Izmir Transportation Center (IZUM) since 2018. The most important benefit of the system is the use of road capacities at high efficiency, a safer vehicle and pedestrian traffic, shortening travel times, and reduced accumulation and waiting times at the intersections. Currently, Izmir citizens can download the free application "IZUM" to smart devices. A summary of the system can be found at the beginning of the section. Although the system is in operation since 2018 Izmir wants to place more devices and enhance the system continuously.
Steps for Implementation	Some of the actions by IZUM can be summarized as incorporating smart intersections (402), monitoring traffic at 110 points, traffic measuring (201 points), management of public transportation system with 1500 buses, data gathered from 65 parking lots and other roadside parking, accident and road closure data, meteorological data. 1. The system has been quite new and need to improve the efficiency constantly. 2. The system will be expanded to the other districts (districts outside the city centre). 3. Update needed regularly with additional modes of transportation or infrastructure (car club, bicycle schemes, charging infrastructure data, etc. to be implemented)

	4. Analyse the big data gathered periodically to implement more efficient measures. 5. Promote the system to increase the use by citizens
Timeframe	2021 – 2030
Potential Emission Reductions	Calculated a 10% emission reduction targeted by 2030. 625.295 tCO_2e in 2030
Potential Barriers	The system is already in operation since 2018. Data security High number of data users (system capacity)
Action Owner	IBB,
Stakeholders	• IZUM • Citizens • Entrepreneurs (for new app development) • NGOs (cyclists, pedestrians, logistic sector representatives, etc)
Financing Options	Municipal Budget, IFIs, PPP, IIBank.

SECAP T.1.4: Eco driving training (driving more economically) for IBB employees (As per SEAP Action - in lieu of EV / hybrid vehicles)	
SP Objectives:	2.2 A Sustainable Transport System Will Be Created With a Harmonious Interaction Between Different Modes of Transport, Offering Different Options
Rationale / Purpose	The studies by transport experts indicates that there is a potential to decrease consumptions by eco driving trainings. ECOWILL project of EU conducted studies and found the positive effects of eco-driving as follows. • Average decrease in fuel consumption and CO_2 emissions by 5-15% • Reduced noise (due to lower revs) • Positive effects on traffic safety: up to 40% fewer accidents • Lower maintenance costs (e.g. brakes, tyres) • Increase in comfort (fewer shifting gears, less braking, less stress) • Contributes to EU CO_2 emission targets Training will be provided to drivers for the use of public transportation, vehicles with different driving experience and fuel consumption.
Steps for Implementation	Intelligent Energy Europe Programme of EU indicates 5-10% less fuel consumption of participants of Eco driving courses 1. Study with experts to compile updated “Eco-driving tips” 2. Determine different levels and lengths of education schemes (long versions for new drivers, shorter for experienced) 3. Set quality standards for the trainings 4. Conduct training the trainer seminars for drivers of different levels 5. Quantitative targets: Training of at least 100 driving instructors and educating 40,000 learner and novice drivers starting with public transportation drivers 6. Conducting at least 4000 Eco driving trainings per year till 2030. 7. Prepare and distribute flyers about “Eco driving tips” Use posters, billboards to inform citizens 8. Establishing a program with driving schools for all drivers to benefit from eco-training trainings
Timeframe	2021-2030
Potential Emission Reductions	Calculated by taking into account public transportation consumptions and logistic sector (assumptions made by using public transportation, light and heavy-duty vehicles) 10 % emission reduction targeted by 2030

	128.649 tCO_2e reductions in 2030.
Potential Barriers	Lack of awareness from logistic sector, citizens Lack of cooperation between institutions Lack of supporting regulations Lack of human resources
Action Owner	IBB
Stakeholders	• ESHOT • Logistic sector • Professional chambers • Local municipalities • Driving schools • Ministry of Transportation and Infrastructure
Financing Options	Municipal Budget, PPP, IFIs, IIBank,

T1.5: Municipal Fleet and Service Vehicles: Electric and Low-carbon Vehicles	
Strategic Plan Objectives:	**2.2** A Sustainable Transport System Will Be Created With a Harmonious Interaction Between Different Modes of Transport, Offering Different Options **2.4** Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted
Description	This action can be split into two parts, renewal of IBB's bus fleet by purchasing e-buses and the procurement of low carbon service vehicles. **a) E-Buses purchase:** IBB will continue and expand its efforts to replace old municipal buses and expand its existing capacity with e-buses. This action builds upon the ESHOT Strategic Plan, which has an expectation of approximately 400 e-buses to be purchased by 2024. Currently, 20 e buses have already been purchased from a local producer in 2017 at a cost of 400,000 EUR per bus, with a further 380 to be procured. After operating e-buses for 3 years, it has been observed by ESHOT that despite e-buses having a greater upfront cost of 250,000 EUR compared to diesel buses, they are 78% cheaper to fuel and 40% cheaper to maintain over the life cycle of the vehicle. Taking into consideration the renewal of older vehicles and projections for future capacity needed, ESHOT have planned the need to replace 871 buses in 2020-2025 and 530 buses between 2025 – 2030, totalling a need for 1,401 new buses to be purchased by 2030. As the first step of this renewal process, ESHOT will purchase 304 diesel buses in 2021. The remaining 1097 buses will be purchased as e-buses. **b) Service Vehicle procurement:** IBB currently tender the provision of service vehicles, which are predominantly made up of fossil-fuel based vehicles: petrol & diesel. According to IBB's Activity Report of 2018, IBB owns 120 passenger cars, 197 caryall trucks and cargo carrier vehicles, 9 land vehicles and 553 special purpose vehicles. In addition, IBB rented 235 vehicles (Passenger and van), 1.801 minibuses and buses, 12 construction vehicles and 12 water tankers. This action aims to revise IBB's current procurement policy to encourage the provision of electric or low-carbon alternative vehicle types.
Rationale	53% of public transport is delivered through buses. Most of these are diesel fuelled, with relatively high operating cost, risks of oil price volatility and environmental concerns[59]. The EU has set ambitious targets to reduce the number of fossil fuel vehicles should be reduced by 50% by 2030, and by 2050 all fossil fuel vehicles should be eliminated. The City has already purchased 20 electric buses. However, most of IBB's fleet is old, inefficient and comfort for passengers can be improved. A comprehensive upgrade programme will be a key driver of modal shift, resulting in improved air quality, reduced noise levels and improved comfort.

[59] *Izmir Transportation Master Plan (UPI 2030), page 166*

<table>
<tr><td>Steps for Implementation</td><td colspan="2">E-Bus purchase:
1. Establish annual targets for fleet replacement.
2. Engage with funders to determine finance options.
3. Identify new sites for charging buses and service vehicles, taking into consideration the space requirements, charging rates and grid capacity. This could include dedicated charging sites for many buses or en-route charging.
4. Prepare feasibility studies for PV for clean energy production to reduce emissions further.
Service Vehicles procurement:
1. Establish the timeframe for service vehicle renewal / replacement.
2. Revise existing service vehicle procurement policy to reflect the desire for electric or low-carbon vehicles.
3. Prepare the procurement documents and release the invitation for tender.</td></tr>
<tr><td>Type of action</td><td colspan="2">Capital project</td></tr>
<tr><td>Environmental values positively affected</td><td colspan="2">  </td></tr>
<tr><td>Climate Change risks and / or vulnerabilities addressed.</td><td colspan="2">N/A</td></tr>
<tr><td>Potential Emission Savings</td><td colspan="2">55% of emission reduction targeted in 80% of all vehicle fleet
127.494 tCO_{2e} savings in 2030</td></tr>
<tr><td rowspan="5">Plan for delivery</td><td>Action owner</td><td>ESHOT</td></tr>
<tr><td>Stakeholders</td><td>IBB</td></tr>
<tr><td>Financing options</td><td>Municipal budget, IFIs, Ilbank, PPP, private operators</td></tr>
<tr><td>Revenue/savings opportunities</td><td>After initial outlay, the operating costs of electric vehicles will be lower than for the existing fleet. It will be possible to save EUR 14,500 from fuel cost and EUR 3,900 from maintenance cost for one bus per year. Increased revenue may also be generated through higher public transport patronage. Air quality benefits may also lead to avoided healthcare costs.</td></tr>
<tr><td>Timeline</td><td>2021 – 2030</td></tr>
<tr><td>Impact measures</td><td colspan="2">• Proportion of fleet that is electrified
• Public transport CO_2 emissions
• Number of EV passengers
• Total number of EVs in fleet</td></tr>
<tr><td>Estimated cost</td><td colspan="2">CAPEX: €400,000,000 - €600,000,000
OPEX: €78,000 - €98,000
Design/development costs: €64,000 - €80,000</td></tr>
<tr><td>Estimated benefits</td><td colspan="2">Health impacts: Public health – reduced pollution
Economic Development: Increased economic efficiency; economic growth; employment creation, Revenue/savings generating activities
Social Inclusion: Access to basic services
Environment: reduced pollution, mitigation of GHG emissions.</td></tr>
<tr><td>Existing Work Leveraged:</td><td colspan="2">Izmir SEAP 2016</td></tr>
<tr><td>1/25,000 scaled IBB Environmental Plan Alignment</td><td colspan="2">Not Spatially Dependent</td></tr>
</table>

T1.1.3: Promote a Step Change in the Uptake of Privately and Municipality Owned Low Emission Vehicles	
Strategic Plan Objectives:	**2.2** A Sustainable Transport System Will Be Created With a Harmonious Interaction Between Different Modes of Transport, Offering Different Options **2.4** Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted
Description	This action will help Izmir take advantage from being at the forefront of the transition to electrified mobility through measures to that support electric vehicle use including: • priority parking for electric vehicles; • the provision of new and smart electric vehicle (EV) charging infrastructure; • To promote and encourage commercial buildings to have EV charging stations, with business licences granted by IBB • Install EV charging stations for all municipal buildings and municipal parking area • Introduction of an all-electric / hybrid car club pool
Rationale	Emissions from fossil fuel degrade Izmir's air quality, which is significantly poorer in the city centre, and contribute to climate change. EV have several advantages, including lower emissions, noise and vibration levels. The environmental impact of fossil fuel vehicles is leading to stricter EU emissions standards leading to several major automotive producers have announcing they will stop working on diesel engines and concentrate on hybrid and electrical vehicle engines in the first half of the next decade. A local brand of e-vehicle is under development. Mass production will start in the next 3-5 years. Furthermore, EVs typically have lower the operating costs of the municipal fleet over time, with generally lower maintenance costs, and EVs will not be dependent on the volatile prices of oil Promoting hybrid and electric vehicles in the city is also one of the actions planned in Izmir Transportation Master Plan (2019). Supporting the uptake of EVs will help improve Izmir's environment and benefit from being at the forefront of the transition.
Steps for Implementation	**Priority parking and EV charging infrastructure:** 1. Undertake mapping of dedicated parking areas and street parking 2. Develop provision standards for EV charging sites (including catchment / distribution density, charging capacity (speed), type of charging connections. 3. Identify spaces within municipal buildings, municipal parking areas and streets which have beneficial positioning / access that can be reserved for EVs. 4. Re-paint parking spaces and add install new signage. 5. Work with GDZ Electricity for a feasibility study to evaluate grid capacity for installation of charging infrastructure. 6. Monitor and enforce correct use of parking spaces. 7. Work with EV charging operators to fund, install and operate charge points. These could be connected to other municipal infrastructure such as lighting columns. 8. Work with private parking operators to encourage their support of priority parking for EVs and installation of charging infrastructure. 9. Develop policies for EV parking and charging within new development 10. Stakeholder engagement consultations and public awareness campaigns for the use of EV's and Road Safety. 11. To promote and encourage commercial buildings to have EV charging stations through business licences granted by IBB. **Introduce EV / Hybrid vehicle car club :** 1. In conjunction with identifying EV priority parking, identify locations for positioning EVs to be used as part of a shared pool 'car club'. These could be specific locations on residential streets, or within development areas. 2. Set up carpool club sharing company or working with existing car club operators to provide EVs. 3. Promote benefits of scheme
Type of action	Capital projects
Environmental values positively affected	
Climate Change risks and / or vulnerabilities addressed.	N/A

Potential Emission Savings	It is assumed that 30 % of private cars will be switched to electric vehicles by 2030 335.686 tCO_2e in 2030	
Plan for delivery	**Action owner**	IBB
	Stakeholders	Izelman A.Ş. Ministry of Transportation and Infrastructure GDZ Electricity NGOs District Municipalities Citizens Entrepreneurs, start-ups, EV retailors, car club operators Developers
	Financing options	Municipal budget, IFIs, private finance (charging companies, car companies etc), PPP, Ilbank,
	Revenue/savings opportunities	Electric vehicles will lower OPEX of the municipal fleet over time as EVs will not be dependent on the volatile prices of oil and generally have fewer associated maintenance costs. Air quality benefits may also lead to avoided healthcare costs.
	Timeline	2021 – 2030
Impact measures	• All air quality indicators • Concentration of heavy metals in soils (zinc, cadmium) • Annual CO_2 equivalent emissions per capita • Annual CO_2 emissions per unit of GDP • Average age of car fleet total and by type • Share of total passenger car fleet run by electric hybrid fuel cell Liquefied Petroleum Gas LPG and Compressed Natural Gas CNG energy total and by type • Number of private EVs • Number of charge points delivered	
Estimated cost	**CAPEX:** €17,000 for 50 rapid charging points. €11,000 for 50 slow charging points. **OPEX:** N/A **Design/development costs:** N/A	
Estimated benefits	**Health impacts:** Public health – reduced pollution **Economic Development:** Increased economic efficiency; economic growth; employment creation, Revenue/savings generating activities **Social Inclusion:** Access to basic services **Environment:** reduced pollution, mitigation of GHG emissions. .	
Existing Work Leveraged:	Izmir SEAP 2016	
1/25,000 scaled IBB Environmental Plan Alignment	1. Gulf of Izmir 2. Central City	

I.B: Develop more sustainable logistical practices

Strategic Plan Objectives:	**5.3** Gulf of Izmir and All The Coastal and Marine Areas Will Be Protected and Used Sustainably **2.2** A Sustainable Transport System Will Be Created With a Harmonious Interaction Between Different Modes of Transport, Offering Different Options
Description	A baseline study will be undertaken with a view of informing policy development around the uptake of more sustainable practices and the adoption of environmental and cultural factors in port operations (international and national logistics) and the development of coastal structures. The basic aims of this these studies will focus on: • An understanding of current port infrastructure, assets and management structure / protocols. • Identify operation and smart-infrastructure improvements that can be made that improve the emissions and reduce the environmental impacts associated with port operations, enhancing their sustainability practices.

	Opportunities to leverage the knowledge and best practice in regard to efficient/green operations will be sought through operational and management PPP options.	
Rationale	Izmir's geographical position caused the development of sea transportation and the city is a big hub for industry. Alsancak port located at centre, Çeşme, Dikili, Seferihisar ports providing international connections via shipping, Aliağa port which is an industrial area with petrol transport and Alaybey shipyard where the military facilities are located. These ports play an integral role in city's transportation links, by helping create more sustainable logistical operations in the port, it will positively influence both national and international transportation from these facilities in regard to their environmental impacts, use of natural resources and greenhouse gas emissions produced.	
Steps for Implementation	For the baseline studies: • Develop the scope and specification of the study, working with appropriate stakeholders. • Identify and secure the necessary funding • Procure a contractor to carry out the study.	
Type of action	Plan / Strategy	
Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	N/A	
Potential Emission Savings	Emissions of ports are not calculated separately from the city emissions; savings are not foreseen for port operations	
Plan for delivery	**Action owner**	IBB
	Stakeholders	MoTI MoEnvU General Directorate of Maritime Affairs Professional Chambers Local Municipalities Marine and Heavy Vehicle Logistic Sector Representatives International Ship Companies IZDENIZ
	Financing options	Municipal budget, Ilbank, O&M PPP, private sector
	Revenue/savings opportunities	Savings opportunities will come from reduced energy costs, decreased pressure on energy networks and public health benefits
	Timeline	2021 – 2030.
Impact measures	• All air quality indicators • Concentration of heavy metals in soils (zinc, cadmium) • Annual CO_2 equivalent emissions per capita • Annual CO_2 emissions per unit of GDP • Water Quality: Eutrophication • Sediment Quality • WFD Assessment: Seagrass	
Estimated cost	**CAPEX:** N/A **OPEX:** N/A **Design/development costs:** €8,000 - €20,000	
Estimated benefits	**Health impacts:** Public health – reduced pollution. **Economic Development:** Increased economic efficiency; economic growth; employment creation **Social Inclusion:** Access to basic services **Environment:** reduced pollution, mitigation of GHG emissions.	
Existing Work Leveraged:	N/A	

1/25,000 scaled IBB Environmental Plan Alignment	1. Gulf of Izmir

5.2.3. Energy

The following section outlines the actions developed to help mitigate the impacts of Izmir's energy sector on global climate change.

Sector Objective:
Increase renewable energy uptake and investments for sustainable and affordable energy for everyone

Number of Actions: 7

Sector Target against 2018 baseline:

Introduce 745 MW of LZC energy capacity in the city

Introduce15 MW of LZC energy capacity in IBB premises

Developed in co-ordination with the adaptation actions for energy in section 5.2.3 of this report, these actions recognise and leverage the existing work undertaken by IBB whilst acknowledging Izmir's extremely high potential to generate renewable energy. This includes Izmir's Sustainable Energy Acton Plan (2016).

At a national level, due to economic and population growth the demand for energy is rising rapidly in Turkey, the government has set a target to increase the share of renewable energy supply to at least 30% by 2023. This is supported by several national strategic plans and regulations, including the National Renewable Energy Action Plan (2011 – 2023). IBB also has a target to prepare pre-feasibility studies for different types of renewable energy (solar, biogas, etc.) in the next five years. These studies will be useful guides for potential investors.

The table below (Table 46) highlights relevant goals and objectives from the IBB Strategic Plan that have been considered in developing these actions.

Table 46: Summary of the IBB Strategic Plan goals and objectives that relate to the energy sector

Heading	Goal	Objective (s)
Quality of Life – Accessible and Clean Energy	**2.** Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network	**2.4:** Access to reliable, sustainable and affordable energy by everyone will be promoted
Quality of Life – Urban Transportation	**2.** Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network	**2.2:**A sustainable transport system will be created with a harmonious interaction between different modes of transport, offering different options

The SECAP mitigation actions for energy sector are summarised below in Table 47 and further developed into a business case.

Table 47: Energy sector actions

Action ID	Action Headline	Intervention Area	Policy Instrument	Responsible Body
ES1.1	Assess the feasibility of connecting public sector and / or industrial buildings to geothermal heat network(s)	Geothermal	Not applicable	IBB
SECAP ES1.2	Encourage the fuel switch from coal to more renewable sources in residential areas (geothermal, electricity)	Coal Transition	Grants and subsidies	IBB
ES.A	Develop Izmir bioeconomy strategy and action plan	BioEconomy	Other	IBB
ES1.7	Undertake a public lighting replacement scheme for all poles owned / run by municipality by installing LEDs.	Public Relam	Public procurement	IBB

ES1.11	Implement an environmental labelling scheme for companies within Izmir.	Clean Energy	Not applicable	IBB
ES1.12	Work with utility companies to understand capacity constraints and support a shift to smart-renewable electric systems.	Renewable	Not applicable	IBB
SECAP ES1.14	Municipality to encourage the private sector to install solar panels using existing national subsidies or financial schemes.	Photovoltaic	Grants and subsidies	IBB

ES1.1: Assess the feasibility of connecting public sector and / or industrial buildings to geothermal heat network(s)

Strategic Plan Objectives:	**2.4** Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted	
Description	Undertake mapping and associated baseline analysis to understand the number, distribution and fuel consumption of public sector and industrial buildings that currently use fossil fuel-based heating and understand the feasibility and potential benefits of connecting these to the geothermal heat network. Heat networks operate most efficiently when there is a high anchor load and therefore it is expected that the focus will initially be on large public sector or industrial buildings (or zones).	
Rationale	Heat generation can result in high carbon emissions. Connecting high heat users to the existing geothermal heat network and/or delivering new heat network(s) could result in the provision of more efficient, lower carbon heat. As with other forms of decentralised energy systems, it also offers benefits in terms of resilience and security of energy supply. At present there is very limited data available regarding the prevalence of different fuels and heating systems in Izmir, due in part to the number of informal settlements. In order to realise the potential benefits of heat networks, it is first necessary to undertake feasibility work to understand the scale and spatial distribution of opportunities along with their potential benefits.	
Steps for Implementation	1. Create a project team from different departments and establish rules for investment decisions 2. Undertake area-wide fuel consumption and heating demand analysis of existing buildings (in particular large public sector or industrial buildings) to identify heat network opportunity areas followed by more detailed feasibility work for opportunities with the greatest potential in terms of energy / CO_2 savings, cost effectiveness and deliverability 3. Analysis of the geothermal network for capacity, sizing and investment needs 4. IBB and stakeholders to agree on capital project opportunities that can be taken forward following results of the feasibility studies Although it is out of the scope of this report to identify opportunity areas, we note that some of the existing buildings in the geothermal region include: Dokuz Eylül University Hospital Campus, Izmir Economics University, Balçova Municipality Sports Facilities, Narlıdere Municipality	
Type of action	Plan / Strategy	
Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	N/A	
Potential Emission Savings	Savings not calculated for the action, although it would be anticipated that substantial emission savings could be achieved as a result of diverting buildings away from a reliance on fossil fuel heating and towards a geothermal.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	Izmir Jeotermal A.S. Public buildings Geothermal energy companies Finance institutions Technical experts, consultants, and academics
	Financing options	Municipal Budget

	Revenue/savings opportunities	Potential cost savings if the new source of heat is cheaper than existing fuels.
	Timeline	2021 – 2025
Impact measures	• Fossil fuel consumption in buildings • Total geothermal energy consumption by year • Share of industrial energy consumption from renewable energy • Proportion of total energy demand derived from RES as a share of total city energy consumption • Average carbon factor of heat generated / used	
Estimated cost	**CAPEX:** N/A **OPEX:** N/A **Design/development costs:** €20,000 - €33,000	
Estimated benefits	**Health impacts:** Improved air quality through use of local renewable energy sources, potential reductions in fuel poverty. **Economic development:** Potential to create jobs during roll-out of the heat network **Environment:** reduced pollution, mitigation of GHG emissions.	
Existing Work Leveraged:	Izmir SEAP 2016	
1/25,000 scaled IBB Environmental Plan Alignment	1. Gulf of Izmir 2. Central City 3. Urban / Rural Periphery	

SECAP ES1.2 Encourage the fuel switch from coal to more renewable sources in residential areas (geothermal, electricity).	
SP Objectives:	2.4 Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted
Rationale / Purpose	2 % of total emissions and 22 % of fuel combustion emissions in residential buildings is from coal. Coal use has negative effects on public health as well as being the dirtiest fuel in all aspects. It is important to provide an environment for coal users to switch to cleaner resources. There is a process of urban transformation applied through the “Law No 6306 Transformation of Areas under Disaster Risk”. Some of the residential buildings using coal as a fuel are also located in the planned Transformation Areas. Although at present it is more common to switch from coal to the use of natural gas, in order to achieve deeper decarbonisation, it will be necessary to switch away from fossil fuels and facilitate use of low and zero carbon energy technologies.
Steps for Implementation	1. Determination of coal-consuming residential areas and consumptions e.g. through surveys and GIS mapping 2. Determination of the conversion potential from coal to geothermal and/or electricity from renewable sources 3. Analyse expansion of natural gas infrastructure if other renewable sources are not available or feasible for the citizens. 4. Increase awareness among citizens using coal about the benefits of other energy sources including externalities.
Timeframe	2021 – 2030
Potential Emission Reductions	The emission reduction is calculated assuming 50% of coal consuming households switch to natural gas in order to be conservative on the calculations. The exact household number which are using coal is not known. However, the average heating demand is calculated as ~5,700 kWh/household. Based on this, it is calculated that over 210 thousand households are consuming coal for heating.83,331 tCO_2e reductions by 2030
Potential Barriers	Lack of awareness Unwilling to cooperate and change habits of citizens High initial costs Lack of cooperation between institutions
Action Owner	IBB

Stakeholders	Citizens Contractors of Transformation Area Projects Academics, consultancy companies for detailed studies Financial institutions
Financing Options	IFIs, PPP, IIBank.

