NET ZERO CITIES

EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

Climate City Contract

2030 Climate Neutrality Action Plan

2030 Climate Neutrality Action Plan of the City of Sofia

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Summary

An abstract **summarizes the content** of the 2030 Climate Neutrality Action Plan (CCC Action Plan) that is developed jointly by local authorities, local businesses, and other stakeholders.

Textual element
This Action Plan is a document summarizing the work process on climate neutrality achievement. It shows the progress of Sofia Municipality in reduction of GHG emissions as of 2007 – the first year for which enough data are available. Due to the dedicated climate work since 2011 as reported to the CDP-ICLEI tracking platform and to the CoM for the implementation of the SEAP 2021-2020 and the SECAP 2021-2030, the baseline emissions for 2022 taken as a baseline for the development of this Action Plan are already nearly 27% lower than those in 2007. Despite this fact, emissions have to be further reduced to reach the target of 81% until 2030. The Action Plan aims at making a comprehensive review of Sofia climate policies and all strategic documents having impact on the process of reaching the climate neutrality target, to map the relevant stakeholders and expected challenges along the way. This Action Plan provides a calculation of the emissions gap taking into account the actions set out in the existing documents to reach a share of 41% reduction of GHG and the target of 81% to reach climate neutrality up to 2030. The additional share to be achieved by the complementary actions presented in this Action Plan amount to 40%. Sofia Municipality has presented a list of actions achieving a nearly 90% of the target. However, the city will complement the Action Plan with additional actions in the field of industry in the second iteration planned for year 2026. A good network of stakeholders has been established and the communication is quite well developed. The transition team will take the role of a Monitoring Transition Unit during the implementation of the plan where the main leading role is taken by Sofia Municipality. However, the members from the national institutions and the private stakeholder will also have crucial roles in the process of implementation.

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Abbreviations and acronyms

The list of abbreviations and acronyms **identifies the abbreviations** (a shortened form of a word used in place of the full word) **and acronyms** (a word formed from the first letters of each of the words in a phrase of name) used in the CCC Action Plan.

Abbreviations and acronyms	Definition
AFOLU	Agriculture, forestry and other land use
BAU	Business as usual
BMS	Building Management System
CCC	Climate City Contract
CoM	Covenant of Mayors
EBRD	European Bank for Reconstruction and Development
EU	European Union
GCAP	Green City Action Plan
GCoM	Global Compact of Mayors for Climate and Energy
GDP	Gross Domestic Product
GVA	Gross Value Added
HVAC	Heating, ventilation and air-conditioning
IPPU	Industrial processes and product use
NG	Natural gas
NSI	National Statistical Institute
SEAP	Sustainable Energy Action Plan
SECAP	Sustainable Energy and Climate Action Plan
SEDA	Sustainable Energy Development Agency
SMC	Sofia Municipal Council
SUMP	Sustainable Urban Mobility Plan
IUDP	Integrated Urban Development Plan
GCMEC	Global Compact of Mayors on energy and Climate

1 Introduction

Sofia Climate Neutrality Action Plan has been developed as a holistic document providing integrated vision of the measures needed to achieve climate neutrality and to adapt to climate change.

Sofia City has been systematically working for decades for the adoption and implementation of a goal-setting policy in the field of climate change and adaptation to it by defining and deploying multiple sectoral strategies.

This continuous process is an evidence for the firm commitment to the sustainable development concept and green transition.

1.1 Administrative territories

The city of Sofia is situated within the largest of Trans-Balkan valleys, the Sofia Valley, between the Balkan Mountain to the north and Viskyar Mountain to the northeast, Lyulin and Vitosha Mountains to the southwest, Lozenska Mountain to the south, and Vakarelska Mountain and Belitsa ridge to the southeast.

Sofia´s geographic boundaries cover the territories of Sofia Municipality as an administrative unit being one of the 27 districts within the territory of Bulgaria. Sofia Municipality includes the city of Sofia, the towns of Bankya, Buhovo and Novi Iskar, and 34 villages. It covers an area of 1,344.9 km²[1], of which about 256 km^2 is urban territory, about 89 km^2 is transport territory, about 464 km^2 agricultural territories, about 442 km^2 forests, about 52 km^2 water & water bodies, about 14 km^2 protected areas and about 20 km^2 disturbed territories. The shares of territories distributed by land use is shown in the below chart.

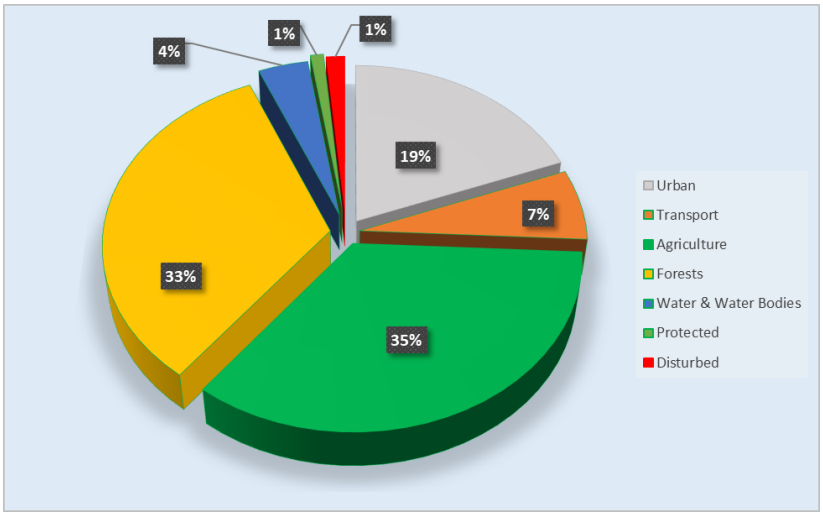


Figure 1 Territorial structure of Sofia Municipality by land use

The boundaries of the municipality are shown on the below map

[1] NSI Land use report

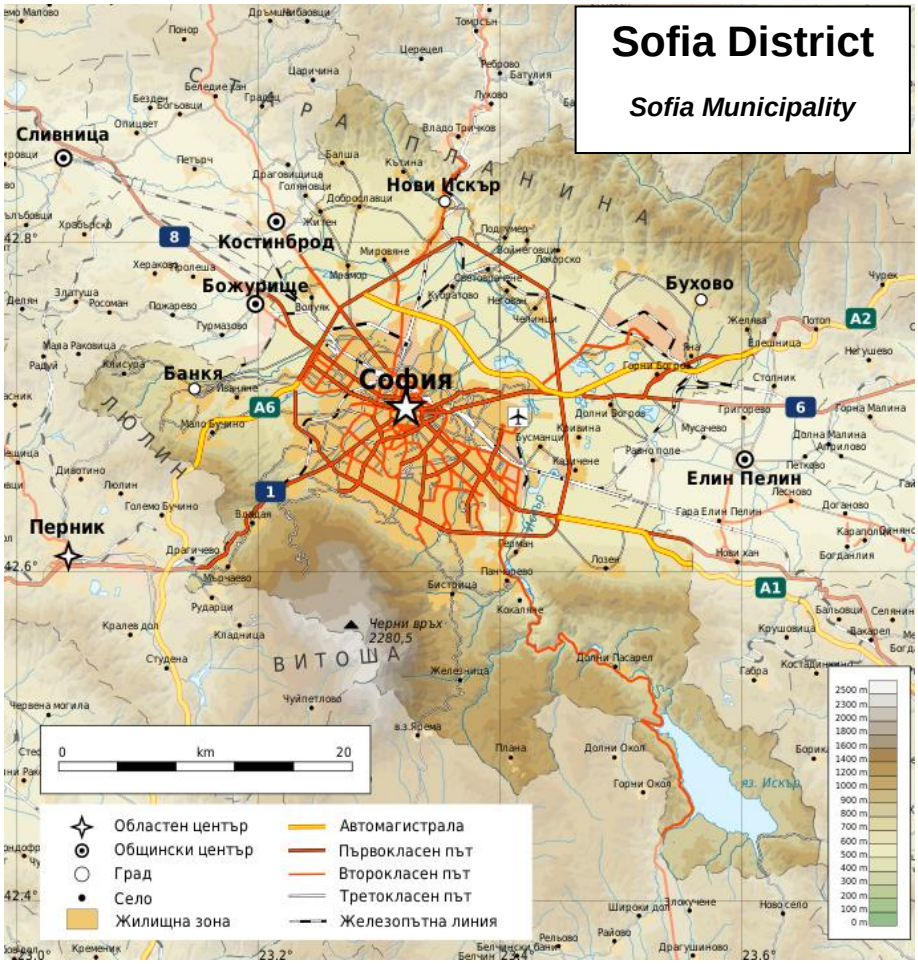


Figure 2 Geographic boundaries of Sofia Municipality

1.2 Administrative and political organization

Sofia Municipality consists of 38 settlements including Sofia City which covers 15% of the territory of the municipality. The municipality is divided into 24 administrative regions – 16 falling entirely within Sofia City, 5 covering both parts of Sofia City and outskirts and 3 regions including towns and villages out of the city but in immediate proximity.

The Sofia municipality is governed by a municipal council elected every 4 years. The Sofia Municipal Council (SMC) has powers over the entire Sofia Municipality, the main part of which is the city of Sofia. The municipal councilors, the municipal mayor and the regional mayors are elected by the residents of the municipality through local elections. The SMC determines the budgets of both the Sofia Municipality and the 24 individual Sofia districts.

Current organigram of Sofia City governance hierarchy is shown in the below figure.

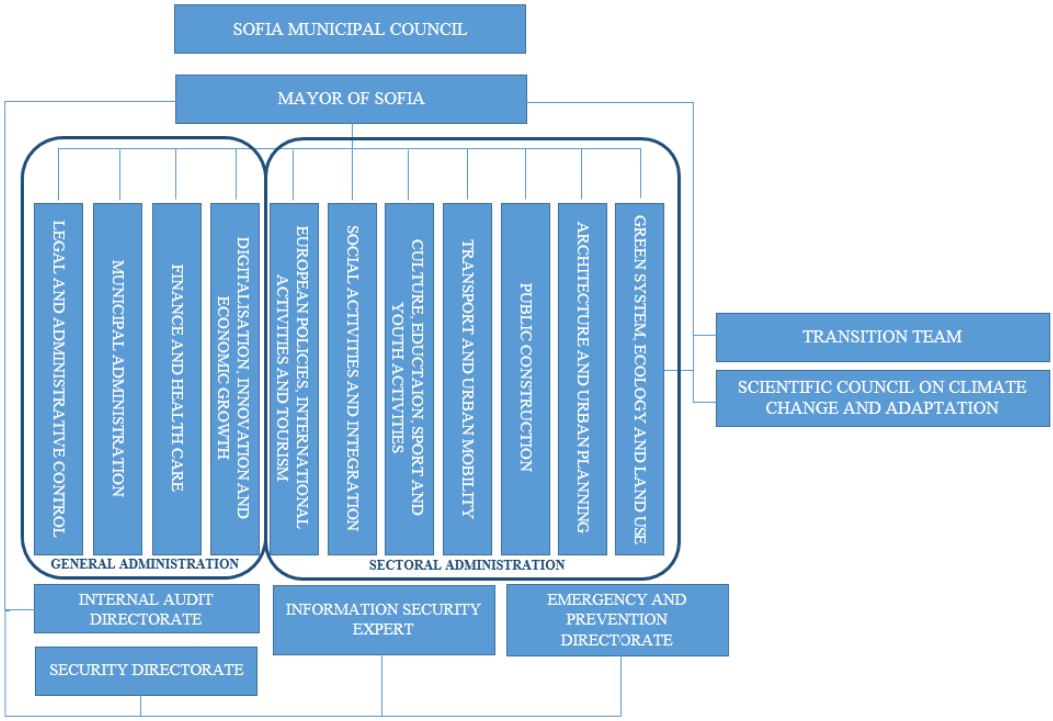


Figure 3 Governance organigram of Sofia Municipality

1.3 Demographic and Socio-economic characteristics

1.3.1 Population

The population of Sofia Municipality as per the last census in 2021 is 1 307 439 people, where ca. 96% is urban population. This makes Sofia municipality the region with the largest number of citizens and the most densely populated one in Bulgaria.

Though traditionally the population of Sofia constantly increases, it follows the general national trend of gross decrease in population as shown in the below chart.

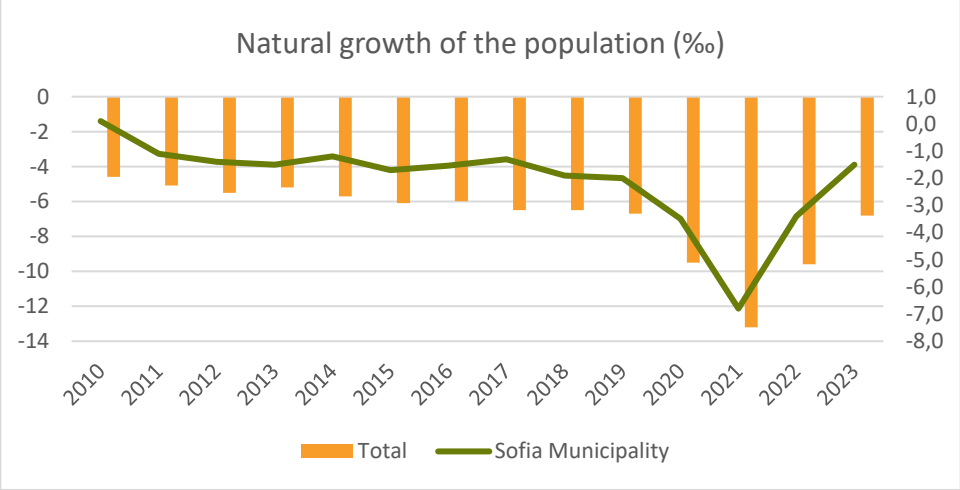


Figure 4 Population growth of Sofia Municipality, NSI

However, the population trend of Sofia compared to the preceding decades is positive and going up as the last censuses show that the population of the city has considerably grown in the last two decades.

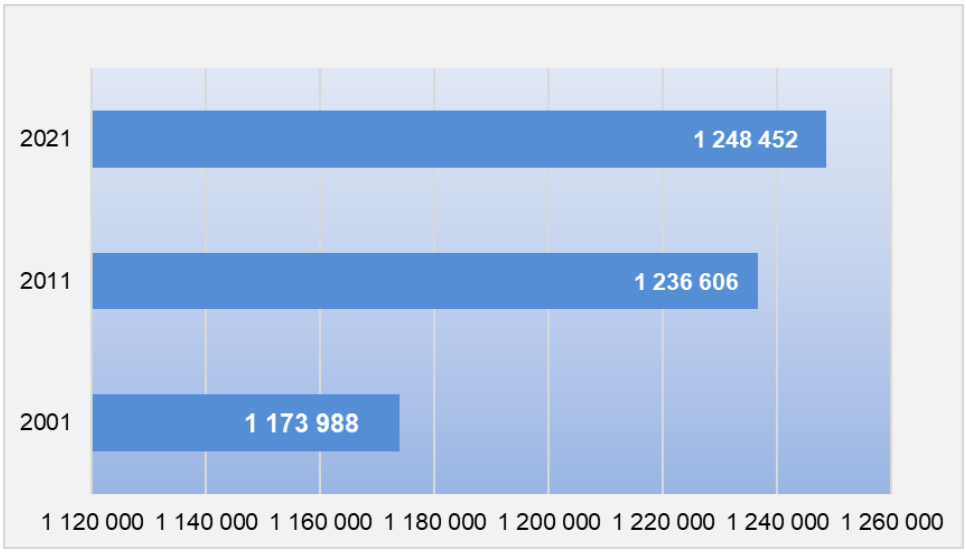


Figure 5 Population growth of Sofia Municipality according to the three last censuses, NSI

The same trend of increase is also confirmed by the forecast of the National Statistical Institute (NSI) for the Sofia municipality which shows a relatively steady trend of the population growth in the municipality in both optimistic and realistic scenarios for population growth with 0,2% average annual growth rate.

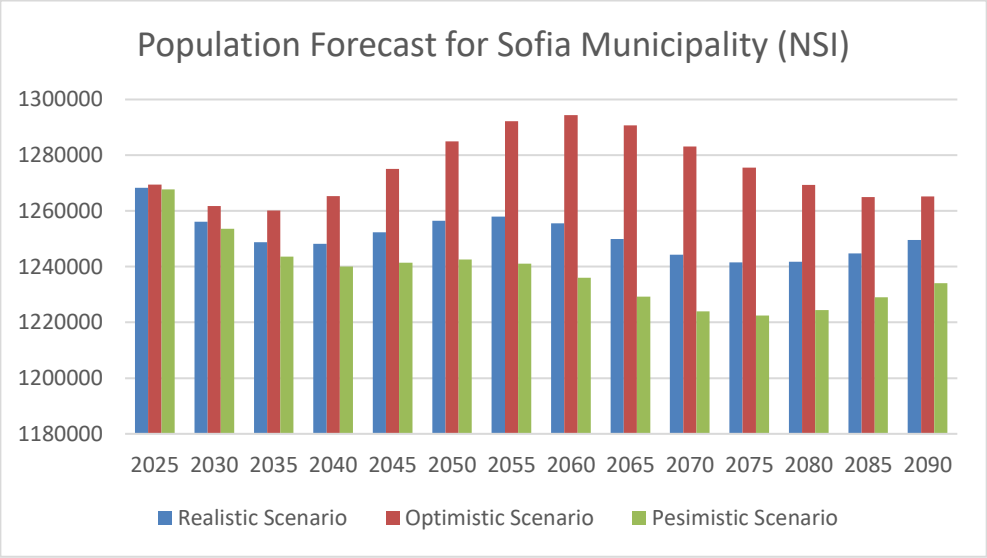


Figure 6 Population forecast within the boundaries of Sofia Municipality

Population in Sofia Municipality is distributed in 614 392 households (HH), 94% of which are in Sofia city. The average number of HH members is 2.0 persons.

1.3.2 Socio-economic characteristics

In the recent years, Sofia has played an increasingly significant role in the country's economy. It is supported by a longer lifespan and the long-term trend of the mechanical growth of the capital's population due to the good opportunities for education and realization in the labor market.

According to the Economic investment profile of Sofia published in 2024, in 2022 the share of Sofia in the national economy was above 40%[2]. According to NSI data in 2022 the GDP per capita[3] in Sofia amounts to BGN 53.75 thousand, which is more than two times the average value for Bulgaria. The economy of Sofia is traditionally strongly oriented towards the services. In 2022, the GVA in the services sector amounts to BGN 51.5 billion, which is over 80% of the added value in the economy of the metropolitan city. The gross value added in the industry reaches over BGN 9 billion, or about 15% of the added value in the economy of Sofia.

The economic profile of the capital is very different from that of the national economy. The processing industry accounts for only 13% of production in Sofia, compared to as much as 33% in total in the country's economy. The leading sectors in Sofia are trade - 20% of the production of enterprises and information and communication technologies – 17% of the production of the enterprises. Construction is also among the leading industries in Sofia's economy, bringing 13% of the output produced.

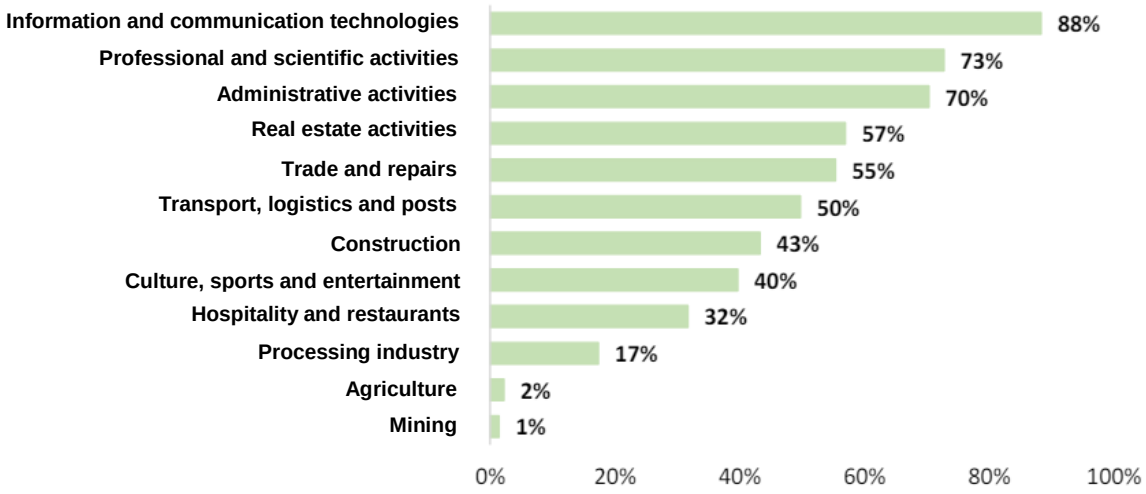


Figure 7 Added value of enterprises in Sofia as a share of GVA of all enterprises in the country in selected sectors (%, 2022)[4]

Economic profile of Sofia is complemented by the deep regional effect and the development of capital's peripheral territories. A number of industrial entities and logistic hubs are located out of the administrative boundaries of the city within the territory of neighboring and nearby municipalities.