ES1.7: Undertake a public lighting replacement scheme for all poles owned / run by municipality by installing LEDs.	
SP Objectives:	2.4 Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted
Rationale / Purpose	Street lighting accounts for 4% of IBB's CO2e emissions, equivalent to roughly 0.13% of total emissions for Izmir. When other street lighting* is added it is 0.8% of the total emissions. Studies indicate that replacing conventional bulbs with LEDs can reduce energy consumption for lighting by around 80% and lower operational costs, lower maintenance, longer lifetime of the system. The payback period usually is much less than other energy efficiency measures. There are other advantages of LED street lighting. The high quality of light is safer for vehicle drivers, cyclists, pedestrians. There are no toxic substances such as mercury, it is not hazardous as waste. More savings can be achieved by controlling illumination of certain areas (dimming lighting when unused) *Within the responsibility of district municipalities, Ministry of Transportation or Highways management
Steps for Implementation	1. Analyse the energy use by lighting zone. 2. Prepare feasibility studies for installation of LEDs, prioritizing zones with higher energy use. 3. Search for financing options; PPP (public-private-partnerships), revenue sharing and other schemes to be investigated 4. Plan the roll out of existing lighting poles when broken or economic life is over 5. Conduct pilot projects to test the advantages of LEDs IBB has targets since 2014 and planned to start the implementation in 2020.
Timeframe	2020 – 2030
Potential Emission Reductions	Reductions for IBB: 10,980 tCO_2e in 2030 Reductions from other institutions' consumptions: 111,102 tCO_2e in 2030
Potential Barriers	Lack of human resources to conduct studies Lack of cooperation between institutions Lack of finance
Action Owner	IBB
Stakeholders	District Municipalities Ministry of Transportation and Infrastructure Regional Directorate of Highways Manufacturers Installers Finance institutions Citizens as users
Financing Options	Municipal Budget, PPP, IFIs, IIBank.

ES1.11: Implement an environmental labelling for companies within Izmir.		
Strategic Plan Objectives:	**2.4** Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted	
Description	This action involves implementing a company-level environmental labelling scheme (and associated marketing strategy) to raise consumer awareness of sustainability issues and promote environmentally responsible production and purchasing decisions. The aim would be to encourage industrial businesses to participate in clean energy and green infrastructure efforts.	
Rationale	'Green' labelling schemes include, for example, organic certification and fair-trade products, sustainable timber, or energy efficiency ratings for appliances. The aim is to help customers understand the environmental and social sustainability impacts of their decision-making and by extension promote responsible purchases. Some research suggests that green labelling schemes can directly increase the value of a product, which offers potential economic benefits to participating organisations, along with sustainability benefits.[60].	
Steps for Implementation	1. Form a project team to assess opportunities to deploy labelling schemes, considering topics such as appropriate sectors, market trends and relevant legislation 2. Once a suitable initiative is identified, develop a marketing campaign to (a) encourage businesses to participate in these efforts and (b) raise consumer awareness 3. Monitor uptake and the success of the scheme	
Type of action	Plan / Strategy	
Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	N/A	
Potential Emission Savings	There would be positive mitigation effects if, for instance, energy labelling of appliances resulted in significant increases in efficiency and a net decrease in fuel consumption.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	District Municipalities within the Metropolitan Area Private Sector companies, cooperatives, and NGOs Finance institutions
	Financing options	Municipal budget
	Revenue/savings opportunities	Potential increase in product value (for more environmentally friendly products)
	Timeline	2021 – 2025
Impact measures	Qualitative market research survey to understand any shift in customer decisions making around responsible purchasing.	
Estimated cost	**CAPEX:** N/A **OPEX:** €500, - €700 **Design/development costs:** €10,000 - €13,000	
Estimated benefits	**Health impacts:** Depends on the sectors or businesses targeted for labelling **Economic development:** The innovation needed to develop lower-impact products can create new jobs **Environment:** reduced pollution, mitigation of GHG emissions. **Social:** Skills development.	
Existing Work Leveraged:	Izmir SEAP 2016	
1/25,000 scaled IBB Environmental Plan Alignment	1. Gulf of Izmir 2. Central City 3. Urban / Rural Periphery	

[60] Ulf J. J. Hahnel et al, 'The power of putting a label on it' (2015). DOI: 10.3389/fpsyg.2015.01392

ES1.12: Work with utility companies to understand capacity constraints and support a shift to smart-renewable electric systems.	
SP Objectives:	2.4 Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted
Rationale / Purpose	The municipality aims to pursue a collaborative approach with local utility providers in order to help facilitate: - effective clean energy procurement and integration, - decarbonization of the grid, - A review of utility resource plans, and a stronger relationship between the local utility companies and their Izmir based customers that can lead to future innovation. Collaboration through resource planning, specifically including public demand in integrated resource planning processes, allows municipalities and utility companies to better anticipate the associated additional renewable energy capacity within the city's energy generation portfolios. It gives the utility companies the opportunity to site these resources where they are most efficient and to work to reduce grid issues that arise from variable renewable sources. Aligned planning also supports faster decarbonization for the utility territory with increasing customer purchasing options[61].
Steps for Implementation	1. Establish a team from utility company, IBB, TMMOB, academia 2. Study the barriers, constraints towards a shift to renewable electric systems with utility company 3. Cooperate with academics, technology providers to overcome the barriers 4. Publish the results for guidance
Timeframe	2021 – 2030
Potential Emission Reductions	*Includes emissions from SECAP ES1.14.* 895 MW of installation of solar pv 726,024 tCO_2e reduction in 2030
Potential Barriers	Lack of human resources to conduct studies Lack of cooperation between institutions Conflict of interest of utility companies Potentially high cost of upgrading network capacity National policy context supports expansion of domestic fossil fuel production (local coal), which could lead to competing priorities in regard to funding for studies and/or implementing any network upgrades
Action Owner	IBB
Stakeholders	Utility companies District Municipalities under Metropolitan Area Manufacturers Finance institutions Ministry of Energy and Natural Resources
Financing Options	Municipal Budget,

SECAP ES1.14: Municipality to encourage the private sector to install solar panels using existing or new national subsidies or financial schemes.	
SP Objectives:	2.4 Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted
Rationale / Purpose	Total electricity consumption related emissions are 30% of the total emissions. This consumption consists of residential, tertiary buildings, public lighting. It is extremely essential to get private sector on board to be able to reach the desired emission reduction targets. After the latest legislation changes regarding grid connection fees, feed-in-tariff incentives introduced by the government have become ineffective. Although the procedures are eased step by step with legislation changes the incentives and fed-in-tariffs are no longer considered as incentives. There are still some advantages implementing solar energy systems under the form of energy cooperatives which can easily be led by local government and NGOs.

[61] *Pathways To Integrating Customer Clean Energy Demand In Utility Planning - Heidi Bishop Ratz And Lori Bird*

	When we look at the best practices of renewable energy penetration national incentives have been actively in the early stages then became a free market after certain thresholds. It is important to get central management on board for the uptake of renewables by citizens.
Steps for Implementation	1. Create a project team from different departments to assess key renewable energy opportunities / locations within Izmir. 2. Study best practices of incentives, financial schemes from around the world 3. Prepare guidelines that will help citizens, business owners about the legislation, procedures 4. Establish an energy cooperative to set an example for the citizens. 5. Provide or support consultancy services for citizens 6. Conduct awareness increasing activities for citizens 7. Investigate and put in practice new subsidies, financial schemes with international funding mechanisms, public/private finance institutions 8. Lobbying to establish incentive mechanisms at national level
Timeframe	2021 – 2030
Potential Emission Reductions	895 MW of installation of solar pv 726,024 tCO_2e reduction in 2030
Potential Barriers	Unwilling to change habits Lack of human resources to conduct studies Lack of cooperation between institutions Weaknesses of the grid infrastructure
Action Owner	IBB
Stakeholders	District Municipalities Citizens Consultants and/or academia for consultancy services to citizens Private sector businesses and organisations Renewable technology providers and installers Financial institutions
Financing Options	Municipal Budget, IFIs, PPP, IIBank.

ES.A: Develop Izmir bioeconomy strategy and action plan	
Strategic Plan Objectives	**3.1.** The Right Ecosystem Will be Created to Make İzmir an Attraction Center for New Investments, Technological Innovations, and Creative Industries.
Description:	Covers all kinds of industries and economic sectors producing, managing and distributing biological resources (e.g. Agriculture, Food, Forestry, Fishery and other bio-based industries).
Rationale	It has become mandatory to make a transition from a structure based on unsustainable fossil resources to a bio-based economic system aiming to produce innovative and reliable products through the use of bio-based resources. Efforts should be spent on the provision of biomass supply for bio-based products and services, diversification of biomass resources, fostering their production and ensuring sustainable provision in the fields of agriculture and forestry. Izmir has the potential to take important steps particularly towards transition to sustainable and nature-based agricultural practices, blue bioeconomy and forest bioeconomy in mountain ecosystems.
Steps for Implementation	1. A meeting should be organized with the relevant public institutions, private sector institutions, universities, chambers, cooperatives and associations in order to identify the areas of Izmir offering a bioeconomy potential, which will constitute the basis for the strategic plan of IBB. 2. IBB should appoint individual(s) or department(s) in charge who will ensure the conduct of the relevant strategy on the part of the administration. 3. The relevant bioeconomy strategy and action plan should be prepared, and services should be procured on the issue. 4. Strategy should be created, and the results obtained should be ensured to be shared widely through the strategy website, press releases and social media.

	5. The action plan should be created via a dialogue conference in order to determine the internal officers of IBB and the relevant external institutions who are in charge of the implementation processes. 6. The structure founded at IBB for monitoring the relevant strategy and action plan (Item 2) should be authorized to perform the monitoring activities and be ensured to be competent in the relevant job.	
Action Type	Plan / Strategy	
Environmental values positively effected		
Risks and/or vulnerabilities addressed	N/A	
Expected reduction in emissions	This action will result in reduced emissions through the recycling of bio-based waste materials, reduced use of raw materials (conversion of recycled materials into biomass and biogas) and thus a reduced transportation requirement for the disposal of these materials (e.g. designing bioreactors for the fast production of compost fertilizers in market places and where segregation is not required). Emission figures have not been calculated yet.	
Implementation plan	**Action Owner**	IBB
	Stakeholders	District Municipalities Industries / industrial organizations which may use the wastes Cooperatives Technical experts, consultants and academicians
	Financing Options	Municipality Budget
	Revenue/savings opportunities	Bioeconomy is a key component of circular economy, and hence will maximize total resource efficiency by means of conversion of wastes into resources. Some "circular" solutions will become suitable and cost-efficient once they are disseminated to residential areas, which are responsible for the large building stocks of the city (e.g. garden wastes produced by districts where garden houses are common and, on a smaller scale, by large housing complexes can be used in pyrolysis facilities for biocoal production).
	Timeframe	2021 – 2025
Impact measures	To be determined as a result of the strategy and action plan produced as part of this action.	
Estimated cost:	**CAPEX:** - **OPEX: -** **Design/Development Costs: -**€60,000	
Estimated benefits	**Health impacts:** Production of food supplement and nutraceuticals (e.g. extraction of bioactive substances from agricultural production wastes and agricultural industries' waste). In addition, production of disinfectants under pandemic conditions (e.g. food businesses employing fermentation of sugar products whose shelf life has expired and producing industrial ethyl alcohol to be used in cologne making). **Economic development**: Will increase industrial symbiosis potential among industrial businesses. In addition, contribution will be made to the production of food with added value and clean energy thanks to reduced dependency on fossil fuels. **Environmental:** Bioeconomy practices will result in reduced carbon emissions. They will support smarter use of natural resources and prevent wastage.	
Existing Actions Leveraged	Izmir SEAP 2016	
IBB Spatial Strategy Alignment	1. Gulf of Izmir 2. Central City 3. Urban / Rural Periphery	

5.2.4. Waste

Sector Objective: Adopt sustainable waste management schemes and develop recycling mechanisms to support the national Zero Waste Initiative

Number of actions: 8

Sector Target against 2018 baseline: ~ 97% decrease in CO_2e emissions by 2030

GHG emissions arise from the collection, transportation, storage, processing and incineration or landfill disposal of waste. Solid waste management accounted for around 4.2% of the total emissions of Izmir in 2018 (595,316 tCO_2e). Emissions from wastewater treatment accounts for around 0.7% of emissions (96,141 tCO_2e), around half of which is due to CO_2 emissions from the wastewater treatment plant.

Strategies developed by MoEnvU focus on prevention or reduction of waste generation at the source. The Zero Waste Regulation dated 12 July 2019[62] emphasizes the effective use of resources, and it is one of the priorities to prevent waste generation in the production process as well as in consumption. Another priority is the separation of waste at source by citizens, businesses and to recycle for material and energy savings.

IBB is responsible for developing and implementing a provincial waste management plan.[63] Currently, it is estimated that 93% of waste by volume is disposed in regulated landfills and 7% is disposed of in unregulated landfills, as shown in the figure below. There are ongoing projects to assess the various options to rehabilitate the present sites, and a new waste separation facility is planned for the Harmandalı Landfill with a capacity of 5,400 ton/day for the year 2025 (Figure 26).

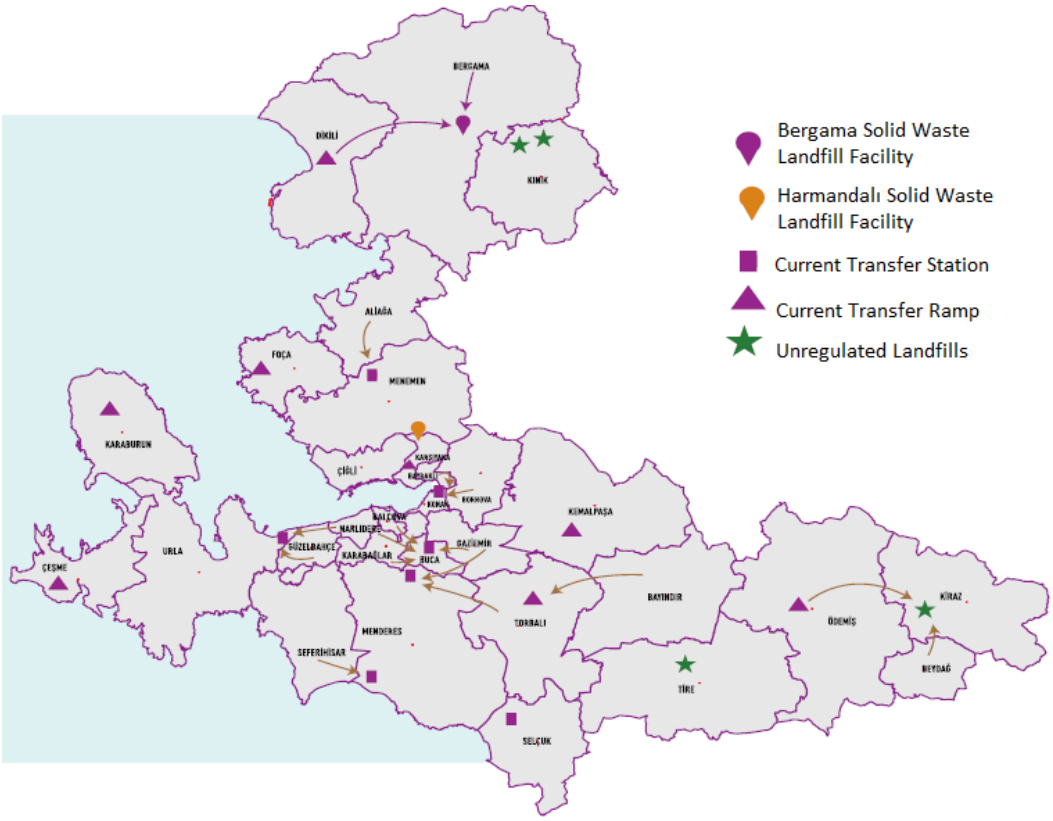

Figure 26: Izmir landfill areas, transfer centres

In addition, IBB has been working on how to achieve a more sustainable waste management system, stated in its Strategic Plan 2020-2024. To this end, rehabilitation of Harmandalı Solid Waste Landfill Facility as a sustainable waste management centre has been finalized and electricity generation with a capacity of 15 MW has started in 2019.

[62] Ministry of Environment and Urbanization, "Zero Waste Regulation" numbered 30829, 12 July 2019.
[63] Metropolitan Municipality Law No. 5216, 10 July 2004.

The Izmir Province Integrated Waste Management Plan sets out waste management practices and infrastructure enhancements for Izmir that support the vision to become a more liveable city[64]. Key actions can be summarized as follows:

- The use of sufficient number of containers and vehicles of the same standards throughout Izmir province with appropriate consideration given to the potential increase in waste generated over time
- Establishing new waste collection systems to facilitate the separation and processing of recyclable and biodegradable waste and raising public awareness on this issue.
- Establishment of additional waste collection centres by district municipalities and efficient collection of waste.
- Planning of integrated solid waste recovery and disposal facilities, where energy and raw materials are recycled from waste, and the amount of waste to landfill is minimized.
- Collecting municipal waste directly and transferring it to newly planned integrated recovery and disposal facilities through transfer stations
- Continued rehabilitation of unregulated landfill areas,
- Gradual implementation of facilities (Compost, Biomethanization, Incineration) planned for adaptation of regional strategies adapted to national level waste management requirements.

The actions developed to address and reduce emissions associated with the waste sector for the SECAP align with the following goals and associated objectives within IBB strategic plan (Table 48)

Table 48: Summary of the IBB Strategic Plan goals and objectives that relate to the waste sector.

Heading	Goal	Objective (s)
Nature - Recycling	**5.** Making Izmir one of the model cities of the world in harmony with nature.	**5.1** Sustainable waste management and recycling mechanisms will be developed

The SECAP mitigation actions for waste sector are summarised below in Table 49 and further developed into a business case.

Table 49: Waste sector actions

Action ID	Action Headline	Intervention Area	Policy Instrument	Responsible Body
SW1.6	Partner and / or cooperate with relevant institutions and organisations that can act jointly in line with Zero Waste Regulation to develop and invest in the necessary recycling infrastructures (bins, trucks, routes etc).	Waste	Other	IBB
SECAP SW1.8	Development of a detailed analysis (number, type, size, age etc) and action plan for the development and low-emission management of dumpsites / landfills (both closed and operational). This could incorporate the development of mandatory energy recovery and landfill gas and anaerobic digestion.	Landfill Gas	Public procurement	IBB
SW1.16	Investigate potential to provide dedicated waste collection for restaurant / food industry traders in-line with management infrastructure and technology.	Waste	Other	IBB
SW1.1	Establish a municipality-wide awareness campaign (schools etc) for waste reduction and separation at household level.		Awareness raising / training	
SW1.3	Make separate collection of key dry recyclable materials mandatory, formulating policy at the district municipality level.		Other	IBB

[64] Izmir Province Integrated Waste Management Plan, 2018, p.104-105.

SW1.4	Supplement and speed up investment in waste separation facilities, (dry recyclables and organic waste), a clean materials recovery infrastructure and composting facilities, building on the Izmir Integrated Solid Waste Management Plan (2018).		Other	
SW1.10	Municipality to commit to banning the use of single-use plastics within their buildings, encouraging local businesses to do the same.		Awareness raising / training	
SW1.17	Undertake an assessment of waste collection infrastructure (collection service, coverage rate, bins/ containers, vehicles), including smart collection systems and route optimisation software in collaboration with district municipalities.		Other	

SW1.3: Make separate collection of key dry recyclable materials mandatory, formulating policy at the district municipality level.		
Strategic Plan Objectives:	**5.1** Sustainable Waste Management and Recycling Mechanisms Will Be Developed	
Description	In line with the National Zero Waste Regulation[65] and in collaboration with SECAP SW1.8, IBB will establish mandatory requirements for the separate collection of dry recyclable materials at the district municipality level and will by raise public awareness on this issue. In addition, according to the Regulation, District Municipalities of IBB are required to start implementation of Zero Waste Management System by 31 December 2020.	
Rationale	According to the waste characterisation study of Izmir Province conducted in 2018, the samples identified that recyclable packaging waste was the most prominent element (with an average of 18.97% by weight). Therefore, mandatory separate collection of dry recyclable materials will; • reduce the amount of waste sent to landfill (the reduction rate of waste sent to disposal should be at least 15% according to the National Zero Waste Regulation) and therefore, decrease the land needed for landfilling • be beneficial for the economy • help to achieve one of the goals of the Integrated Solid Waste Management Plan of IBB developed in 2018, which is to collect at least 12% of packaging waste separately at source by 2023.	
Steps for Implementation	1. Explore the regulatory and fiscal measures available to the municipality to set enforceable policies for dry recycle separation 2. Baseline assessment of current markets and infrastructure for recyclable collection, separation, processing and export. 3. Evaluate and determine practical infrastructure requirements needed for District Municipalities to undertake effective separate waste collection (i.e. bin, storage, collection, bulking and processing requirements) 4. Engage with District Municipalities 5. Formulate and approve policy and enforcement measures 6. Develop implementation plan to include infrastructure investment and revisions to building codes required.	
Type of action	Enforcement with potential capital investment	
Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	N/A	
Potential Emission Savings	In combination with action SECAP action SECAP SW1.8, and GCAP action SW1.6, SW1.16 an SW1.17.	
Plan for delivery	**Action owner**	IBB

[65] *MoEnvU, "Zero Waste Regulation" numbered 30829, 12 July 2019*

	Stakeholders	MoEnvU, Provincial Directorate of Environment and Urbanisation, CEVKO Foundation, District Municipalities, Izmir citizens.
	Financing options	Municipal budget
	Revenue/savings opportunities	Revenue could be generated from the key dry recycled materials
	Timeline	2020-2025
Impact measures	• Share of the population with weekly municipal solid waste (MSW) collection • Proportion of MSW that is sorted and recycled total and by type of waste e.g. paper glass batteries PVC bottles metals	
Estimated cost	**CAPEX:** Collection asset set-up cost: €980,000 - €1,230,000 **OPEX:** Public Information Campaign: €1,300 – 1,600, Collection asset cost per year: €1,600,000 - €2,400,000. **Design/development costs:** Studies and Information Campaign: €23,000 - €29,000	
Estimated benefits	**Economic Development:** economic growth; employment creation; revenue generating activities **Social Inclusion:** skills development (behavioural) **Environment:** Mitigation of GHG Emissions	
Existing Work Leveraged:	Izmir Integrated Solid Waste Management Plan 2018.	
1/25,000 scaled IBB Environmental Plan Alignment	Not spatially dependent.	

SW1.4 Supplement and speed up investment in smart-waste separation facilities, (dry recyclables and organic waste), a clean materials recovery infrastructure and composting facilities, building on the Izmir Integrated Solid Waste Management Plan (2018).	
Strategic Plan Objectives:	**5.1** Sustainable Waste Management and Recycling Mechanisms Will Be Developed
Description	In accordance with the targets of the Integrated Solid Waste Management Plan of IBB developed in 2018; waste have to be separated in source, or that mechanical / biological treatment has to be carried out, before waste is accepted to landfill. To ensure that, undertake an assessment study with a view to investing in waste separation facilities (such as Harmandalı Physical Separation Facility), a clean materials recovery facility and composting facility and complete the waste collection systems.
Rationale	• Segregating recyclable waste will reduce the amount of waste sent to landfill, and thus, the land needed for landfilling will decrease • Recycled materials will be introduced to the economy. • Biodegradable wastes are evaluated in compost production before disposal.
Steps for Implementation	1. Assess expected quantities of different waste streams 2. Assess current infrastructure and expected infrastructure / area needs, for waste separation, recovery and composting 3. Identify requirements for separate collection, recovery and composting, including any funding or financial support, technology assessment 4. Complete the investment of waste collection systems to facilitate the separation and processing of recyclable and biodegradable waste
Type of action	Capital project
Environmental values positively affected	
Climate Change risks and / or vulnerabilities addressed.	N/A
Potential Emission Savings	The specific reduction associated with this action has not been calculated at this time, however emissions can be reduced as:

	• Waste separation, minimisation, reuse and recycling reduce GHG emissions by conserving raw materials and fossil fuel use during the products life cycle. • Waste offers a significant source of renewable energy. Incineration and other thermal processes for waste-to-energy, landfill gas recovery and utilisation, and use of anaerobic digester biogas can play important roles in reducing fossil fuel consumption and GHG emission. • Increasing the material recovery rate and compost production reduces GHG emissions that are currently associated with their disposal in landfill.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	MoEnvU, Provincial Directorate of Environment and Urbanisation, District Municipalities, Investors
	Financing options	Municipal budget, IFIs, Ilbank, PPP, private banks
	Revenue/savings opportunities	Revenue could be generated from reuse of dry recyclables
	Timeline	2020 – 2025
Impact measures	• Share of the population with weekly MSW collection • Proportion of MSW that is sorted and recycled total and by type of waste e.g. paper glass batteries PVC bottles metals	
Estimated cost	**CAPEX:** €8 / tonne for a clean materials facility and €18 / tonne for a composting facility. **OPEX:** **Design/development costs:**	
Estimated benefits	**Health impacts:** public health – reduced pollution **Economic Development:** economic growth; employment creation; revenue generating activities **Social Inclusion:** skills development (behavioural) **Environment:** Mitigation of GHG Emissions, reduced pollution	
Existing Work Leveraged:	Izmir SEAP 2016, Izmir's Integrated Solid Waste Management Plan 2018.	
1/25,000 scaled IBB Environmental Plan Alignment	Not spatially dependent.	

SW1.6: Partner and/or cooperate with relevant institutions and organisations that can act jointly in line with the Zero Waste Regulation to develop and invest in the necessary recycling infrastructures (bins, trucks, routes etc).	
SP Objectives:	**5.1.** Sustainable Waste Management and Recycling Mechanisms Will Be Developed
Rationale / Purpose	This action would focus on investing in and developing the necessary smart waste collection infrastructure and assets that IBB requires to help advance the Izmir Integrated Solid Waste Management Plan 2018. It would be developed in-line with actions SW1.3 and SECAP SW1.8. The amount of solid waste per capita in Izmir has increased in recent years, rising from 390.55 kg per capita in 2008, 469.09 kg per capita in 2018 – a 20% increase. According to the (Izmir Province Integrated Waste Management Plan, the amount of waste per capita is expected to continue to rise in the next decade (p.99). In 2018, 4800 tons of waste was accepted per day in Harmandalı Solid Waste Storage Area. The amount of urban solid waste is expected to be 5,413 tons in 2025. This action is therefore necessary to minimise the increase in waste, and associated GHG emissions. There should be a focus on both expanding capacities to ensure that 100% of areas within the province receive a weekly collection, whilst also upgrading to a smart waste management system. The first stage of this action would involve filling the current data gaps regarding the current number of waste collection trucks and the district through Izmir that would require more extensive collection coverage. Developed in-line with the timeframes for the construction of disposal and recycling facilities, outlined in the Izmir Integrated Solid Waste Management Plan 2018
Steps for Implementation	1. Cooperate with District Municipalities for effective recycling. Determine the necessary infrastructures needed (bins, adequate trucks, route optimizations, etc) 2. Harmandalı waste separation unit will be finalized. 3. Establishment of new waste transfer stations (5 already planned till 2025) 4. Operation of recycled waste transfer stations to include monitoring and reporting on targets

	5. Effective cooperation with private/public recycling institutions/facilities 6. Raising awareness of the public on recycling 7. Raise awareness and encouragement activities and campaigns for the use of recycled materials through channels such as print, visual media and social media.
Timeframe	2020 – 2030
Potential Emission Reductions	Although waste reduction in general would likely result in lower emissions (e.g. due to the reduced need for processing / management, transportation and incineration or landfill gas), the potential magnitude of reductions is not possible to quantify without further detailed feasibility studies.
Potential Barriers	Difficulty in achieving long-term behaviour change among the general public and institutions Lack of cooperation between institutions and departments Increased amount of waste per capita
Action Owner	IBB
Stakeholders	Ministry of Environment and Urbanization District Municipalities Recycle facilities Finance institutions
Financing Options	PPP, IFI's, State Investment, Municipal Budget, Municipality Issued Green Bonds,

SECAP SW1.8: Development of a detailed analysis (number, type, size, age etc) and action plan for the development and low-emission management of dumpsites / landfills (both closed and operational). This could incorporate the development of mandatory energy recovery and landfill gas and anaerobic digestion.	
SP Objectives:	**5.1.** Sustainable Waste Management and Recycling Mechanisms Will Be Developed
Rationale / Purpose	When the necessary investments and preparations are completed, the emission of a large amount of methane into the atmosphere will be prevented.
Steps for Implementation	Harmandalı Solid Waste Landfill Facility has already been rehabilitated and generation of electricity has started at the end of 2019. The energy generation capacity is 15 MW and can be extended up to 45MW. The landfill area uses the energy generated within the site. Harmandalı SWLF is operated by a private company under the control of our Municipality under the Public Procurement Law No. 2886. • It should be investigated if the Harmandalı model is applicable to Bergama due to lower capacity there. • Alternative investment models need to be investigated for Bergama landfill • Conduct studies on the 2 landfills to see the potential of the rehabilitation • Since IBB now has necessary experience, the 5 open landfills will be turned into regulated landfills.
Timeframe	2020 – 2030
Potential Emission Reductions	Reductions from all landfills:667,279 tCO_2e in 2030 Electricity generation from biogas in Harmandalı: 136,890 tCO_2e in 2030 when the facility reaches full capacity of 45MW.
Potential Barriers	Lack of financial resources Inapplicability due to low capacities of landfills other than Harmandalı Landfill gas decreases over time, eventually becoming a non-viable source of energy In line with the Waste Hierarchy, and in line with Circular Economy principles, waste should be significantly minimised (if not eliminated) over time, making it a sub-optimal energy source in the medium to long term
Action Owner	IBB
Stakeholders	MoEnvU MoAF District Municipalities Investors Finance institutions
Financing Options	Municipal Budget, IFIs, PPP, IIBank.

SW1.10: Municipality to commit to banning the use of single-use plastics within their buildings and operations, encouraging local businesses to do the same.		
Strategic Plan Objectives:	**6.2** Institutional Capacity and Functioning Will Be Made More Effective, Economic and Efficient	
Description	In order to reduce the amount of non-recyclable waste and GHG emissions, Municipality will commit to banning the use of single-use plastics within their buildings and operations, while encouraging other organisations, businesses and institutions to do the same.	
Rationale	According to the United Nations Environment Programme report "Single-Use Plastics - A Roadmap for Sustainability", the impacts of single-use plastics include: • Impacts on wildlife from direct ingestion/entanglement or from ingestion of microplastics following plastic degradation; • Blockage of watercourses and sewage systems; • Visual impacts and disamenity from litter; • Economic costs of beach and sea clean-up and economic impacts on fisheries, tourism and shipping industries. • Plastic production and disposal generate GHG emissions, and the majority of plastics are not recycled[66]. IBB has direct control over municipal buildings. Banning the use of single-use plastics is a simple step to reduce İzmir's total amount of non-recyclable waste and GHG emissions	
Steps for Implementation	**Municipality to commit to banning the use of single-use plastics:** 1. Stakeholder mapping and confirmation of policy scope. 2. Inventory of single-use plastics 3. Identify potential alternatives and any essential/non-substitutable items. 4. Carry out impact assessment of costs and risks. 5. Develop and implementation plan, including allocating roles and responsibilities, communication strategy and timeframe. 6. Implementation and monitoring. **Encouraging local businesses to do the same:** 1. Voluntary reduction strategies for local businesses and agreements 2. Stakeholder mapping 3. Develop case studies and "how to" guides (including mode policies). Public campaign to encourage uptake. 4. Monitoring of uptake.	
Type of action	Plan / Strategy	
Environmental values positively affected	 	
Climate Change risks and / or vulnerabilities addressed.	N/A	
Potential Emission Savings	The emissions savings cannot be quantified at this stage since the amount of single-use plastic is not known. A ban has the potential to: • Reduce overall waste generation • Reduce GHG emissions.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	Local Businesses NGOs Citizens
	Financing options	Municipal budget

[66] *Zheng, J., Suh, S. Strategies to reduce the global carbon footprint of plastics. Nat. Clim. Chang. 9, 374–378 (2019). https://doi.org/10.1038/s41558-019-0459-z*

	Revenue/savings opportunities	Savings opportunities will come from public health benefits
	Timeline	2020-2030
Impact measures	• Annual CO_2 equivalent emissions per capita • Annual CO_2 emissions per unit of GDP • Total solid waste generation per capita • GDP per domestic material consumption • Proportion of municipal solid waste that is sorted and recycled total and by type of waste e.g. paper glass batteries PVC bottles metals	
Estimated cost	**CAPEX:** N/A **OPEX:** €600 - 800 **Design/development costs:** €15,000 - €20,000	
Estimated benefits	**Health impacts:** Public health – reduced pollution **Economic Development:** Increased economic efficiency, Revenue/savings generating activities **Social Inclusion:** Strengthens social fabric **Environment:** reduced pollution	
Existing Work Leveraged:	Izmir Integrated Solid Waste Management Plan 2018	
1/25,000 scaled IBB Environmental Plan Alignment	Not spatially dependent	

SW1.1-SW1.16-SW1.17 Actions supporting zero waste initiative	
SP Objectives:	**5.1**. Sustainable Waste Management and Recycling Mechanisms Will Be Developed
Rationale / Purpose	There are a number of actions identified during studies and workshops that support "Zero Waste Regulation" and the efforts to reduce waste. All these actions are collected under one action. It is important to take action to reduce waste production in many ways. In case of a deviation from projections and a higher increase would lead to new investments needs for waste management. By preventing waste increase these investment need can be eliminated as well as lower GHG emissions. Undertaking awareness raising campaign's and provide guidance / instruction on how citizens can embark on home or community composting (the recycling of organic wastes such as food and kitchen waste from households, restaurants, caterers), or other means of recyclable waste This will help to reach the objective of sustainable waste management and effective recycling with a view of encouraging and informing behaviour change.
Steps/Actions for Implementation	**SW1.1:** • A number of awareness raising activities and meetings have already been planned in the IBB Strategic Plan. District Municipalities are also conducting trainings in schools. IBB can cooperate with District Municipalities for the dissemination of these trainings to a wider audience. • Prepare promotion material visual, social media Short info messages animations shared on social media accounts, billboards on busy routes can be used for the purpose. • Competitions and reward mechanisms will be established **SW1.16:** • IBB can study the areas that food businesses are more concentrated • Conduct a study to identify an area where the collected waste can be composted. One of the transfer centres where relevant District Municipalities bring the waste can be investigated. • Cooperate with District Municipalities to collect food waste • Competitions and reward mechanisms will be established **SW1.17**: • Cooperation with District Municipalities is crucial since it is their responsibility to collect waste. • Undertake a study for the optimization of container size, vehicle sizes, route optimization • Undertake a study about smart systems including benchmarks from the world and Turkey.
Timeframe	2021 – 2025
Potential Emission Reductions	Supporting actions for SECAP SW1.8, emission reductions cumulated.

Potential Barriers	Resistance to change habits Lack of cooperation with District Municipalities Lack of human resources to conduct studies
Action Owner	IBB
Stakeholders	District municipalities Izmir citizens Restaurants, food industry CEVKO Foundation Ministry of Environment and Urbanisation
Financing Options	Municipal Budget, PPP, Private Investment, IIBank, IFIs.

5.3. Adaptation

The following section contains 24 actions that are specific to adaptation.

5.3.1. Water

Number of actions: 9

These actions recognise and leverage the existing work undertaken by IZSU, which was established by Law No. 2560 to carry out the water and sewerage services and operate appropriate infrastructure for IBB, provides distribution of drinking water and disposal of wastewater within the municipality. In order to prepare the City against global climate change in the future (2050) by establishing new water resources according to the population projections, IZSU prepared both a Potable Water Master Plan (2017) and a Sewerage and Stormwater Management Plan (2016) which are incorporated within the IZSU Strategic Plan (2020 – 2024). The "Gulf of Izmir and Port Rehabilitation project" is another study to improve the water quality in Gulf of Izmir[67], and high standard water quality tests are regularly conducted at the potable water network points.Water management is also incorporated broader sector programmes for land-use management, such as the Green Infrastructure Strategy, which provides recommendations of water management in / by green infrastructure.

At a national level both the MoAF and MoEnvU take responsibility for various aspects of water management, with a number of directives to help protect and manage water resources. This includes the Water Pollution Control Regulation (2014), The National Regulation of Wastewater Collection and Disposal Systems,the National Regulation of Storm Water Collection and Disposal systems and Water Basin Protection .

In developing effective adaptation measures to increase the resilience of the water sector, it is important to recognise and incorporate the cross-sector dependencies and influences on water resources in order to avoid any maladaptive outcomes. Driven by global trends such as climate change, increasing urbanisation and rapid population growth, water systems face increasing threats and challenges to future uncertainties and pressures regarding operating conditions and environments. Such threats can be observed across all aspects of the water management network, found at the supply side due to climatic variability, the delivery side as current infrastructure and treatment methods become older and less reliable and at the demand side as industrial activity, demographics and socio-economic trends alter demand level and competition for resources.

Table 50 below demonstrates the IBB strategic plan objective that aligns with actions presented for the water sector.

Table 50: IBB Strategic Plan 2020 – 2024 objectives addressed

Strategic Heading	Strategic Goal	Strategic Objective(s)
Nature – Climate Action	**5.** Making Izmir a Global Mode for its Harmony with Nature `	**5.2:** In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy
Experimental Learning, Institutional Capacity - Enterprise Resource Management	**5.** Making İzmir a Leading City in the World in Experiential Learning, and Creating an Urban Environment, Where Innovative Ideas Flourish	**6.2:** Institutional Capacity and Functioning Will Be Made More Effective, Economic and Efficient

The SECAP adaptation actions for water are summarised below in Table 51 and further developed into a business case.

[67] http://www.imo.org.tr/resimler/ekutuphane/pdf/18342_53_40.pdf

Table 51: A summary of action for the Water sector.

Action ID	Action Headline	Responsible Body	Cross-sector benefits	Link to Mitigation
WCM: A	Ensuring that it will be possible to access safe clean water in case of emergencies, such as disasters.	IZSU	Civil Protection & Emergency	No
WCM1.10	Upgrade the existing water management infrastructure to incorporate the separation of wastewater and stormwater lines	IZSU	N/A	No
WCM1.6	Implementation of a maintenance program for existing drinking water supply systems, water management plan and construction of proposed facilities in line with Potable Water Master Plan (2017) of IZSU	IZSU	N/A	No
WCM1.7	Review existing design and installation standards to increase efficiency of new water infrastructure networks.	IZSU	N/A	No
WCM1.5	Integration of stormwater management techniques with urban greening e.g. sponge city principles.	IBB	Land Use Planning	No
WCM1.11	Incorporate sustainable water practices and design within municipal-owned buildings and municipality controlled open spaces through refurbishment and retrofitting.	IBB	Land - Use Planning Buildings	No
WCM1.9	Incorporate SuDs (Sustainable Urban Drainage) and WSUD (Water Sensitive Urban Design) principles into all planned green areas and publicly owned buildings within the scope of green infrastructure.	IBB	Land - Use Planning Buildings	No
WCM1.4	Stormwater management storage systems for Municipality owned or operating Building and infrastructure at a building level, under-ground, linked to green spaces.	IBB	Land - Use Planning Buildings	No
WCM1.18	Initiate a flood protection scheme for high-risk areas e.g. industrial, residential.	IZSU	Civil Protection & Emergency Land Use Planning Buildings, Economy	No

WCM. A: Ensuring that it will be possible to access safe, clean water in case of emergencies such as disasters .	
SP Objectives:	6.2 Institutional Capacity and Functioning Will Be Made More Effective, Economic and Efficient
Description	Building on the IZSU Potable Water Master Plan (2017) up to 2050, undertake and develop a disaster preparedness plan with a specific focus on ensuring citizens have access to safe and clean drinking water in the event of an emergency. This would incorporate both climate related hazards as well as earthquakes, looking at infrastructure resilience and also personal preparedness.
Rationale / Purpose	Ensuring a plan is in place that prepares for and manages access to safe and clean drinking water for citizen during a climate event will help reduce the possible impacts. This would also help mitigate the potential impacts of Earthquakes within Izmir.
Project Type	Plan / Strategy
Timeframe	2021 - 2025
Risk and/or vulnerabilities addressed	**Risks:** IM8 IM25 **Vulnerabilities**: SE-B, PE-H, PE-F
Responsible Body / Department	IZSU
Stakeholders	AFAD Izmir Citizens. MoAF
Financing Options	Municipal Budget, State funding, Charity Organsations, IFIs.

WCM1.10: Upgrade the existing water management infrastructure to incorporate the separation of wastewater and stormwater lines	
Strategic Plan Objectives:	**5.2.** In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy
Description	IBB and IZSUs 2020 Izmir Province Metropolitan Area Wastewater, Stomwater and Streams Master plan, alongside existing IZSU projects, are aiming to collect wastewater and rainwater through separate channels, which will reduce the hydraulic load of the wastewater system and increase the useability of water within the stormwater lines and storage areas. The aim of this action is to analyse the findings of these projects by making the use of the existing feasibility studies, to improve and develop the infrastructure facilities and to further develop the construction technoqoues during the construction stages. (i.e. the transition from the combined sewer system where wastewater and storm water are collected together through the same channel to a separate system). 480 km storm water network and collector lines are planned to be constructed between 2020-2024 according to IZSU Strategic Plan.
Rationale	Heavy rainfall can cause the combined foul and stormwater sewer system to overflow, causing surface water flooding and increasing the risk of organic pollution entering waterways, water bodies and the Bay. Separate collection of stormwaters can reduce the burden on the drainage network and WWTPs to reduce flood risk and safeguard water quality.
Steps for Implementation	1. Work with IZSU to understand wastewater capacity constraints 2. Identify areas most at risk from sewer flooding 3. Scope and map required interventions including disconnection of stormwater drainage into combined sewers through Sustainable Drainage Systems. This could be combined with opportunities to reuse stormwater and reduce water stress. 4. Tender projects for development. 5. Allocate budget and/or operating requirements for ongoing maintenance (this could be through IZSU or third-party adoption and management). 6. Develop policies for new development to identify opportunities for reducing runoff into combined sewer network to greenfield rates.
Type of action	Capital project
Environmental values positively affected	

Climate Change risks and / or vulnerabilities addressed.	**Risks:** IM2, IM8, IM9, IM13 **Vulnerabilities:** PE-D, PE-E	
Potential Emission Savings	Indirect emission savings. A reduction in water reaching wastewater treatment plants because stormwater has been removed and treated indirectly will reduce emissions associated with the energy required to run the plant.	
Plan for delivery	**Action owner**	IZSU
	Stakeholders	IBB.
	Financing options	Municipal budget, Izsu, IFIs, Ilbank
	Revenue/savings opportunities	Savings opportunities will occur from the reduction in flooding and runoff-related damage.
	Timeline	2020-2025
Impact measures	• Annual number of storm water or sewerage overflows per 100km of network length • Buildings access to wastewater collection and treatment systems is improved through plans and investment • Area of permeable surfacing	
Estimated cost	**CAPEX:** Storm Water Network: €100,000 / km, Wastewater Network: €50,000 / km **OPEX:** **Design/development costs:**	
Estimated benefits	**Health impacts:** Public health - safety **Economic Development:** Revenue generating activities, avoided damage costs **Social Inclusion:** Access to basic services	
Existing Work Leveraged:	IZSU Strategic Plan (2020-2024) Wastewater, Stormwater and Streams Master Plan for Izmir Metropolitan Area (2020)	
1/25,000 scaled IBB Environmental Plan Alignment	Not spatially dependent but should target areas with greatest challenges on capacity.	

WCM1.6: Implementation of a maintenance program for existing drinking ater supply systems, water management plan and construction of proposed facilities in line with Potable Water Master Plan (2017) of IZSU	
SP Objectives:	6.2. Institutional Capacity and Functioning Will Be Made More Effective, Economic and Efficient
Description	To implement and fund projects identified in the IZSU Potable Water Master Plan (2017); a maintenance programme across the existing water supply network to reduce leakage rates and additional water transmission lines from alternative water resources developed to create a more resilient system.
Rationale / Purpose	To be able to meet the 2050 water demand for İzmir, new surface water resources together with new additional water transmission lines are required, and maintenance of the existing water-supply network has to be implemented for the efficiency of water supply network (loss-leakage ratio) With drought an already present climate related risk in Izmir, increasing the efficiency of the potable water infrastructure and reducing the overall system leakage reduction will prevent further exacerbation of water scarcity and associated impacts of prolonged drier periods.
Project Type	Capital Project
Timeframe	2021 - 2030
Risk and/or vulnerabilities addressed	**Risks:**IM8
Responsible Body / Department	IZSU
Stakeholders	• MoAF • MoEnvU

Financing Options	IZSU budget, IFIs, PPP, IIBank.

WCM 1.7: Review existing design and installation standards to increase efficiency of new water infrastructure networks.	
SP Objectives:	6.2. Institutional Capacity and Functioning Will Be Made More Effective, Economic and Efficient
Description	Undertake a review of existing IZSU design and installation standards for water infrastructure networks, with a view of increasing the efficiency of new pipe networks to reduce loss-leakage ratio. This would be building on the potable water network and transmission line projects conducted by İZSU's Water and Construction Works Department, which are prepared in line with the principles set forth in the Regulation on Water Losses in Potable Water Supply and Distribution Systems published in the Official Gazette dated 8 May 2014. It is numbered 28994, and uses Ductile Iron Pipes and HDPE100 pipes in order to minimize the water loss-leakage ratios.
Rationale / Purpose	Ensuring that the design and installation standards of new water infrastructure networks is as efficient as possible, will reduce the loss-leakage ratio for potable water distribution and therefore reduce the systems vulnerability to the impact of droughts and water scarcity.
Project Type	Policy / Strategy
Timeframe	2021 - 2025
Risk and/or vulnerabilities addressed	**Risks:** IM8.
Responsible Body / Department	IZSU
Stakeholders	• MoAF • Design and installation contractors for the water network.
Financing Options	IZSU budget.

WCM1.5: Integration of stormwater management techniques with urban greening e.g. sponge city principles	
Strategic Plan Objectives:	**6.2.** Institutional Capacity and Functioning Will Be Made More Effective, Economic and Efficient
Description	This action would involve the integration of Izmir's Green Infrastructure Strategy, Urban Green UP programme and IZSU Strategic Plan and action WCM1.18, in order to identify opportunities within proposed GI, GreenUP an IZSU Strategic Plan projects that can be enhanced to incorporate 'sponge city principles. This would be in accordance with the following storm water management techniques: • construction of stormwater deposition tanks in suitable areas such as parks and school gardens • green rooftops that allow for large amounts of water to be absorbed into the soil and plants that sit atop numerous buildings, • permeable spaces that are between surfaces such as sidewalks and roads that help absorb some of the water that comes from rain, • green spaces such as parks and gardens which can absorb the rainwater.
Rationale	Impermeable surfaces increase stormwater runoff rates, picking up diffuse urban pollution which can impact the quality of water bodies including the bay and rivers. Furthermore, the speed at which stormwater that does reach the combined storm and foul water sewer system arrives can overwhelm capacity resulting in overflows and contamination with sewerage. Sponge city principles priorities green infrastructure approaches to increasing surface permeability to control and cleans stormwater runoff.
Steps for Implementation	1. Identify areas of stormwater flooding and combined sewer overflow risk 2. Identify potential stormwater absorber areas upstream of the areas at risk. 3. Design stormwater absorbers according to the type of the absorber areas 4. Implement projects 5. Monitor their efficiency
Type of action	Plan/Strategy and associated capital projects

Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	**Risks:** IM2, IM8, IM9, IM13 **Vulnerabilities:** PE-D, PE-E	
Potential Emission Savings	Indirect emission savings. A reduction in water reaching wastewater treatment plants because stormwater has been removed and treated indirectly will reduce emissions associated with the energy required to run the plant.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	IZSU MoEvU MOAF General Directorate of Nature Conservation and Natural Parks.
	Financing options	Municipal budget, Ilbank
	Revenue/savings opportunities	Savings opportunities will occur from the reduction in flooding and runoff-related damage and saving the energy needed to water numerous places throughout a city
	Timeline	2020-2030
Impact measures	• Drainage facilities are developed through plans and investment • Areas at risk of stormwater flooding • Annual number of sewerage overflows per 100km of network length • Area of permeable surfacing within the city	
Estimated cost	**APEX:** Stormwater deposition tanks: €88 / m^3 Green roofs: €80 / m^2 Permeable spaces: €79 / m^2 Green spaces to absorb rainwater: €11 / m^2 **OPEX:** N/A **Design/development costs:** N/A	
Estimated benefits	**Health impacts:** public health – safety **Economic Development:** Revenue generating activities, Avoided damage costs **Social Inclusion:** Access to basic services	
Existing Work Leveraged:	A framework for Resilient Cities to Climate Change: Green Revision Guidebook, 2019. Izmir's Green Infrastructure Strategy, Urban Green UP	
1/25,000 scaled IBB Environmental Plan Alignment	1. Gulf of Izmir 2. Central City 3. Urban / Rural Periphery	

WCM1.11: Incorporate sustainable water practices and design within existing municipal-owned buildings and municipality controlled open spaces through refurbishment and retrofitting.	
Strategic Plan Objectives:	**6.2** Institutional Capacity and Functioning Will Be Made More Effective, Economic and Efficient
Description	Sustainable water cycle management within the 6,630 buildings within the Municipalities real estate and open spaces will be delivered to reduce potable water demand and wastewater to the combined sewer. The development and use of support tools aimed at the building water cycle are as follows: • Rainwater harvesting • Greywater and black water recycling. • Water efficient irrigation methods. • Upgrade to water efficient fixtures and fittings
Rationale	To reduce potable water demand through smart-measures such as water efficient fittings and appliances and alternative non-potable sources such as rainwater harvesting and wastewater re-use.
Steps for Implementation	5. Calculate potable water demand from municipal buildings and open spaces to fill the current data gap.

	6. Targeting the highest users, undertake cost benefit analysis of potable water demand reduction options. 7. Target building retrofit through planned refurbishment schedules. 8. Develop projects. 9. Allocate budget for and undertake ongoing maintenance.	
Type of action	Capital project	
Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	**Risks:** IM9, IM8 **Vulnerabilities:** PE-H, PE-D.	
Potential Emission Savings	Indirect emission savings. hile there might be a short-term increase in emissions associated with energy for managing alternative water sources and embodied carbon from the need to have duel pipe networks (potable water and non-potable water), the long-term carbon impact related to managing water stress is likely to be significantly higher.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	IZSU
	Financing options	Municipal budget, Ilbank, private banks
	Revenue/savings opportunities	Savings opportunities will occur from the reduction in water cost
	Timeline	2020-2030
Impact measures	Reduction in potable water use per person	
Estimated cost	**CAPEX:** offices: €14 / m^2, Irrigation to open spaces: €1 / m^2 **OPEX:** N/A **Design/development costs**: N/A	
Estimated benefits	**Health impacts:** Public health – more active lifestyles **Economic Development:** Revenue generating activities, Increased economic efficiency	
Existing Work Leveraged:	EBRD Pilot Climate Change Adaptation Market Study: Turkey Urban Green Up	
1/25,000 scaled IBB Environmental Plan Alignment	Not spatially dependent.	