Sofia Airport is the biggest airport in the country and it is situated within the boundaries of the municipality. However, it is used for airborne transportation out of the city boundaries.

[2] Economic and Investment Profile of Sofia, 2024

[3] GVA and GDP per capita as of 31.12.2022, NSI

[4] Economic and Investment Profile of Sofia, 2022

Sofia's economic records a serious growth after the COVID-19 pandemic and the social restrictions in 2020. The long-term trend in the economy is constant, it concentrates over 40% of the country's economy, expands its periphery and accounts for a steady rate of economic growth.

In view of climate change and the influence of economy on it, the greatest emitters of GHG within the territory of Sofia Municipality are the buildings and the transport.

1.4 Existing Climate Policies and Strategies

Sofia city is fully committed to urban sustainability and innovation and stepped on this path yet in 2011 when the city joined the Covenant of Mayors. This led to the adoption of a Sustainable Energy Action Plan (SEAP) setting a goal of 22% reduction of GHG emissions vs 2007, the first and the closest to 1990 year with enough data available to perform the analysis and calculations of the GHG emissions. Additionally, a Risk and Vulnerability Assessment has been prepared and a Climate Adaptation Strategy has been adopted in 2015. Another milestone in the transition path to neutrality of Sofia has been the adoption of a Climate Change Adaptation Action Plan and the accession to the Global Compact of Mayors for Climate and Energy in 2019. Together with the commitments to climate neutrality, the city of Sofia is also committed to environmental transparency and disclose its progress annually in the CDP-ICLEI platform for which in 2019 it was included in the 'A List'.

With the aim to make cities greener and more livable, in 2020 the EBRD launched the Green Cities initiative. With a decision of SMC, Sofia took this commitment and with the support of the EBRD, the municipality developed a Green City Action Plan defining the most important steps to turn Sofia cleaner, greener and healthier. In view of the goal for increasing the renewable energy in the energy mix of the city, a Short-term program for promoting the use of renewable energy sources and biofuels for the period 2020-2022 was adopted and implemented.

The final GHG inventory for 2020, for the reporting of the SEAP 2012-2020 outcomes, prepared in 2021, showed that Sofia had achieved 24,7% reduction that was higher compared to the target of 22% set up in the document.

Further developing its efforts to provide citizens a sustainable urban future, in 2021 the SMC adopted a Sustainable Energy and Climate Action Plan for the period 2021-2030 that amplified the commitments to the Covenant of Mayors and became the main milestone in alignment with the Mission. This documents set an ambitious goal of achieving 40.6% reduction of CO_2 emissions mainly through reduction of energy consumption and increase of renewable energy in the final consumption. This document was supported complemented by the adoption in the same year of a Complex Ambient Air Quality Program for the period 2021-2026 thus ensuring the horizontal effects on the environment and human health.

The basic strategic document in the field of climate and energy in Sofia is the SECAP 2021-2030 and it sets the city's neutrality goals and targets summarized in the below graphic.

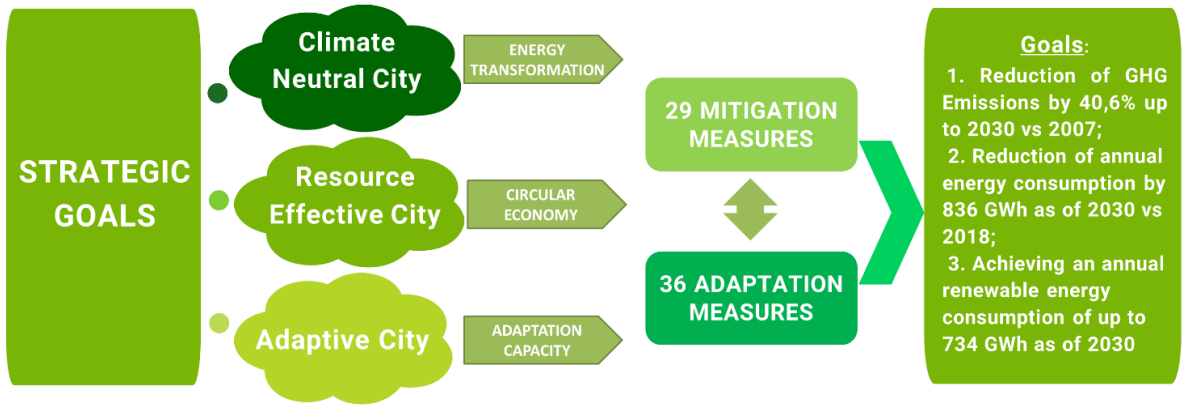


Figure 8 Target set out in the existing strategic policy of Sofia Municipality

The target set above covers the entire administrative territory of Sofia Municipality – all 24 administrative regions. However, the AFOLU sector, the airborne transport and the emissions from the networks for supply of NG had been excluded from the scope of the SECAP and from the scope of CO_2 emissions inventory since they contribute less than 1% to the total emissions of Sofia Municipality.

With the development, signing and implementation of the CCC, all existing targets will be brought in consistency to the new ambitious targets in view of sustainability and climate change. Thanks to the approach of engaging all parties, it will bring the possibility for constantly monitoring and changing if necessary the efforts in view of achieving climate neutrality and pave the path for Sofia to become a climate positive city and playing the role of pioneer to be followed by all Bulgarian or European cities.

The CCC will complement the existing strategies and the actions included in the portfolios herein will be implemented in parallel with all existing efforts towards climate-neutrality to address the emissions gap.

More efforts shall be made in bringing the GHG inventories in consistency to the requirements of the Mission by including all scopes (all sectors) and account for all the gases as per the Global Protocol of Community-based GHG and the Kyoto Protocol.

No actions have been envisaged in the AFOLU sector yet. It is to be further investigated and found how this domain could be addressed and what the most appropriate measures thereof are. This will be further developed in the next iteration of Sofia's CCC.

1.5 Work process

Sofia City has already made huge steps towards climate neutrality before becoming a Mission City. Nevertheless, we acknowledge that there is more work ahead in the future, and our participation in the EU Mission Cities will play an important role along this journey.

We believe shifting towards a greener economy is a major element of the transition to a net-zero emissions society, and it requires action on all fronts. Therefore, we in Sofia municipality, in our climate-related policies, focus on:

- Renovation of buildings to make them more energy efficient – up to 2020 about 50% of all municipal buildings have been renovated by implementing common measures for better energy efficiency

- Changing the inefficient transport fleet with a more environmentally friendly one – about 40% of the fleet has been replaced with non-fossil or more efficient vehicles.
- Increasing the carbon sinks – we plant new forests in the municipal lands around the urban city, yet in 2019 we started the initiative “The new forest of Sofia” and currently over 40 000 saplings had been planted and are well developing.
- Adapting to the circular-economy model - textiles, construction materials and electronics are recycled or re-used in order to decrease the use of primary raw materials and we are constantly improving our recycling management system and we are working hard on decreasing the waste at source.
- Developing further the waste-to-energy production from bio-degradable and food waste and composting of material from pruning and green waste.

The present document is based on existing strategies and our above priorities, and will be fully integrated within the existing framework. The work process of its development followed strictly the recommendations of the Net Zero Cities project team and the Climate Transition Map and the Theory of Change Model proposed by it for implementing a just climate transition.

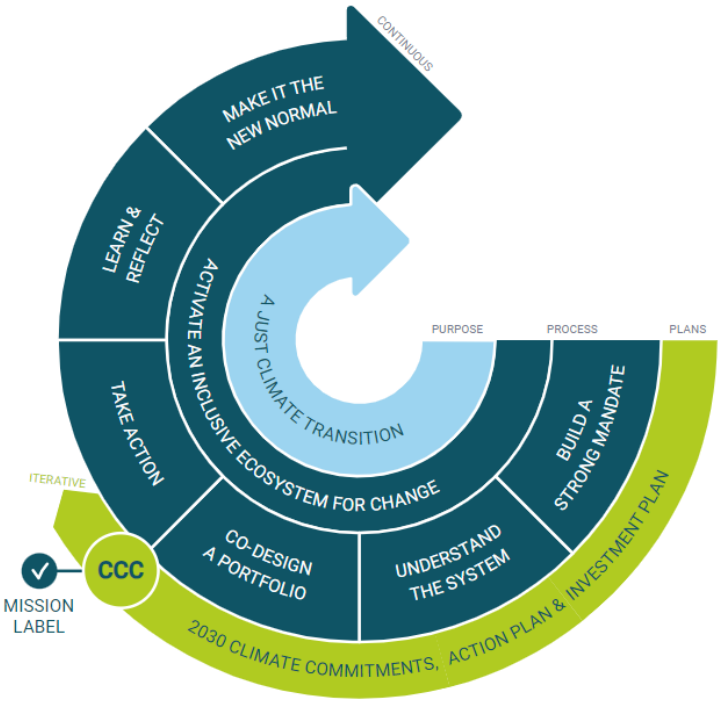


Figure 9 Transition map to climate neutrality followed by Sofia Municipality

Since the CCC is an extensive integrated document, the most important step in the process was **building a strong mandate**. The political commitment has been set years ago and continuously confirmed and improved - **a Coordination Unit** on the energy efficiency and climate has been created yet in 2021 following the adoption of the **SECAP in the framework of the CoM**. The structure is interdepartmental and flexible. Another very important structure is the body formed to engage academic society in the process of climate change mitigation and adaptation of Sofia – **the Scientific Council on Climate Change and Adaptation,** where nine university representatives are engaged to support the decision-making and strategy development in the field. However the existing structures do not cover the ecosystem needs. Therefore a governance

structure involving national government representatives, NGOs, businesses and many other participants having relation to delivering carbon neutrality by 2030 has been established – **a Transition Unit (Team).** The Team is planned to greatly accelerate the city's ability to carry out climate policy, and to ensure its support from the community. Its composition and interactions are shown in the below figure.

A very important step in the process of development and implementation of the CCC of Sofia is the selection of appropriate actions to address the emissions gap.

The actions selected by Sofia to complement the strategic actions within the existing documents, yet following the policies set out toward climate neutrality cover four criteria. They are:

Immediately Actionable: could be launched by city staff within one-two years.

Achievable: proven and economically viable.

Impactful: leading-edge solutions that either make immediate, significant impact or enable large, longterm GHG reductions.

Relevant: corresponding to the requirements of NZC ToC and applicable for most cities with similar social, geographic and political characteristics. These action may not always have a dramatic direct impact on citywide carbon emissions (even if significant for the city government's footprint). However, they are an important catalyst for others in the city and demonstrate municipal leadership.

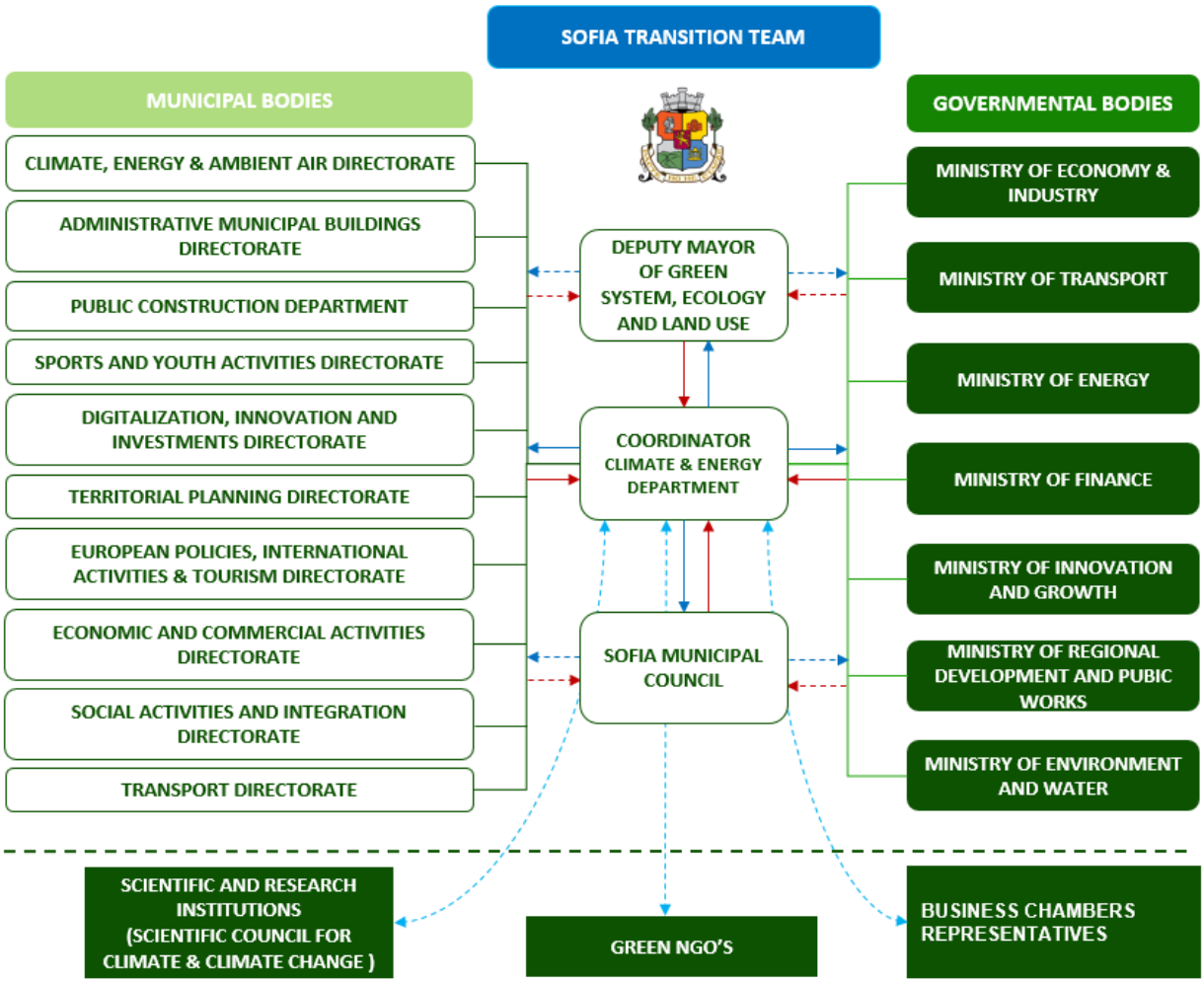


Figure 10 Target set out in the existing strategic policy of Sofia Municipality

This helped to work with all actors across the city for gathering information and data needed for the next steps in the process – **understanding the system** and **co-design a portfolio**. In this regard the following steps had been made:

Step 1 - Updating GHG Inventory of the City

- A comprehensive assessment of the domains of current greenhouse gas emissions, energy consumption, transportation patterns, waste generation, and other relevant data.
- A comprehensive inventory report outlining the current state of emissions.
- Analysis of the city's current sustainability initiatives and policies to understand existing efforts.

Step 2 - Stakeholder Engagement and Mapping

- Identifying and engaging the key stakeholders, including local government officials, community groups, businesses, and academic institutions.
- Mapping out stakeholder roles, interests, and potential contributions to the CCC Action Plan.

Step 3 – Review and Analysis of Current Policies and Strategies

- Reviewing and assessment of existing climate-related policies, regulations, and strategies at the local, regional, and national levels.
- Identifying gaps, overlaps, and inconsistencies in the current policy framework.
- Evaluating the effectiveness of current initiatives in driving climate action and sustainability.

Step 4 – Analysis of the System and Identification of Risks and Barriers

- Conducting a detailed analysis of city systems, such as energy, transportation, waste management, and urban planning, to identify barriers to climate neutrality.
- Engaging stakeholders in Transition Unit sessions and discussions to identify systemic challenges and opportunities

Step 5 – Development of the Action Plan

Step 6 – Implementation and Monitoring

It is vital that citizens and stakeholders play a role and have a say in making the transition to climate neutrality a reality. This is why we at Sofia Municipality aim to foster engagement and co-operation between individuals, communities, and organizations, which will encourage people to commit to concrete actions to reduce their own greenhouse gas emissions.

The transformation of Sofia into a carbon-neutral capital by 2030 relies on the **active involvement of and collaboration with all stakeholder**s. Each of them plays a crucial role in this ambitious project, bringing unique perspectives and essential resources to ensure the success of this transition.

The stakeholders' involvement strategy of Sofia defines the role of the stakeholders.

The **key structures of the city** of Sofia are at the heart of the transformation. They are responsible for creating and implementing environmental policies, sustainable urban planning, public service management, and the renovation of municipal buildings. Their role is to plan, regulate, and oversee local initiatives, ensuring that the city's infrastructure supports the carbon reduction goals.

National authorities, such as the Bulgarian government and relevant ministries, play a crucial supporting role by providing necessary funding, establishing favorable regulations, and coordinating national initiatives with local efforts. This intergovernmental collaboration ensures a harmonized approach and strengthens the impact of climate actions at all levels.

Municipal organizations, including public enterprises and municipal management services, are essential for executing waste management, water supply, and public transport programs. Their participation ensures that the city's basic services operate sustainably and contribute to reducing greenhouse gas emissions.

The private sector, comprising businesses, trade unions, and business clubs, is a driver of innovation and investment in green technologies. By adopting sustainable business practices and collaborating with the municipality, these actors can develop and deploy environmentally friendly solutions, thus stimulating the local economy while contributing to carbon neutrality.

Academic and research institutions provide the scientific knowledge and technological innovations needed to tackle climate challenges. Their research and development are crucial for identifying new solutions, improving existing technologies, and training the next generation of climate leaders.

Finally, **citizens and NGOs** play a fundamental role in ensuring strong community support and raising awareness about climate issues. Their active participation through citizen initiatives, environmental advocacy groups, and community projects is essential for establishing sustainable behaviors and strengthening society's resilience to climate change.

In summary, the success of Sofia's climate neutrality project depends on **a holistic and inclusive approach**, where each stakeholder contributes significantly. Their collaboration and commitment create a robust and resilient ecosystem, capable of leading the capital towards a sustainable and prosperous future.

However, the commitment of several stakeholders is crucial to bringing about accelerated change and these include **academic and research organizations, municipal structures and organizations and private sector, including citizens.**

The strategy developed to engage and collaborate with stakeholders in Sofia as part of the Climate Neutrality Action Plan 2030 is based on a number of essential methods:

a. **Dialogue and consultation with stakeholders:**

- **Democratic Process:** The formulation of policies and implementation of actions involve a democratic process that includes the active consultation and participation of all stakeholders.
- **Openness and transparency:** All meetings and decisions made are documented and accessible to the public to ensure transparency.
- **Consultation and co-construction:** Regular organization of public consultations, co-construction workshops, and discussion forums to gather feedback and ideas from citizens, businesses, and local organizations.
- **Periodic meetings:** Establishment of periodic meetings with stakeholders to discuss progress and adjust strategies based on feedback and new information.

b. Sectoral strategies:

- **Specific sector approach:** Development of sectoral strategies covering key areas such as energy, transport, waste management, and urban planning.
- **Dialogue with sector actors:** For each sector, the municipality engages in dialogue with the concerned stakeholders to define policies and actions to be implemented. For example, discussions with businesses and energy cooperatives for the energy sector, or with resident associations for urban planning projects.
- **Expert participation:** Inclusion of technical and scientific experts in discussions to ensure that policies are based on best practices and the latest data.

c. Energy renovation initiatives:

- Implementation of a pilot energy renovation program targeting municipal and residential buildings, with technical advice and financial support for property owners and managers.
- Collaboration with local businesses to develop innovative solutions for green heating and energy efficiency.

d. Engagement and participation:

- Organization of regular consultation forums with stakeholders, including co-design workshops and feedback sessions to discuss climate initiatives and potential obstacles.
- Creation of specific working groups for key sectors such as transport, energy, and waste management, comprising representatives from businesses, universities, and civil society organizations.

e. Communication and awareness:

- Robust communication campaigns using various media (social networks, radio, television, print media) to raise public awareness of climate neutrality initiatives and encourage community participation.
- Use of local successes and best practices to inspire and motivate other actors to engage in climate actions.

f. Financial and technical support:

- Exploration of partnerships with national and international financial institutions and development agencies to secure additional funding for ambitious climate projects.

g. Innovation and research:

- Collaboration with universities and research center s to develop and test innovative emission reduction and climate adaptation technologies.
- Support for pilot projects and demonstrations of new energy technologies, with a particular focus on solutions adapted to Sofia's local context.