WCM1.9: Incorporate SuDS (Sustainable Urban Drainage System) and WSUD (Water Sensitive Urban Design) principles into all planned green areas and publicly owned buildings within the scope of green infrastructure.	
Strategic Plan Objectives:	**6.2** Institutional Capacity and Functioning Will Be Made More Effective, Economic and Efficient
Description	IBB will integrate WSUD and SuDS principles into all planned publicly owned development, prioritising a green infrastructure solution. This would include the collection of rain and stormwater from rooftops of buildings and through natural attenuation areas for us in toilet flushing, laundry, garden watering and car washing. This will be designed with the aim of conserving potable water and partially meeting domestic water demands using rainwater. IBB's Strategic Plan highlights 8 new municipal buildings and 7 new fire station buildings are planned to be constructed between 2020-2024. In addition, Green Infrastructure strategy of the City has been developed for environmentally-friendly green areas.
Rationale	WSUD and SuDS principals integrate the water cycle more effectively into the urban fabric to reduce flood risk, improve water quality and limit water stress. SuDS will become an integral method to manage the water cycle, by adopting a fit-for-purpose approach to the use of potential alternative sources of water such as rainwater; incorporating the use of water efficient appliances and fittings; minimising wastewater generation

	Climate-friendly park arrangements and plant pattern selections will be made.
Steps for Implementation	1. Ensure WSUD and SuDS solutions considered in the design and tendering of new municipal buildings, 2. Undertake whole life-cycle benefit analysis to determine preferred approaches 3. Ensure principles are followed through to constriction and maintenance. 4. Choose climate change-resistant plants that require minimal irrigation for green areas, 5. Set up and implement nature compatible green infrastructure systems and establish drought-resistant green corridors and multi-functional parks within this context.
Type of action	Design / Capital project
Environmental values positively affected	
Climate Change risks and / or vulnerabilities addressed.	**Risks:** IM9, IM8 **Vulnerabilities:** PE-H, PE-D.
Potential Emission Savings	While there might be a short-term increase in emissions associated with energy for managing alternative water sources and embodied carbon from the need to have duel pipe networks (potable water and non-potable water), the long-term carbon impact related to managing water stress is likely to be significantly higher.
Plan for delivery	**Action owner**: IBB **Stakeholders**: IZSU **Financing options**: Municipal budget, Ilbank, IZSU **Revenue/savings opportunities**: Savings opportunities will occur from the reduction in water cost **Timeline**: 2020-2025
Impact measures	• Potable water demand • Area of permeable surfacing • Flood risk • Annual number of storm water or sewerage overflows per 100km of network length
Estimated cost	**CAPEX:** Rainwater harvesting for publicly owned buildings: €4 / m^2 **OPEX:** N/A **Design/development costs:** N/A
Estimated benefits	**Economic Development:** Increased economic efficiency
Existing Work Leveraged:	A framework for Resilient Cities to Climate Change: Green Revision Guidebook, 2019. Küçük Menderes Basin Flood Management Plan Gediz Basin Flood Management Plan Kuzey Ege Basin Flood Management Plan
1/25,000 scaled IBB Environmental Plan Alignment	1. Gulf of Izmir 2. Central City 3. Urban / Rural Periphery

WCM1.4 Stormwater management storage systems for Municipality owned or operating Building and infrastructure at a building level, under-ground, linked to green spaces.	
Strategic Plan Objectives:	**6.2** Institutional Capacity and Functioning Will Be Made More Effective, Economic and Efficient
Description	To set up smart- storage water systems, including collection tanks, cisterns, or attenuation basins in and around Municipality owned or operating buildings and sites
Rationale	The collection of storm water will help reduce flow rates to the combine sewer, in turn reducing flood and overflow risks. The stored water could also be used to help reduce potable water demand by providing an alternative non-potable water source for irrigation and toilet flushing. Green attenuation solutions will also support biodiversity, reduce the urban heat island and improve the attractiveness of the city.

Steps for Implementation	1. Identify suitable sites for attenuation, with priority for surface level green solutions. Underground solutions may be more space efficient but can be more costly to deliver and have less additional benefits. Sites should ideally be upstream of flooding issues. 2. Undertake whole life cycle cost benefit of utilising stored water for non-potable reuse either in nearby buildings of for irrigation. 3. Develop project specification and tender the project for development. 4. Allocate budget and implement ongoing maintenance.	
Type of action	Capital project	
Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	**Risks:** IM9, IM8 **Vulnerabilities:** PE-H	
Potential Emission Savings	Indirect emission savings. While there might be a short-term increase in emissions associated with energy for managing alternative water sources and embodied carbon from the need to have duel pipe networks (potable water and non-potable water), the long-term carbon impact related to managing water stress is likely to be significantly higher.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	IZSU
	Financing options	Municipal budget
	Revenue/savings opportunities	The savings opportunities will occur through the irrigation of green spaces
	Timeline	2020-2030
Impact measures	• Potable water demand • Area of permeable surfacing • Flood risk • Annual number of storm water or sewerage overflows per 100km of network length	
Estimated cost	**CAPEX:** Collection tanks for buildings: €88 /m^2 Attenuation basins for open space: €22 / m^2 **OPEX:** N/A **Design/development costs:** N/A	
Estimated benefits	**Health impacts:** Public health – more active lifestyles **Economic Development:** Increased economic efficiency **Social Includsion:** Access to essential services **Environment:** Increasing the flexibility of the energy system	
Existing Work Leveraged:	A framework for Resilient Cities to Climate Change: Green Revision Guidebook; 2019 Urban Green UP Küçük Menderes Basin Flood Management Plan Gediz Basin Flood Management Plan Kuzey Ege Basin Flood Management Plan	
1/25,000 scaled IBB Environmental Plan Alignment	Not spatially dependent.	

WCM1.18: Initiate a flood protection scheme for high risk areas (e.g. industrial, residential	
Strategic Plan Objectives:	**5.2** In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy
Description	IBB will take steps to initiate a flood protection scheme for high risk areas across Izmir, building on existing work such as the Küçük Menderes Basin Flood Management Plan, Gediz Bsin Flood Management Plan, Kuzey Ege Basin Flood Management Plan and the Izmir Green Infrastructure Strategy, this would include: A. Determine flood hazard and risk level at all gradual scales and produce appropriate maps across Izmir province.

<table>
<tr><td></td><td colspan="2">B. Implement an early warning and control system of high-risk areas. Increase te number of stream flow monitoring stations, which is currently 4.
C. Determine appropriate flood defences which incorporate climate change projections
D. Implement and develop flood resilient design into existing and future building and infrastructure.</td></tr>
<tr><td>Rationale</td><td colspan="2">Climate change will result in an increase in surface water, fluvial and coastal flooding within Izmir, so the initiation of a flood protection scheme will become an integral part of managing the water cycle in coordination, alongside reducing exposure and vulnerability to the anticipated impacts.</td></tr>
<tr><td>Steps for Implementation</td><td colspan="2">(a) Flood Mapping:
1. Develop the scope and specification of the study.
2. Identify and secure necessary funding
3. Procure a contractor to carry out the study
(b) Early Warning System
1. Liaise with AFAD at a national and provincial level and with the Turkish State Meteorological Service to understand existing strategies and capability for monitoring required indicators.
2. Build on the SECAP risk and vulnerability assessment to better identify the physical, social and economic vulnerabilities to flooding throughout the province.
3. Based on this information, undertake a feasibility study to determine the best EWS approach for Izmir, in-line with the Sendai Framework for Disaster Risk Reduction (2015-30)[68]: Top down and hazard-centred, or bottom-up, people centred.
(c) Flood Defences.
1. Carry out a feasibility study, based on the flood mapping to:
A. Assess current infrastructure vulnerability
B. Identify key locations for future defence development
C. Identify suitable partners for investment in the defences.
D. Consider hard and soft engineering options, alongside WSUD and SuDs and stormwater management techniques in-line with other actions.
(d) Flood Resilient Design
1. Liaise with National government to identify any existing building standard for flood resilient design.
2. If present translate national law into applicable municipal policy
3. If absent, develop new, applicable municipal policy.
4. Ensure the Municipality is appropriate structures and resourced to implement new design standards.</td></tr>
<tr><td>Type of action</td><td colspan="2">Strategy and policy leading to capital investment</td></tr>
<tr><td>Environmental values positively affected</td><td colspan="2">  </td></tr>
<tr><td>Climate Change risks and / or vulnerabilities addressed.</td><td colspan="2">Risks: IM2, IM4, IM6, IM9, IM10, IM13, IM25, IM27, IM28, IM31, IM21
Vulnerabilities: SE-A, PE-A, PE-B, PE-D, PE-E, PE-G</td></tr>
<tr><td>Potential Emission Savings</td><td colspan="2">This action does not result in emission savings.</td></tr>
<tr><td rowspan="5">Plan for delivery</td><td>Action owner</td><td>IZSU</td></tr>
<tr><td>Stakeholders</td><td>• MoAF- Ministry of Agriculture and Forestry
• MOEnvU
• AFAD
• General Directorate of Meteorology
• IBB
• Vulnerable groups; infirm, elderly, disabled, ethnic minorities etc.</td></tr>
<tr><td>Financing options</td><td>Municipal budget, IFIs, Ilbank, EU Solidarity Fund, land value capture.</td></tr>
<tr><td>Revenue/savings opportunities</td><td>Saving opportunities will occur from the reduction in flooding and run-off related damage.</td></tr>
<tr><td>Timeline</td><td>2021-2030</td></tr>
<tr><td>Impact Measures</td><td colspan="2">Adaptation resilience to natural disaster risk:
• Percentage of public infrastructure at risk to flooding
• Percentage of households at risk to flooding</td></tr>
</table>

[68] https://www.undrr.org/implementing-sendai-framework/what-sf

	• Estimated economic damage from flooding.
Estimated cost	**CAPEX:** N/A **OPEX:** N/A **Design/development costs:** €207,000
Estimated benefits	**Health impacts:** Reduction in injuries, deaths and flood related disease **Economic Development:** Economic creation, avoided damages. **Social Inclusion:** Strengthens social fabric **Other:** Increased community resilience.
Existing Work Leveraged:	Küçük Menderes Basin Flood Management Plan, Gediz Basin Flood Management Plan, Kuzey Ege Basin Flood Management Plan, and the Izmir GI strategy.
1/25,000 scaled IBB Environmental Plan Alignment	This action would cover all aspects of IBB spatial alignment where they are exposed to flooding: surface, fluvial or coastal. 1. Gulf of Izmir 2. Central City 3. Urban / Rural Periphery 4. Agricultural Basin 5. Green Belt

5.3.2. Agriculture & Forestry

Number of actions: 2

Developed in co-ordination with the mitigation actions for agriculture in section 5.1.4 these actions recognise and leverage the existing national and local level work undertaken by the Department of Agricultural Services Directorate of IBB and other key sector stakeholders within Izmir. This includes; studies on the use of sewage sludge in agriculture and the use of treated water in irrigation (IZSU: 2014-15), the Saplings from Us Fruits from You Project (IBB: 2009 – present) and establishing the Sasali Climate Sensitive Agriculture Education Research Institute (IBB: 2017-2020). Recognising existing gaps in disaster risk awareness, IBB have also set up a Fire and Natural Disaster training Centre which strives to improve disaster risk awareness among the public

Informed by theMoEnvU, there are also several national strategic plans and regulations that incorporate agriculture & forestry. This includes the Turkey's National Climate Change Action Plan 2011-2023, and the National Energy Efficiency Action Plan (NEEAP) 2017-2023.

When developing and implementing these actions it is also important to consider maladaptive practices. Inefficient water and irrigation practices could act as a catalyst to more severe and frequent periods of drought, the growth of ill-adapted crop species could lead to more substantive yield reduction and therefore a greater economic loss when a period of drought hits and poor soil management techniques could lead to larger quantities of CO_2 emitted into the atmosphere. In this regard, it is vital to acknowledge the non-climatic socio-political and economic factors that could inhibit the effective implementation of adaptation measures e.g. the lack of funding and access to appropriate agricultural equipment.

Table 52 below demonstrates the IBB strategic plan objective that aligns with actions presented for the Agriculture & Forestry sector.

Table 52: IBB Strategic Plan 2020 - 2024 objective addressed.

Strategic Heading	Strategic Goal	Strategic Objective(s)
Nature – Climate action	**5.** Making Izmir a Global Model City for Its Harmony with Nature.	**5.2:** In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy

The SECAP adaptation actions for agriculture and forestry are summarised below in Table 53 and further developed into a business case.

Table 53: Summary of agriculture & forestry actions.

Action ID	Action Headline	Responsible Body	Cross-sector benefits	Link to Mitigation
SECAP AF 1	Prepare of a drought action plan	IBB	Water	No
SECAP AF 2	Develop a management strategy for forest fires	IBB.	Environment & Biodiversity Civil Protect & Emergency	No

SECAP AF1: Prepare a drought action plan.	
SP Objectives:	5.2. In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy
Description	Develop a comprehensive drought action plan in-line with the relevant stakeholders that will enhance the resilience of agriculture and forestry to drought and help mitigate the exacerbating factors the industry creates. This would include: - To develop and implement drought early-warning systems covering all agricultural areas - Educate and inform farmers around drought-resistant groups. - Monitoring and management of the volume and quality of water used for irrigation and optimization of agricultural irrigation. - "Optimization of Agricultural Irrigation" project. - Switching to a drought-resistant plant pattern that require less irrigation for the areas that are likely to be affected from drought.
Rationale / Purpose	The impacts of drought are currently being experienced in Izmir, with an anticipation that this will only increase with climate change. This climate hazard imparts pressure and enhances the competition for water resources throughout the province.
Type of Action	Plan / Strategy
Timeframe	2021 – 2030
Risk and/or vulnerabilities addressed	**Risks:** IM17 **Vulnerabilities:** SE-B, PH-H
Responsible Body / Department	IBB
Stakeholders	- Ministry ofAgriculture and Forestry 4th Regional Directorate - IZSU - MoAF - MoEnvU - DSI - Farmers - Headman's
Financing Options	Municipal Budget

SECAP AF 2: Develop a management strategy for forest fires.	
SP Objectives:	5.2 In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy
Description	Building on existing work such as the Fire and Natural Disaster training Centre, IBB are to develop and implement a management strategy for forest fires, with appropriate measures to mitigate and manage the risk that they present. With a focus on: - Understanding and managing the root cause of wildfires (e.g. existing land management practices, biomass accumulation) - Be better prepared to face the extreme event (e.g. undertake research to predict wildfire behaviour and extreme wildfire vulnerability in the province, develop clear responsibility and stewardship models for local stakeholders and communities) - Communicate risk shift and perception (engage communities and broader stakeholders in the co-design of approaches and actions, understand broader impacts such as threat to human health from air pollution).
Rationale / Purpose	Recent forest fires events in Izmir have demonstrated the current risk that they pose to the rural and semi-rural areas within the province. With climate change expected to result on longer dry periods and extended drought, the risk of wildfires will rise, exposing larger numbers of people and areas of land to the impacts they can bring.
Action Type	Policy / Strategy
Timeframe	2021 - 2030

Risk and/or vulnerabilities addressed	**Risks:** IM20, IM21 **Vulnerabilities:** PE-C
Responsible Body / Department	IBB
Stakeholders	- Provincial Directorate of Disaster and Emergency - AFAD - Landowners, occupiers and residents of land-use areas at risk to wildfires. - City Planners - Insurance Companies
Financing Options	Municipal Budget

5.3.3. Land Use Planning

Number of actions: 5

These actions recognise and leverage the existing work undertaken by IBB. At the forefront of their Municipalities agenda, recent programmes include the Green Infrastructure Strategy (2019) and the Urban GreenUP programme. Izmir has also developed Sustainable development for wider areas across the province, including Gediz Bakircay Basin and Küçük Menderes Basin.

At a national level, Turkey became a party to the United Nations Convention to Combat Desertification (UNCCD) and in response developed a national report titled Land Degradation Neutrality in Turkey (2016-2030), which lays out a basic strategy plans and financing method require to manage land-use protect soils and reduce desertification in the country.

As a sector that both drives and is heavily impacted by climate change, it is important to develop and implement strategies and mitigation measures that consider the inter-connected nature of land-use patterns. These incorporate factors such as; inappropriate land use, urbanisation, industrialisation, tourism, agricultural activities, biodiversity, water resources, soil quality and other technical and socio-economic aspects. A balance is required when developing efforts to adapt land-use change noting that what may be beneficial in one aspect, has the ability to be detrimental for another. An example being that some adaptation options can become maladaptive due to their unintended environmental impacts, such as irrigation causing soil salination and over extraction of waste resources leading to ground-water depletion or saline intrusion.

Table 54 below demonstrates the IBB strategic plan objective that aligns with actions presented for the land-use planning sector.

Table 54: IBB Strategic Plan 2020 - 2024 objectives addressed.

Strategic Heading	Strategic Goal	Strategic Objective(s)
Infrastructure – Urban Infrastructure	**1.** Building a Sustainable Infrastructure Available to Everyone	1.1 A Sustainable Urban Infrastructure Will Be Built to Contribute to the Urban Economy
Infrastructure – Sustainable Living Areas	**1.** Building a Sustainable Infrastructure Available to Everyone	1.2. Planned, Safe and Sound Settlement Areas Will Be Developed or Regenerated
Infrastructure – Green Infrastructure	**1.** Building a Sustainable Infrastructure Available to Everyone	1.3. Climate Friendly Urban Green Areas Network Will Be Created in the Province

The SECAP adaptation actions for land-use planning are summarised below in Table 55 and further developed into a business case.

Table 55: Summary of land-use planning sector actions.

Action ID	Action Headline	Responsible Body	Cross-sector benefits	Link to Mitigation
LU.A	Identify and collaborate with stakeholders to lobby for the necessary amendments to regulations to enable the design and development of the 7 “Risk Areas” identified under Law 6306 (Transformation of Areas under Disaster Risk).	IBB	Buildings Health	No
LU.B	Encourage urban transformation, acting on the Urban	IBB	Buildings	Yes

	Transformation and development areas declared by the Council of Minister's decision for the creation of healthy, liveable urban spaces.		Health	
LU1.7	Identify and implement techniques to mitigate the Urban Heat Island Effect	IBB	Buildings Health	No
LU1.16	Review and update local-level policies, planning regulations and guidelines for future and new infrastructure development to ensure they consider climate projections and urban resilience in design and construction.	IBB	Transport Waste Water	No
LU1.18 & LU1.19	Further development the green and blue infrastructure strategy.	IBB	Health Water	No

LU.A: Identify and collaborate with stakeholders to lobby for the necessary amendments to regulations to enable the design and development of the 7 "Risk Areas" identified under Law 6306 (Transformation of Areas under Disaster Risk).	
SP Objectives:	1.2. Planned, Safe and Sound Settlement Areas Will Be Developed or Regenerated
Description	Within the framework of Law No. 6306 (Transformation of Areas under Disaster Risk), the MoEU is carrying out urban transformation projects on a consensus-based 918.16 ha area in İzmir. IBB will identify and collaborate with the necessary stakeholders in order to make the required amendments to current regulations to enable the transformation of 918.16 ha area (defined as Risk Areas) and creation of sustainable, healthy, and liveable urban spaces throughout the Municipality.
Rationale / Purpose	By help transform the "risk areas" within Izmir will have impacts across multiple sectors. This would include reducing the vulnerability of those who reside in these areas to climate events, increasing energy efficiency and reducing associated GHG emissions, as well as improving the quality of life and health and wellbeing of the residents.
Type of Action	Plan / Strategy
Timeframe	2021 – 2025
Risk and/or vulnerabilities addressed	**Risks:** IM1, IM24, IM26. IM29 **Vulnerabilities:** SE-D
Responsible Body / Department	IBB
Stakeholders	• MoEnvU • Provincial Directorate of Environment and Urbanisation
Financing Options	Municipal Budget

LU.B: Encourage urban transformation, acting on the Urban Transformation and development areas declared by the Council of Minister's decision for the creation of healthy, liveable urban spaces.	
SP Objectives:	1.2. Planned, Safe and Sound Settlement Areas Will Be Developed or Regenerated

Description	This action would involve the regeneration of the urban areas by improving existing buildings stocks and the creation of new living areas. This action can be broken down into the following aspects, covering the consensus-based area of 305.47ha in the scope of the Municipality law 5359; • Issue urban transformation regulations. • Facilitating and provide guidance on grant programmes, setting up a services framework. • Incentivise developers • Allocate funding.
Rationale / Purpose	By encouraging and facilitating urban transformation across 305.47 ha of land within the province, this can achieve multiple benefits, including; local job creation through development, increasing the living standards and health and wellbeing of the residents within the identified areas, reducing urban pollution and reducing current and preventing future building related emissions.
Action Type	Policy / Strategy & Grant Programmes
Timeframe	2021 – 2023
Risk and/or vulnerabilities addressed	**Risks:** IM1, IM2, IM4, IM24 **Vulnerabilities:** SE-D, PE-E
Responsible Body / Department	IBB
Stakeholders	• MoEnvU • MoTF • Informal area residents. • Contractors.
Financing Options	PPPs, IFI's, IIBank, Private Developers, Private banks.

LU1.7 Identify and implement techniques to mitigate the Urban Heat Island Effect	
Strategic Plan Objectives:	**1.3.** Climate Friendly Urban Green Areas Network Will Be Created in the Province
Description	Actions will be taken to reduce urban heat island effect such as promoting micro-climate cooling through increasing tree and vegetative cover, installing green roofs, installing cool—mainly reflective—roofs, using cool pavements (either reflective or permeable), developing a shading strategy for urban areas and including highly efficient water features in open public spaces.
Rationale	Urban materials have a tendency to absorb and trap solar radiation (heat), reradiating this heat once surrounding temperatures drop. These elevated temperatures are known as urban heat islands. They can be particularly detrimental during the summer nights affective the environment and quality of life, such as increase energy demand for cooling, increase in air pollutant and greenhouse gas emissions, affect human health by contributing to general discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and heat-related mortality and raise in water temperatures due to heated storm water. Choice of urban material finishes and particularly green infrastructure, can help reduce the urban heat island effect by reflecting and or reducing the absorption of heat. Green spaces have the added potential to reduce temperatures through evapotranspiration. This action will also help improve on the currently low provision of greenspace across the city which is currently only 8m^2 per person.
Steps for Implementation	This action can be broken down into two aspects in order to reduce the urban heat island effect in Izmir: **Identify:** 1. Undertake urban heat island modelling. This can be done through near earth infrared observations or using proxy data from urban density, permeability of surfacing, tree canopy cover, green space cover and wind modelling. 2. Identify priority areas for urban heat island management 3. Explore range of urban heat management solutions 4. There are likely to be range of delivery options, as such it is important to understand opportunities for implementation including alignment with urban renewable priorities (i.e. urban transformation areas, pavement renewal, public / institutional building retrofit) **Implementation:** 5. Work with public / institutional buildings to install green / reflective roofs 6. Deliver urban greening projects in public open spaces 7. Work with highways management to improve the albedo and permeability of road and pavement surfacing

Type of action	Policy / Strategy and Capital Project	
Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	**Risks:** IM1, IM5, IM6, IM11, IM24, IM25, IM27, IM30, IM32, **Vulnerabilities:** SE-E, PE-D, PE-E	
Potential Emission Savings	Indirect emission savings. Tackling the urban heat island effect has the potential to reduce emissions through the reduced need and therefore use of mechanical cooling such as air conditioning.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	MoEnvU, 4th Regional Directorate of Nature Conservation and Natural Parks, NGO, Vulnerable groups e.g. elderly, infirm, women, ethnic minorities.
	Financing options	Municipal budget, IFIs, Ilbank, private banks, private developers
	Revenue/savings opportunities	Savings opportunities will come from reduced energy costs and improved health outcomes from Izmir's citizens
	Timeline	2020 -2030
Impact measures	• Peak temperatures (particularly at night) • Green canopy cover • Reflective / green roofs installed • Open green space area ratio per 100,000 inhabitants • Share of green space areas within urban limits • Average annual growth rate of built-up areas • Area of permeable, reflective surfacing	
Estimated cost	**CAPEX:** Tree Cover: €21 / m^2, Green Cover: €80 / m^2 Cool roof: €81 / m^2, Cool pavements: €81 / m^2, Shading in public spaces: €286 / m^2. **OPEX:** N/A **Design/development costs:** N/A	
Estimated benefits	**Health impacts:** Public health – reduced pollution, more active lifestyles **Economic Development:** Avoided damage costs **Social Inclusion:** Social equity **Environment:** mitigation of GHG Emissions.	
Existing Work Leveraged:	Urban Green Up A framework for Resilient Cities to Climate Change: Green Revision Guidebook Izmir Green Infrastructure Strategy	
1/25,000 scaled IBB Environmental Plan Alignment	1. Gulf of Izmir 2. Central City	

LU1.16: Review and update local-level policies, planning regulations and guidelines for future and new infrastructure development to ensure they consider climate projections and urban resilience in design and construction.