This strategy is designed to ensure a transition to climate neutrality by actively engaging all stakeholders in Sofia, promoting cooperation and transparency, and supporting sustainable innovation and funding.

To step on a firm ground for developing the CCC, Sofia Municipality made a SWOT analysis.

The SWOT analysis of Sofia's climate neutrality action plan reveals a complex and strategic framework aimed at transforming the city into a model of sustainability by 2030. Sofia demonstrates strong political commitment, supported by rigorous alignment with European climate policies. This commitment is reflected in the development of a detailed plan designed to leverage existing infrastructure while actively involving local stakeholders. The city's existing infrastructure provides a solid foundation for improving energy efficiency and adopting green technologies, thereby reducing the costs and time required for implementation.

However, Sofia faces several challenges, including administrative complexity and funding difficulties. Coordination between various governmental entities, as well as effective data management, is crucial to avoiding delays and maximizing the efficiency of initiatives. Additionally, reliance on external grants and funding presents a risk to the continuity of projects, necessitating careful financial planning and diversification of funding sources.

Public engagement is another area where Sofia could strengthen its efforts. Although the plan encourages citizen participation, the involvement of the entire population remains uneven, which could limit the effectiveness of climate initiatives. Increased awareness and citizen engagement campaigns could help bolster public support and ensure the success of the projects.

On the other hand, Sofia benefits from significant opportunities, particularly access to European funding and the adoption of new technologies. These external resources can catalyze the city's transformation, facilitating the deployment of large-scale projects such as energy infrastructure modernization and public transportation improvements. Technological innovation plays a key role in this transition, allowing Sofia to experiment with and adopt sustainable solutions that enhance urban resilience in the face of climate challenges.

However, the city must also prepare to face potential threats, such as the impacts of climate change, complex regulations, and political fluctuations. These external factors can complicate project implementation and require proactive risk management. Additionally, Sofia's aging infrastructure poses a major obstacle, necessitating substantial investments to modernize and align it with current ecological standards.

In conclusion, the SWOT analysis of Sofia's climate neutrality plan shows a city at a crossroads, with significant strengths but also considerable challenges to overcome. The success of this transition will depend on Sofia's ability to effectively mobilize its resources, overcome administrative and financial obstacles, and capitalize on the opportunities presented by technological innovations and European funding. The integrated and participatory approach adopted by Sofia could be the key to achieving its ambitious climate neutrality goals, ensuring a sustainable future for its citizens.

Another very important step in the process of development and implementation of the CCC has been made by Sofia – a risk analysis based on the ACT Methodology.

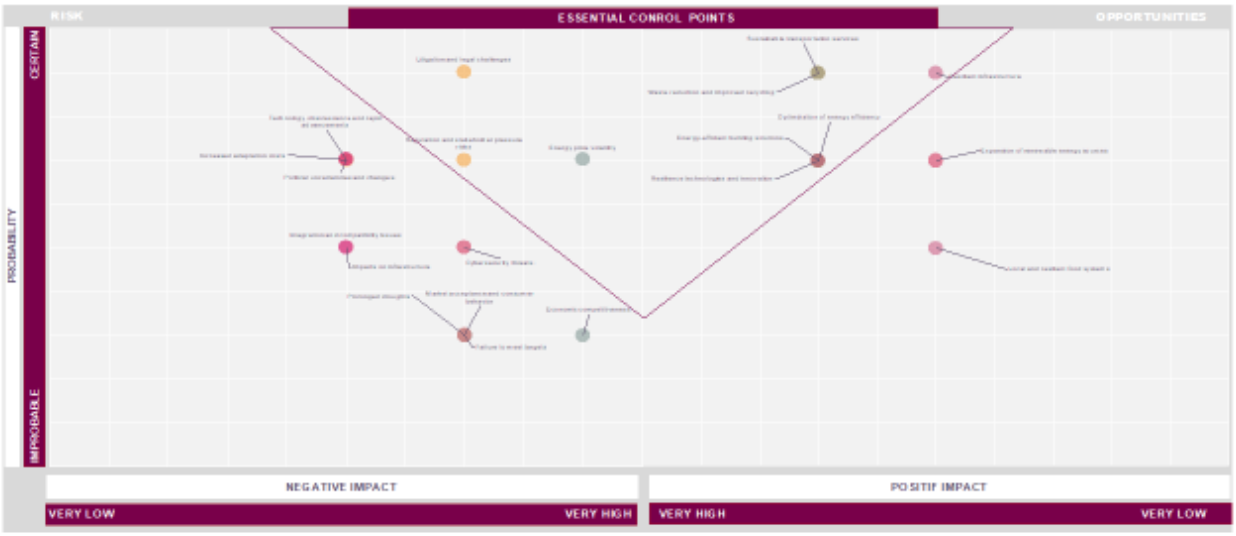
This analysis was conducted using the "ACT Step-by-Step" methodology, a structured approach designed to provide a comprehensive and systematic evaluation of risks and opportunities. The process of evaluation involving the following steps:

1. **Acknowledge (A):** This initial phase involves identifying and acknowledging all potential risks and opportunities that could impact the project. For Sofia, this meant systematically collecting data on political, technological, environmental, and economic factors that could influence the city's climate transition.

2. **Consider (C):** In this phase, each identified risk and opportunity is carefully considered in terms of its probability of occurrence and potential impact. This step involves detailed analysis, including scenario planning and impact assessment, to determine how each factor might influence Sofia's objectives.

3. **Take Action (T):** Based on the considerations, this phase focuses on developing strategic responses. For risks, this means creating mitigation plans, while for opportunities, it involves devising strategies to capitalize on them. The emphasis is on actionable steps that align with Sofia's overall strategic goals for climate neutrality.

By following the ACT methodology, Sofia's analysis ensures a thorough and well-structured approach to managing the risks and opportunities inherent in its climate transition. This methodology not only supports informed decision-making but also facilitates the ongoing adaptation of strategies in response to evolving challenges and opportunities.



The risks and opportunities triangle, as used in the context of Sofia, is a top-tier analytical tool for evaluating the complex dynamics associated with the city's climate transition. This visual framework enables the mapping and ranking of various risks and opportunities based on their probability and impact, facilitating an in-depth analysis of the challenges the city might face, as well as the advantages it could leverage in its journey toward climate neutrality.

Assessment of challenges:

The triangle allows for the identification and prioritization of the most probable risks that could disrupt the implementation of climate initiatives in Sofia. These risks may include political uncertainties, economic disruptions, or extreme weather events, all of which have the potential to hinder the city's progress toward its environmental goals. By highlighting the most pressing risks, the triangle guides officials in developing appropriate risk management strategies, minimizing the impact of these threats on ongoing and future projects.

Identification of opportunities:

Simultaneously, the risks and opportunities triangle highlights the most promising opportunities for the city of Sofia. These opportunities may involve the integration of new technologies, improvements in energy efficiency, or access to European and international funding. By ranking these opportunities by probability and impact, the tool helps decision-makers prioritize actions that will provide the greatest benefit to the city, both in terms of reducing greenhouse gas emissions and promoting sustainable economic development.

Guidance for strategic Decision-Making:

One of the key advantages of the risks and opportunities triangle is its ability to guide strategic decision-making. By providing an overview of the risks and opportunities, the triangle helps leaders determine where to focus resources, which initiatives to prioritize, and which strategies to adopt to maximize the efficiency and impact of the actions taken. This ensures that decisions are aligned with the city's long-term goals, while remaining flexible and adaptable to changes in the environmental and political context.

Effective resource allocation:

Through the analysis provided by the triangle, Sofia can allocate its resources more effectively. Limited resources, whether financial, human, or technological, can be directed toward initiatives that present the best cost-benefit ratio, while also considering potential risks. This allows for the optimization of public and private funds, while maximizing the chances of success for climate transition projects.

Maintaining the path toward climate neutrality:

Ultimately, the use of the risks and opportunities triangle helps Sofia stay on track to achieve its climate neutrality goals. By anticipating potential threats and capitalizing on the most promising opportunities, the city can adjust its strategies in real-time, thereby avoiding major deviations from its environmental objectives. This proactive approach ensures that Sofia continues to progress toward a sustainable future, despite the complex and varied challenges it may face.

Mitigating potential threats:

Finally, the triangle offers a methodology for mitigating identified threats. By categorizing risks based on their probability and impact, it becomes possible to develop specific mitigation plans for the most critical risks. This includes preventive actions to reduce the likelihood of these risks materializing, as well as response strategies to minimize their impact if they do occur. This dual approach enables Sofia to strengthen its resilience to future challenges and ensure a successful climate transition.

In summary, the risks and opportunities triangle, informed by the ACT Step-by-Step methodology, is an indispensable tool for Sofia in its quest for climate neutrality. It allows for a comprehensive and nuanced assessment of risks and opportunities, thereby supporting informed strategic decision-making, optimal resource allocation, and proactive management of potential threats.

1.6 Next steps

The future steps comprise the process of review, monitoring and evaluation of the implementation of the CCC with main milestones being the:

- drafting of the CCC of Sofia City – July-August 2024;
- submission of the CCC for informal review – August 30th, 2024;;
- official submission to the platform – September 16th, 2024;
- 1st review and iteration – July-August 2026;
- 2nd review and iteration – July –August 2028;
- Final review – July-August 2030;
- Final GHG emissions inventory – September 2032

Since due to the lack of sufficient data on industry, the baseline inventory is not reliable for this domain to be addressed through appropriate actions, so this first version is missing the actions that will be implemented by industrial stakeholders. This will be clarified and complemented in the first iteration in 2026 after the comprehensive inventory for the year 2024. This will also lead to complementing the GHG inventory by covering also the other gases as per the Kyoto Protocol.

In addition, we have planned some actions for which the emissions and investments will be calculated additionally and this is to be done in the first iteration in 2026.

All other issues identified during implementation or additional actions proposed by some of the key stakeholders within the major emitting domains will be collected and included in the first and second iterations.

All indicators will be strictly monitored and certain decisions and steps will be made in view of changed conditions when indicators show any disruptions.

The final review will be made in 2030 to finally confirm the completion of all the planned actions and their outcomes.

The final inventory to be done in 2032 for the year of 2030 will prove the effect of the CCC and will confirm the completion of the target – achievement of 80%+ reduction of the GHG emissions.

Table I-1.1: Climate Neutrality Target by 2030			
Sectors	**Scope 1**	**Scope 2**	**Scope 3**
Stationary energy	*Included*	*Included*	*Optional information*
Transport	*Included*	*Included*	*Optional information*
Waste/wastewater	*Included*	*Not applicable*	*Included*
IPPU	*To be further define*	*Not applicable*	*Optional information*
AFOLU	*To be further define*	*Not applicable*	*Optional information*
Other	*Not applicable*	*Not applicable*	*Not applicable*
Geographical boundary	**Same as city administrative boundary**	**Smaller than city administrative boundary**	**Larger than city administrative boundary**
Tick correct option	√		

2 Part A – Current State of Climate Action

Part A "Current State of Climate Action" describes the point of departure of the city towards climate neutrality, including commitments and strategies of key local businesses, and informs the subsequent modules and the outlined pathways to accelerated climate action.

2.1 Module A-1 Greenhouse Gas Emissions Baseline Inventory

GHG Emissions Baseline inventory

Sofia is a member of the Covenant of Mayors since 2011 and reports emissions inventories each 4th year. The monitoring of emissions is done vs the baseline year 2007. It has been defined as the baseline year (BEI) since this was the first year for which enough reliable data were available for the preparation of an inventory. The last reported to the GCoM inventory is the one for year 2020. Additionally, Sofia reports to the CDP/ICLEI each year since 2018, and in 2019 it had been enlisted in the A List of the platform when the data from 2018 inventory had been reported. Having in mind that year 2020 was characterized by unusual economic behavior due to the COVID-19 pandemic, it has been considered appropriate to update the inventory vs 2018 inventory and year 2022 inventory has been prepared and taken as a baseline for the development of the CCC.

The decision to change the reference year of Sofia's greenhouse gas (GHG) emissions inventory to 2022 is based on several strategic and methodological considerations. The year 2022 provides a more current and accurate representation of emissions, reflecting recent economic, social, and environmental developments in the city. By adopting this year as the reference, Sofia aligns its climate strategies and actions with the most recent data and trends, which is essential for effective planning that is well-adapted to the current reality.

Since 2018, Sofia has implemented new policies and measures aimed at reducing its GHG emissions. By selecting 2022 as the reference year, the emissions inventory captures the impact of these recent initiatives, thus providing a relevant baseline for assessing progress made. Moreover, 2022 reflects the post-COVID-19 economic recovery, avoiding the anomalies observed in 2020 when economic disruptions related to the pandemic temporarily reduced emissions. The year 2022, with a return to normal economic activity, is based on data that better reflects the structural emissions situation in the city.

This change in reference year allows Sofia to align its emission reduction targets with recent international commitments, such as those defined by the Paris Agreement. The city's efforts are part of a global dynamic towards carbon neutrality. Additionally, data collection methods and GHG emissions monitoring technologies have significantly evolved between 2018 and 2022. By using 2022 as the new baseline, Sofia benefits from these methodological and technological improvements, ensuring that the inventory is based on the most accurate and reliable data available.

The shift to 2022 as the reference year is a strategic decision that enables Sofia to establish a solid and up-to-date basis for evaluating and planning its actions towards achieving carbon neutrality, while taking into account recent changes and advancements made in recent years.

Sofia Municipality has undertaken a GHG inventory for the year 2022, aligning with its commitments under the Covenant of Mayors European initiative and the Global Compact of Mayors for Climate and Energy. This inventory utilized methodologies from the Sustainable Energy and Climate Action Plans

(SECAPs) guidelines, specifically Part II on Basic Emissions Inventory, the Global Protocol for GHG Emissions Inventory, and the IPCC's 2006 Guide for National GHG Inventories. It is done on the grounds of the final energy consumption within the administrative boundaries of Sofia Municipality.

The inventory encompasses several sectors: stationary energy - residential, tertiary and municipal buildings, equipment and facilities; industry and construction; agriculture and forestry; accidental emissions from natural gas supply; transportation (road, rail, and aviation), and waste and wastewater management. Data was gathered from municipal sources as well as numerous public and private organizations. The inventory covers all 24 administrative regions within the municipality.

In terms of energy consumption, the total for the municipality has been estimated to 10,060,567 MWh in 2022, a reduction of 12% from 11,437,985 MWh in 2018.

Regarding emissions, the total for 2022 has been evaluated to amount to 4.2 million tons of CO2-equivalent, down from 4.6 million tons in 2018, reflecting a decrease of 8%. Households (43%), industry (21%), road transport (16%) and trade and services (13%) being, in that order, the prominent sources of emissions.

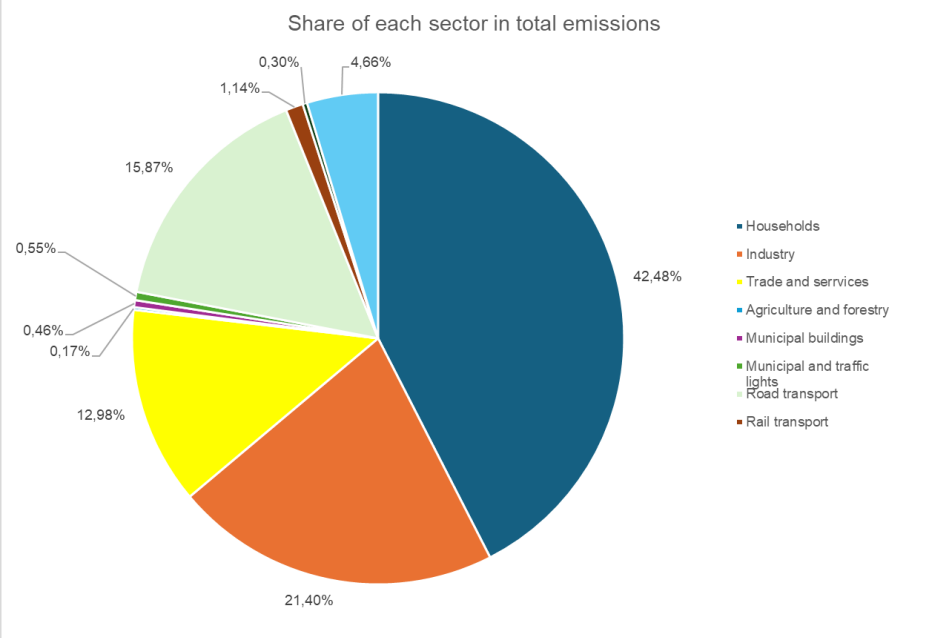


Figure 11 Shares of GHG emissions by sector within Sofia Municipality

The GHG inventory covers all major sectors contributing to emissions within the municipality, including households, industry, road transport, trade and services, as well as municipal buildings. It is conducted in accordance with established methodologies, ensuring that all relevant emission sources are accounted for. However, we did not include data related to emissions from local flights and food products consumed in Sofia in this inventory. This exclusion does not, however, present any significant potential impact and does not constitute an obstacle to Sofia's goal of climate neutrality. These emission sources are relatively limited, and their overall contribution to the municipality's total emissions is negligible. Therefore, their omission does not compromise the validity of the inventory nor the achievement of the city's ambitious climate goals.

Natural gas networks and air transport contributed less than 1% of Sofia's total emissions in 2018, and have been excluded from the scope of the baseline greenhouse gas inventory.

The available GHG emission inventory for Sofia meets the core requirements set forth in the Cities Mission's Info Kit for Cities. The inventory was prepared using the methodologies aligned with the Covenant of Mayors, the Global Protocol for Community-based GHG Emissions Inventory, and the IPPC's 2006 Guide for National GHG Inventories. It comprehensively covers all major emission sources within the administrative boundaries of Sofia, including households, industry, transport, trade, services, and municipal buildings.

Compared to the recommendations set forth in the Cities Mission's Info Kit for Cities, the baseline inventory of Sofia Municipality is also not fully consistent in view of the types of GHG considered. However, following the requirements of the GCoM for reporting GHG inventories every four years, a new comprehensive inventory of GHG emissions will be made in 2025-2026 for the year 2024 and reported accordingly to the GCoM. This inventory will comply with all the requirements published as of the date of its production, including all scopes as per the Global Protocol and all gases as per the Kyoto Protocol

The baseline greenhouse gas (GHG) emissions inventory for the municipality of Sofia plays a central role in designing impact pathways and climate actions for the city. This inventory provides a detailed view of the main sources of emissions within Sofia's administrative boundaries and serves as a basis for targeting sectors where emission reductions are necessary.

The results show that the buildings, especially residential buildings, industry and road transport sectors are the primary contributors to GHG emissions. However, the data for the industry were not sufficient and results had been calculated based on interpolation vs national data that lead to a distortion in the outcomes since industry in the economy of Sofia has a very small share, comprises only few industrial entities in the field of food and medicine production and only one bigger industrial producer of products from non-ferrous metals, so it is unlikely for the industrial sector to produce such a big share of GHG emissions in Sofia. Therefore this sector will be examined in detail in the comprehensive inventory to be produced for year 2024 as mentioned above and will not be taken into account in current portfolio. Currently, only the sector of buildings, transport and waste will be considered to addressing the emissions gap. These three sectors will be at the heart of future climate actions, with efforts focused on improving energy efficiency, promoting renewable energy, modernizing public transport and its infrastructure, and fostering the separation of waste at source and its recycling or utilization.

In terms of perspectives, the inventory highlights the importance of implementing more efficient data collection and management systems. A more robust and centralized data management approach will be searched to allow for better tracking of progress, refining emission mitigation strategies, and ensuring that reduction efforts are properly targeted and measured. Strengthening local capacities in data collection and analysis, developing digital tools, and more integrated monitoring platforms will be essential and will be a step to on the pathway to becoming a smart city.