SP Objectives:	1.2 Planned, Safe and Sound Settlement Areas Will Be Developed or Regenerated
Description	This action would involve collaboration with relevant bodies to review and update policies, planning regulation and guidelines for new infrastructure development for; buildings transport, water management energy.

	This would consider the latest climate projections for the province, as outlined in the Cities. "A framework for Resilient Cities to Climate Change: Green Revision Guidebook"[69]applying RCP4.5 and RCP8.5 scenarios for 2050 – 2100. The consideration of urban resilience should incorporate both direct and indirect impacts. Direct impacts include resilience to shocks (e.g. disaster resilience) and to slow-onset impacts (e.g. climate change). Indirect impacts include the effects of depleting or degrading the natural environment, such as through deforestation or pollution, otherwise phrased as a reduction of 'ecosystem services that enable the natural environment to increase our resilience. - Infrastructure systems are an important factor to consider, meaning the resilience considered is not just related to an individual infrastructure element but how these elements work together as a network. A resilient infrastructure system should be sufficiently robust, have sufficient redundancy and allow for sufficient resourcefulness to resolve issues with sufficient rapidity to continue operating a normal or near normal performance levels.
Rationale / Purpose	Developing resilient infrastructure make it's sustainable, with increased resource use efficiency and greater adoption of clean and environmental sound technologies and industrial processes. It will help support long-term economic development and also human well-being, alongside reducing the long-term impacts, such as disruption and maintenance / repair costs as a result of a climatic event.
Type of Action	Policy / Strategy
Timeframe	2021 – 2025
Risk and/or vulnerabilities addressed	**Risks:** IM1, IM4, IM9. IM31
Responsible Body / Department	IBB
Stakeholders	• IZSU • MoTI • MOEnvU • Expert engagement: consultants, urban planners and Infrastructure design teams.
Financing Options	Municipal Budget

LU1.18 & LU1.19: Further development the green and blue infrastructure strategy.	
SP Objectives:	1.3 Climate Friendly Urban Green Areas Network Will Be Created in the Province
Description	Implement the green infrastructure strategy recommendations of the IBB Green Infrastructure Strategy (2018) and EU funded Urban GREENUP Project (2019), to incorporate and support: - Cohesive and inter-connected green spaces within the urban areas. - Blue infrastructure for microclimate cooling - Sequestration potential for urban greening.
Rationale / Purpose	Alongside other environmental benefits, interconnected, green spaces will help mitigate against the urban heat island effect and enhance the stormwater management capacity of the city, providing natural storage and interception for the rainwater, reducing lag time for flooding event and enhance carbon sequestration.
Type of Action	Plan / Strategy
Timeframe	2021 – 2025

[69] https://direnclikent2019.izmir.bel.tr/YuklenenDosyalar/Dokumanlar/AFRAMEWORKFORRESILIENTCITIESTOCLIMATECHANGEGREENREVISIONGUIDEBOOK.pdf

Risk and/or vulnerabilities addressed	**Risks:** IM11, IM13 **Vulnerabilities:** PE-D
Responsible Body / Department	IBB
Stakeholders	MOEnvU
Financing Options	Municipal budget, IFIs, Ilbank, private banks, private developers

5.3.4. Environment & Biodiversity

Number of actions: 2

These actions recognise and leverage the existing national and local level work undertaken to date by IBB and other key sector stakeholders to help improve the current state of Izmir's environment and biodiversity. The IBB Strategic Plan 2015-2019 and 2020 – 2024 both contain a specific strategy and objectives focused on biodiversity in Izmir, with several ongoing projects and studies relating to biodiversity and ecosystem enhancement having been completed. These include; the Gediz Basin Management Plan of the MoAF 2018 and A Review on Urbanisation, Pollution and Biodiversity in Izmir 2019. Environment & Biodiversity is also considered in other sector strategies by the IBB, namely the Green Infrastructure Strategy 2018

With Turkey becoming a signatory of the United Nations Convention on Biological Diversity in 1992, several national strategies have been developed to address challenges in this sector, including' a National Biodiversity Strategy and Action Plan (2007-2017) and National Biodiversity Action Plan (2019 – 2028), both of which strive to protect and conserve the sustainable use of Turkey's biological resources.

When developing and implementing these actions it is also important to consider maladaptive practices, recognising that an action for the protection and conservation of habitat, might be detriment for another or not achieve its desired purpose. For example, a misalignment of human perception of the environment (which guides restoration activities) with how animals perceive and use the habitat, resulting in the restoration not providing the key elements of the habitats that ultimately derive its ability to support the animals.

Table 56 below demonstrates the IBB strategic plan objective that aligns with actions presented for the environment and biodiversity sector.

Table 56: IBB Strategic plan 2020 - 2024 objectives addressed.

Strategic Heading	Strategic Goal	Strategic Objective(s)
Nature – Ecosystem Integrity	Making Izmir a Global Model for its Harmony with Nature	**5.4.** Agricultural Areas Will be Developed to Protect the Ecosystem; Loss of natural Areas and Biodiversity Will be Stopped.

The SECAP adaptation actions for the environment and biodiversity sector are summarised below in Table 57 and further developed into a business case.

Table 57: Summary of environment & biodiversity sector actions.

Action ID	Action Headline	Responsible Body	Cross-sector benefits	Link to Mitigation
LU1.2	Maintain, protect and enhance existing biodiversity and ecological habitats through the restoration of wetlands, lagoons and afforestation (incorporating natural ecosystem creation)	IBB.	Land-use Planning Water-	No
WCM1.14	Conservation, protection and enhancement of marine biodiversity in Gulf of Izmir, increasing the	IBB	Tourism Industry Economy	No

cleanliness of the Gulf.

LU1.2: Maintain, protect and enhance existing biodiversity and ecological habitats through the restoration of wetlands, lagoons and afforestation (incorporating natural ecosystem creation)		
Strategic Plan Objectives:	**5.4.** Agricultural Areas Will Be Developed to Protect the Ecosystem; Loss of Natural Areas and Biodiversity Will Be Stopped	
Description	In line with the National Biodiversity Strategy and Action Plan (2007-2017) and the National Biodiversity Action Plan (2018-2028), this action will implement the restoration and enhancement / conservation management programme for wetlands in Izmir. This would focus and prioritise Important Natural Areas (INA), as author by the Municipality, alongside afforestation schemes of native species in cooperation with relevant stakeholders and community volunteers. Improved sequestration could be achieved by increasing the size of carbon sinks through afforestation, with native species, reforestation and restoration of other natural habitats, alongside the maintenance of existing carbon stores through avoiding deforestation or protecting wetlands.	
Rationale	Climate change is recognised as a threat to the survival of ecosystems such a wetlands and lagoons, which are vulnerable to changes in the quantity and quality of their water supply and changes in hydrological regimes. Afforestation schemes will be beneficial due to carbon sequestration, also helping mitigate impacts such as soil erosion and degradation, landslides and surface water flooding. Enhanced, protection and improved management of natural ecosystems clearly can contribute to survival of ecosystems.	
Steps for Implementation	1. Undertake a study of the quality and connectivity of natural habitats, focusing on INAs. 2. Work with relevant stakeholders (including landowners) and community volunteers to prioritise areas of habitat for restoration, afforestation base on biodiversity priorities and maximisation of ecosystem service benefits. 3. Develop appropriate habitat restoration or afforestation projects 4. Scope funding and delivery options 5. Work with stakeholders to deliver projects 6. Prioritise Important Natural Areas (INA) that fall under the jurisdiction of IBB	
Type of action	Capital project	
Environmental values positively affected		
Climate Change risks and / or vulnerabilities addressed.	**Risks:** Im16, IM17, IM18, IM19, IM20, IM21, IM22, IM23 **Vulnerabilities:** PE-C, PE-G	
Potential Emission Savings	Indirect emissions savings. This would promote carbon sequestration and increase the Municipalities offsetting capability.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	4th Regional Directorate of Nature Conservation and Natural Parks, MoEnvU, Ministry of Agriculture and Forestry, Ege Forest Foundation, Doğa Derneği – (Nature Association), TEMA, WWF, Mediterranean Conservation Association, SAD-AFAG
	Financing options	Municipal budget, IFIs, Ilbank, forestry NGOs
	Revenue/savings opportunities	Savings opportunities will come from decreased pressure on natural ecosystem
	Timeline	2021 – 2025

Impact measures	• Area of rehabilitate habitat or afforestation • Open green space area ratio per 100,000 inhabitants • Share of green space areas within urban limits • Abundance of bird species all species, Abundance of other species • Green space connectivity • Water Quality: Eutrophication • WFD Assessment: Seagrass (*Posidonia oceanica*)
Estimated cost	**CAPEX:** €120,000 per 1000m^2 of wetlands, 1000m^2 of lagoon and 1000m^2 of forest. (**OPEX:** N/A **Design/development costs:** N/A
Estimated benefits	**Health impacts:** Public health – reduced pollution **Economic Development:** Avoided damage costs **Environment:** enhanced ecological value, prevention of biodiversity loss.
Existing Work Leveraged:	A framework for Resilient Cities to Climate Change: Green Revision Guidebook; 2019 Urban Green UP Izmir Green Infrastructure Strategy
1/25,000 scaled IBB Environmental Plan Alignment	4. Agricultural Basins 5. Green Belt

WCM1.14: Conservation, protection and enhancement of marine biodiversity in Izmir Gulf, increasing the cleanliness of the Gulf	
Strategic Plan Objectives:	**5.3** Gulf of Izmir and All The Coastal and Marine Areas Will Be Protected and Used Sustainably
Description	Izmir Bay contributes significant marine biodiversity value. Designated sites that reflect the importance of some of this diversity, and require further protection, are; the Foça Special Environmental Protection Area (SEPA), Karaburun - Ildır Bay SEPA, Çakalburnu Lagoon, Meles Delta and the Gediz Delta Ramsar site. Analysing and allocating the spatial and temporal distribution of human activities in these marine areas will be carried out to achieve ecological, economic and social objectives by marine spatial planning. Marine spatial planning is a strategic tool for regulating, managing and protecting the marine environment. Developing a marine spatial plan will help identify measures to be taken to help reduce pollution into the bay, this is likely to include actions for both the public and private sectors in managing land cover, surface run-off and drainage into the bay. As such, there will need to be both public and private investment and behavioural change.
Rationale	The Gulf of Izmir support a variety of habitats including seagrass beds and coastal lagoons which are critical for fauna and flora. The Bay supports rare and endangered marine mammals, turtles and a high diversity of bird species. These habits are threatened by heavy pollution from nutrient run-off and domestic and industrial materials resulting in high concentrations of heavy metals. There is also evidence of eutrophication. Climate change is anticipated to exacerbate this, with periods of drought reducing discharge rates in freshwater bodies which will reduce the natural environments capacity to manage the pollution. This is coupled with more extreme precipitation events which will increase nutrient run-off during more intense, higher magnitude events. Furthermore, demand for marine goods and services, such as food, energy, and habitats, usually exceed the capacity of marine areas.
Steps for Implementation	1. Identify the management actions required to achieve the protection goals of the marine diversity 2. Identify possible alternative financing mechanisms for plan tasks 3. Engage key stakeholders 4. Prepare an implementation plan, including a timetable for the management actions 5. Measure indicators of the performance of marine spatial management actions and modify if required 6. Monitor and increase the water quality of Izmir Gulf, and clean the Gulf 7. Strengthen the wastewater system by separating the stormwater and sewage systems, thus reducing the pollution of the Gulf 8. Prevent stream-related pollution of the Gulf by ensuring effective cleaning of the streams reaching the Gulf 9. Undertake activities that maintain and promote the biodiversity of the Gulf
Type of action	Policy / Strategy / Behavioural / Capital and Implementation Projects
Environmental values positively affected	

Climate Change risks and / or vulnerabilities addressed.	**Risks:** IM21, IM22, IM23 **Vulnerabilities:** PE-G	
Potential Emission Savings	Carbon sequestration potential of restoring marine habitats has not been calculated.	
Plan for delivery	**Action owner**	IBB
	Stakeholders	Ministry of Agriculture and Forestry, Ege Forest Foundation, Doğa Derneği – (Nature Association), TEMA, WWF, Mediterranean Conservation Society, SAD-AFAG, Universities, funding bodies.
	Financing options	Municipal budget, landowners/private finance
	Revenue/savings opportunities	Savings opportunities will come from decreased pressure on natural ecosystem
	Timeline	2021 – 2025
Impact measures	- Marine water quality - Marine and coastal biodiversity values and abundance of marine species.	
Estimated cost	**CAPEX:** N/A **OPEX:** N/A **Design/development costs**: €29,000 - €37,000	
Estimated benefits	**Economic Development:** Avoided damage costs **Social Inclusion:** Skills development (behavioural) **Environment:** Enhanced ecological value, prevention of biodiversity loss.	
Existing Work Leveraged:	Izmir Green Infrastructure Strategy	
1/25,000 scaled IBB Environmental Plan Alignment	1. Gulf of Izmir	

5.3.5. Health

Number of actions: 3

These actions recognise and leverage the existing national and local work undertaken by IBB and other key stakeholders in this sector. A key aspect of this has focused around water quality, with IZSU and Izmir's Provincial Directorate of Public Health undertaking measurements of the potable water network, ensuring the water supply complies with the regulations on water for human consumption.

On a national level the Ministry of Health published a National Programme and Action Plan on reducing the Adverse impacts of Climate Change on Public Health (2015) which is currently being implemented with a focus on raising public awareness and strengthening situational capacity to monitor diseases.

When developing and implementing these actions it is also important to consider maladaptive practices. For health it is important to recognise the need for a multi-sectoral approach, meeting the demands and needs across the various scales (e.g. City-level vs provincial) sectors and social groups. For example, a mitigating action may be effective in decreasing the vulnerability of one social group i.e. men, but at the same time it inadvertently enhances the vulnerability of another i.e. women. In order to avoid this, there is a need for the recognition of how climate change effects the various socioeconomic sources of vulnerability such as gender equality, by placing equity front and centre when designing policies, practices and interventions.

Table 58 below demonstrates the IBB strategic plan objective that aligns with actions presented for the health sector.

Table 58: IBB Strategic Plan 2020 – 2024 objective addressed.

Strategic Heading	Strategic Goal	Strategic Objective(s)
Quality of Life - Health and Sports	Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network	**2.3** Health of Human and All Creatures will be Promoted.

The SECAP adaptation actions for the health sector are summarised below in Table 59 and further developed into a business case.

Table 59: A Summary of the Heath sector actions.

Action ID	Action Headline	Responsible Body	Cross-sector benefits	Link to Mitigation
PH1.3	Carry out awareness raising activities on the effects of climate change on human health	IBB	N/A	No
SECAP H1	Periodic collection and monitoring of data by creating a monitoring board to address climate and health impacts	IBB	N/A	No
SECAP H2	Identifying groups that are vulnerable to health in the face of the effects of climate change and implementing strengthening strategies such as early warning systems.	IBB	Civil Protection & Emergency	No

PH1.3: Carry out awareness raising activities on the effects of climate change on human health.	
SP Objectives:	2.3. Health of Human and All Creatures will be Promoted.
Description	This action would held raise the understanding around potential impacts of climate change on human health. The awareness raising activities should target the most vulnerable population groups within Izmir, as they are less likely to be able to prepare for, respond to and recover from the impacts of climate change. This would include but not be exclusive of; the elderly, infirm, those living in poor quality housing stock and low-income families. It should focus on impacts that could and are already occurring from both acute and chronic hazards, including but not exclusive of; overheating, water scarcity due to drought, reduced air quality and flooding from surface water, coastal and riverine sources. The awareness raising activities could also consider incorporating information on preparedness, response plans and mechanisms that residents could undertake or utilise to help enhance their own personal resilience to the events.
Rationale / Purpose	Increasing the awareness of the potential impacts of human health, particularly in vulnerable population groups, will help improve the social resilience of Izmir's population and reduce the resilience gap that is currently present in society. This would in-turn, potentially reduce the impacts experienced by vulnerable population groups when the risks occur, therefore reducing the pressure on emergency response and healthcare systems in the future.
Action	Capacity Building
Timeframe	2020 - 2024
Risk and/or vulnerabilities addressed	**Risks:** IM24, IM25. IM26 **Vulnerabilities:** SE-D
Responsible Body / Department	IBB
Stakeholders	• Provincial Directorate of Public Health • MoH • WHO • Other public health organisations. • MoEnvU • IZSU
Financing Options	Municipal Budget

SECAP H1: Periodic collection and monitoring of data by creating a monitoring board to address climate and health impacts	
SP Objectives:	2.3 Health of Human and All Creatures will be Promoted.
Description	Begin a monitoring board with representatives from the appropriate stakeholders for the collection and analyse of data around observed and predicted climate impacts / infectious disease links that Izmir's population could be exposed too. This could include: - Historical evidence - Early impacts of climate change: e.g. health impacts of temperature extremes, impacts of climatic and weather events, infectious diseases (vector and water borne). - Predictive Modelling, understanding transmission cycles for infectious diseases
Rationale / Purpose	By enhancing the municipalities understand of the health impacts that climate change could have on the population it would better inform and educate decisions around preventative and mitigating actions
Action	Capacity Building
Timeframe	2021 - 2025
Risk and/or vulnerabilities addressed	**Risks:** IM24, IM25. IM26 **Vulnerabilities:** SE-D

Responsible Body / Department	IBB
Stakeholders	Provincial Directorate of Public Health MoH MoEnvu IZSU
Financing Options	Municipal Budget

SECAP H2: Identifying groups that are vulnerable to the public health effects of climate change and implementing strengthening strategies targeting these groups.	
SP Objectives:	2.3 Health of Human and All Creatures will be Promoted.
Description	Commission work that identifies and researches the vulnerable population groups in the city, broadly defined as those who are not able to access and use the standard resources offered in disaster preparedness and planning, response and recovery. This factors in age, class, race, poverty language and other social, cultural, economic and physiological characteristics. Use this information to develop and implement strengthening strategies for these groups This could identifying and fill gaps around vulnerable population groups in publicly available emergency preparedness training resources for public health, develop responder-targeted course / trainings around vulnerable groups, provide guidelines on how to both engage with an incorporate vulnerable population groups in the urban and disaster response planning process.
Rationale / Purpose	During a climatic or weather event, material and physical resources are stretched thing and often, the needs of those who most need help, namely the vulnerable population groups are left unmet. By understanding these groups better and developing a strategy that specifically targets ways of strengthening these groups it could ultimately reduce their vulnerability.
Action	Plan / Strategy
Timeframe	2021 - 2025
Risk and/or vulnerabilities addressed	**Vulnerabilities:** SE-D:
Responsible Body / Department	IBB
Stakeholders	• MoEnvU • MoH
Financing Options	Municpal Budget

5.3.6.Civil Protection & Emergency

Number of actions: 2

These actions recognise and leverage the existing work undertaken by IBB and other key stakeholders such as AFAD (the Department of Disaster and Emergency Management Authority). Working in Izmir in coordination with IBB under the Provincial Directorate of Disaster and Emergency, interventions undertaken include the revision of zoning regulations, expansion of fire engines, development of a building stock inventory and the creation of the IBB Fire and Natural Disaster Training centre to raise disaster awareness among the public.

At a national level, Turkey has developed a National Disaster Response Plan (2013) in line with the AFAD Strategic Plan (2012). These informed by the Disaster and Emergency Response Services Regulation which dictates the forces and resources that will be needed in response to disaster and emergency situation and a national and local level, outlining the duties and responsible units at a local level.

A key consideration in avoiding maladaptive practices for Civil Protection and Emergency is balancing the short and long-term benefits derived from the various strategies. For example, when developing a plan to address forest fires, the short-term plan would focus on extinguishing and then recovering from the event whereas long-term considerations should consider aspects such as land-use management changes to reduce the risk of a fire occurring and the retrofitting of houses to make them more fire resistant. It is also important to recognise the multi-sectoral approach required in Civil Protection and Emergency, meeting the demands and needs across the various scales, sectors and social groups in relation to the various hazards they are exposed too.

Table 60 below demonstrates the IBB strategic plan objective that aligns with actions presented for the civil protection & emergency sector.

Table 60: IBB Strategic Plan 2020 - 2024 objective addressed.

Strategic Heading	Strategic Goal	Strategic Objective(s)
Nature – Climate Action	Making İzmir A Global Model City for Its Harmony With Nature	**5.2.** In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy

The SECAP adaptation actions for the civil protection & emergency sector are summarised below in Table 61 and further developed into a business case.

Table 61: A Summary of Civil Protection & Emergency Actions.

Action ID	Action Headline	Responsible Body	Cross-sector benefits	Link to Mitigation
AOS1.1	Establishing the necessary tools, mechanisms and management structure for the effective implementation of climate change adaptation strategies.	IBB	Heath	No
AOS1.3	Develop an administrative organisational structure for the implementation and monitoring of GCAP and SECAP actions.	IBB	Land Use Planning, Waste, Water Buildings	No

AOS1.1: Establishing the necessary tools, mechanisms and management structure for the effective implementation of climate change adaptation strategies.	
SP Objectives:	5.2 In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy
Description	This action would require the following: - development of an inter-institutional management strategy e.g. establish an adaptation "Coordination Board". - Development of monitoring methods and tools for key risks and vulnerabilities. - Collection, evaluation and management of adaptation impact indicator data. - Setting up a Climate Adaptation Green Dashboard that allows access and navigation of this data by all necessary stakeholders.
Rationale / Purpose	This action recognises that the impacts associated with climate change do not adhere to sector boundaries and therefore nor should the approach to manage and mitigate these impacts.
Action Type	Plan / Strategy
Timeframe	2021 - 2025
Risk and/or vulnerabilities addressed	This action is overarching and would act as a catalyst to help inform action towards all climate change risks & vulnerabilities identified.
Responsible Body / Department	IBB
Stakeholders	• MoEnvU • MoAF • MoTI • MoENR • IZSU
Financing Options	PPPs, IFI's, IIIBank, Private Developers, Private banks.

AOS1.3: Develop an administrative organisational structure for the implementation and monitoring of GCAP and SECAP actions.	
SP Objectives:	5.2 In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy
Description	Develop an internal organisation structure or body that would oversee the implementation and monitor progress made on both the GCAP and SECAP actions.
Rationale / Purpose	Given the cross-departmental and inter-organisation span of action owners across all of the GCAP and SECAP, it would be difficult to effectively oversee and monitor the progress these actions make without developing a dedicated organisational structure.
Action Type	Plan / Strategy
Timeframe	2020 - 2021
Risk and/or vulnerabilities addressed	This action is overarching and would act as a catalyst to help inform action towards all climate change risks & vulnerabilities identified.
Responsible Body / Department	IBB

Stakeholders	• MoEnvU • MoAF • MoTI • MoENR • IZSU
Financing Options	Municipal Budget

5.3.7.Tourism

Number of actions: 1

Tourism in an important industry for Izmir and influences multiple sectors – driving a reduction in green space for allocation of land to serve the tourist economy, building hotels, increasing the demand for water services and detrimentally impacting biodiversity by contributing to the changes in ecosystem conditions (e.g. exotic species introduction). There is also a drive-in eco-Tourism within Izmir, with organisations such as Eco Turkey[70] promoting responsible and ethical tourisms, displaying the following principles; 1. Minimize Impact, 2. Travel to natural destination, 3. Build environmental and cultural awareness and respect, 4. Provide direct financial benefits for conservation 5. Provide financial benefits and empowerment for local people, 6. Respect local culture and 7, Support human rights and demographic movement.

This cross-sector influence is reflected in the local and national strategies and policies that act in support of the industry as part of a wider plan, alongside striving to protect the natural environment and resources from the associated pressures Tourisms brings. This includes consideration in land-use strategies such as Izmir's Urban GreenUP programme and broader national level strategies such as the National Transport Master Plan 2019.

When developing and implementing these actions it is also important to recognise the positive and negative cross-sector, influences that the Tourism industry can both impart and be affected by. In taking action to better understanding the implications that climate change will have on the tourism-recreation sector, more informed, effective and integrated action can be adopted.

Table 62 below demonstrates the IBB strategic plan objective that aligns with actions presented for the tourism sector.

Table 62: IBB Strategic Plan 2020 - 2024 objective addressed.

Strategic Heading	Strategic Goal	Strategic Objective(s)
Economy – World City Izmir	Creating an Innovative and Entrepreneurial Local Ecosystem Capitalizing on Geographical Characteristics of the City.	3.5 Tourism Will be Supported and İzmir Will Be Promoted To Make it a Global Meeting Point

The SECAP adaptation actions for the tourism sector are summarised below in Table 63 and further developed into a business case.

Table 63: A summary of the tourism action.