These perspectives also include enhanced cooperation between various local actors, both public and private, to improve data access and ensure regular and accurate updates of the inventory. This will enable the city of Sofia to more effectively track its progress towards carbon neutrality and adjust its actions in real-time to maximize their impact.

Sofia's baseline GHG inventory is not only a diagnostic tool but also a lever for developing targeted and effective climate actions while paving the way for better data management to support these efforts in the long term.

The baseline greenhouse gas (GHG) emissions inventory for the city of Sofia plays a crucial role in guiding the key strategic priorities outlined in our 2030 climate neutrality commitments. This inventory allows us to identify the sectors most responsible for emissions, such as households, transportation, waste, and municipal buildings. Based on this data, we can target specific actions within each sector to ensure significant emission reductions.

The baseline inventory also serves as a starting point for measuring our progress over time, enabling us to adjust our strategies based on the results achieved and ensuring that we remain on track to meet our 2030 goals.

The baseline inventory is also a valuable tool for engaging stakeholders, including citizens, businesses, and local institutions, around our climate initiatives. By providing concrete and transparent data, we facilitate communication about the required efforts and the expected benefits of our emission reduction actions.

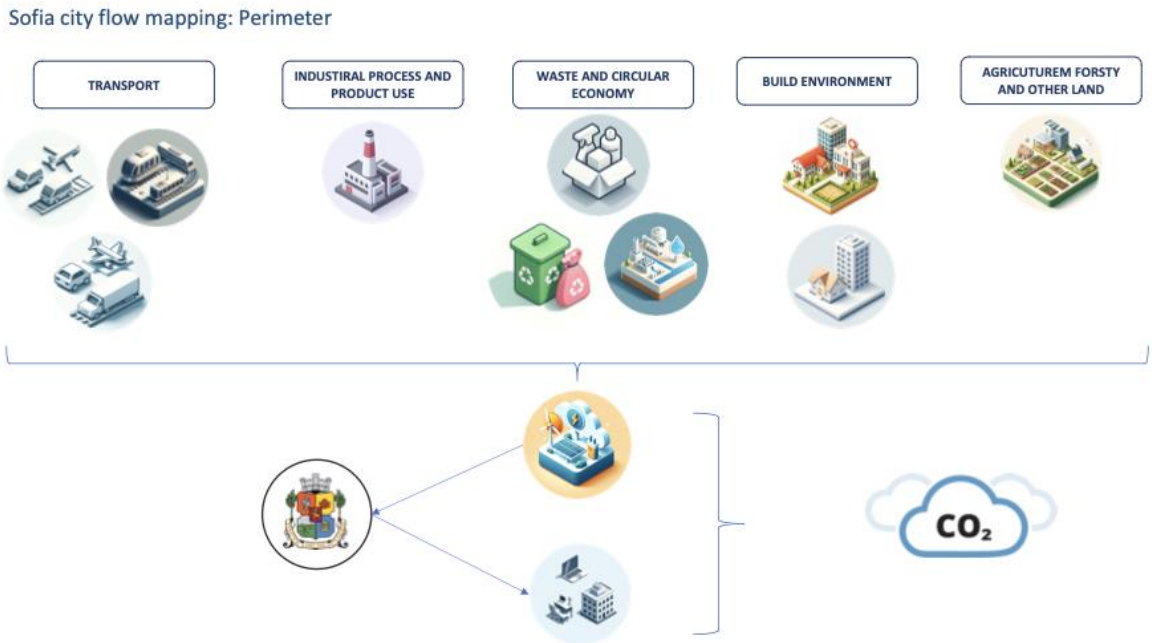
In addition, this inventory guides the development of our local policies and regulations aimed at reducing GHG emissions. By basing our decisions on solid data, we ensure that the measures taken are both accepted and effective. The inventory also allows us to adapt our strategic priorities to the local realities, taking into account Sofia's unique challenges and specificities while aligning these priorities with our global climate commitments.

Thus, Sofia's baseline GHG inventory forms the cornerstone of our climate neutrality strategies for 2030, providing us with the necessary data to guide our actions, track our progress, and mobilize the entire community towards a more sustainable future.

2.1.1 Scope and limits of the inventory

2.1.1.1 Emission sources covered

The inventory covers GHG emissions within the administrative boundaries of the municipality of Sofia. This means that only the emissions generated by activities occurring within this geographical area are accounted for.



Sofia's inventory covers several categories of emission sources, each with its own characteristics and emission factors:

- Stationary sources :
  - **Residential and commercial buildings**: Emissions from these sources come mainly from energy consumption for heating, cooling, lighting and the use of household appliances.
  - **Municipal buildings**: This includes schools, libraries, community center s and other public infrastructure. Emissions are calculated from recorded energy consumption, with a particular effort to extrapolate data where direct access is limited.
  - **Industrial facilities**: Includes emissions from manufacturing processes, construction activities and industrial facilities, which are determined by the consumption of fossil fuels and other energy sources.
  - **Municipal lighting**
- Mobile sources :
  - **Private and commercial vehicles**: Includes all cars, motorbikes, light and heavy trucks operating within the city limits. Emissions are calculated on the basis of mileage and fuel consumption data, with adjustments for vehicle age and emission standards.
  - **Municipal fleet:** Includes vehicles owned by the municipality, including service and emergency vehicles. Fuel consumption is accurately recorded using internal distribution systems.
  - **Public transport**: Includes buses, trolleybuses, trams and underground trains. Energy consumption data is collected directly from transport operators.
- Indirect emissions :
  - Electricity and heat consumption: Includes emissions associated with the use of electricity and heat, regardless of where they are produced. Emission factors are adjusted according to the energy mix specific to local and national production
- Other direct sources :
  - **Waste management**: Emissions from the treatment and incineration of solid waste. Although precise data on the characteristics of refuse derived fuels (RDF) is limited, average emission factors are applied.
  - **Gas distribution**: Accidental emissions resulting from natural gas leaks in the distribution network are also included.
  - **Agriculture**

2.1.1.2 Direct and indirect emissions

As part of the greenhouse gas (GHG) emissions inventory for the city of Sofia, we applied two reference protocols: the **GHG Protocol** and the **Covenant of Mayors**. These two methodologies, widely recognized and adopted internationally, provide similar frameworks for evaluating GHG emissions. One of the common features of these two approaches is the clear distinction between two types of emissions: direct emissions and indirect emissions.

1. Direct emissions (Stationary Sources)

Direct emissions, also known as stationary source emissions, are those that come directly from the combustion of fossil fuels within the geographical limits of the city. These emissions are generated by activities that take place within the city and involve the use of fuels to produce energy or for industrial processes. In Sofia's inventory, this includes:

- **Building heating**: Emissions resulting from the combustion of natural gas, fuel oil, or coal to heat residences, offices, commercial spaces, and municipal installations.
- **Industrial and construction activities**: Emissions generated by industrial processes or construction that require the combustion of fuels.
- **Local heat production**: When heat is produced within the city, for example, in local thermal power plants, the associated emissions are considered direct.
- **Transportation**: Emissions generated by private, commercial, and municipal vehicles that consume fossil fuels (gasoline, diesel, natural gas) within the city. This includes personal cars, trucks, municipal buses, and other motorized transport used daily in the city.
- **RDF (Refuse Derived Fuel) waste incineration**: When waste is converted into derived fuels for incineration, the emissions produced by this incineration, if it takes place within the city limits, are considered direct emissions.

These emissions are accounted for directly in the city's inventory as they are generated by activities that physically take place within the territory of Sofia. In the table, direct emissions are presented under Scope 1, while indirect emissions are shown under Scope 2, as follows:

	Energy MWH									Emissions tCO2eq										
	households	Industry	Trade and services	agriculture and forestry	Municipal buildings	municipal and traffic lights	Road transport	Rail transport	Others	Total Emissions From Energy	households	Industry	Trade and services	agriculture and forestry	Municipal buildings	municipal and traffic lights	Road transport	Rail transport	Others	
Solid	207 170	542 558	3 482	2 007						203 490	16 328	186 043	440	680						
Liquid	29 329	400 843	86 998	21 994	218			426		765 871	6 811	102 296	22 551	6 520	56		627 510	127		Scope 1
Gas	359 279	308 685	262 954	0						219 676	72 760	62 403	53 253				31 260			
Electricity	2 206 960	893 573	761 192	0	16 305	45 555	26 423	94 881	0	2 054 804	1 121 136	453 935	386 686	0	8 283	23 142	13 423	48 199	-	Scope 2
Heat Energy	2 880 582	504 239	429 537	0	55 807					782 412	582 353	101 939	86 837		11 282					
Total	5 683 320	2 649 897	1 544 162	24 000	72 321	45 555		95 307		4 026 253	1 799 387	906 616	549 767	7 200	19 621	23 142	672 193	48 326		

2. Indirect emissions

Indirect emissions, on the other hand, come from energy consumption within the city, but where the production of this energy occurs outside its geographical limits. This type of emissions mainly includes those associated with the use of electricity and heat. For Sofia, these indirect emissions are calculated based on energy consumption by the city's various sectors, taking into account specific emission factors for electricity and heat produced elsewhere.

Indirect emissions include:

- **Electricity consumed in buildings**: Electricity used by households, offices, commercial spaces, and public services. Although this electricity is consumed within the city, the emissions associated with its production may have occurred in power plants located outside Sofia, often using fossil fuels.
- **Heat supplied by district heating networks**: When heat is produced outside the city, for example, in a thermal power plant, but used for heating within the city, the emissions related to this heat production are considered indirect.

In Sofia's inventory, these indirect emissions are carefully accounted for to reflect the total impact of the city's energy consumption, even when the emissions do not occur directly within its borders.

2.1.1.3 Data collection

The first step involved gathering accurate data on electricity and heat consumption across all sectors of the city. This includes:

- **Residential**: Electricity and heat consumption in households.
- **Commercial and services**: Consumption in offices, shops, hospitals, schools, etc.
- **Industrial**: Consumption in factories and production facilities.
- **Municipal**: Consumption in public buildings and infrastructure, such as schools, administrative offices, street lighting, etc.

For the specific case of Sofia, the following sectors were considered:

- **Households**: Includes electricity and heat consumption for heating, air conditioning, hot water, and household appliances in the city's homes.
- **Trade and services**: Includes consumption in offices, shops, banks, SMEs, hospitals, and other private sector buildings.
- **Municipal buildings**: Electricity and heat consumption in buildings managed or owned by the municipality, such as administrative offices, schools, libraries, community centers, etc.
- **Industry and construction**: Includes energy consumption in factories, production facilities, and construction sites in the city.
- **Agriculture and forestry**: Energy consumption for local agricultural activities, including the use of agricultural machinery and greenhouse heating.
- **Private and commercial vehicles**: Electricity consumption (for electric vehicles) and fuel consumption for private and commercial vehicles operating in the city.
- **Municipal fleet**: Energy consumption for vehicles owned by the municipality and used by municipal employees.
- **Public transport**: Includes electricity consumption for electric buses, trams, trolleybuses, and urban trains, as well as the use of fossil fuels for other public transport means.
- **Public lighting and traffic lights**: Electricity consumption for street lighting, public spaces, and traffic lights.
- **Accidental emissions**: Gas leaks during distribution in the urban network.
- **Waste**: Energy consumption for waste treatment, including the incineration of Refuse Derived Fuel (RDF) outside the city limits.

2.1.2 Uncertainty and precision

The global uncertainty of Sofia's greenhouse gas (GHG) inventory is a composite of two primary sources of uncertainty.

The first component stems from the emission factor, which typically carries an uncertainty level of 1 to 2 percent. This relatively low uncertainty is due to the well-established scientific methods used to determine emission factors.

The second component, however, introduces a more variable level of uncertainty and is linked to the process of data gathering. This aspect of uncertainty is highly dependent on the specific emission source being measured and the capabilities and methods employed in collecting the relevant data.

The detailed inventory data are presented in the following tables.

A-1.1: Final energy use by source sectors			
Base year	2022		
Unit	MWh		
	Scope 1	Scope 2	Scope 3
Households (Residential Buildings)			
Solid fuels	207 170		
Liquid fuels	29 329		
Gas	359 279		
Electricity		2 206 960	
Heat		2 880 582	
Trades and services (Private Buildings)			
Solid fuels	3 482		
Liquid fuels	86 998		
Gas	262 954		
Electricity		761 192	
Heat		429 537	
Public Buildings			
Solid fuels	0		
Liquid fuels	210		
Gas	0		
Electricity		16 305	
Heat		55 807	
Public lighting and traffic lights			
Electricity		45 555	
Industry and construction			
Solid fuels	542 558		
Liquid fuels	400 843		
Gas	308 685		

Electricity		893 573	
Heat		504 239	
Agriculture and forestry			
Solid fuels	2 007		
Liquid fuels	21 994		
Road transport[5]			
Liquid fuels			
Gas			
Electricity		26 386	
Rail Transport			
Liquid fuels	426		
Electricity		94 881	

The energy consumption by sector is shown in the below chart.

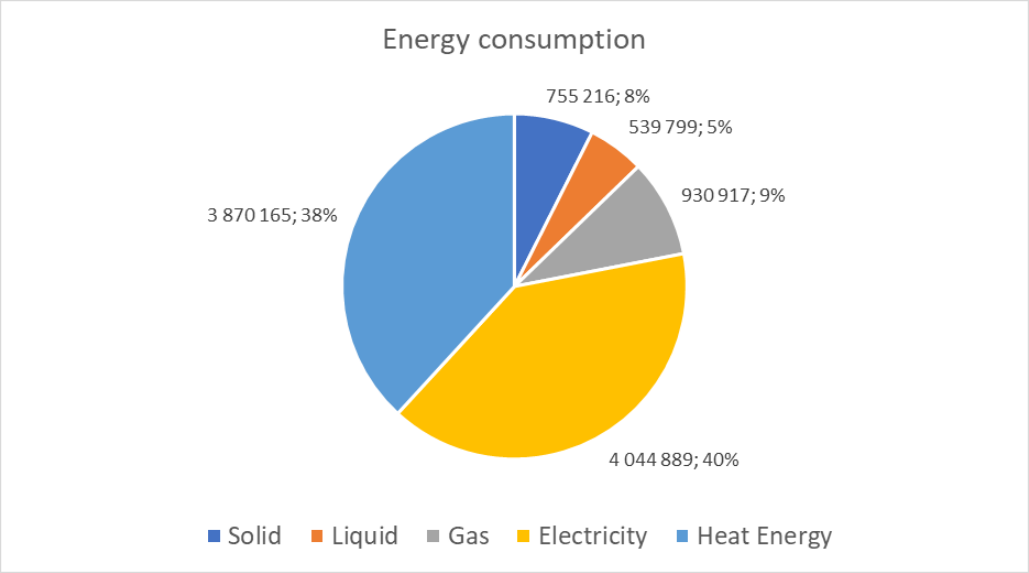


Figure 12 Energy consumption by fuel type

[5] The calculation of road transport emissions has been made based on the mileage and fuel efficiency and no energy consumption has been calculated for the liquid fuels.

A-1.2: Emission factors applied						
Specified for primary energy type and GHG emission factor according to methodology used						
For calculation in MWh of primary energy						
IPCC method used						
Primary energy/ energy source	Carbon Dioxide (CO_2) **tCO_2/MWh**	Methane (CH_4) **Kg CH_4/MWh**	Nitrous Oxide (N_2O) **Kg N_2O/MWh**	F-gases (hydrofluorocarbons and perfluorocarbons)	Sulphur hexafluoride (SF_6)	Nitrogen trifluoride (NF_3)
Anthracite coal	0,35	0,036 (industry, services)	0,0054	-	-	-
Black coal	0,34	1,08 (households)		-	-	-
Lignite and brown coal	0,36			-	-	-
briquettes	0,35			-	-	-
Propane-Butane (LPG)	0,23	0,0036 (industry)	0,00036	-	-	-
		0,018 (services, households)		-	-	-
Gas oil / Diesel fuel	0,27	0,0108 (industry)	0,00216	-	-	-
		0,036 (services, households)		-	-	-
Petrol	0,26	0,0108 (industry)	0,00216	-	-	-
		0,036 (services, households)		-	-	-
Fuel oil	0,26	0,0108 (industry)	0,00216	-	-	-
		0,036 (services, households)		-	-	-
Natural gas	0,20	0,0036 (industry)	0.00036	-	-	-
		0,018 (services, households)		-	-	-
Biomass	0,36	0,108 (industry)	0.0144	-	-	-
Wood	0,40					

A-1.3a: GHG emissions by source sectors				
Base year	2022			
Unit	tCO_2 equivalent			
	Scope 1	**Scope 2**	**Scope 3**	**Total**
Transport	658 897			658 897
Buildings	852 671			852 671
Electricity		2 054 804		2 054 804
Waste			197 527	197 527
Other *(incl. IPPU & AFOLU)*	472 419			472 419
Total	**1 983 987**	**2 054 804**	**197 527**	**4 236 317**

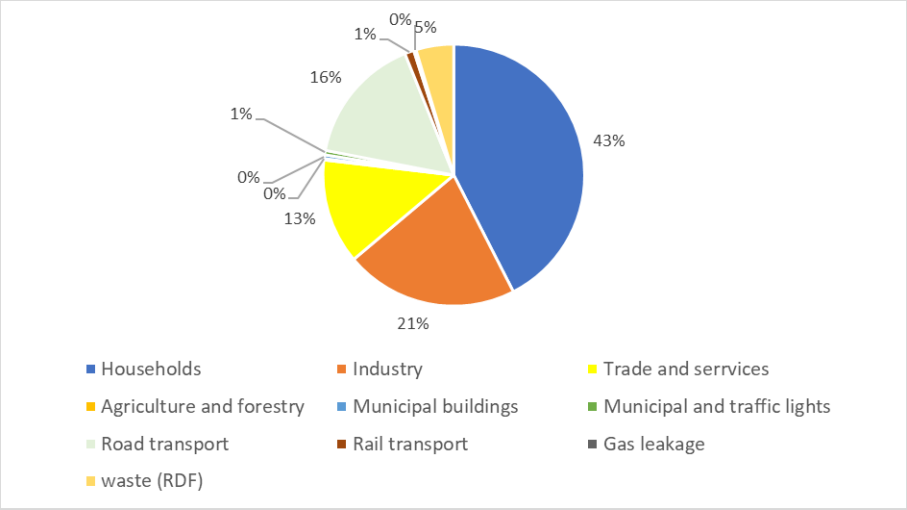


Figure 13 Shares of GHG emissions by source sector

A-1.3b: GHG Emissions by Source Sector - Business as Usual (BAU) 2030					
Base Year	**BAU 2030**				
Unit	t CO_2 equivalent/year				
	Scope 1	**Scope 2**	**Scope 3**	**Total**	**% of Total**
Transport	546612			546612	13%
Buildings & Heating	873144			873144	20%
Electricity		2348403		2348403	54%
Waste*			127430	127430	3%
Other (incl. IPPU & AFOLU)	452996			452996	10%
Total	1872753	2348403	127430	4348586	100%
** Includes Scope 1 Waste emissions (produced and processed in the city) and Scope 3 (produced by the city but processed outside the city border) - solid waste only; wastewater falls under "Other" sector*					

A-1.4: Activity by source sectors			
Base year		2022	
	Scope 1	Scope 2	Scope 3
Buildings			
Heating demand (space heating + domestic hot water)(GWh/year)	7 245		
Transport			
Transport need - passenger cars + motorcycles (M km/year)	1 698		
Transport need - buses (M km/year)	50		
Transport need - trains/metro (M km/year)	7		
Transport need - light duty trucks (<3.5 t) (M tkm/year)	124		
Transport need - heavy duty trucks (>3.5 t) (M tkm/year)	637		
Waste			
Collected waste within city boundaries (tonnes)			304 894
Other (incl. IPPU & AFOLU)			

2.2 Module A-2 Current Policies and Strategies Assessment

A-2.1: List of relevant policies, strategies & regulations					
Name & Title	**Type**	**Level**	**Scope**	**Relevance**	**Impact on climate neutrality ambition**
Municipal strategic, planning and program documents					
Climate Change Adaptation Strategy	Strategy	Local	• Identification of potential risks for the municipality caused by climate change;	The document is in consistence with the EU Mission in view of climate	

A-2.1: List of relevant policies, strategies & regulations					
Name & Title	**Type**	**Level**	**Scope**	**Relevance**	**Impact on climate neutrality ambition**
			• Determination of adaptation measures aimed at the main risks and preparation of Sofia Municipality for climate change. Adaptation measures include: • Development of green spaces between buildings and maintenance of street lighting; • Timely informing the population about predicted periods with extreme temperatures, storms, floods; • Increasing the number of projects and incentives to improve energy efficiency in buildings; • Optimization of transport connectivity; • Analysis of the renovation, maintenance and optimization of the water supply system to reduce water losses; • Acquisition of new territories for landscaping (e.g. "Vartopo" Park,	neutrality by 2030	

A-2.1: List of relevant policies, strategies & regulations					
Name & Title	**Type**	**Level**	**Scope**	**Relevance**	**Impact on climate neutrality ambition**
			"Iskar" Hydropark, Eastern Park).		
Long-term Development Strategy of Sofia and Its Suburban Areas until 2050 (Vision for Sofia)	Strategy	Local/Regional	• It contains several main elements: • 5 priorities, which unite the most significant and important goals in the long-term development of the municipality; • 24 long-term strategic objectives that work towards the implementation of the five priorities and are linked with the long-term development of the municipality in the seven directions of the Vision: Urban Environment, Environment, Transport, Economy, Identity and Culture, Governance and People; • 230 key steps towards achieving the 24 long-term goals, spread over time from 2020 to 2050; • 385 specific measures to achieve the goals and steps;	The plan contains certain parts related to transport& mobility, and energy consumption as well as propose some policies related to climate change adaptation, i.e. it complies with the main objectives of the Mission	

A-2.1: List of relevant policies, strategies & regulations					
Name & Title	**Type**	**Level**	**Scope**	**Relevance**	**Impact on climate neutrality ambition**
			• Indicators to regularly measure and report the progress and the achievement of long-term goals.		
Green City Action Plan	Action plan	Local	Aims to improve the state of the environment, including a visible, tangible improvement of the physical environment, air quality and create prerequisites for better management of natural capital within the municipality. It includes a set of measures and activities in the following sectors - urban planning, energy consumption and energy efficiency, building stock and urban communities, transport and blue-green infrastructure. The GCAP is a 5-year investment program for sustainable development that is not intended to be a detailed pre-investment study in each area, but contains additional synergistic measures. It is a document containing preparatory and actual investment measures. The implementation of the	The plan is fully consistent to the EU Mission climate neutrality ambition by 2030	

A-2.1: List of relevant policies, strategies & regulations					
Name & Title	**Type**	**Level**	**Scope**	**Relevance**	**Impact on climate neutrality ambition**
			set measures leads to the achievement of the plan's vision - "Sofia - a green, clean city full of life". The goals of the plan are: 1. Improving ambient air quality and reducing greenhouse gas emissions through measures primarily, but not exclusively, aimed at energy efficiency, change of the fuel base and replacement of heating devices, as well as through measures stimulating electric vehicles and modernization of trams in the public transportation; 2. Improving the quality of the urban environment, creating opportunities for higher land value and tourism growth through measures such as integrating green solutions in the urbanized territory, using the potential of abandoned industrial zones and their revitalization, etc. 3. Health benefits from improved physical activity and well-being of the municipal residents by promoting cycling and walking and providing		

A-2.1: List of relevant policies, strategies & regulations					
Name & Title	**Type**	**Level**	**Scope**	**Relevance**	**Impact on climate neutrality ambition**
			appropriate infrastructure; 4. Preservation of ecosystems by improving inter-block spaces, creating green areas, linear parks, etc.		
SECAP 2021-2030 including the Energy Efficiency Program and the Long-term program for promoting the use of renewable energy of Sofia Municipality	Action plan	Local	Developed following the commitment of Sofia made by joining the Global Covenant of Mayors on Climate and Energy (GCCME). With its implementation, at the end of this period, is envisaged to achieve a reduction GHG emissions within the established scope of the plan by a minimum of 40%. The plan provides for totally 65 measures in the field of both climate change mitigation and adaptation	The SECAP complies with the EU Mission climate neutrality ambition by 2030	The plan contributes to the achievement of 40% reduction of GHG emissions and addresses the adaptation to climate change in the urban environment. It should be updated to get in full consistency with the new targets at local, national and European level
Sustainable Urban Mobility Plan 2019-2035	Strategy	Local	The general objectives of the plan include: • Reducing the negative impact of transport on human health and the environment; • Increasing the attractiveness of the urban environment and		

A-2.1: List of relevant policies, strategies & regulations					
Name & Title	**Type**	**Level**	**Scope**	**Relevance**	**Impact on climate neutrality ambition**
			ensuring a better quality of life; • Application of transport innovations and strengthening of local mobility and economy; • Improving the safety and security of passengers and all road users; • Achieving an integrated and accessible transport system.		
Integrated Urban Development Plan 2021-2027 (Sofia Program)	Strategy	Local	The program sets medium-term goals and priorities for the sustainable and integrated development of the municipality. It identifies priority areas for impact based on an analysis of the territory's strengths, weaknesses, and development potential. Aims to select the most founded and necessary projects for the city. It fully incorporates the SUMP, the GCAP, and the SECAP, including their objectives and measures.		
Complex Program for	Strategy	Local	The program proposes measures	The program is fully consistent	

A-2.1: List of relevant policies, strategies & regulations					
Name & Title	**Type**	**Level**	**Scope**	**Relevance**	**Impact on climate neutrality ambition**
improving the Ambient Air Quality 2021-2026			for the domestic heating domain (replacement of wood and coal with less emitting alternatives), the transport sector (reducing car use by promoting public transport, walking, cycling; replacement with lower emissions vehicles; introduction of a low emission zone; improvement of road surface) as well as measures to reduce re-suspended dust from landfills and other surface sources. Expected reduction of emissions are: - domestic heating – 70% by 2026 - transport – 30% by 2026 - dust from surface sources – 30% by 2026	to the EU Mission climate neutrality ambition by 2030	
Environment Protection Program 2027	Strategy	Local			
Strategy for using the potential of mineral water and ground water heat on the territory of Sofia Municipality	Strategy	Local	• Development of knowledge about territorial hydrothermal resources, research and preparation for research of thermal zones;		

A-2.1: List of relevant policies, strategies & regulations					
Name & Title	**Type**	**Level**	**Scope**	**Relevance**	**Impact on climate neutrality ambition**
			• Starting and developing projects for the creation of hydrothermal centers and establishments of various functional types and categories; • Management and storage of hydrothermal resources, water sources and facilities that have not been utilized for many years. • Increasing the share of renewable energy used for heating of buildings.		
Program for the utilization of hydrothermal resources from mineral water deposits on the territory of Sofia Municipality	Strategy	Local	Aims at the sustainable use of mineral water resources on the territory of Sofia Municipality through long-term protection of the available water resources.		
Waste Management Program 2021-2028	Strategy	Local	The overall long-term goal of the program is to effectively use waste as a resource and reduce its generation. Several strategic objectives will contribute to the achievement of the long-term goal:		

A-2.1: List of relevant policies, strategies & regulations					
Name & Title	**Type**	**Level**	**Scope**	**Relevance**	**Impact on climate neutrality ambition**
			• Reducing the harmful impact of waste by disrupting its formation and, in particular, its reuse; • Increase in recycled and reused waste; • Implementation of waste management, which guarantees a clean and safe environment; • Involvement of the public in waste management.		
Digital Transformation Strategy of Sofia Municipality	Strategy	Local			
ORDINANCE on the establishment of low emissions zones on the territory of Sofia Municipality	Regulation	Local			
National strategic, planning and program documents					
Integrated Energy and Climate Plan of Bulgaria	Strategy	National			

A-2.1: List of relevant policies, strategies & regulations					
Name & Title	**Type**	**Level**	**Scope**	**Relevance**	**Impact on climate neutrality ambition**
Integrated Transport Strategy	Strategy	National			
National Air Pollution Control Program	Policy	National			
National program for improving the quality of the ambient air	Policy	National			
National Digital Transformation Strategy of Bulgaria	Strategy	National			
National strategy for development of scientific research in Bulgaria	Strategy	National			
Road infrastructure development strategy of Bulgaria	Strategy	National			
Long-Term Strategy for the Renovation of the National Building Stock of Residential and Non-Residential Buildings	Strategy	National			

Except for the strategic, planning and program documents managing the environmental and climate policies of Sofia Municipality, a range of national regulatory documents set the requirements in these fields:

- Renewable Energy Sources Act
- Climate Change Limitation Act
- Regional Development Act
- Spatial Planning Act
- Purity of Ambient Air Act
- Descriptive assessment of the current climate-relevant policy context, summarizing the objectives and implementation concepts, addressing e.g., spatial planning, energy, local economy, circular/bio economy, waste, transport, housing, urban greening/nature-based solutions).

A-2.1: Description & assessment of policies – textual element

Sustainable Energy and Climate Action Plan 2021-2030 (SECAP2021-2030).

The SECAP 2021-2030 is the major document in view of climate change mitigation and adaptation. This is an integrated horizontal document including also the Long-term Energy Efficiency Program and Long-term program to promote the use of energy from renewable sources and biofuels. It has been adopted in 2021, with Decision No. 812/16.12.2021 of the Sofia City Council (SCC).

The Sustainable Energy and Climate Action Plan of the Sofia Municipality 2021-2030 (SECAP) has been developed in accordance with the obligations of the Sofia Municipality arising not only from the Global Agreement of Mayors on Climate and Energy, but also from national legislation, being the leading energy and climate strategy document. The SECAP builds on the actions of Sofia Municipality in the field of sustainable energy development and offers a new integrated approach to planning and reporting activities in the field of energy and climate, ***harmonizing the existing policies of the municipality in terms of mitigation and adaptation to climate change, increasing energy efficiency and the use of energy from renewable sources***. It sets the framework for achieving the target of ***reducing greenhouse gas emissions by at least 40,6% by 2030***, while following the EU's guiding principle "Energy Efficiency First".

The SECAP covers a 10-year period of action, from 2021 to 2030 inclusive and the entire territory of the Sofia Municipality. The plan envisages a total of 65 measures to be implemented in the period 2021-2030, of which 29 on mitigation of climate change and 36 on adaptation to climate change. The planned measures enable the municipality to speed up a number of reforms related to the building stock, public lighting systems, transport, the environment and other areas.

7 important documents have been annexed to the SECAP, as follows:

Annex 1: 2018 GHG emissions inventory

Annex 2: SWOT analysis regarding the sectors included in the scope of the baseline inventory

Annex 3: Summary of climate change mitigation measures

Annex 4: Summary of climate change adaptation measures and sample scopes of measures

Annex 5: Summary of measures to the long-term programs to promote the use of energy from renewable sources and biofuels and for energy efficiency

Annex 6: Climate change vulnerability and risk assessment for Sofia municipality, incl. Analysis of the current situation by sector

SECAP provides for the achievement of three major strategic goals:

1. Sofia – a climate neutral city

Turning Sofia into a carbon-neutral city by 2050 by implementing the highest standards in terms of energy efficiency and transforming the energy mix towards the use of energy from RES with an emphasis on shared energy production and consumption at local level.

2. Sofia – a resource-efficient city

Development of Sofia according to the principles of circular economy with an emphasis on the protection of the environment and biodiversity and the creation of comfortable and healthy conditions for the life and professional realization of citizens.

3. Sofia – an adaptive city

Increasing the adaptation capacity of the Sofia Municipality to deal with the negative impacts caused by climate change by developing the regulatory framework and institutional capacity, attracting the attention of the public and business, implementing environmentally friendly solutions for adaptation and increasing the possibilities for prevention and improving preparedness and the response to the occurrence of extreme climatic events.

With a view to achieving the strategic goals thus set, the implementation of a set of measures is envisaged in the sectors of residential buildings, buildings from the tertiary sector, municipal buildings, public transport and mobility, waste, public lighting, and industry and construction.

The SECAP covers both mitigation and adaptation to climate change.

With regard to mitigation, 29 mitigation measures are planned in the SECAP, divided into the following groups:

1. Legal-administrative and management framework for climate policy - measures related to legislative initiative and development of regulatory documents, including internal rules and municipal regulations;
2. Improving the management of climate change mitigation activities - measures related to improving the information base for the implementation of plans, programs and projects;
3. Investment measures to reduce greenhouse gas emissions and/or increase the share of energy use from renewable sources - investment measures to intervene in the physical environment (urban and non-urban);
4. Building a system for broad public involvement in the implementation of the measures - measures related to communication with the interested parties, providing information, engaging the representatives of the individual sectors to implement activities in support of the implementation of the goals of the plan.

The **expected results** of the implementation of the measures are:

- Reduction of greenhouse gas emissions by 40,6% by 2030 compared to 2007 levels;
- Increasing energy efficiency and the use of energy from RES in individual sectors;
- Implementation of a fully functional system for information assurance for the purposes of reporting climate change mitigation measures and future planning;
- Ensuring broad public support in climate change mitigation policies, with the aim of building a positive attitude towards the implemented policies of more than half of the population in the capital.

In terms of adaptation to climate change, the measures are mainly aimed at reducing vulnerability in individual sectors and limiting damage from negative climate events like the Urban Heat Island. A total of 36 measures are foreseen, divided into the following groups:

1. Legal-administrative and management framework for climate policy - measures related to legislative initiative and development of normative documents;
2. Upgrading the institutional, expert and financial capacity and the planning basis for the implementation of the measures - measures related to the creation of structural units, development of planning documents, management of activities;
3. Applied urban research and development activities - measures related to conducting specialized research, cooperation and interactions, implementation of pilot projects;
4. Investments in technical and green infrastructure, buildings and improvements - investment measures for intervention in the physical environment (urban and non-urban);
5. Building a system for broad public involvement in the implementation of measures - measures related to communication with interested parties, providing information, upgrading education programs and developing and conducting thematic training.

Expected results when implementing the measures include:

- Necessary regulatory documents developed, additional dedicated structures created and specialized sector plans developed;
- A dedicated information system developed to provide data for sectoral analyzes related to the impact of climate and for assessment and monitoring of indicators;
- Improved assessments of impact indicators for high climate risks in each sector.

Given the new and constantly changing trends, policies and goals in the field of climate, not only at national, but also at European and global level, the periodic revision and updating of the long-term strategic documents of the Sofia Municipality, including the SECAP, is foreseen. Currently a public procurement is on-going for update and upgrade of the SECAP in view of the new targets and for including the analysis and strategy for tackling the energy poverty.

Green City Action Plan 2020-2030 (GCAP)

The GCAP was adopted by Decision No. 249 of June 25, 2020 of the Metropolitan Municipal Council. The plan was prepared with the support of the European Bank for Reconstruction and Development (EBRD), using the Green Cities Planning Methodology developed by the EBRD, together with expert support from the Organization for Economic Co-operation and Development and the Cities Network for Sustainable Urban development. The document was developed in accordance with international agreements and conventions, such as the Paris Agreement, as well as with the relevant strategic documents at the national, regional and municipal level available at the time of its drafting.
The aspiration of the GCAP is to transform Sofia Municipality into a green, vibrant municipality with a clean environment and sustainable use of natural resources. To achieve this vision, an analysis was carried out based on data collected according to the EBRD methodology, taking into account the specific geographical location of the city and the settlements around it, and the environmental challenges facing the municipality were ranged by priority.
The GCAP sets out three main strategic goals aimed at improving:

- The urban environment and preservation of biological diversity and ecosystems by improving and expanding green spaces, integrating green infrastructure and promoting transit-oriented development of the city.
- Ambient air quality and reducing the carbon footprint by increasing the share of public transport, promoting the use of environmentally friendly vehicles, increasing the energy efficiency of buildings and increasing the share of energy from renewable sources in the heating of buildings.

- The use of natural resources to achieve resilience to climate change by optimizing surface water management and recycling and reducing the amount of landfilled waste.

The objectives are in line with the criterion of excellence in relation to the EBRD methodology and are aligned with the objectives of the European Union. At the same time, each goal is related to the existing national goals and programs and contributes to a significant improvement of the state of the environment.

For the achievement of the goals set forth seventeen short-term key measures are foreseen in the following priority sectors: energy, urban planning, building stock and communities, green-blue infrastructure and transport and mobility.
To deal with the identified challenges in each of the priority sector, the GCAP has developed basic measures to improve the environment and the quality of life in the municipality. The measures are complementary and accompanied by a series of supporting activities.
The GCAP specifies the priority and sequence in the implementation of the measures, includes a financial analysis, a financing mechanism, as well as an assessment of the benefits of their implementation.
Measures in the main sectors include:

- Energy Sector - upgrade of the existing programs for energy efficiency in municipal buildings; renovation of public lighting; use of natural geothermal energy on the territory of Sofia Municipality as an alternative source of heat energy in buildings.
- Urban Planning Sector - transit-oriented transport; restoration of abandoned industrial zones and terrains.
- Building stock and communities Sector - improvement of inter-block residential spaces; construction of micro-parks in densely populated residential districts; energy efficiency of multi-family residential buildings; building centers for repair and reuse of items.
- Blue-green infrastructure - assessment of the risk of expected climate changes and reduction of the danger of floods; surface water management; protection, improvement and expansion of green corridors; optimizing the recycling and management of construction waste.
- Transport & Mobility – promoting cycling and walking; encouraging the use of electric vehicles; modernization of trams; city parking management.

The GCAP provides a complex system for reporting, control and evaluation of the implementation of the measures and the effect of their implementation. The document contains guidelines for engaging key stakeholders and the public.
The monitoring of the implementation of the GCAP is carried out at two levels:

1. Monitoring of the implementation of the GCAP - implemented by a coordination unit specially created for the purpose, which monitors the implementation of the measures by the relevant responsible directorates in the structure of the Sofia Municipality.
2. Impact monitoring - the effect of the implementation of the GCAP is reported annually by the respective responsible directorates.

As a result of this activity, an assessment of the expected and achieved results is carried out and an analysis of the progress achieved in the implementation of the goals set in the GCAP is carried out.
The GCAP is in full consistency with all European and global goals in view of tackling the challenges of the climate change effects. It is not replaced but rather complemented and developed further by the SECAP. It has been taken into consideration in the preparation of the SECAP in order to avoid double counting of measures and their effect.

Sustainable Urban Mobility Plan 2019-2035 (SUMP)

The SUMP is the first integrated mobility planning document of Sofia Municipality in line with sustainable decarburization policies and puts the municipality in a strong position to promote active public transport and implement better management approaches to reduce vehicle traffic and mitigating its negative impact.
The plan is a strategic document designed to meet the mobility needs of people and businesses in the city and its surroundings, for a better quality of life. It responds to new challenges by proposing an integrated vision and policies for all modes of transport and planning a transport system for people that is socially, environmentally and economically sustainable. This is primarily achieved by adopting

a holistic approach to the relationship between urban planning and sustainable mobility. The plan is an important key in the process of creating a well-connected sustainable Sofia city that provides a better quality of life for more residents and visitors. The plan is based on the principles of sustainability and takes into account the best international transport practices and future trends in mobility in view of achieving better sustainability.
The SUMP is prepared in parallel and in coordination with other strategic documents and programs concerning the long-term development of the Sofia Municipality, including:

- "Vision for Sofia" – a comprehensive sustainable urban development strategy for Sofia and its suburban territories with a horizon of 2050;
- "Green Sofia" - an initiative that aims to encourage local authorities in their efforts to reduce the negative impact of the urban environment on the health of residents and to apply high environmental standards in their management;
- "Sofia - a city for people" - a project focused on developing public spaces for pedestrians and cyclists, limiting car traffic and turning Sofia into a city on a human scale.

The objectives of the SUMP are aimed to:

- ✓ reducing traffic and, accordingly, reducing the time spent in traffic and travel;
- ✓ convenient, fast and safe movement,
- ✓ reduction of air pollution and noise pollution, etc.

The GCAP indicates a number of benefits from its implementation, including travel time savings, OPEX savings; improvement of human health, increased physical activity, etc.
The SUMP contains:

- **A Sustainable urban mobility Vision of Sofia 2035**, according to which Sofia will develop sustainable urban mobility by:
  - ✓ Protecting the environment and human health
  - ✓ Focusing on people, not vehicles
  - ✓ Becoming effective and innovative
  - ✓ Becoming safe and secure
  - ✓ Becoming integrated and accessible to all.