Action ID	Action Headline	Responsible Body	Cross-sector benefits	Link to Mitigation
I1.10	Commission a study to better understand both the direct and indirect impacts of climate change on tourism: both positive and negative.	IBB	Economy	No

I1.10: Commission a study to better understand both the direct and indirect impacts of climate change on tourism: both positive and negative and recommendations to improve the industry's resilience.	
Strategic Plan Objectives:	**3.5** Tourism Will be Supported and İzmir Will Be Promoted To Make it a Global Meeting Point
Description	Establish funding to commission a study which will derive and analyse both positive and negative cascading impacts (direct and indirect) on tourism, in line with the most recent projections. This will consider the move to a low carbon and resilient economy and be in-line with the Paris Agreement and a

[70] http://www.ecoturkey.com/about-us/

<table>
<tr><td></td><td colspan="2">1.5ºC to 2.0ºC warming. It would also incorporate an element of how tourisms can both mitigate and exacerbate the impacts of climate change alongside building the resilience of the industry.

This study would focus on both chronic and acute hazards, as outlined in Izmir's SECAP report, including sea level rise and coastal erosion. Key actions could focus on:
- Integrating disaster management principles into Tourism management plans to help enhance destination and organisational resilience.
- Provide central steering of collaborative action between stakeholders of the tourism supply chain by developing a governance structure which supports resilient actions. This could include; preparing for gradual changes by fostering social learning and innovation and reacting to short-term shocks by demanding the quick distribution of information and a centralized governance of the collective action taken by the industry.
- Understanding the characteristics of individual destinations in order to determine the appropriateness and effectiveness of the adaptive action required. Whether it be the protection and rejuvenation of a natural asset (e.g Gediz Delta Wetlands), the protection of long-term benefits for short-term loss of Tourism through natural adaptive strategies, or managed coastal realignment whether through facilitating a natural process or building flood defences to protect coastal resorts in Izmir.</td></tr>
<tr><td>Rationale</td><td colspan="2">By fully understanding the complex and inter-connected nature of the impacts that could face Tourisms as a result of climate change, it will lay the groundwork for a more informed and comprehensive action to help the Tourism industry in Izmir adapt to changing circumstances.</td></tr>
<tr><td>Steps for Implementation</td><td colspan="2">1. Develop the scope and specification of the study, including the destinations and organisational structures that are considered.
2. Identify and secure necessary funding</td></tr>
<tr><td>Type of action</td><td colspan="2">Plan / Strategy</td></tr>
<tr><td>Environmental values positively affected</td><td colspan="2">  </td></tr>
<tr><td>Climate Change risks and / or vulnerabilities addressed.</td><td colspan="2">Risks: IM31
Vulnerabilities: SE-B</td></tr>
<tr><td>Potential Emission Savings</td><td colspan="2">No emission savings will occur as a direct result of this action.</td></tr>
<tr><td rowspan="5">Plan for delivery</td><td>Action owner</td><td>IBB</td></tr>
<tr><td>Stakeholders</td><td>• MoIT
• Aegean Region Chamber of Industry
• Industry representatives such as Visit Turkey
• Funding bodies</td></tr>
<tr><td>Financing options</td><td>Municipal budgets, grant funding, research projects</td></tr>
<tr><td>Revenue/savings opportunities</td><td>This study will better inform the sector around the future impacts they could potentially face, informing action around adaptation and increasing resilience, which could lead to future savings in relation to reduced cost of impacts from climate events.</td></tr>
<tr><td>Timeline</td><td>2021 - 2025</td></tr>
<tr><td>Impact measures</td><td colspan="2">Indicators in relation to climate risk and vulnerabilities.</td></tr>
<tr><td>Estimated cost</td><td colspan="2">CAPEX: N/A
OPEX: N/A
Design/development costs: €6,000 - €8,000</td></tr>
<tr><td>Estimated benefits</td><td colspan="2">Economic Development: increased economic efficiency, avoided damages, economic growth and creation.
Social: Skills training</td></tr>
<tr><td>Existing Work Leveraged</td><td colspan="2">N/A</td></tr>
</table>

1/25,000 scaled IBB Environmental Plan Alignment	This action would cover all the spatial areas within Izmir that house elements of the tourism industry: 1. Gulf of Izmir 2. Central City 3. Urban / Rural Periphery 4. Agricultural Basin 5. Green Belt:

6. Road Map for Local Government

6.1. SECAP Monitoring Process

6.1.1 Adaptation

In order to ensure that Izmir's adaptation process is both effective and sustainable over time, it is important to regularly evaluate the progress of planned and implemented actions and check the actual outcomes against the objectives set out by the accompanying strategy (IBB Strategic Plan 2020 – 2024).

Furthermore, it is important to consider if it is necessary to adjust, add too or drop certain actions in view of the monitoring results, recognising any maladaptive practice / unintended side effects that may have occurred.

Important elements of the monitoring and evaluation process are the selection of suitable indicators and establishing an internal process for collection and evaluate the information in order to inform the Cities actions in the future.

As a part of the SECAP process, these indicators were identified, with focus group meetings held to collect and analyse the data where was more readily available. Assigned to the appropriate risks and vulnerabilities in the associated CoM Reporting template excel workbook, these indicators are outlined in the below Table 64 and Table 65.

Table 64: Impact-related indicators.

Indicator Code	Impact-related indicators
A_B1	Number or % of (public/residential/tertiary) buildings damaged by extreme weather conditions/events
A_T1	Number or % of transport/energy/water/waste/ICT infrastructure damaged by extreme weather conditions/events
A_L1	% of grey/blue/green areas affected by extreme weather conditions/events (e.g. Heat Island Effect, Flood, Rockfalls and/or Landslides, Forest/Land Fire)
A_T2	Number of days with public service interruptions (e.g. energy/water supply, health/civil protection/emergency services, transport, waste)
A_T3	Average length (in hours) of the public service interruptions (e.g. energy/water supply, public transport traffic, solid waste, health/civil protection/emergency services)
A_H1	Number of people injured/evacuated/relocated due to extreme weather event(s) (e.g. heat or cold waves)
A_H2	Number of deaths related to extreme weather event(s) (e.g. heat or cold waves)
A_CP1	Average response time (in min.) for police/fire-fighters/emergency services in case of extreme weather events
A_H3	Number of water quality warnings issued
A_H4	Number of air quality warnings issued
A_E1	% of areas affected by soil erosion / soil quality degradation
A_E2	% of habitat losses from extreme weather event(s)
A_E3	% change in number of native species
A_E4	% of native (animal/plant) species affected by diseases related to extreme weather conditions/events
A_A1	% of agriculture losses from extreme weather conditions/events (e.g. drought/water scarcity, soil erosion)
A_A2	% of livestock losses from extreme weather conditions
A_A3	% change in crop yield / evolution of the annual grassland productivity
A_A4	% of livestock losses from pests/pathogens
A_A5	% of timber losses from pests/pathogens

A_A6	% change in Forest composition
A_A7	% change in water abstraction
A_TO1	% change in tourist flows / tourism activities
A_O1	€ annual direct economic losses (e.g. in commercial/agricultural/industrial/touristic sectors) due to extreme weather event(s)
A_O2	€ annual amount of compensation received (e.g. insurance)

Table 65: Vulnerability related indicators.

Indicator Code	Vulnerability-related indicators
A_C1	Number of days/nights with extreme temperature (compared to ref. annual/seasonal temperatures at day/night times)
A_C2	Frequency of heat/cold waves
A_C3	Number of days/nights with extreme precipitation (compared to ref. annual/seasonal precipitation at day/night times for each season)
A_C4	Number of consecutive days/nights without rainfall
A_S1	Current population vs. projections 2020/2030/2050
A_S2	Population density (compared to national/regional average in year X in country/region X)
A_S3	% share of sensitive population groups (e.g. elderly (65+)/young (25-) people, lonely pensioner households, low-income/unemployed households) - compared to national average in year X in country X
A_S4	% of population living in areas at risk (e.g. flood/drought/heat wave/ forest or land fire)
A_S5	% of areas non-accessible for emergency / firefighting services
A_P1	% change in average annual/monthly temperature
A_P2	% change in average annual/monthly precipitation
A_P3	Length of transport network (e.g. road/rail) located in areas at risk (e.g. flood/drought/heat wave/ forest or land fire)
A_P4	Length of coastline / river(s) affected by extreme weather conditions / soil erosion (without adaptation)
A_P5	% of low-lying or at altitude areas
A_P6	% of areas at coasts or rivers
A_P7	% of protected (ecologically and/or culturally sensitive) areas / % of forest cover
A_P8	% of (e.g. residential/commercial/agricultural/industrial/touristic) areas at risk (e.g. flood/drought/heat wave/ forest or land fire)
A_P9	Current energy consumption per capita vs. projections 2020/2030/2050
A_P10	Current water consumption per capita vs. projections 2020/2030/2050
A_S6	% of land area which houses industry / agriculture located within areas at risk to climate hazards (flooding, drought, heatwave, forest or wildfire).

6.1.2. Mitigation

In order to successfully implement climate change mitigation policies, it is important to develop clearly stated evaluation and reporting requirements and set deadlines to allow performance assessment. There is a need for cities to bring rigour and structure into their efforts to measure progress in achieving their mitigation goals, working in harmony with different departments, institutions, NGOs, private sector and citizens. A lack of standardised tools to develop performance benchmarks or create a monitoring system would tend to hinder policy evaluation and performance over time.

Encouraging better development of urban climate policy networks, in particular through the engagement of regional and local non-governmental stakeholders at various stages of the policy process, could deepen local scientific knowledge and integrate local perspectives in the drafting and implementation of coordinated and integrated mitigation and adaptation strategies

A performance assessment process like the one used in Izmir's Strategic Plans can be adopted for mitigation monitoring. This should include reviews and monitoring of the data sources for inventory calculation, per the table below (a detailed list of data sources is provided in Appendix B Recognising that data quality is crucial for the monitoring process, the table below (Table 66) also outlines some potential improvement areas that could potentially be adopted in future.

Table 66: Monitoring the data

Sector	Required Data	Frequency of Data Collection	Improvement Areas
Municipal Buildings/Facilities	All fuel and electricity	Yearly	A system among IBB and subsidiaries can be implemented for data collection and storing.
Tertiary	All fuel and electricity	Yearly	More information of building stock (Year of build, building properties, m^2, fuel type, etc.)
Residential	All fuel and electricity	Yearly	More information of building stock (Year of build, building properties, m^2, fuel type, etc.) Uncertainty of solid fuel consumption is high
Street Lighting	Electricity	Yearly	Number of lighting pole and current change)
TRANSPORTATION			
Mun. Fleet	All fuel and electricity	Yearly	A system among IBB and subsidiaries can be implemented for data collection and storing.
Public Transportation	All fuel and electricity	Yearly	-
Private vehicles	All fuels and electricity	Yearly	-
OTHER SOURCES			
Solid waste	Amount of waste	Yearly	-
Wastewater	Amount of wastewater	Yearly	-
Agriculture	Livestock, fertilizer, irrigation	Yearly	-
Local energy generation	Solar, wind, biogas, geothermal, etc.	Yearly	The production quantities from the distribution company can be requested License and unlicensed installations can be requested from EMRA

6.2. Focus Group Meetings and Institutional Collaboration

Focus group meetings held with IBB (detailed in Section 2.5) identified some requirements that need to be met in order to ensure that the adaptation indicators are localised and to facilitate an effective monitoring process. These are described below.

- Climate adaptation strategies should reflect locally specific risks and vulnerabilities. Therefore, there is a need to identify sub-zones within the metropolitan area of Izmir based on criteria such as climatic attributes (meteorological data sets), agro-ecological features, population and economic activity density, and rural or urban characteristics. Detailed work is required to define these zones, which will then be used to establish an effective location-specific sustainable energy and climate adaptation strategy.
- Collaboration with institutions, universities and sectoral stakeholders is also required to carry out work for localization of adaptation indicators. Multi-stakeholder workshops and several focus group meetings need to be organized to fulfil this aim; these should build on work undertaken to date as part of the SECAP and GCAP development process.
- Further focus group meetings with external stakeholders need to be organized in which relevant institutions and organizations are invited to share their work and expertise (such as the Aegean Forestry Research Institute and the Aegean Agricultural Research Institute). Data for some indicators are not directly available in national or local databases. For this reason, a data analysis study should be done on what kind of data is produced by related institutions or organizations, identify key gaps and understand whether these can be filled.
- Vulnerabilities to climate change risks need to be investigated in more detail in order to have insight and data for areas that are under risk of climate hazards such as flooding, landslide, drought, heat waves,

forest or wildfires. Flooding risks have been better studied; however, other risk categories for some of the high-impact climate change related hazards have not been identified. Gathering data on damage and losses caused by extreme weather events is important to understand how buildings, industry, agriculture and transport networks may be affected.

- In addition to physical / geographic context, the localisation of climate risks must also consider the human element. Vulnerable groups need to be identified to reveal target group and spatial focus of both mitigation and adaptation actions. Demographic parameters can be reached from national databases; however socio-economic studies need to be carried out locally to reach targeted vulnerable groups. In this context, internal collaboration between the units of IBB such as social services, climate change and fire department and collaboration with external stakeholders such as charities and civil defence organizations are required.

6.3 Strategy Integration and Coordination for Actions

Institutional collaboration and multi-stakeholder approaches are necessary to provide environmentally, socially and economically sustainable urban services. With this in mind, the SECAP has been developed to integrate with regional and city-scale strategic implementation plans, to ensure that it holistically addresses existing policies and measures regarding:

- Energy efficiency and sustainable design in buildings,
- Strategies and practices related to urban infrastructure (energy, water, waste, transportation, etc.),
- Urban planning and design,
- Planning decisions on protected areas (ecological, cultural, archaeological, historical)
- Green areas (parks, forests, pastures etc.) and green area quality,
- Water management for urban use (drinking and potable water) and agricultural use (irrigation water),
- Soil quality and agricultural production,
- Risk and emergency management action plans for natural disasters (floods, forest fires, landslides etc.),
- Institutional capacity building and public awareness,
- Administrative organization and cooperation models,
- City databases and monitoring systems

Going forward, it is recommended that IBB should continue to coordinate the targets, outcomes and monitoring procedures of its various strategic plans, such as the IBB Strategic Plan, the Green Infrastructure (GI) Strategy, and so on. In addition to supporting IBB's goal of providing an integrated and holistic approach to sustainable management of resources, urban activities and services, this also presents an opportunity to establish common resource management and cooperation networks: greater efficiencies can be achieved by sharing roles and responsibilities in the implementation of the related strategies. An important example would be establishing a coordination board consisting of experts and decision-makers who can carry out the necessary works.
Finally, it should also be noted that any collaboration process needs to be supported with ICT tools via creation of working platforms that allow inter-agency cooperation and coordinated work, particularly with regards to information sharing and joint data entry.

Appendix A IBB Strategic Plan 2020-2024

A summary of IBB's 2020 – 2024 strategic plan, utilised and referred to in business case development.

Heading	Sub-heading	No	Goal	No	Objective
Infrastructure	Urban Infrastructure	1	Building a Sustainable Infrastructure Available to Everyone	1.1	A Sustainable Urban Infrastructure Will Be Built to Contribute to the Urban Economy
Infrastructure	Sustainable Living Areas	1	Building a Sustainable Infrastructure Available to Everyone	1.2	Planned, Safe and Sound Settlement Areas Will Be Developed or Regenerated
Infrastructure	Green Infrastructure	1	Building a Sustainable Infrastructure Available to Everyone	1.3	Climate Friendly Urban Green Areas Network Will Be Created in the Province
Quality of Life	Public Transport	2	Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network	2.1	Public Transport Will Be Affordable, Energy Efficient, Fair, Comfortable, Available to and Accessible for all residents
Quality of Life	Urban Transportation	2	Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network	2.2	A Sustainable Transport System Will Be Created With a Harmonious Interaction Between Different Modes of Transport, Offering Different Options
Quality of Life	Health and Sports	2	Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network	2.3	Health of Human and All Creatures will be Promoted
Quality of Life	Accessible and Clean Energy	2	Making Izmir a Smart City with a High Level of Quality of Life and A Well-Developed Transport Network	2.4	Access to Reliable, Sustainable and Affordable Energy by Everyone Will be Promoted
Economy	Sustainable Economic Growth	3	Creating an Innovative and Entrepreneurial Local Ecosystem Capitalizing on Geographical Characteristics of the City.	3.1	The Right Ecosystem Will be Created to Make İzmir an Attraction Center for New Investments, Technological Innovations, and Creative Industries.
Economy	Partnerships for Sustainable Development	3	Creating an Innovative and Entrepreneurial Local Ecosystem	3.2	Local, National and Global Partnerships and Harmony Among

			Capitalizing on Geographical Characteristics of the City.		Different Sectors Will Be Encouraged.
Economy	Poverty Reduction	3	Creating an Innovative and Entrepreneurial Local Ecosystem Capitalizing on Geographical Characteristics of the City.	3.3	Full Time, Productive and Innovative Business Environment Will Be Created for Everyone and All Kinds of Poverty Will Be Reduced in İzmir
Economy	Access to Food	3	Creating an Innovative and Entrepreneurial Local Ecosystem Capitalizing on Geographical Characteristics of the City.	3.4	Food Safety Will Be Provided, Nutrition Will Be Improved, and Sustainable Agriculture Will Be Supported.
Economy	World City İzmir	3	Creating an Innovative and Entrepreneurial Local Ecosystem Capitalizing on Geographical Characteristics of the City.	3.5	Tourism Will be Supported and İzmir Will Be Promoted To Make it a Global Meeting Point
Democracy	Peace and Justice	4	Including Izmir Residents in Decision Making, Making Decisions Transparent and Auditable, and Urban Rights and Identity An Integral Part of the City Culture	4.1	Peaceful and Inclusive Social Consensus Will be Encouraged, Justice Will be Accessible To All, Human Rights and Rights of All Living Things Will be Advocated
Democracy	Gender Equality, Children, Youth and Disadvantaged Communities	4	Including Izmir Residents in Decision Making, Making Decisions Transparent and Auditable, and Making Urban Rights and Identity An Integral Part of the City Culture	4.2	Gender Equality in Urban Life Will be Promoted, Women Will Be Empowered In The Society; Equal Opportunities Will Be Provided for Children, Young People and Disadvantaged Communities
Democracy	Reducing Inequalities	4	Including Izmir Residents in Decision Making, Making Decisions Transparent and Auditable, and Making Urban Rights and Identity An Integral Part of the City Culture	4.3	The Value and Welfare Generated in İzmir Will be Distributed Fairly To All Districts and Villages

Democracy	Urban Rights and Identity	4	Including Izmir Residents in Decision Making, Making Decisions Transparent and Auditable, and Making Urban Rights and Identity An Integral Part of the City Culture	4.4	A Social Environment, Where Security, Peace and Urban Rights Are Protected, Will Be Created
Democracy	Digital Transformation	4	Including Izmir Residents in Decision Making, Making Decisions Transparent and Auditable, and Making Urban Rights and Identity An Integral Part of the City Culture	4.5	Participatory Digital Change Will Lead to a Sustainable a Efficient Urban Ecosystem Management
Nature	Recycling	5	Making İzmir A Global Model City for Its Harmony With Nature	5.1	Sustainable Waste Management and Recycling Mechanisms Will Be Developed
Nature	Climate Action	5	Making İzmir A Global Model City for Its Harmony With Nature	5.2	In Order to Adapt to Climate Change and its Impacts, Actions Will Be Taken in All Areas, Primarily in Agriculture and Energy
Nature	Marine and Coastal Areas	5	Making İzmir A Global Model City for Its Harmony With Nature	5.3	Gulf of Izmir and All The Coastal and Marine Areas Will Be Protected and Used Sustainably
Nature	Ecosystem Integrity	5	Making İzmir A Global Model City for Its Harmony With Nature	5.4	Agricultural Areas Will Be Developed to Protect the Ecosystem; Loss of Natural Areas and Biodiversity Will Be Stopped
Experimental Learning - Institutional Capacity	Experimental Learning	6	Making İzmir a Leading City in the World in Experiential Learning, and Creating an Urban Environment, Where Innovative Ideas Flourish	6.1	Innovative, Equal and High-Quality Experimental Learning Opportunities as well as Life-Long Learning Opportunities Will Be Provided for All
Experimental Learning - Institutional Capacity	Enterprise Resource Management	6	Making İzmir a Leading City in the World in Experiential Learning, and Creating an Urban Environment, Where Innovative Ideas Flourish	6.2	Institutional Capacity and Functioning Will Be Made More Effective, Economic and Efficient
Culture and Arts	Cultural activities	7	Making İzmir a Cultural Hub for the Aegean and Mediterranean Regions,	7.1	Culture and Arts Will Be Made A Part of All Areas of Life

			and the World once again		
Culture and Arts	Keeping the Culture Alive	7	Making İzmir a Cultural Hub for the Aegean and Mediterranean Regions, and the World once again	7.2	Ancient Cultural Assets of İzmir Will be Preserved and Made A Part Of Life Again
Culture and Arts	World Arts	7	Making İzmir a Cultural Hub for the Aegean and Mediterranean Regions, and the World once again	7.3	İzmir Will Become the Meeting Point For World Culture and Arts

Appendix B Mitigation Data Sources

Scope	Inventory	Category	Types	Data Sources
S1	Municipal	Stationary	Fuel oil	Izmir Metropolitan Municipality (IBB)
S1	Municipal	Stationary	Diesel	IBB, Grand Plaza
S1	Municipal	Stationary	Natural gas	IBB, ESHOT, IZBETON, IZMIR METRO, IZSU, IZENERJI, IZELMAN
S1	Municipal	Stationary	LNG	IZBETON
S1	Municipal	Stationary	LPG	ESHOT
S2	Municipal	Electricity	Public buildings, parks, street lighting	IBB
S1	Municipal	Transport	Fuel oil	IBB, ESHOT, IZBETON, IZMIR METRO, IZSU, IZBELCOM, Ege City Planning
S1	Municipal	Transport	Diesel	IZBAN, IZBETON, IZMIR METRO, IZULAŞ, IZENERJI, IZSU, IZELMAN, IZBELCOM, IZMIR JEOTERMAL
S3	Municipal	Transport	Jet Kerosene	Izmir Metropolitan Municipality (IBB)
S1	Municipal	Transport	Diesel (public transportation)	ESHOT, IZULAŞ, IZDENIZ, IZELMAN
S1	City	Stationary	Fuel oil, natural gas, LPG	EMRA, LPG Market Report, 2018, p. 29.
S1	City	Stationary	Coal and coke coal	Izmir Provincial Environmental Status Report (2018)
S1	City	Stationary	Jeotermal	Izmir Jeotermal A.S., IBB
S1	City	Stationary	Fugitive	Annual Reports of Cement Plants
S1	City	Waste	Solid waste Landfill Facility	*IBB - Waste Management Department *Izmir CO_2 Inventory, 2016 (IBB – Directorate of Climate Change and Clean Energy)
S1	City	Wastewater	Wastewater Treatment Plant	*Izmir Provincial Environmental Status Report, 2019, p.89 *IZSU, https://www.izsu.gov.tr/tr/TesisDetay/1/32/2
S1	City	Agriculture & Livestock	Animal numbers, chemical fertilizer	TÜIK, Izmir Directorate of Provincial Agriculture and Forestry
S2	City	Electricity	Residential, Commercial and Industrial	EMRA,Electricity Market Development Report, 2018, p. 26.
S1	City	Transport	Fuel oil, Diesel, LPG	EMRA, LPG Market Report, 2018, p. 29.
S1	City	Transport	Diesel (bus station)	ESHOT
S2	City	Transport	E-vehicles	ESHOT; IZMIR METRO, IZBAN
S3	City	Transport	Jet Kerosene	EPDK, Petroleum Market Report, 2018, p. 28.

Appendix C Adaptation indicators – data sources[71]

Code	Indicator	Related institution	Content of the data is provided by the institution	Other data sources (reports, national statistic databases etc.)	To reach the indicator	Notes
A_C1	Number of days/nights with extreme temperature (compared to ref. annual/seasonal temperatures at day/night times)	2nd Regional Directorate of Meteorology	Station-based daily measured temperature values		The days which are + 10 ° C higher than the average temperature are taken as extreme heat; The days which are - 10 ° C lower than the average temperature are taken as extreme cold.	
A_C2	Frequency of heat/cold waves					
A_C3	Number of days/nights with extreme precipitation (compared to ref. annual/seasonal precipitation at day/night times for each season)	2nd Regional Directorate of Meteorology	Station-based daily measured precipitation values	General Directorate of Meteorology Website Seasonal Normals of the provinces / the highest daily precipitation amount (mm)	Comparison of the daily rainfall (mm) provided by the institution with the excessive rainfall (mm) obtained from the seasonal norms.	
A_C4	Number of consecutive days/nights without rainfall	2nd Regional Directorate of Meteorology	Station-based daily measured precipitation values		Determination of the longest period (consecutive days/nights without rainfall) in a year. (station-based anaylse)	It takes time to get it from raw data. If such information is kept in institution, it is useful to try to provide the relevant indicator directly.