The sustainable urban mobility vision of Sofia gives the direction in which the transport system of the city should develop. To achieve the vision, SUMP defines five general goals, each corresponding to one of the elements of the vision:

1. **Green City:** Reducing the negative impact of transport on people's health and the environment;
2. **Attractive city:** Increasing the attractiveness of the urban environment and ensuring a better quality of life;
3. **Smart City:** Introducing transport innovations and strengthening local mobility and economy;
4. **Safe City:** Improving the safety and security of all actors;
5. **Accessible city:** An integrated and accessible transport system for all.

- **A concept for the development of urban mobility**, which covers all the main areas of the capital city transport system - road traffic and street network, parking, logistics, public transport, bicycle and pedestrian traffic.

In support of this sustainable urban mobility concept, the plan includes a series of specific policies and measures to be implemented to achieve the goals.
The main goal of the SUMP is ***to achieve a lasting change in the behavior of travelers*** and ***a transition to sustainable forms of transport***.
It includes two types of measures:

- **Pull measures:** Promotional measures aimed at attracting and stimulating more people to use sustainable forms of transport such as walking, cycling, public transport, shared mobility.
- **Push measures:** Restrictive measures aimed at reducing the number of people using private cars, parking restrictions, limiting certain types of freight transport in certain parts of the city, etc.

In turn, these two types of measures are divided into the following groups:

- ✓ **Regulatory/economic measures** - limiting car traffic and stimulating public transport

- ✓ **Physical/Technical measures** - limiting car traffic and stimulating public transport, improving cycling infrastructure
- ✓ **Planning and urban design** - urban planning limiting car dependence and urban design oriented towards pedestrians and cyclists;
- ✓ **Complementary measures** - increased control and greater public awareness. In turn, these two types of measures can be divided into the following groups:

The SUMP also offers a set of projects and initiatives that will contribute to the fulfillment of the vision and achievement of the goals of the SUMP for turning Sofia into a green, attractive, smart, safe and accessible city. The projects are grouped by specific goals in each direction:

- Pedestrian traffic - improving the conditions, comfort and safety of pedestrian movement by increasing the pedestrian network in the central city part, creating pedestrian connectivity in and between residential districts, city parks and work zones, ensuring pedestrian safety, increasing the quality of the urban environment, promotion of pedestrian traffic.
- Bicycle traffic – together with pedestrian traffic, it is ecological, healthy and contributes to the vitality of the city. The development of bicycle traffic is largely determined by providing a network of comfortable, safe and interconnected routes in a network that will allow comfortable and safe bicycle movement throughout the city.
- Public transport and intermodality – this includes the expansion of the metro, development of the ground transport system and reduction of travel time, increase in comfort and quality of travel by public transport; introduction of integrated travel billing, etc.
- Parking - since it is a problem not only in the central city, the main specific goals in this direction are to stimulate parking in underground and multi-story parking lots, as well as the expansion of the system of buffer parking around metro stations and the central city; improving parking management and regulation; implementing a flexible pricing policy for parking regulation.
- Electromobility - in the short term, the efforts of Sofia Municipality should be aimed at expanding the charging infrastructure in public municipal property and placing fast charging stations, as well as promoting and stimulating the entry and use of electric vehicles;
- Urban logistics - its improvement can be achieved through quality planning, provision of appropriate infrastructure, good administrative regulation, etc.
- Intelligent Transport Systems (ITS) - in the short term, Sofia Municipality should implement a wide range of ITS systems and create an institutional and operational model to achieve a greater degree of integration of data, systems and service. In this way, the city will achieve a complete and unified management in terms of transport and will allow the implementation of the planned projects in the long term.

In order to achieve a more accurate traceability of the effects of the implementation of the selected measures, specific measurable indicators have been defined to be monitored over time, like:

- **Output indicators** - determine what the final result of the implementation of a specific project activity is. They are measured by physical units of measurement (for example: number of new vehicles serving public transport, km of built/rehabilitated tram network).
- **Result indicators** - related to the direct immediate effect (physical or financial) in favor of the population as a result of the implementation of a given project. For example, if the specific objective is to develop the surface transport system and reduce travel time, a performance indicator is "length of tram network built" and an outcome indicator is "population served by the newly built tram network".
- **Impact indicators** – refer to the consequences of project implementation beyond immediate effects/results. Two types of impact are distinguished: specific impact - these are effects that occur after a certain period of time, which are directly related to the action taken and the directly affected population, and global impact - takes into account the long-term effects affecting a wide range of the population.

Environmental Protection Program until 2027 (EPP)

The EPP of the Sofia Municipality until 2027 was adopted by the SCC on 21.07.2022. The document sets out the main goals and tasks of the administration to protect and improve the state of the

environment. The program was developed in accordance with the current strategic and planning documents at the national and regional level in the field of environmental protection, following the main goals and policies of the European Union in this area.
The general objective of this Program is to increase the quality of life of the residents of the municipality and minimize the risk to human health by continuously improving the status of the individual components and factors of the environment. To achieve it, the following specific strategic goals have been formulated:

- **Improving ambient air quality** by implementing key measures, such as reducing emissions generated by domestic heating; reducing the contribution of public road transport to general air pollution; restricting the movement of motor vehicles that pollute more (diesel cars from categories before Euro and Euro 1) ; inventory of pollution sources; reducing the contribution to atmospheric air pollution from construction and repairs, as well as secondary suspended dust particles from automobile traffic on polluted infrastructure and unorganized emissions from adjacent and roadside territories; increasing the awareness and commitment of the population.
- **Maintaining the good condition of surface and underground waters** and optimizing the quality of services in the field of water management, including using the potential of mineral waters on the territory of the municipality by implementing measures aimed at maintaining/improving the quality of surface and underground waters; completion of the sewerage system of the Metropolitan Municipality; reconstruction of the sewage system in the central part of the city and in other territories; suspension of construction in riverbeds; modernization of the water supply system in order to reduce drinking water losses; arranging the quarry lakes as sites for the protection of biological diversity, recreation and rest; improving the technical condition and ensuring the functioning of irrigation canals on the territory of the municipality; taking steps to grant the Capital Municipality the ownership of the routes of hydromelioration facilities with abandoned purpose for the construction of infrastructure objects; inventory, introduction of a system for monitoring and utilization of the balneological and geothermal potential of mineral waters and others.
- **Increasing resource efficiency** by applying measures according to the waste management hierarchy - prevention, preparation for reuse, recycling, recovery of materials and energy and, to a minimum, environmentally friendly disposal by landfilling using key measures affecting the field of waste management; measures for preparation for reuse and recycling of construction, large-sized, household, textile waste, waste from industrial production and waste from electrical and electronic equipment, bio-waste , and others; measures related to conducting explanatory campaigns to the public in general or to specific groups of the population, for example adolescents, businesses, certain consumers and others.
- **Increasing the effectiveness in protecting biological diversity** on the territory of the Metropolitan Municipality by implementing key measures aimed at improving the management of protected areas, localities and natural attractions; study of biodiversity on the territory of the municipality, outside the protected territories and zones; restoration of areas as habitats for species, including forest habitats and wetland-type habitats and others; improving the conditions in the zoo in the city of Sofia and working together with non-governmental organizations for the protection of wild animals; conducting information campaigns to increase public engagement and initiative.
- **Preventing the negative impact of harmful physical factors** - noise, ionizing and non-ionizing radiation by implementing key measures aimed at updating the Strategic Noise Map of the Sofia agglomeration and the corresponding Action Plan, determining the new priority sources of noise and areas; implementation of noise protection measures when designing objects with public purpose, acoustic survey and research of areas for future development; inspecting construction sites with regard to noise from machines and equipment working outdoors and compliance with day and night noise standards; improvement of the recreational functions of the parks for wide public use, planning of noise reduction zones on the outskirts of the parks; control and monitoring of electromagnetic field values, ensuring security in case of radiation accidents.
- **Improving the management and increasing the area of the green system** on the territory of the municipality by implementing key measures concerning the condition and aesthetic

value of the vegetation in the parks and intra-neighbourhood spaces; identification, mapping and valuation of ecosystem services; maintenance of existing and provision of new green areas; construction of new parks for public use, priority improvement and greening of the outer districts.

- **Limiting and preventing the risks** faced by the Metropolitan Municipality, as a result of the changes in the climate and adaptation to them through the implementation of specific measures, such as the implementation of the strategic documents of the Metropolitan Municipality in this area; systematization of the available information and construction of a database and system for monitoring the main parameters related to the risks of climate change - floods, overheating, drought; updating/developing disaster and accident prevention plans; developing a model to identify areas that would be most affected by climate change and take preventive actions and others.
- **Reducing the population of stray dogs** on the territory of the Metropolitan Municipality by implementing key measures, such as creating a municipal program for the implementation of the National Program for Controlling the Population of Stray Dogs; preparation and implementation of educational programs and information campaigns; construction of areas for free walking of domestic dogs; strengthening the control over the fulfillment of the obligations of the owners of pet-companion animals.

The Environmental Protection Program provides for a system for monitoring, reporting and control of its implementation. With the help of the program monitoring and control, the correct implementation of the strategic goals and the measures provided for them is monitored. The activity is carried out by the relevant specialized structure in the Sofia Municipality. The control over the implementation of the Program is carried out by the Sofia City Council on the basis of annual reports provided by the mayor of the Sofia Municipality.

Waste Management Program 2021 – 2028 (WMP)

The Waste Management Program of Sofia Municipality for the period 2021-2028 was developed in accordance with the structure, goals and predictions of the National Waste Management Plan 2021-2028 and is an integral part of the Environmental Protection Program.
The main purpose of the WMP is to provide a practical tool for Sofia Municipality for planning at the earliest stage of the necessary resources, measures and actions for waste management for the population and business, including improving waste management system in compliance with the pan-European waste management policy.
The municipal program is an open document that can be supplemented and updated periodically in the event of changes in the context and/or regulatory conditions, in the event of changes to the goals and priorities of the national and/or European legislation, which enables timely and adequate actions to be taken in the implementation of the policy related to waste management.
The structure and objectives of the program have been developed in accordance with the Methodological guidelines for the development of regional/municipal programs for waste management, as well as the applicable municipal regulations at the local level.
The main task of the Program is to contribute to the sustainable development of the Municipality of Sofia, through the implementation of an integrated waste management system, which will lead to:

- ✓ a reduction of environmental impacts caused by generated waste,
- ✓ an increase in the share of separately collected waste, as well as
- ✓ stimulating investments to improve waste management.

The program was prepared on the basis of available data on waste in the municipality, results of conducted studies on waste management systems, as well as on the grounds of the analysis of the possibilities for financing activities related to waste.
The program includes expert proposals and forecasts for the period 2021-2028 for the development of waste management infrastructure and practices, including:

- ✓ demographic forecast;
- ✓ forecast for generated waste;
- ✓ an estimate of the types of waste that can be prevented;
- ✓ forecast of the types of waste that can undergo preparation for reuse.

The main objective of the program is the population and the to improve the implementation of the waste management hierarchy in all processes and levels.
The strategic goals set in the program are:

- ✓ Reducing the harmful impact of waste by preventing its formation and promoting its reuse;
- ✓ Increasing the amount of recycled and recovered waste;
- ✓ Reduction of the quantities and the risk of landfilled household waste.

The municipal waste management program of Sofia Municipality contains programs and sub-programs with specific measures addressed to each one of them, including:

- ✓ Waste prevention program, including a food waste prevention sub-program;
- ✓ Program to reach the goals for preparing for reuse and for recycling of household waste;
- ✓ Program for achieving the goals for recycling and recovery of construction waste and building demolition waste;
- ✓ Program for achieving the goals for recycling and utilization of MRO, incl. packaging and packaging waste management subprogram;
- ✓ Program to reduce the quantities and the risk of landfilled household waste.

The sub-programs represent a specific plan of action where some of the measures have horizontal character, that is, they contribute to the achievement not only of the objectives of the specific program, but also to the achievement of the objectives of other programs and sub-program. Some of the measures are soft measures including a diverse palette of activities like trainings, information and awareness raising campaigns, development and implementation of information systems, etc.
The program also includes the necessary measures to fulfil the duties of the mayor of the municipality in compliance with effective legislation. The relevant administrative, technical and financial measures have been implemented to ensure the practical implementation of the Program and exercise control and monitoring activities of its practical implementation.
The monitoring and evaluation of the implementation of the Waste Management Program of the Sofia Municipality is of a key importance for tracking progress in achieving the set goals, deadlines and resources and taking timely actions to overcome emerging problems during the implementation of the actions, and if necessary - undertaking actions for improvement of the program . The monitoring is carried out through periodic collection of information related to the implementation of the measures included in the Program and the degree of achievement of the indicators, as well as analysis of the collected information, problems encountered during implementation and their causes. In addition, compliance with the planned schedule and the degree of resource utilization are also monitored for each measure. The activities of implementation of municipal plans and strategies in the field of environment and waste management are carried out by a unit appointed by the Mayor of Sofia Municipality.
The authority for control over the implementation of the Waste Management Program is the Sofia City Council. The mayor of the municipality annually informs the municipal council and the public about the implementation of the program for the previous calendar year. For this purpose, he prepares a report on the implementation of the Waste Management Program. The purpose of the report on the implementation of the Program during the previous calendar year is to track the progress of the actions and to identify the necessary amendments or its adaptation for the current year.
The WMP fully comply with the principles of Circular Economy founded in the European policy documents and is conformable to the objectives and targets of the Mission Cities.

Integrated Ambient Air Quality Improvement Program of the Sofia Municipality for the period 2021-2026 (IAAQIP)

Improving the quality of ambient air (AQ) and reaching and maintaining the national and European environmental standards for air cleanliness is among the most important priorities of the Sofia Municipality and aims to improve the quality of life of citizens and the state of the environment. In this regard, the municipality has adopted and is implementing an **Integrated Ambient Air Quality Improvement Program of the Sofia Municipality for the period 2021-2026**.
The requirements and competences of the local authorities, regulated in the Clean Air Act and the regulations adopted on its basis, have been taken into account when developing the Program for Air Pollution Control. A large volume of information has been collected, systematized and analyzed:

reports, documents, information arrays with data and good practices in the field under consideration have been studied. The current program is in line with the National Program for Improving Air Quality (2018-2024) and the National Program for Air Pollution Control (2020-2030), adopted by the Council of Ministers in 2019.

IAAQIP contains general information about the area - geographical, administrative, etc. It takes into account the population exposed to pollution, as well as the influence of socio-economic and natural-geographical characteristics. Also the urbanization of the Sofia Municipality and the impact on the quality of the ambient air.

The actions included in the **IAAQIP** are aimed at reducing the levels of pollutants for which excessive pollution has been established like PM10, PM2.5 and polycyclic aromatic hydrocarbons (PAH) and reaching the established thresholds for these indicators as both the monitoring points of ambient air quality and the areas with excessive pollution established during modeling.

The program contains various measures divided into the following groups:

1. **Technical measures**

The main types of measures of this program are addressing the following sectors:

- domestic heating;
- transport & mobility;
- construction;
- industry;
- emissions from re-suspension of particles from surface sources.

Measures in the domestic heating sector (replacing wood and coal stoves with environmentally friendly alternatives, fitting filters to wood and coal heated homes, using dry wood for heating by households) are a strategic priority for the city due to their predominant contribution to air pollution and ability to reduce harmful emissions. With these measures, as far as possible, the fastest step-by-step reduction of emissions of PM10, PM2.5 and PAH can be achieved.

The main measures included, in combination with the additional and long-term actions are expected to lead to an estimated reduction in domestic heating emissions as follows:

- 20% reduction in emissions compared to the base year by 2022;
- 40% reduction in emissions compared to the base year by 2024;
- 70% reduction in emissions compared to the base year by 2026.

These targets are in full compliance with the strategic goals of the city and also contribute to the achievement of commitments made to the Mission.

Measures to reduce emissions in resuspension of particles from surface sources

Surface sources (eg, landfills, "mud patches", streets and sidewalks, etc.) are the second most important source contributors to concentrations of PM10 and PM2.5, mostly through wind resuspension and secondary entrainment from motor vehicles. At the same time, these sources are of particular importance for the quality of the environment at the local (neighborhood) level and must be taken into account. A priority among this group of measures is the implementation in all 24 districts of the Sofia Municipality of the measures to remove the "mud spots" in inter-block and other open public spaces, the control to prevent parking in green areas (which is prohibited and turns green areas into "mud spots"), etc.

Measures in the motor transport sector

The main measures included, in combination with additional and long-term actions, are expected to lead to an estimated reduction in emissions from vehicles as follows:

- 10% reduction in vehicle emissions compared to the base year by 2022;
- 20% reduction in vehicle emissions compared to the base year by 2024;
- 30% reduction in vehicle emissions compared to the base year by 2026.

The emission reduction is expected to be achieved as a result of three main groups of measures:

- ✓ Reduction of the average annual mileage and the forced stay of motor vehicles on the streets of Sofia - includes development, optimization, greening, integration and increasing the attractiveness of public urban transport. Through this measure, an

increase in public transport trips is expected at the expense of car trips and a reduction in traffic;
- ✓ Increasing the ecological class of the motor vehicle and the compliance of its emissions;
- ✓ Improving the condition of the road surface.

Measures in the industry sector
The measures in this sector are aimed at industrial and energy facilities, which are a source of emissions of PM - 1% of the total emissions of PM10 and 2% of PM2.5, but are the source of about 15% of N_2O emissions.
The role of the Sofia Municipality to influence this sector is limited, as the industrial sector is controlled by the Regional Inspectorate of Environment and Water. The Sofia Municipality will continue to implement control of the technological process in the municipal enterprises and commercial companies that operate the sites, sources of emissions in the ambient air, such as municipal installations and waste dumps and sites of the municipal heating system.

Measures in the construction and repair sector
Construction and repair activities in construction are a source of emissions of FPC10, and the relative share in the total emissions of this pollutant is insignificant - 1%. Construction sites, however, can be a serious source of local dusting in the neighborhoods and deterioration of the aesthetic elements of the neighborhood urban environment, especially in case of non-compliance with the requirements of the municipal ordinance to prevent pollution and dusting from the sector.

Information measures
These measures are aimed at improving and increasing people's knowledge and awareness of the quality of ambient air and the harm of polluted air on human health and the consequences for the environment, as well as campaigns on the important role and possible ways citizens with their daily behavior and habits to contribute to cleaner air in the municipality.

Control measures - implementation of control over emission sources.

Organizational measures, such as design and development of municipal information systems, registers, etc. to inform the process of tracking trends in the field under consideration, creating and improving cooperation with other organizations, etc.

The timeline for applying the measures is:
- short-term plan – 2021-2022
- medium-term plan – 2023-2024
- long-term plan – 2025-2026

The main strategic goal of the program is to reach the European standards for ambient air quality as an important factor in ensuring a healthy environment for the population.
A strategic priority for reaching the goals of the program are measures in the domestic heating sector. To achieve the goal of the program, a detailed **Action Plan** has been developed. The purpose of the Action Plan is to facilitate the process of monitoring the progress, control and reporting on the implementation of the program. It has been developed according to sub-programs, which specify and address the measures identified as the most suitable for reaching the AQ, corresponding to the regulatory requirements.

The action plan includes the list of the measures and the deadlines for their achievement; the estimated funds needed to secure the measures and the possible sources of funding; the organizations and structures of the Sofia Municipality, which are leading and supporting units of the Sofia Municipality for the implementation of the measures.

The Municipality of Sofia monitors and evaluates the implementation of the Program in order to track the progress of the implementation of the measures and take appropriate actions in a timely manner in case of identified bottlenecks.

The monitoring and reporting on the implementation of the IAAQP is carried out through annual collection of information on the degree of achievement of the indicators of progress/implementation of the measures of the Action Plan, as well as analysis and identification of problems arising during the implementation and their causes. The report also contains summary information and analysis on the quality of the ambient air for the last year and the trends for the last three years based on the data from the monitoring of the AQ. In addition, for each measure, compliance with the planned schedule is monitored and the extent of resource consumption is reported.

The coordination for tracking progress and for preparing the annual reports on the implementation of the program to the SCC is carried out by the Climate, Energy and Ambient Air Directorate.

The program will be updated in case of changes in the legislation that require significant amendments in the program and in the planned measures to achieve its goals. The program can also be updated if changes/additional measures are necessary due to a significant delay in the implementation and achievement of the target indicators, as well as in other unforeseen circumstances.

Vision for Sofia. Long-term strategy for sustainable development of Sofia and the suburban areas until 2050.

The Vision for Sofia is an initiative of the Sofia Municipality to create a shared and long-term strategy for the development of the city of Sofia and the suburban territories until 2050. The idea for its creation started in 2016 in the discussions led by the informal Laboratory for Urban Development, which brings together architects, urban planners and experts from various sectors to discuss the necessary changes and reforms in Sofia's town planning and planning. During these meetings, it became clear the need for a long-term strategy for the development of the municipality, which would serve for the informed and responsible amendment of the General Development Plan of Sofia.
The strategy paper was developed by a multi-disciplinary team of specialists who have different backgrounds from the business, the non-governmental sector and academia in the fields of the urban environment, transport, environment, economy and governance, identity, culture and people.
The purpose of the document is to create a platform for an informed conversation about the future of the city, which includes at the beginning of the decision-making process all citizens and the organizations that determine the development of the capital (municipal authorities, non-governmental sector, investors, entrepreneurs, researchers, experts).
The strategic document Vision for Sofia contains several main elements:

- ✓ Five priorities, which unite the most significant and important goals in the long-term development of the city of Sofia and the suburban territories;
- ✓ 24 long-term strategic goals that work for the implementation of the five priorities and are related to the long-term development of the municipality in the seven directions of the Vision: Urban Environment, Environment, Transport, Economy, Identity and Culture, Management and People;
- ✓ 230 key steps towards achieving the long-term goals, spread over time from 2020 to 2050;
- ✓ 385 specific measures to achieve the goals and steps;
- ✓ Indicators with which to regularly measure and report progress on taking steps and achieving long-term goals.

The strategic goals laid down in the Vision for Sofia are the following:

- ✓ Multi-functional city;
- ✓ Quality urban environment;
- ✓ Compact and concentrated city;
- ✓ Sustainable and innovative tourism;
- ✓ A highly productive economy;
- ✓ Innovation Center;
- ✓ Circular economy;
- ✓ Rapprochement and community;
- ✓ Future-oriented education;
- ✓ Healthy life and healthy people;
- ✓ Sustainable resource and energy balance;

- ✓ Clean environment;
- ✓ Adaptive City;
- ✓ Living environment;
- ✓ Developed cultural center;
- ✓ Positive image;
- ✓ An authentic and multi-layered city;
- ✓ Active movement;
- ✓ Global and regional connectivity;
- ✓ Popular mass transport;
- ✓ Mobility as a service;
- ✓ Decentralized and democratized governance;
- ✓ The municipality is a strategist;
- ✓ Automated administrative process.

Many of the proposed 385 concrete measures help to achieve more steps and goals. This is an example of the good communication and cooperation of the Sofia Municipality and various stakeholders for co-creation of a common vision for the sustainable development of the city.

A very important document for the climate-neutrality of Sofia city is the one introducing the **Low Emission Zones** for transport and heating.

Ordinance on the introduction of low emission zones on the territory of Sofia Municipality

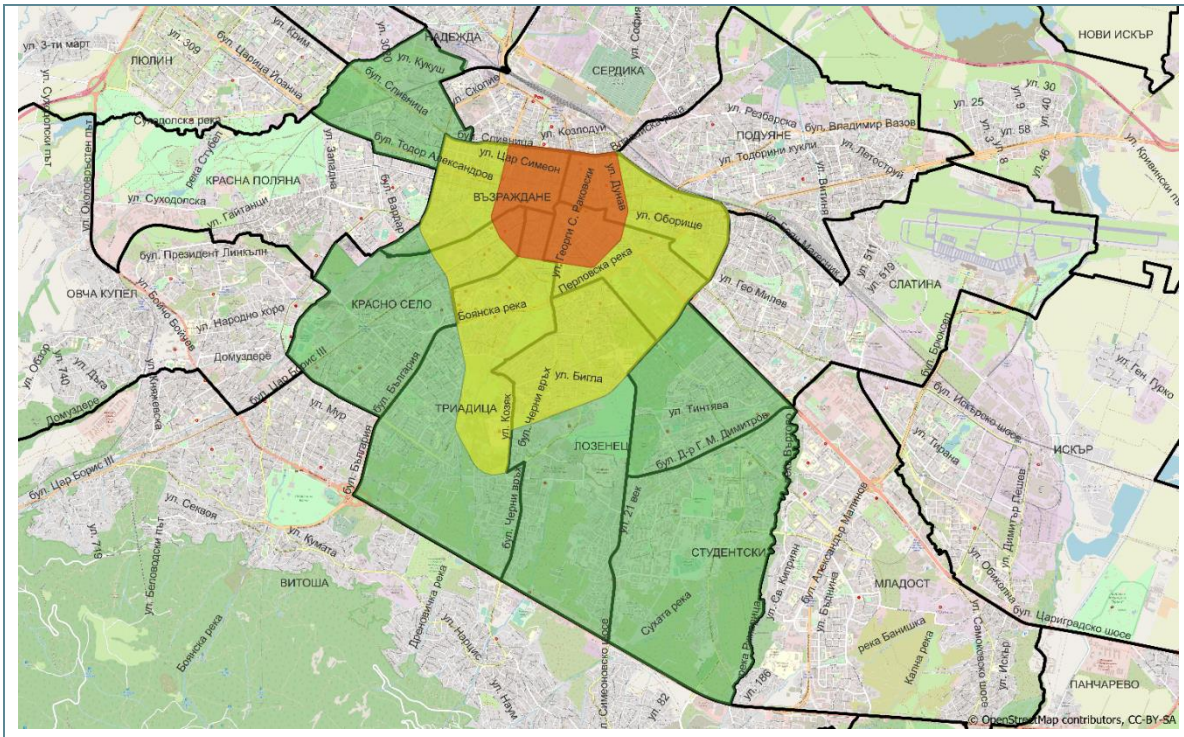
The Ordinance was adopted by the Metropolitan Municipal Council on 15.12.2022, it is in force as of 01.12.2023.

The purpose of adopting the ordinance is to reduce the sources of air pollution and harmful emissions and to improve the air quality and human health. It regulates the rules and conditions for the introduction of low emission zones on the territory of the Municipality and also introducing restrictions and prohibitions on the movement of motor vehicles of certain eco groups for a certain period of time, within the zones. It also regulates the introduction of restrictions and prohibitions on the use of solid fuels for domestic heating in a part of and subsequently in the entire territory of Sofia Municipality.

The legal act establishes two low-emission zones in the central part of Sofia, in which, for a certain period of time, a ban on the movement and passage of motor vehicles of categories M 1 and N 1 with low ecological groups (from the first to the third ecological group) is gradually introduced.

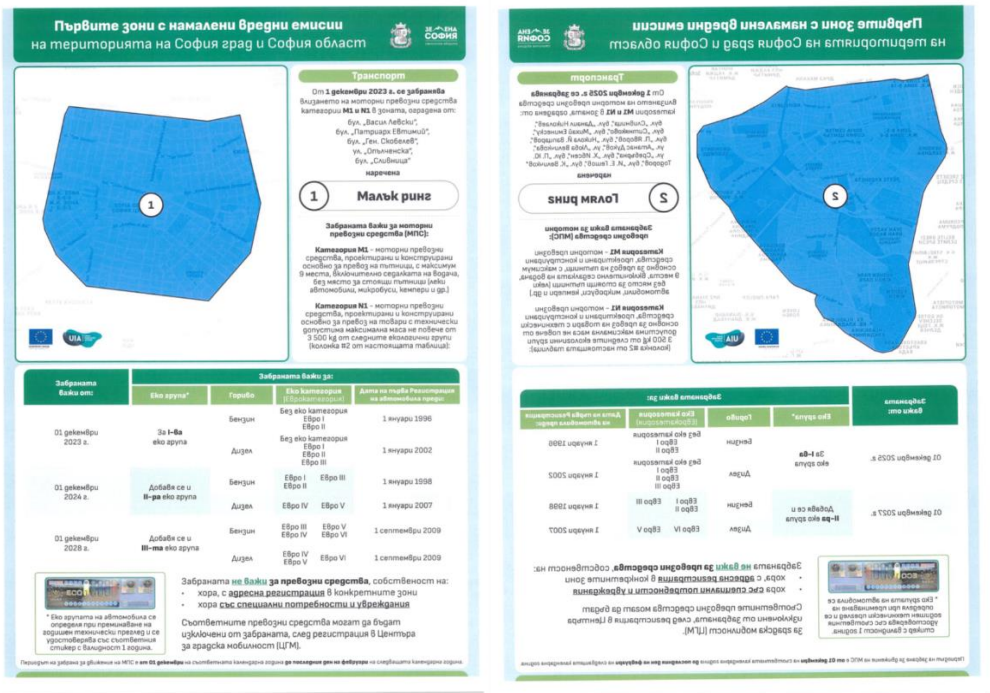
The restriction covers the period from December 1 of the relevant calendar year to the last day of February of the following calendar year, in which period the most serious exceedances of the norms of harmful substances and air polluter are registered.

The two zones are tentatively designated as "The Small Ring" and "The Big Ring" and cover the ideal and wider center of the city of Sofia, respectively.



Low-emission zones for **transport** and **domestic heating** in the territory of Sofia Municipality

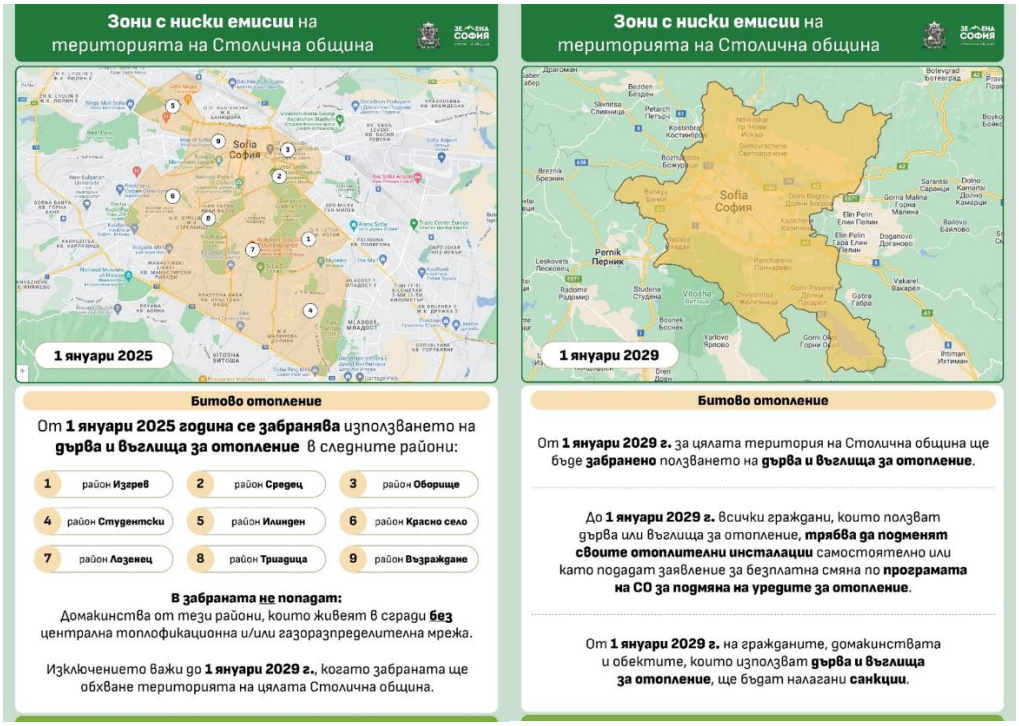
The two rings for transport sector are shown in the below figure.



The Ordinance does not apply to motor vehicles with a special traffic regime and those intended for public transport of passengers as well as the vehicles of the real estate owner in within the zones, and the people with disabilities.

The regulatory act introduces a gradual ban on the use of solid fuel for domestic heating in the territory of the Sofia Municipality starting as of 01.01.2025 in buildings located in areas where there is a built

and functioning central district heating and/or gas distribution network. As of 01.01.2029, the ban covers the entire territory of Sofia Municipality.
The scope of local heating with solid fuel ban is shown below.



The impact of the ordinance for the climate-neutrality will be more or less an indirect one and will occur as a result of the changed behavior of the citizens for using public transport in the central part of the city, but also gradually start using public transport more than their private cars.

The above described documents are the major strategic and legal documents incorporating policies related to climate and environment. Sofia Municipality has a long list of strategic documents in various sectors of economic and social life and all of them are in full consistency with the European policies and goals.
All major strategic documents of the municipality are in perfect synergy to make Sofia a green, resilient, circular, climate-neutral and smart city.

With all strategic goals and policies and measures provided in the existing strategic documents Sofia has a good ground to commit to achieving **at least 81% reduction of the GHG emissions** as per baseline inventory. The existing strategic documents has provided for various measures in the major domains identified by the Mission which measures will achieve nearly a 41% reduction of the harmful emissions. So, the remaining gap to be addressed by implementing the measures included in the portfolios of this CCC document is about 40%. The rest share to completed neutrality

For the present action plan, the baseline taken as reference is the business-as-usual (BAU) at 2030, the worst scenario, while the emission reduction target is the total impact of the strategic pathways re-targeted with the support of the stakeholders.

The emissions gap calculated as per the BAU scenario via the Economic Model is presented in the below table.

A-2.2: Emissions gap analysis											
Sector	**Baseline emissions**	**Emissions Reduction Target 2030**		**Emission reduction through other Action Plans**		**Emissions Gap**		**Emissions reduction through the CCC Action Plan to address the Gap**		**Residual emissions**	
	(absolute) KtCO2eq	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)
Buildings	547	328	60%	230	42%	98	18%	98	18%	219	40%
Transport	873	849	97%	434	50%	415	48%	415	48%	24	3%
Electricity	2348	1996	85%	958	41%	1038	44%	1038	44%	352	15%
Waste	127	8	6%	2	1%	6	5%	6	5%	119	94%
Other (inlc. IPPU&AFOLU)	453	362	80%	161	36%	201	44%	201	44%	91	20%
Total	4349	3543	81%	1765	41%	1758	40%	1758	40%	806	19%

The estimated residual emissions amount to 19%. Currently, these estimations are based on the possible actions that could be implemented in the major domains. However, next iterations may provide for different conditions and this may lead to reduction of the residual emissions. Moreover, Sofia Municipality has a steadfast strategy for development and improvement of green areas and green infrastructure within the city. Currently about 52% of the territory of the city is green and the expanding of green carbon sinks may in a long-term perspective, up to 2050, be able to offset a considerable amount of the residual emission.

2.3 Module A-3 Systemic Barriers and Opportunities to 2030 Climate Neutrality

A-3.1: Description of urban systems, systemic barriers, and opportunities

2.3.1 Description of Urban Systems, Systemic Barriers, and Opportunities for Sofia

The city of Sofia, the capital of Bulgaria, has committed to achieving climate neutrality by 2030 as part of the European Union's initiative to make 100 cities climate-neutral and smart. This initiative, supported by the Horizon Europe program, emphasizes innovation and collaboration to reach ambitious emission reduction targets. This commitment aligns perfectly with the strategies and policies of the city of Sofia.

2.3.1.1 Relevant Systems and Key Stakeholders

To achieve its climate neutrality goal, Sofia must examine and manage various interconnected systems:

Technological and Infrastructural: Sofia invests in green public transport infrastructure, such as trams and electric buses, and develops charging networks for electric vehicles. The city also modernizes its waste management systems and promotes energy efficiency in buildings through smart technologies. Currently, Sofia is working to improve its electric vehicle charging infrastructure and develop cleaner and more efficient public transport solutions, including the development of new metro lines. For example, Sofia has recently launched several pilot projects for installing electric vehicle charging stations in strategic areas of the city, aiming to encourage the adoption of electric vehicles among its citizens.

Institutional and Regulatory: Sofia is establishing robust legislative frameworks to support emission reductions, including regulations on building standards and policies promoting sustainable mobility. Collaboration with national and European authorities is essential to ensure policy coherence. The municipal government of Sofia works closely with the Ministry of Environment and Water to harmonize local regulations with European climate and energy directives.

Organizational: Coordination between different municipal agencies, public-private partnerships, and the involvement of academic institutions and NGOs is crucial. For instance, partnerships with universities for research on sustainable technologies can accelerate innovation. Effective and inclusive governance mobilizes all stakeholders and ensures coherent and integrated implementation of climate initiatives. Sofia has established a climate coordination committee comprising representatives from municipal agencies, local universities, and civil society organizations to oversee the implementation of climate policies and ensure the participation of all stakeholders.

Financial: Sofia will benefit from diversified financing mechanisms, including EU grants, green loans, and private investments. Access to additional funds through the Horizon Europe program will help finance pilot projects and innovative demonstrations. Financing mechanisms must be diversified and innovative to support green projects. Investments in sustainable infrastructure, subsidies, and green loans are essential to catalyze the energy transition.

Political and Social: Political commitment is vital to integrate climate goals into urban planning. Additionally, raising awareness and educating citizens, along with their active participation in local initiatives, will strengthen community support for climate policies. Strong political commitment to sustainability and the integration of climate goals into urban development plans are necessary to drive significant changes. Citizen participation is equally important: initiatives to raise awareness and educate citizens, as well as their active involvement in planning and implementing climate policies, create a

dynamic of support and adherence essential to the success of projects. Sofia has launched several awareness campaigns to educate residents on the benefits of emission reduction and encourage them to adopt sustainable practices in their daily lives.

The key stakeholders has been identified and mapped as follows:

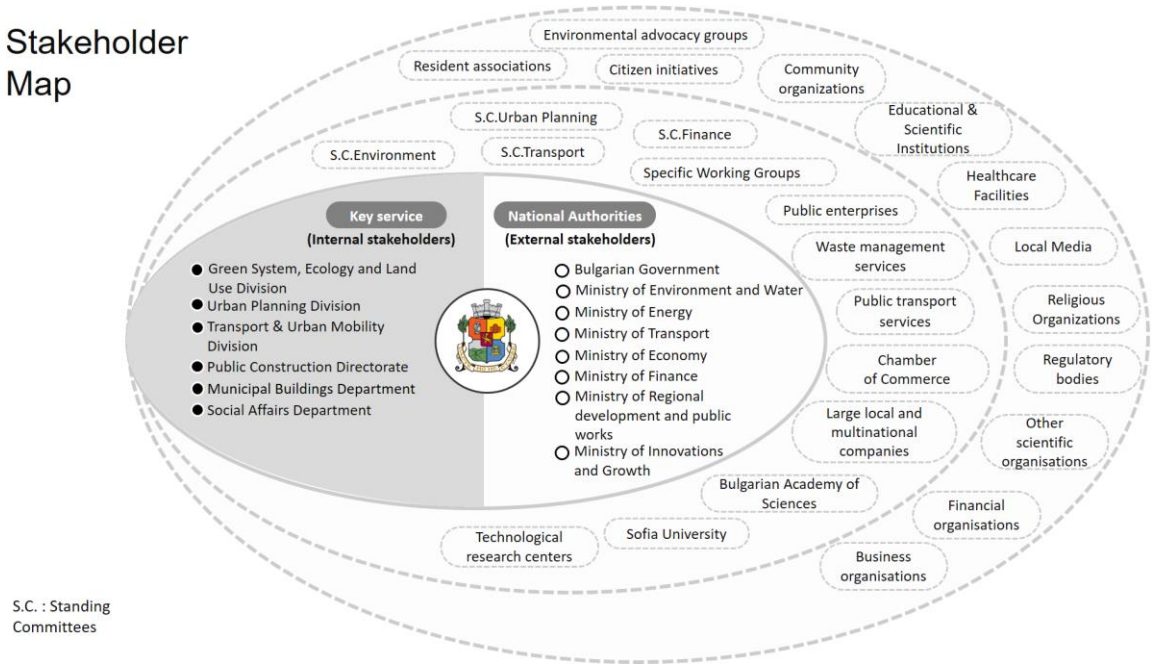


Figure 14 Stakeholder Map of Sofia Municipality

An in-depth analysis of the stakeholders' impact and influence as well as risks related to them has been prepared, identifying the most influential stakeholders being the national government through he Ministry of Environment and Waters and the local government, and the large business companies, especially the multinational ones.

The impact and influence of the stakeholders is summaries in the below chart.

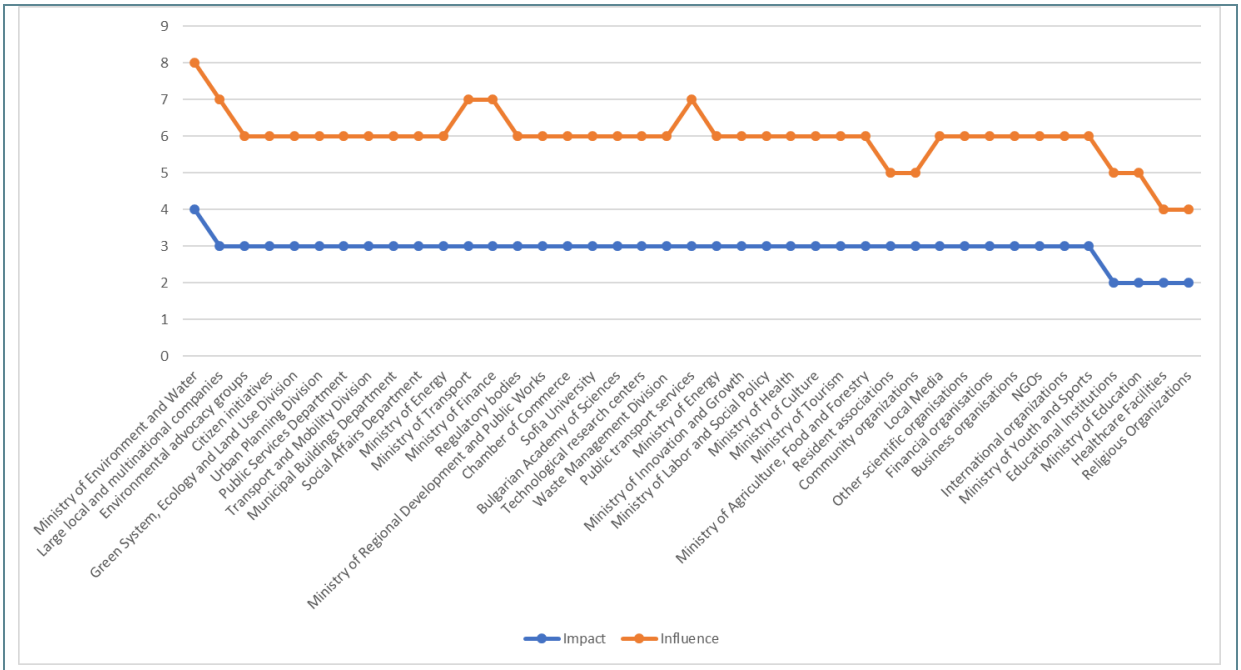


Figure 15 Analysis of the impact and influence of the Stakeholders in Sofia Municipality

The transformation of Sofia into a carbon-neutral capital by 2030 relies on the active involvement and collaboration of all stakeholders. Each plays a crucial role in this ambitious project, bringing unique perspectives and essential resources to ensure the success of this transition.

The **key structures of the city of Sofia** are at the heart of this transformation, responsible for creating and implementing environmental policies, sustainable urban planning, public service management, and the renovation of municipal buildings. Their role is to plan, regulate, and oversee local initiatives, ensuring that the city's infrastructure supports the carbon reduction goals.

National authorities, such as the Bulgarian government and relevant ministries, play a crucial supporting role by providing necessary funding, establishing favorable regulations, and coordinating national initiatives with local efforts. This intergovernmental collaboration ensures a harmonized approach and strengthens the impact of climate actions at all levels.

Municipal organizations, including public enterprises and municipal management services, are essential for executing waste management, water supply, and public transport programs. Their participation ensures that the city's basic services operate sustainably and contribute to reducing greenhouse gas emissions.

The private sector, comprising businesses, trade unions, and business clubs, is a driver of innovation and investment in green technologies. By adopting sustainable business practices and collaborating with the municipality, these actors can develop and deploy environmentally friendly solutions, thus stimulating the local economy while contributing to carbon neutrality.

Academic and research institutions provide the scientific knowledge and technological innovations needed to tackle climate challenges. Their research and development are crucial for identifying new solutions, improving existing technologies, and training the next generation of climate leaders.

Finally, **citizens and NGOs** play a fundamental role in ensuring strong community support and raising awareness about climate issues. Their active participation through citizen initiatives, environmental advocacy groups, and community projects is essential for establishing sustainable behaviours and strengthening society's resilience to climate change.

In summary, the success of Sofia's climate neutrality project depends on **a holistic and inclusive approach,** where each stakeholder contributes significantly. Their collaboration and commitment create a robust and resilient ecosystem, capable of leading the capital towards a sustainable and prosperous future.

I. Roles of key stakeholders

Key structures of the city of Sofia: As planners and regulators, they are responsible for creating policies and infrastructures that promote the reduction of carbon emissions. Their role includes implementing large-scale municipal projects, overseeing the energy renovation of public buildings, and managing urban transport to make it more ecological.

National authorities: Support and coordination with the central government and relevant ministries are crucial for securing funding, favorable legislation, and national initiatives that complement and strengthen local efforts.

Municipal organizations: Public enterprises and municipal management services play a key role in executing waste management, water management, and public transport programs in alignment with the city's sustainability goals.

Private sector: Businesses and business unions can drive innovation and invest in green technologies, adopt sustainable business practices, and collaborate with the municipality to develop environmentally friendly solutions.

Academic and research institutions: They provide the necessary research and development for innovative technologies and scientific solutions. They can also play a role in raising awareness and educating the next generation of climate leaders.

Citizens and NGOs: The active participation of citizens and NGOs is essential to ensure strong community support, raise awareness about climate issues, and encourage sustainable behaviours at both individual and collective levels.

II. Stakeholder involvement

The stakeholders involved in Sofia's Climate Neutrality Action Plan 2030 include a variety of organizations and entities. The main actors and their respective roles are:

1) **Internal stakeholders of the city of Sofia:**
   a. **Key services of the city of Sofia:**
      - **Environmental department:** Responsible for planning and implementing environmental policies.
      - **Urban planning department:** Management of urban planning and renovation projects.
      - **Public services department:** Supervision of waste management and water supply services.
      - **Transport department:** Development and management of sustainable transport infrastructure.
      - **Municipal buildings department:** Maintenance and renovation of city-owned buildings.
      - **Social affairs department:** Support programs for vulnerable populations in the context of the climate transition.

   b. **Municipal council:**
      - **Standing committees:** Environment, urban planning, transport, finance.
      - **Specific working groups:** Created to address specific climate issues.

2) **External stakeholders:**
   - **National authorities:** Bulgarian Government, Ministry of Environment and Water.
   - **Municipal organizations:** Public enterprises, waste management services, public transport services.

a) Private sector:
- **Businesses:** Large local and multinational companies.
- **Unions and Business Clubs:** Industrial associations, workers' unions.
- **Academic and Research Institutions:** Sofia University, Bulgarian Academy of Sciences, technological research center s.

b) Citizens and NGOs:
- **Citizens:** Resident associations, environmental advocacy groups, citizen initiatives.
- **NGOs:** Community organizations, non-profit associations dedicated to sustainability and climate action.

III. Decision-Making structures

1. **Decision-Making bodies:**
   - **Municipal council:**
     - **Plenary meetings:** Strategic decisions on climate and budget policies.
     - **Standing committees:** Preparation of sectoral policies and monitoring their implementation.
   - **City executive committee:**
     - **Mayor of Sofia:** Leadership and approval of climate initiatives.
     - **Deputy Mayors:** Responsible for specific areas such as environment, transport, urban planning.
     - **Climate working group:** Brings together technical experts from various city departments to develop concrete solutions.
     - **Energy working group:** Focus on energy transition and building renovation projects.
   - **Strategic committee:** A strategic committee is established to oversee the implementation of the Climate Action Plan. This committee includes representatives from different ministries and plays a key role in coordinating efforts between local and national levels.
     - **Members:**
       - Ministry of Environment and Water
       - Ministry of Economy
       - Ministry of Transport
       - Ministry of Education
       - Ministry of Finance
     - **Functions:**
       - **Interministerial coordination:** Ensure alignment of policies and climate initiatives at all levels.
       - **Monitoring and evaluation:** Track project progress and assess their impact.
       - **Financial and technical support:** Facilitate access to resources necessary for project implementation.

2. **Strategies concerning stakeholders**

The strategy developed to engage and collaborate with stakeholders in Sofia as part of the Climate Neutrality Action Plan 2030 is based on a holistic and inclusive approach:

a. **Dialogue and consultation with stakeholders:**
- **Democratic Process:** The formulation of policies and implementation of actions involve a democratic process that includes the active consultation and participation of all stakeholders.
- **Openness and transparency:** All meetings and decisions made are documented and accessible to the public to ensure transparency.

- **Consultation and co-construction:** Regular organization of public consultations, co-construction workshops, and discussion forums to gather feedback and ideas from citizens, businesses, and local organizations.
- **Periodic meetings:** Establishment of periodic meetings with stakeholders to discuss progress and adjust strategies based on feedback and new information.

b. **Sectoral strategies:**

- **Specific sector approach:** Development of sectoral strategies covering key areas such as energy, transport, waste management, and urban planning.
- **Dialogue with sector actors:** For each sector, the municipality engages in dialogue with the concerned stakeholders to define policies and actions to be implemented. For example, discussions with businesses and energy cooperatives for the energy sector, or with resident associations for urban planning projects.
- **Expert participation:** Inclusion of technical and scientific experts in discussions to ensure that policies are based on best practices and the latest data.

c. **Energy renovation initiatives:**

- Implementation of a pilot energy renovation program targeting municipal and residential buildings, with technical advice and financial support for property owners and managers.
- Collaboration with local businesses to develop innovative solutions for green heating and energy efficiency.

d. **Engagement and participation:**

- Organization of regular consultation forums with stakeholders, including co-design workshops and feedback sessions to discuss climate initiatives and potential obstacles.
- Creation of specific working groups for key sectors such as transport, energy, and waste management, comprising representatives from businesses, universities, and civil society organizations.

e. **Communication and awareness:**

- Robust communication campaigns using various media (social networks, radio, television, print media) to raise public awareness of climate neutrality initiatives and encourage community participation.
- Use of local successes and best practices to inspire and motivate other actors to engage in climate actions.

f. **Financial and technical support:**

- Exploration of partnerships with international financial institutions and development agencies to secure additional funding for ambitious climate projects.

g. **Innovation and research:**

- Collaboration with universities and research center s to develop and test innovative emission reduction and climate adaptation technologies.
- Support for pilot projects and demonstrations of new energy technologies, with a particular focus on solutions adapted to Sofia's local context.

This strategy is designed to ensure a transition to climate neutrality by actively engaging all stakeholders in Sofia, promoting cooperation and transparency, and supporting sustainable innovation and funding.

2.3.1.2 Barriers and Opportunities

Sofia faces several systemic barriers:

Barriers: Insufficient infrastructure for electric vehicles, underdeveloped cycling infrastructure, and energy-inefficient buildings are major obstacles. Additionally, there is a need for specialized skills and innovative financing mechanisms. Missing infrastructure, limited capacity in specialized skills, and gaps in coordination and monitoring processes are significant challenges. For instance, although Sofia has initiated projects to improve cycling infrastructure, its development remains limited and insufficient to meet the growing needs of urban cyclists.
Opportunities: Sofia plans to leverage its well-developed public transport networks and research center s to promote innovation. European funds for the energy transition and new energy storage technologies offer promising prospects. Leveraging European funds for the energy transition, adopting new energy storage technologies, and implementing national policies supporting renewable energy provide promising prospects. Integrating urban planning with climate goals and using urban data to optimize municipal services illustrate how existing processes can be strengthened. For example, Sofia collaborates with international partners to develop energy storage solutions and integrate smart energy management systems in public buildings.

2.3.1.3 Monitoring and Data Collection

To evaluate progress towards climate neutrality, Sofia intends to implement rigorous monitoring systems for greenhouse gas emissions, conduct regular energy audits, and monitor the impact of climate policies. Collecting relevant data, such as energy consumption, transport usage, and recycling rates, is essential. Analyzing this data through management software and predictive modelling will measure the effectiveness of actions and adjust strategies accordingly. Monitoring systems and relevant data collection are crucial for evaluating progress and adjusting strategies. Greenhouse gas emission monitoring systems, regular energy audits, and climate policy impact monitoring provide valuable indicators. Sofia currently uses smart sensor technologies to monitor air quality and pollution levels throughout the city, allowing for rapid response and real-time policy adjustments.

Sofia adopts a systemic and integrated approach to achieve climate neutrality by 2030, involving a diversity of stakeholders, resources, and strategies. While challenges are numerous, the opportunities for a sustainable and resilient transformation of the city are also significant. Coordinated efforts among public institutions, the private sector, civil society organizations, and citizens are essential to create a sustainable urban environment resilient to climate challenges.

A-3.2: Systems & stakeholder mapping

System	Stakeholders	Influence on the city´s climate neutrality ambition	Interest in the city´s climate neutrality ambition
Technological and Infrastructural	Municipality of Sofia, Public Transport Companies, Electric Vehicle Manufacturers	High - Responsible for implementing and maintaining green infrastructure	High - Ensuring sustainable transport options and enhancing city infrastructure
Institutional and Regulatory	Ministry of Environment and Water, European Union, Sofia Municipal Government	High - Sets the legislative and policy frameworks for climate actions	High - Aligning local regulations with EU directives, ensuring compliance and effectiveness

A-3.2: Systems & stakeholder mapping			
System	Stakeholders	Influence on the city´s climate neutrality ambition	Interest in the city´s climate neutrality ambition
Organizational	Municipal Agencies, Public-Private Partnerships, Universities, NGOs	High - Coordinates and implements climate initiatives	High - Ensuring integrated and coherent implementation of climate policies
Financial	European Investment Bank, Horizon Europe, Private Investors	High - Provides necessary funding for climate projects	High - Investment returns and supporting sustainable development initiatives
Political and Social	Municipal Politicians, Citizens, Community Organizations, Educational Institutions	High - Drives policy changes, community support, and engagement	High - Political commitment to sustainability and community participation in climate initiatives

3 Part B – Pathways towards Climate Neutrality by 2030

Part B represents the core of the CCC Action Plan, shaped by local authorities, local businesses, and stakeholders, comprising of the most essential elements: scenarios, strategic objectives, impacts, action portfolios and indicators for monitoring, evaluation, and learning.

3.1 Module B-1 Climate Neutrality Scenarios and Impact Pathways

3.1.1 List of Impact Pathways

Sustainable Transport: Increased usage of electric vehicles, expansion of charging infrastructure, and promotion of eco-friendly public transport.

Building Energy Efficiency: Energy renovation of public and private buildings, integration of smart energy management technologies.

Waste Management: Improvement of recycling and waste management systems, reduction of waste at the source

Renewable Energy: Development of solar and geothermal energy projects, promotion of energy storage solutions, promotion of energy communities.

Green infrastructure & nature based solutions: Expanding the existing green system of Sofia and maintaining what has already been built.

Community Engagement: Awareness and education programs, citizen participation initiatives for planning and implementing climate actions.

3.1.2 Descriptions of Impact Pathways

3.1.2.1 Sustainable Transport

The transition to electric vehicles and the improvement of public transport infrastructure aim to reduce greenhouse gas emissions while improving air quality. This aligns with Sofia's priorities in sustainable urban mobility and reducing air pollution.

3.1.2.2 Building Energy Efficiency

Energy renovations and the integration of smart technologies reduce energy consumption and associated costs while increasing occupant comfort. These interventions are essential for achieving the city's energy goals.

Though there are no internal for the municipality flights and the airborne transport has not been considered in the inventory for its minor impact on the GHG emissions, we have a very good collaboration with the operator of the airport – SOF Connect, and we are planning to implement several measures within the territory of the airport that will bring to a reduction of energy consumption of buildings & facilities as well as the open area lighting thus contributing to the GHG reduction in the built environment domain.

3.1.2.3 Waste Management

By improving waste management systems, Sofia aims to reduce the city's environmental footprint and promote a circular economy. Actions include modernizing waste treatment facilities and promoting recycling.

3.1.2.4 Renewable Energy

Developing renewable energy is crucial to reduce dependence on fossil fuels and diversify the city's energy mix. Sofia plans to invest in solar projects, supported by innovative financing mechanisms.

3.1.2.5 Green infrastructure & nature based solutions

Sofia is constantly developing its green system covering the green and blue infrastructures, the green public areas (parks) and the green belt around the city. A Master Plan for the development of the green system is in place. Each year old trees are replace by new more appropriate as per the scientific recommendations species, new trees are planted in the city and a new forest is developed to surround the city and protect it from outside harmful emissions impact.

3.1.2.6 Community Engagement

Active citizen participation is essential for the success of climate initiatives. Sofia implements educational and awareness programs to involve residents in the transition to a climate-neutral city.

B-1.1: Impact Pathways					
Fields of action	Systemic levers	Early changes (1-2 years)	Late outcomes (3-4 years)	Direct impacts (Emission reductions	Indirect impacts (co-benefits)
Energy systems	Technology/ Infrastructure	Reduced consumption of conventional fuels	State of the art, energy efficient heating /cooling; Higher share of green vehicles	136 895 tCO2e	Better energy efficiency and savings on the energy bill, improved comfort
		Increased share of renewable energy in the final energy consumption by introducing RES	A higher share of heat, hot water, and cooling generated from green electricity.		
		Established procedures and rules for energy communities	Energy communities established		
Mobility & transport	Technology/ Infrastructure	Development and promotion of eco-friendly public transport	Modal shift to public transport and decreased commuting by personal cars within the city	449 214 tCO2e	Reduced harmful emissions and carbon footprint, reduced traffic congestion, better air quality; improved human health; lower transport costs;
		Development and improvement of charging infrastructure	Public areas more attractive for electric cars and increased share of electric vehicles		
		Promote investments in walking and biking infrastructure to make the city center and neighborhoods more easily accessible by	Most short commuters in the city will shift from cars to a greener mobility mode – by foot, bike or other		

B-1.1: Impact Pathways					
Fields of action	Systemic levers	Early changes (1-2 years)	Late outcomes (3-4 years)	Direct impacts (Emission reductions	Indirect impacts (co-benefits)
		foot, bike and other green mobility options	green mobility option, including mobility sharing		improved social equity
	Social Innovation	Implementing new transport service for people with disabilities	Introduction of modern low-emission vehicles providing better mobility options for people with disabilities on municipal expenses		
	Governance & Policy	Introduced and well managed LEZ for transport vehicles	Reduction of vehicles in the city center and reduction of fossil-fuel vehicles within the municipality		
Waste & circular economy	Technology/ Infrastructure	Improvement of recycling and waste management systems, developing eco-islands for selective collection, incl. bio-waste, building sited for processing of voluminous waste and construction waste	Introduced fast-tracking zero-waste system; Reduced GHG emissions from waste treatment;	31 463 tCO2e	Improved living environment; better quality of life;
		Transforming waste facilities in green energy fueled ones	Operating energy efficient waste treatment facilities		
		Collection of waste at source	Reduced GHG emissions from waste		
	Governance & Policy	Deep demonstration of circular economy	Reduced waste in the landfills, better resource-efficiency, lower GHG emissions from waste		
Built environment	Technology/ Infrastructure	Retrofitting the municipal buildings, including schools, kindergartens, health care centers and hospitals	State of the art, energy efficient net zero buildings	975 070 tCO2e	Better energy efficiency and savings on the energy bills, improved comfort in buildings and improved comfort and
		Introducing Energy Management Systems and Building management systems	Better management of energy use and consumption		
		Introducing RES in private buildings	A higher share of heat, hot water, and		

B-1.1: Impact Pathways					
Fields of action	Systemic levers	Early changes (1-2 years)	Late outcomes (3-4 years)	Direct impacts (Emission reductions	Indirect impacts (co-benefits)
			cooling generated from green electricity		safety in open public spaces
		Make public lighting greener & more sustainable	Public lighting network equipped with LED lamps, remote management, and dimming systems		
	Governance & Policy	Introduce policies (e.g. urban planning regulations) that promote net zero energy building standards in new and existing residential or public buildings	Most new buildings built to NZEB standards, and at least 75% of housing units with improved energy performance		

3.2 Module B-2 Climate Neutrality Portfolio Design

Module B-2 "Climate Neutrality Portfolio Design" contains a project description for **each action planned** in the CCC Action Plan. This includes interventions targeted at creating/enhancing carbon sinks to address residual emissions.

The planned actions are divided into two categories: (1) actions from existing SECAP and (2) actions for covering the gap. In order