[71] All data is sourced from the excel worbook: “SECAP-adaptation_indicators_data_04.03.202v1.xlsx”

A_S1	Current population vs. projections 2020/2030/2050	TurkSTAT		- Master Plan Report (50.000 or 100.000 scale) - Population projections of Turkısh Statıstıcal Instıtute (TurkSTAT)		Can be benefit form also Projections of Urban Planning Department of IBB
A_S2	Population density (compared to national/regional average in year X in country/region X)			TurkSTAT		Can be benefit form also Projections of Urban Planning Department of IBB
A_S3	% share of sensitive population groups (e.g. elderly (65+)/young (25-) people, lonely pensioner households, low-income/unemployed households) - compared to national average in year X in country X			TurkSTAT		The only age parameter taken into account. · Society Health · Social Services · Social Projects Departments of IBB These departments may have socio-economic data about vulnerable citizens .
A_S4	% of population living in areas at risk (e.g. flood/drought/heat wave/ forest or land fire)			Q50, Q100 and Q 500 Flood Scenarios of Basin Scale Flood Management Plans such as Gediz Basin Flood Management Plan; Küçük Menderes Basin Flood Management Plan and Kuzey Ege Basin Flood Management Plan		Aegean Forestry Research Institute.
A_S5	% of areas non-accessible for emergency / firefighting services					· Provincial Directorate of Disaster and Emergency (AFAD) · Provincial Health Directorate IBB Department of Fire Brigade. There are studies carried out in certain districts such as Çeşme and Bergama related to dead-end streets.)

A_P1	% change in average annual/monthly temperature	2nd Regional Directorate of Meteorology	Weather station based data; daily / monthly/ annual temperature			Required data interval may be longer than other indicators
A_P2	% change in average annual/monthly precipitation	2nd Regional Directorate of Meteorology	Weather station based data; daily / monthly/ annual precipitation			Required data interval may be longer than other indicators
A_P3	Length of transport network (e.g. road/rail) located in areas at risk (e.g. flood/drought/heat wave/ forest or land fire)			Basin Scale Flood Management Plans such as Gediz Basin Flood Management Plan; Küçük Menderes Basin Flood Management Plan and Kuzey Ege Basin Flood Management Plan	Roads at flooding risk were determined according to the Q50, Q100 and Q500 scenarios.	MoAF / Water Management Department - (Ankara)
A_P4	Length of coastline / river(s) affected by extreme weather conditions / soil erosion (without adaptation)					
A_P5	% of low-lying or at altitude areas					Collaboration with GIS Department of IBB
A_P6	% of areas at coasts or rivers					Since errors were detected in the current water bodies study, a new study is required. - DSI GIS Department of IBB
A_P7	% of protected (ecologically and/or culturally sensitive) areas / % of forest cover	· Provincial Directorate of Environment and Urbanization · 4th Regionall Directorate of Nature Conservation and National Parks · Provincial Directorate of	National parks, forest areas, natural sites, and conservation areas	Data on Natural site areas and conservation areas are taken from Mater Plans for east-west and north regions of the province of IBB		

		Agriculture and Forestry				
A_P8	% of (e.g. residential/commercial/agricultural/industrial/touristic) areas at risk (e.g. flood/drought/heat wave/ forest or land fire)					MoAF / Water Management Department - (Ankara) · Flood risk has been studied in the Flood Basin Management Plans and studies have been carried out on how much areas such as housing / commerce / industry / agriculture will be affected. Data for indicators and any study for wildfires: · Regional Forest Directorate · Aegean Forest Research Institute Izmir Provincial Directorate of Disaster and Emergency (AFAD)
A_P9	Current energy consumption per capita vs. projections 2020/2030/2050	Data from energy providers of the city				
A_P10	Current water comsumption per capita vs. projections 2020/2030/2050	Data from IZSU				
A_S6	% of land area which houses industry / agriculture located within areas at risk to climate hazards (flooding, drought, heat-wave, forest or wild-fire).		The size of agricultural areas at flood risk	Basin Scale Flood Mangement Plans such as Gediz Basin Flood Management Plan; Küçük Menderes Basin Flood Management Plan and Kuzey Ege Basin Flood Management Plan		Data for industrial areas at flood risk can be found from studies that are carried out for basin scale flood management plans of the MoAF, Department of Water Management Data for indicators and any study for wildfires: · Regional Forest Directorate · Aegean Forest Research Institute Izmir Provincial Directorate of Disaster and Emergency (AFAD)
A_B1	Number or % of (public/residential/tertiary) buildings damaged by extreme weather conditions/events	AFAD (				Fire Brigage Department collaborates with Social Services Department in this issues. Data analysis on studies and services of this department can be beneficial.

A_T1	Number or % of transport/energy/water/waste/ICT infrastructure damaged by extreme weather conditions/events					Climate-chanege related repair and miantaince works are not recorded by AYKOME. • 2nd Regional Directorate of Highways • Provincial Electricity and Gas Companies (Gediz AŞ., iZMIRGAZ, TEDAŞ etc.) can be beneficial.
A_L1	% of grey/blue/green areas affected by extreme weather conditions/events (e.g. Heat Island Effect, Flood, Rockfalls and/or Landslides, Forest/Land Fire)					
A_T2	Number of days with public service interruptions (e.g. energy/water supply, health/civil protection/emergency services, waste)					· Provincial Electricity and Gas Companies (Gediz AŞ., iZMIRGAZ, TEDAŞ etc.) IZSU, DSI (for water use both urban and rural)
A_T3	Average length (in hours) of the public service interruptions (e.g. energy/water supply, public transport traffic, health/civil protection/emergency services)					· Provincial Electricity and Gas Companies (Gediz AŞ., iZMIRGAZ, TEDAŞ etc.) IZSU, DSI (for water use both urban and rural)
A_H1	Number of people injured/evacuated/relocated due to extreme weather event(s) (e.g. heat or cold waves)	AFAD				
A_H2	Number of deaths related to extreme weather event(s) (e.g. heat or cold waves)	AFAD				
A_CP1	Average response time (in min.) for police/fire-fighters/emergency services in case of extreme weather events	AFAD	Response time for flooding within urban areas			· Provincial Health Directorate · Provincial Police Directorate
A_H3	Number of water quality warnings issued					
A_H4	Number of air quality warnings issued	IBB	Air quality normals and the number of days above these values			
A_E1	% of areas affected by soil erosion / soil quality degradation			In 25.000 scale Master Plans of IBB: Soil Problems Map shows that areas with		Urban Planning Department of IBB

				problems in terms of erosion and soil quality have been identified across the Province.		
A_E2	% of habitat losses from extreme weather event(s)					Inventory of Bio-diversity Was conducted for 2017-2018 years. There is a need for an update list to see changes.
A_E3	% change in number of native species					
A_E4	% of native (animal/plant) species affected by diseases related to extreme weather conditions/events					Provincial Agriculture and Forestry Directorate · Crop Production and Plant Health Unit · Animal Health and Breeding Unit And also Aegean Agricultural Research Institute.
A_A1	% of agriculture losses from extreme weather conditions/events (e.g. drought/water scarcity, soil erosion)					Provincial Agriculture and Forestry Directorate · Crop Production and Plant Health Unit · Animal Health and Breeding Unit And also Aegean Agricultural Research Institute.
A_A2	% of livestock losses from extreme weather conditions					Provincial Agriculture and Forestry Directorate · Animal Health and Breeding Unit
A_A3	% change in crop yield / evolution of the annual grassland productivity					Provincial Agriculture and Forestry Directorate · Crop Production and Plant Health Unit Pasture and Forage Plants Unit
A_A4	% of livestock losses from pests/pathogens					Provincial Agriculture and Forestry Directorate · Crop Production and Plant Health Unit

						And also Aegean Agricultural Research Institute.
A_A5	% of timber losses from pests/pathogens					· Regional Directorate of Forestry Aegean Forestry Research Institute
A_A6	% change in Forest composition					· Provincial Agriculture and Forestry Directorate Regional Directorate of Forestry
A_A7	% change in water abstraction					DSI and IZSU
A_TO1	% change in tourist flows / tourism activities	Provincial Culture and Tourism Directorate	the number of foreign touris and the number of museums / historical sites visits	Statistics from Website of Provincial Culture and Tourism Directorate		
A_O1	€ annual direct economic losses (e.g. in commercial/agricultural/industrial/touristic sectors) due to extreme weather event(s)					Fire Brigage Department and Social Services Department of IBB
A_O2	€ annual amount of compensation received (e.g. insurance)					For agricultural losses: TARSIM (Agricultural Insurance Pool)

Appendix D Risk Assessment Guidance

The risk assessment guidance applied in the RVA for Izmir SECAP was derived from the 'Global Covenant of Mayors for Climate & Energy: Guidance Note: Explanatory Note Accompanying the Global Covenant of Mayors Common Reporting Framework. V9. 12 April 2019. FINAL Version[72]".

			Consequence			
			High 4	Moderate 3	Low 2	Do Not Know 1
Probability	High	4	High	High	Moderate	Moderate
	Moderate	3	High	Moderate	Moderate	Low
	Low	2	Moderate	Moderate	Low	Low
	Do Not Know	1	Moderate	Low	Low	Not Known

Probability

4	High	Extremely likely that the hazard / impact occurs (e.g. greater than 1 in 20 chance of occurrence)
3	Moderate	Likely that the hazard / impact occurs (e.g. between 1 in 20 and 1 in 200 chance of occurrence)
2	Low	Unlikely that the hazard / impact occurs (e.g. between 1 in 200 and 1 in 2,000 chance of occurrence)
1	Do Not Know	City has not experienced or observed climate hazards in the past / there is no probability of the impact occurring. Alternatively, there is no way of accurately reporting this information based on evidence or data.

Consequence of Climate Risk

4	High	The hazard represents a high (or the highest) level of potential concern for your jurisdiction. When it occurs, the hazard results in (extremely) serious implications to the jurisdiction and (catastrophic) interruptions to day-to-day life.
3	Moderate	The hazard represents a moderate level of potential concern for your jurisdiction. When it occurs, the hazard results in impacts to your jurisdiction, but these are moderately significant to day-to-day life.
2	Low	The hazard represents a lower (the lowest) level of potential concern for your jurisdiction. When it occurs, the hazards results in impacts to your jurisdiction, but these are deemed less significant (or insignificant) to day-to-day life),
1	Do Not Know	City has not experienced or observed climate hazards in the past or has no ways to accurately reporting this information based on evidence or data.

[72] https://www.globalcovenantofmayors.org/wp-content/uploads/2019/04/Data-TWG_Reporting-Framework_GUIDANCE-NOTE.pdf

Appendix E Risk & Vulnerability Assessment

							Risk Level associated with timeframe			
I.D	**Sector**	**Primary Hazard(s)**	**Impact**	**Timeframe of Occurrence**	**Probability**	**Consequence**	**Rating**	**Risk Level**	**Rationale**	**Impact related Indicators** *(I.D is referenced where included in "SECAP-adaptation_indicators_data_04.03.202v1.xlsx)*
IM1	Building	Extreme Heat	Extreme heat causing overheating in buildings, increasing the demand for cooling, resulting in higher costs for repair and maintenance.	Short-term	4	2	8	**Moderate**	**Timeframe:** short term, given current risk level of hazard and climate projections demonstrating an increase in extreme heat events, but also the impact occurring due to repetitive events over a longer timeframe. **Probability:** High given the historical frequency of the extreme temperature events. Climate projections also demonstrate a rise in temperatures which means the probability remains consistent with the hazard rating. **Consequence:** This impact will not significantly impact day-to-day life but result in pressure on building maintenance in the medium to longer term.	- A-01 Annual direct economic losses due to extreme weather event(s). - A_L1 % of grey/blue/green areas affected by extreme weather conditions / events - Average temperature in urban environments (inc. heat island effect). - Maintenance and repair costs for municipal owned buildings
IM2	Building	Flooding	Surface water and riverine flooding events causing damage to / inundation of buildings within the municipality.	Short-term	4	3	12	**High**	**Timeframe:** Short-term due to the known impact of surface and river flooding timeframes currently and increase of extreme precipitation due to climate change in the short-term. **Probability:** High likelihood of occurring given Izmir's historical and current exposure to costal and surface water flooding. **Consequence:** Damage to	- A_L1 % of grey/blue/green areas affected by extreme weather conditions / events - A_B1 Number or % of (public/residential/tertiary) buildings damaged by extreme weather conditions/events

									and the inundation of buildings could cause significant, short-term disruption and interruption of day-to-day life of impacted residents.	
IM3	Building	Landslides	Landslides result in the damage and loss of buildings within the Municipality.	Short-term	3	4	12	**High**	**Timeframe:** Short-term given the current risk level applied to landslides and the increase in projected increase in intensity, duration and magnitude of weather events that exacerbate their occurrence. **Probability:** High likelihood of occurring given Izmir's historical and current exposure to landslides. **Consequence:** Damage to and the loss of buildings could cause a catastrophic impact on the day-to-day life, although concentrated within the area that the landslide occurs.	- A_L1 % of grey/blue/green areas affected by extreme weather conditions / events - A_B1 Number or % of (public/residential/tertiary) buildings damaged by extreme weather conditions/events
IM4	Transport	Landslides Extreme Heat Flooding Drought	Extreme weather events resulting in the damage to and disruption of transport infrastructure impacting mobility and causing higher maintenance costs.	Short-term	3	3	9	**Moderate**	**Timeframe:** Associated hazards are experienced currently in Izmir, with projections demonstrating an expected increase in the magnitude, intensity and frequency of the climate hazards. **Probability:** Likely that the impact occurs due to the known transport disruption that has occurred in the past in relation to these hazards. **Consequence:** Bigger events could cause significant disruption of day-to-day mobility and movement within the specific location of landslide over the short to medium term, having less significant impacts across	- A_T1 Number or % of energy transmission & distribution infrastructure damaged by extreme weather conditions / events.

									the wider transport network.	
IM5	Energy	Extreme Heat	Extreme heat resulting in increased demand for energy which imparts a greater pressure on infrastructure and power generation facilities causing power blackouts.	Medium-term	4	2	8	**Moderate**	**Timeframe:** Medium, given current risk level of hazard and climate projections demonstrating an increase in extreme heat events, but also the impact occurring due to repetitive events over a longer timeframe. **Probability:** High given the historical frequency of the extreme temperature events. Climate projections also demonstrate a rise in temperatures which means the probability remains consistent with the hazard rating. **Consequence:** This impact will not significantly impact day-to-day life, but result in pressure on infrastructure and generation facilities in the medium to longer term.	- A_T2 Number of days with public service interruptions - Monthly energy consumption levels.
IM6	Energy	Extreme Heat Storms Floods	Extreme weather events damaging generation, transmission & distribution infrastructure causing disruption to the power supply across the municipality and power blackouts.	Medium-term	2	3	6	**Moderate**	**Timeframe:** Medium timeframe given the expected influence of climate change on the associated hazards. **Probability:** Low given the lack of information of historical events causing damage to transmission and distribution infrastructure. **Consequence:** Damage of the infrastructure could cause significant disruption to day-to-day life through power blackouts and reducing productivity levels.	- A_T1 Number or % of energy transmission & distribution infrastructure damaged by extreme weather conditions / events.
IM7	Energy	Extreme Heat	[OPPORTUNITY] Rising average temperatures with longer sunshine-hours can create a greater potential for renewable energy generation such as solar PV.	Short-term	4	1	4	**Moderate**	**Timeframe:** Current given the historical climate and weather patterns in Izmir. **Probability:** High due to generation potential	- Potential capacity and power generation of PV

									provided by Izmir's current and expected future climate. **Consequence:** Lower emissions levels due to a reduction in dependency on fossil fuels.	
IM8	Water	Extreme Heat Droughts	Rising temperatures and drought periods increasing water scarcity, decreasing water quality and reducing ground-water recharge rates.	Short-term	4	3	12	**High**	**Timeframe:** Short-term given past weather events and the expected influence of climate change on the associated hazards. **Probability:** High due to past events data and associated risk ratings for the related hazards in current day. **Consequence:** High, with disruption in and reduced quality of water supply could have a significant impact on day-to-day life and industrial activities.	- A_H3 Number of water quality warnings issued. - A_T2 Number of days with public service interruptions.
IM9	Water	Extreme Precipitation Floods Storms	Extreme weather events increasing the demand on, causing damage too and peaking the capacity of the wastewater and stormwater management infrastructure resulting in flooding and increased maintenance costs.	Short-term	4	3	12	**High**	**Timeframe:** short-term timeframe given the expected influence of climate change on the associated hazards and existing pressures on the management infrastructure. **Probability:** High given the information from past historical events around waste and stormwater management infrastructure reaching peak capacity and the influence of climate change projections on associated hazards. **Consequence:** Surpassing infrastructure capacity could result in flooding which can cause significant disruption to day-to-day life for the duration of the event.	- A_T1 Number or % of water infrastructure damaged by extreme weather conditions / event - A_L1 % of grey/blue/green areas affected by extreme weather conditions/events - Annual cost of maintenance on waste and stormwater infrastructure.

IM10	Waste	Floods Storms Landslides Forest Fires	Extreme weather events causing damage to solid waste infrastructure, treatment / processing facilities and land-fill sites resulting in increased maintenance costs, reduced operational capacity and pollution.	Medium-term	2	2	4	**Low**	**Timeframe:** Medium timeframe given the expected influence of climate change on the associated hazards. **Probability:** Low given the lack of information of historical events causing damage to transmission and distribution infrastructure. **Consequence:** Damage of the solid waste infrastructure would have a insignificant impact on day-to-day life within the municipality.	- A_T2 Number of days with public service interruptions. - A_T1 Number or % of waste infrastructure damaged by extreme weather conditions / event
IM11	Land Use Planning	Extreme Heat	Extreme temperatures causing an increase in the urban heat island effect.	Short-term	4	2	8	**Moderate**	**Timeframe:** Due to known occurrence of this impact in current day. **Probability:** High given that this impact is currently felt within the municipality **Consequence:** This is known to impact Izmir, but does not have a significant impact on day-to-day life within the municipality.	- A_L1 % of grey/blue/green areas affected by extreme weather conditions/events
IM12	Land Use Planning	Extreme Precipitation Storms Landslides Sea Level Rise	Extreme weather events increasing rates of coastal and soil erosion, resulting in loss of land, reducing land quality and limiting land-use.	Medium-term	2	3	6	**Moderate**	**Timeframe:** Medium timeframe given the expected influence of climate change on the associated hazards. **Probability:** Low given the lack of information of historical events resulting in coastal and soil erosions to the extent that causes disruption. **Consequence:** Larger extreme events could cause substantial erosion that significantly impacts day-to-day life in the impacted areas.	- A_E1 % of areas affected by soil erosion / soil quality degradation. - % of areas affected by coastal erosion and degradation.

IM13	Land Use Planning	Floods	Surface/ river flooding causing the inundation of urban or industrial land.	Short-term	3	4	12	**High**	**Timeframe:** Short-term due the Izmir's historical context. **Probability:** Moderate probability given the impacts currently experienced by surface and river flooding, alongside the climate projections expecting an incease in the frequency hazards that influence flooding. **Consequence:** High consequence given Izmir's past experience with flooding, combined ow-lying deltaic plains / river flood plains could have catastrophic impacts on day-to-day life.	- A_L1 % of grey / green / blue areas affected by extreme weather conditions / events. - A-H1 Number of people evacuated / relocated due to extreme weather events.
IM14	Land Use Planning	Sea Level Rise	Sea Level Rise causing the inundation of urban or industrial land.	Long-term	4	4	16	**High**	**Timeframe:** Climate projections demonstrate sea level rise is a longer-term prediction **Probability:** The longerterm probability of sea level rise impacting izmir is high due to its coastal location. **Consequence:** High consequence given the large parts of Izmir located in coastal zones within 10m of current day sea level.	- Number of people and % of land located in coastal zones.
IM15	Land Use Planning	Forest Fires Extreme Heat Drought	Rising temperatures and prolonged periods of drought will dry out landscapes, causing fuel build up that result in the occurrence of forest / wild fires.	Short-term	3	4	12	**High**	**Timeframe:** In line with the hazard assessment and the influence of climate change projections, alongside historical events data which shows forest fires are being experienced currently within Izmir. **Probability:** In-line with current data hazard assessment rating of moderate, climate projections would predict an increase in likelihood at	- A_L1 % of grey / green / blue areas affected by extreme weather conditions / events. - A-H1 Number of people evacuated / relocated due to extreme weather events.

									medium-term timeframes. **Consequence:** Extensive forest fires within the municipality would cause catastrophic impacts on day-to-day life for the duration of the hazard and over the short to medium term.	
IM16	Agriculture & Forestry	Cross-Cutting	[OPPORTUNITY] Rising CO_2 concentration levels causing an increase in photosynthesis, producing greater crop yields.	Medium-term	4	1	4	**Moderate**	**Timeframe:** The effects of rising CO_2 levels of crop yields won't be experienced until the medium-term. **Probability:** High probability given the current projections for CO_2 levels. **Consequence:** No consequence applied as it is an opportunity.	A_A3 % change in crop yield / evolution of the annual grassland productivity.
IM17	Agriculture & Forestry	Extreme Heat Droughts	Extreme heat and drought periods will degrade soil health and quality, and cause shorter and earlier growing seasons, resulting in reduced crop productivity and yield.	Short-term	3	3	9	**Moderate**	**Timeframe:** In-line with the hazard assessment and the influence of climate change projections. **Probability:** Moderate probability due to the existing strains and stresses on soil health and quality, which will only be exacerbated by climate change and the associated hazards. **Consequence:** A significant impact on day-to-day life due to the impacts on the local industry and economy. Not high, as it will not have a catastrophic impact as Izmir does not solely rely on local food production for its supply chain.	- A_A3 % change in crop yield / evolution of the annual grassland productivity. - A_A1 % of agriculture losses from extreme weather conditions / events.

IM18	Agriculture & Forestry	Flooding	River and surface water flooding could result in the damage too, and the inundation of low-lying agricultural land causing the destruction and loss of crops and livestock.	Short-term	4	4	16	**High**	**Timeframe:** Short-term timeframe due to the current level of risk that agricultural land faces from river flooding, with an anticipated rise in extreme events as directed by climate projections. **Probability:** Climate projections and exposure of the coastal and deltaic agricultural land within the province of Izmir to flooding demonstrates a high likelihood of this impact occurring in the medium term. **Consequence:** Catastrophic impact on day-to-day life of the industry, re-shaping irrigational practices and the economic impact of crop loss and livestock fatalities.	- A_A7 % change in water abstraction - A_A1 % of agriculture losses from extreme weather conditions / events. - % of agricultural land flooded
IM19	Agriculture & Forestry	Sea Level Rise	Sea level rise could result in the damage too, and the inundation of low-lying agricultural land causing the destruction and loss of crops and livestock, alongside the salination of ground water sources used for irrigation.	Long-term	4	4	16	**High**	**Timeframe:** Climate projections demonstrate the longer-term projections for sea level rise as directed by climate projections. **Probability:** Climate projections and exposure of coastal and deltaic agricultural land within the province of Izmir to flooding demonstrates a high likelihood of this impact occurring in the medium term. **Consequence:** Catastrophic impact on day-to-day life of the industry, re-shaping irrigational practices and the economic impact of crop loss and livestock fatalities.	- A_A7 % change in water abstraction - A_A1 % of agriculture losses from extreme weather conditions / events. - % of agricultural land flooded

IM20	Agriculture & Forestry	Forest Fires	Forest fires damaging and destroying agricultural and forestry land alongside livestock.	Short-term	3	4	12	**High**	**Timeframe:** Short-term due to existing risk of forest fires within Izmir and climate projections portraying an increase extreme heat and drought periods which exacerbate forest fires. **Probability:** Climate projections and existing risk of forest fires demonstrates a moderate occurrence. **Consequence:** The impacts would be catastrophic due to the potential for destruction and loss of forest, agricultural crops and livestock from larger scale events.	- A_A1 % of agriculture losses from extreme weather conditions / events. - A_A2 % of livestock losses from extreme weather conditions. - A-A6 % change in forest composition.
IM21	Environment & Biodiversity	Extreme Heat Droughts Forestry Fires	Extreme climate events damaging and /or destroying the natural environment resulting in ecosystem degradation, habitat and biodiversity loss.	Short-term	3	4	12	**High**	**Timeframe:** Short-term to align with the hazard related risk analysis and the effect of climate change on the hazards. **Probability:** Reflects current likelihood level of the associated hazards which is directed by past events data. **Consequence:** This has the potential to have a catastrophic impact on the local environment and biodiversity.	- A-E2 % of habitat losses from extreme event(s) - A-A6 % change in forest composition.
IM22	Environment & Biodiversity	Extreme Heat	Gradual warming and seasonal changes could result in species migration and drive insect / pest infestation in both terrestrial and marine environments.	Medium-term	2	4	8	**Moderate**	**Timeframe:** Dictated by climate projections which show a greater rise in temperatures within the medium-term. **Probability:** Low given the lack of local information. Not "unknown" due to scientific research and past events information shows that species and pest infestation is in part dictated by the species ability to	- A_E3 % change in number of native species. - A_E4 % of native (animal/plant) Species affected by diseases related to extreme weather conditions / events.

									adapt to changing climate. As seasons shift and temperatures rise it not unlikely to occur. **Consequence:** Pest species could have a catastrophic impact on native ecosystems and biodiversity.	
IM23	Environment & Biodiversity	Drought	Increased periods of drought will reduce the water levels in rivers and other fresh water bodies and Gulf of Izmir, reducing the natural environments capacity to manage waste-water and run-off pollution, causing habitat and species loss and eutrophication.	Short-term	3	4	12	**High**	**Timeframe:** Past events data and climate projections show that drought is currently and will continue to occur, increasing in magnitude, intensity and frequency. **Probability:** Wastewater and run-off pollution already occurs, with evidence of eutrophication in water bodies in Izmir. Drought is known to occur and projections show it is likely it will increase in frequency over the short-term. **Consequence:** Heightened surface and wastewater pollution levels**,** could result in catastrophic impacts on the natural environment, causing eutrophication of water bodies and the loss of fish and other species that depend on the water bodies.	- A-E2 % of habitat losses from extreme event(s) - The number of / loss of species due to pollution. - Pollution levels in freshwater bodies and Gulf of Izmir.
IM24	Health	Extreme Heat	Extreme heating exacerbating the urban heat island effect, resulting in an increase in heat related illness, disease and mortalities.	Short-term	3	4	12	**High**	**Timeframe:** short-term, given current risk level of hazard and climate projections demonstrating an increase in extreme heat events **Probability:** High given the historical frequency of extreme temperature events. Climate projections also show rising temperatures which will increase the urban heat island effect, influenced by	- A_H1 Number of people injured/evacuated/relocated due to extreme weather event(s) - A_H2 Number of deaths related to extreme weather event(s) - Average temperature in urban environments (inc. heat island effect).

									rising population density and poor housing stock. **Consequence:** The potential for fatalities from heat related illnesses and diseases ranks the consequence level as catastrophic in the short-term.	
IM25	Health	Extreme Heat Extreme Precipitation Floods Storms Landslides Forest Fires	Extreme events resulting in injury or loss of life.	Short-term	3	3	9	**Moderate**	**Timeframe:** This impact can occur as a result of a wide-range of climate events, the climate projections demonstrate that these will increase in magnitude, frequency and intensity in the short-term **Probabilit**y: Moderate given the historical frequency of the different extreme events that could cause this impact. Injury and loss of life are also known to have occurred historically. **Consequence:** The potential for fatalities from the climate events ranks the consequence level as moderate in the short-term.	- A_H1 Number of people injured/evacuated/relocated due to extreme weather event(s) - A_H2 Number of deaths related to extreme weather event(s) - Average temperature in urban environments (inc. heat island effect).
IM26	Health	Drought	Increase periods of drought, resulting in reduced water availability and poorer water quality, causing illness and dehydration.	Short-term	3	3	9	**Moderate**	Timeframe: Climate change projections demonstrate an increase in intensity, frequency and magnitude of drought periods in the short-term, building on a high current risk level of the hazard. Probability: Drought and water scarcity is a high-risk hazard in Izmir, with a greater probability of illness as a result of this in the rural and informal areas of the Municipality.	- A_H1 Number of people injured/evacuated/relocated due to extreme weather event(s)- - A_H2 Number of deaths related to extreme weather event(s)

									Consequence: Illness and dehydration could have significant impact on day-to-day life for the population of Izmir.	
IM27	Civil Protection & Emergency	Extreme Heat Extreme Precipitation Floods Storms Landslides Forest Fires	The more frequent occurrence of extreme events will result in the Increased deployments and pressure on civil protection and emergency agencies.	Short-term	4	3	12	**High**	**Timeframe:** Climate change projections demonstrate an increase in extreme events over the short-term. **Probability:** Covering multiple hazards, the likelihood of this occurring is high. **Consequence:** Deemed to have a significant impact on day-to-day life due to the potential reduced response capacity to events.	- A-CP1 Average response time (in min) for police/fire-fighters/emergency services in case of extreme weather events.
IM28	Civil Protection & Emergency	Extreme Heat Extreme Precipitation Floods Storms Landslides Forest Fires	The occurrence of extreme events will increase insurance costs across all sectors that are impacted.	Short-term	3	3	9	**Moderate**	**Timeframe:** Climate change projections demonstrate an increase in extreme events over the short-term which will influence insurance company response. **Probability:** Past events information demonstrates a precedence set by insurers who raise prices when claims are made, in-line with exposure to losses from climate events. **Consequence:** The economic impact of increasing insurance costs could have a significant impact on day-to-day life within the city, especially in the most vulnerable population groups to this rise.	- A-O1 Annual direct economic losses due to extreme weather event(s) - A-O2 Annual amount of compensation received (e.g. insurance)

IM29	Civil Protection & Emergency	Extreme Precipitation Floods Storms Landslides Forest Fires	The exacerbation of extreme event impacts by the occurrence of earthquakes.	Current	1	4	4	**Moderate**	**Timeframe:** Given Izmir's exposure to both earthquakes and climate hazards, this is an impact which applies current day. **Probability:** Earthquakes coinciding with climate events has not been observed to occur historically and therefore the probability is low. **Consequence:** The occurrence of a high magnitude earthquake alongside extreme weather events would cause a catastrophic impact on day-to-day life.	- A_H1 Number of people injured/evacuated/relocated due to extreme weather event(s) - A_H2 Number of deaths related to extreme weather event(s) Number of magnitude of earthquakes experienced.
IM30	Tourism	Extreme Heat	[OPPORTUNITY]: Seasonal variability and higher temperatures could extend the tourisms season, with warmer weather starting earlier and lasting longer.	Short-term	3	1	3	**Low**	**Timeframe:** Climate projections demonstrate a rise in temperatures over the short-term and changes in seasonal variability. **Probability:** Likely to occur as climate projections predict higher temperatures over longer periods throughout the year. **Consequence:** No consequence applied due to being an opportunity.	- A_TO1 % change in tourist flows / tourism activities.
IM31	Tourism	Flooding Sea Level Rise	Climate events causing the loss of; or damage to the natural environments (e.g. reduced water quality in the bay) and infrastructure (hotels) that attract and facilitate tourism, reducing numbers of visitors.	Medium-term	2	4	8	**Moderate**	**Timeframe:** Medium term due to the balance between a longer-term sea level rise and short-term surface / river flooding. **Probability:** Low given the lack of information in past events demonstrating a reduction in tourisms as a result of climatic events. **Consequence:** Could be catastrophic to day-to-day life due to reliance on the	- A_TO1 % change in tourist flows / tourism activities.

									income from tourism across the municipality.	
IM32	Economic	Extreme Heat Flooding Sea Level Rise	Climate events will damage and disruption local industrial and business activities and supply routes, result in a decrease in local and national GDP.	Medium-term	2	4	8	**Moderate**	**Timeframe:** Medium term due to the balance between a longer-term sea level rise and short-term surface / river flooding and extreme heat. **Probability:** Low given the limited information around the economic impact of past climatic events, but not "unknown" due to the understanding of economic impact that climate events can cause. **Consequence:** Could be a catastrophic impact on the day-to-day life in key industries with the potential to lead to a recession and economic downturn.	- A-O1 Annual direct economic losses due to extreme weather event(s)
IM33	Economic	Extreme Heat Landslides Flooding	Climate events resulting in the damage too and loss of buildings, overheating, as well as disruption of the transport network, will impact productivity and reduce economic activity.	Short-term	4	2	8	**Moderate**	**Timeframe:** Short-term as the climate projections demonstrate these climate hazards will also increase in magnitude, intensity and frequency, building on current risk levels. **Probability:** In-line with the likelihood of impact of overheating and transport impacts. **Consequence:** The consequence is low and a reduced rate of productivity would not have significant impact on day-to-day operations. All but the extreme heat hazard result in spatially dependent impact, and will therefore only effect select areas of the population.	- Staff attendance during the occurrence of extreme events. - Disruption to traffic congestion rates and average commuting time. - Monthly business turnovers

Appendix F Summary of Adaptation Actions

Action ID	Action Headline	Responsible Body	Cross-sector benefits
WCM: A	Ensuring that it will be possible to access safe clean water in case of emergencies, such as disasters.	IZSU	Civil Protection & Emergency
WCM1.10	Upgrade the existing water management infrastructure to incorporate the separation of wastewater and stormwater lines	IZSU	N/A
WCM1.6	Implementation of a maintenance program for existing drinking water supply systems, water management plan and construction of proposed facilities in line with Potable Water Master Plan (2017) of IZSU	IZSU	N/A
WCM1.7	Review existing design and installation standards to increase efficiency of new water infrastructure networks.	IZSU	N/A
WCM1.5	Integration of stormwater management techniques with urban greening e.g. sponge city principles.	IBB	Land Use Planning
WCM1.11	Incorporate sustainable water practices and design within municipal-owned buildings and municipality controlled open spaces through refurbishment and retrofitting.	IBB	Land - Use Planning Buildings
WCM1.9	Incorporate SuDs (Sustainable Urban Drainage) and WSUD (Water Sensitive Urban Design) principles into all planned green areas and publicly owned (or municipal-owned) buildings within the scope of green infrastructure.	IBB	Land - Use Planning Buildings
WCM1.4	Stormwater management storage systems for Municipality owned or operating Building and infrastructure at a building level, under-ground, linked to green spaces.	IBB	Land - Use Planning Buildings
WCM1.18	Initiate a flood protection scheme for high risk areas e.g. industrial, residential.	IZSU	Civil Protection & Emergency Land Use Planning Buildings, Economy
SECAP AF 1	Prepare of a drought action plan	IBB	Water
SECAP AF 2	Develop a management strategy for forest fires	IBB.	Environment & Biodiversity Civil Protect & Emergency
LU.A	Identify and collaborate with stakeholders to lobby for the necessary amendments to regulations to enable the design and development of the 7 “Risk Areas” identified under Law 6306 (Transformation of Areas under Disaster Risk).	IBB	Buildings Health
LU.B	Encourage urban transformation, acting on the Urban Transformation and development areas declared by the	IBB	Buildings

	Council of Minister's decision for the creation of healthy, liveable urban spaces.		Health
LU1.7	Identify and implement techniques to mitigate the Urban Heat Island Effect	IBB	Buildings Health
LU1.16	Review and update local-level policies, planning regulations and guidelines for future and new infrastructure development to ensure they consider climate projections and urban resilience in design and construction.	IBB	Transport Waste Water
LU1.18 & LU1.19	Further development the green and blue infrastructure strategy.	IBB	Health Water
LU1.2	Maintain, protect and enhance existing biodiversity and ecological habitats through the restoration of wetlands, lagoons and afforestation (incorporating natural ecosystem creation)	IBB.	Land-use Planning Water-
WCM1.14	Conservation, protection and enhancement of marine biodiversity in Gulf of Izmir, increase the cleanliness of the Gulf	IBB	Tourism Industry Economy
PH1.3	Carry out awareness raising activities on the effects of climate change on human health	IBB	N/A
SECAP H1	Periodic collection and monitoring of data by creating a monitoring board to address climate and health impacts	IBB	N/A
SECAP H2	Identifying groups that are vulnerable to health in the face of the effects of climate change and implementing strengthening strategies such as early warning systems.	IBB	Civil Protection & Emergency
AOS1.1	Establishing the necessary tools, mechanisms and management structure for the effective implementation of climate change adaptation strategies.	IBB	Heath
AOS1.3	Develop an administrative organisational structure for the implementation and monitoring of GCAP and SECAP actions.	IBB	Land Use Planning, Waste, Water Buildings
I1.10	Commission a study to better understand both the direct and indirect impacts of climate change on tourism: both positive and negative.	IBB	Economy

Appendix G Summary of Mitigation Actions

Action ID	Action Headline	Reduction amounts (MWh)	Reduction amounts (tCO_2e)	Responsible Body
B1.3	Review and update the local-level policies, planning regulations and guidelines for future and new municipality development around energy efficiency.	254,108	85,806	IBB
B1.5	Revise planning regulations and guidelines to ensure efficient water fittings in all new municipality buildings.	N/A	N/A	IBB
B1.6	Municipality to develop policy that commits to net zero in all new municipality buildings by 2030.	N/A	combined with B1.5	IBB
B1.9	Undertake circular economy assessments on all Municipality refurbishment and demolition projects, encouraging uptake in private projects.	N/A	N/A	IBB
B1.11	Explore ways to support residential retrofits being undertaken to a higher and greener energy performance standard.	combined with SECAP B4 and B5 and ES1.5	combined with SECAP B4 and B5 and ES1.5	IBB
SECAP B1	Insulation of Tertiary Buildings	3,249,118	1,445,088	IBB
SECAP B2	Energy Efficiency in Municipal Buildings	134,667	67,884	IBB
SECAP B3	Energy Efficient Light Bulb change in Tertiary Buildings	combined with SECAP B1	combined with SECAP B1	IBB
SECAP B4	Encourage and incentivise thermal insulating in existing residential buildings.	3,736,033	1,096,707	IBB
SECAP B5	Encourage and incentivise energy efficient lighting systems in existing residential buildings (LED etc.)	245,779	124,610	IBB
T.1.1.3	Promote a step change in the uptake of privately / commercially owned low emission vehicles:	6,231,302	335,686	IBB
SECAP T1.3	Apply smart traffic management, e.g. a command centre	2,350,926	625,295	IBB
SECAP T1.4	Eco driving training (driving more economically) for IBB employees (As per SEAP Action - in lieu of EV / hybrid vehicles)	884,183	128,649	IBB
T1.5	Municipal Fleet and Service Vehicles: electric and Low-carbon vehicles.	438,349	127,494	IBB

Action ID	Action Headline	Reduction amounts (MWh)	Reduction amounts (tCO_2e)	Responsible Body
T1.7	More sustainable urban mobility: mass transit and local mobility.	4,602,679	1,215,689	IBB
I: B	Develop More sustainable logistical practices.	N/A	N/A	IBB
ES1.1	Assess the feasibility of connecting public sector and / or industrial buildings to geothermal heat network(s)	N/A	N/A	IBB
SECAP ES1.2	Encourage the fuel switch from coal to more renewable sources in residential areas (geothermal, electricity)	N/A	83,331	IBB
ES1.4	Localised micro-grids renewable energy options study	combined with SECAP ES1.14	combined with SECAP ES1.14	IBB
ES1.5	Mass role out of photovoltaic cells on municipality owned assets and land e.g. municipality buildings, road reserves, bus stops.	24,000	12,168	IBB
ES1.7	Undertake a public lighting replacement scheme for all poles owned / run by municipality by installing LEDs.	240,792	122,081	IBB
ES1.11	Implement an environmental labelling scheme for companies within Izmir.	N/A	N/A	IBB
ES1.12	Work with utility companies to understand capacity constraints and support a shift to renewable electric systems.	combined with SECAP ES1.14	combined with SECAP ES1.14	IBB
SECAP ES1.14	Municipality to encourage the private sector to install solar panels using existing national subsidies or financial schemes.	1,432,000	726,024	IBB
ES.A	Develop Izmir bioeconomy strategy and action plan	N/A	N/A	IBB
SW1.6	Partner and / or cooperate with relevant institutions and organisations that can act jointly in line with Zero Waste Regulation to develop and invest in the necessary recycling infrastructures (bins, trucks, routes etc).	N/A	N/A	IBB
SECAP SW1.8	Development of a detailed analysis (number, type, size, age etc) and action plan for the development and low-emission management of dumpsites / landfills (both closed and operational). This could incorporate the development of mandatory energy recovery and landfill gas and anaerobic digestion.	270,000	804,169	IBB
SW1.16	Investigate potential to provide dedicated waste collection for restaurant / food industry traders in-line with management infrastructure and technology.	N/A	reductions cumulated with SECAP SW1.8	IBB

Action ID	Action Headline	Reduction amounts (MWh)	Reduction amounts (tCO_2e)	Responsible Body
SW1.1	Establish a municipality-wide awareness campaign (schools etc) for waste reduction and separation at household level.	N/A	reductions cumulated with SECAP SW1.8	IBB
SW1.3	Make separate collection of key dry recyclable materials mandatory, formulating policy at the district municipality level.	N/A	reductions cumulated with SECAP SW1.8	IBB
SW1.4	Supplement and speed up investment in waste separation facilities, (dry recyclables and organic waste), a clean materials recovery infrastructure and composting facilities, building on the Integrated Solid Waste Management Strategy (2018).	N/A	N/A	IBB
SW1.10	Municipality to commit to banning the use of single-use plastics within their buildings, encouraging local businesses to do the same.	N/A	N/A	IBB
SW1.17	Undertake an assessment of waste collection infrastructure (collection service, coverage rate, bins/ containers, vehicles), including smart collection systems and route optimisation software in collaboration with district municipalities.	N/A	reductions cumulated with SECAP SW1.8	IBB
I1.1 & I1.2	Support theimplementation of low carbon farming techniques and climate-smart agriculture across the province.	97,592	716,804	IBB
Total		**24,191,526**	**7,717,485**	

Appendix H SECAP Specific Actions

Total number: 14

Mitigation: 10

I.D	Headline
Buildings: Municipal, Tertiary, Residental	
SECAP B1	Insulation of Tertiary Buildings
SECAP B2	Energy Efficiency in Municipal Buildings
SECAP B3	Energy Efficient Light Bulb change in Tertiary Buildings
SECAP B4	Encourage and incentivise thermal insulating in existing residential buildings.
SECAP B5	Encourage and incentivise energy efficient lighting systems in existing residential buildings (LED etc.)
Transport	
SECAP T1.3	Apply smart traffic management: e.g. command centre
SECAP T1.4	Eco driving training (driving more economically) for IBB employees (As per SEAP Action - in lieu of EV / hybrid vehicles)
Energy: local electricity, heat, cold production	
SECAP ES1.2	Encourage the fuel switch from Coal to more renewable sources in residential areas (geothermal, electricity).
SECAP ES1.14	Municipality to encourage the private sector to install solar panels using existing national subsidies or financial schemes.
Waste	
SECAP SW1.8	Development of a detailed analysis (number, type, size, age etc) and action plan for the development and low-emission management of dumpsites / landfills (both closed and operational). This could incorporate the development of mandatory energy recovery and landfill gas and anaerobic digestion.

Adaptation: 4

I.D	Headline
Agriculture & Forestry	
SECAP AF1	Prepare a drought action plan.
SECAP AF2	Develop a management strategy for forest fires.
Health	
SECAP H1	Periodic collection and monitoring of data by creating a monitoring board to address climate and health impacts.
SECAP H2	Identifying groups that are vulnerable to the public health effects of climate change and implementing strengthening strategies targeting these groups.

Appendix I Full list of GCAP Actions

There are **47** GCAP actions in total, covering **21** baskets and **9** different GCAP sectors. Of the 47 actions, **28** have a detailed business case request by IBB within the GCAP report (highlighted by an **underlined** I.D). The I.D of actions that are found in both the SECAP and GCAP are highlighted in **green** and make-up 44 of the 47 actions. The I.D of actions that are specific to GCAP have are highlighted in **blue** and total **3.**

I.D	Headline
Basket 1: Accelerate transition to low emission vehicles	
T1.1.3	Promote a step change in the uptake of privately and Municipality owned low emission vehicles.
T1.5	Municipal fleet and service vehicles: electric and low carbon vehicles.
Basket 2: Develop more sustainable mobility options	
T1.7	More sustainable urban mobility: mass transit and local mobility.
Basket 3: Develop a more sustainable logistics sector	
I: B	Develop more sustainable logistical practices
Basket 4: Commit to net zero energy and end the use of single use plastics in municipality buildings and encourage other organisations, business and institutions follow IBB's leadership	
B1.6	Municipality to commit to net zero energy in all new municipality-controlled buildings by 2030.
SW1.10	Municipality to commit to banning the use of single-use plastics within their buildings, encouraging local businesses to do the same.
Basket 5: Installation of low and zero carbon and energy efficient technologies in Municipality owned buildings and land	
ES1.5	Mass role out of solar energy on municipality owned assets and land e.g. municipality buildings, road reserves, bus stops.
ES1.7	Undertake a public lighting replacement scheme for all poles owned / run by municipality by installing LEDs.
Basket 6: Enhance evidence for action through studies / assessments	
B1.9	Undertake circular economy assessments on all municipality refurbishment and demolition projects, encouraging uptake in private projects.
ES1.11	Implement an environmental labelling scheme for companies within Izmir
ES1.4	Localised micro-grids renewable energy options study.
ES1.1	Assess the feasibility of connecting public sector and / or industrial buildings to geothermal heat network(s)

ES.A	Develop Izmir bioeconomy strategy and action plan
Basket 7: Facilitate more sustainable waste management	
SW1.16	Investigate potential to provide dedicated waste collection for restaurant / food industry traders in-line with management infrastructure and technology.
SW1.17	Undertake an assessment of waste collection infrastructure (collection service, coverage rate, bins / containers, vehicles), including smart collection systems and route optimisation software in collaboration with district municipalities.
Basket 8: Develop Municipality funded subsidy schemes, grant programmes and/or investments	
B1.11	Explore ways to support residential retrofits being undertaken to a higher and greener energy performance standard.
LU: B	Encourage urban transformation, acting on the Urban Transformation and development areas declared by the Council of Minister's decision for the creation of healthy, liveable urban spaces.
SW1.3	Make separate collection of key dry recyclable materials mandatory, formulating policy at the district municipality level.
SW1.4	Supplement and speed up investment in smart-waste separation facilities, (dry recyclables), a clean materials recovery infrastructure and composting facilities, building on the Integrated Solid Waste Management Plan (2018).
Basket 9: Move toward network / infrastructure level water cycle management	
WCM1.10	Upgrade the existing water management infrastructure to incorporate the separation of wastewater and stormwater lines.
WCM1.5	Integration of stormwater management techniques with urban greening e.g. sponge city principles.
WCM1.6	Implementation of a maintenance program for the existing water supply network of Izmir city centre and its surroundings and construction of new additional water transmission lines.
Basket 10: Support building level water cycle management	
WCM1.4	Stormwater management storage systems for Municipality owned or operating Buildings and infrastructure at a building level, under-ground with links to green spaces.
WCM1.9	Incorporate SuDs (Sustainable Urban Drainage) and WSUD (Water Sensitive Urban Design) principles into all planned green areas and publicly owned buildings within the scope of green infrastructure.
WCM1.11	Incorporate sustainable water practices and design within existing municipal-owned buildings and municipality controlled open spaces through refurbishment and retrofitting.
Basket 11: Review and update of existing local policies, regulations and guidelines	
B1.3	Review and update the local-level policies, planning regulations and guidelines for future and new municipality development around energy efficiency.
B1.5	Revise planning regulations and guidelines to ensure efficient water fittings in all new Municipality buildings.
LU1.16	Review and update local-level policies, planning regulations and guidelines for future and new infrastructure development to ensure they consider climate projections and urban resilience in design and construction.

WCM1.7	Review existing design and installation standards to increase efficiency of new water infrastructure networks.
Basket 12: Support collaboration and/or partnerships with Municipality-wide stakeholders	
ES1.12	Work with utility companies to understand capacity constraints and support a shift to smart-renewable electric systems.
LU: A	Identify and collaborate with stakeholders to lobby for the necessary amendments to regulations to enable the design and development of the 7 “Risk Areas” identified under Law 6306 (Transformation of Areas under Disaster Risk).
SW1.6	Partner and / or cooperate with relevant institutions and organisations that can act jointly in line with Zero Waste Regulation to develop and invest in the necessary smart-waste collection requirements (bins, trucks, routes etc) and recycling infrastructure.
Basket 13: Address the urban heat island effect	
LU1.7	Identify and implement techniques to mitigate the Urban Heat Island Effect.
Basket 14: Implement strategies for urban greening	
LU1.18 & LU1.19	Further develop the green and blue infrastructure strategy.
Basket 15: Protection, restoration and regulation of the natural environment and ecosystems	
LU1.2	Maintain, protect and enhance existing biodiversity and ecological habitats through the restoration of wetlands, lagoons and afforestation (incorporating natural ecosystem creation).
WCM1.14	Conservation, protection and enhancement of marine biodiversity in Izmir Gulf, increasing the cleanliness of the Gulf
I: A	Further regulate fishing operations in the gulf aiming to achieve sustainability of fish stocks and habitats.
Basket 16: Reduce pollution	
I1.8	Address emissions and pollution within industrial areas.
Basket 17: Foster cross-sector collaboration	
AOS1.3	Develop an administrative organisational structure for the implementation and monitoring of GCAP and SECAP actions.
Basket 18: Enhance the Municipality’s adaptation planning and implementation	
AOS1.1	Establishing the necessary tools, mechanisms and management structure for the effective implementation of climate change adaptation strategies.
WCM1.18	Initiate a flood protection scheme for high risk areas e.g. industrial, residential.
WCM: A	Ensuring that it will be possible to access safe clean water in case of emergencies, such as disasters.
Basket 19: Understand the impacts of climate change on tourism	
I1.10	Commission a study to better understand both the direct and indirect impacts of climate change on tourism: both positive and negative and recommendations to improve the industry’s resilience.
Basket 20: Raising public awareness across the municipality	
PH1.3	Carry out awareness raising activities on the effects of climate change on human health.

SW1.1	Establish a municipality-wide awareness campaign (schools etc) for waste reduction and separation at a household level.
Basket 21: Collaborate with the agricultural industry to become more sustainable	
I1.1 & I1.2	Support the implementation of low carbon farming techniques and climate-smart agriculture across the province.
I1.6	Increase farm biodiversity through appropriate techniques, such as increasing diversity in plant species and establishing nest blocks.

AECOM disclaimer: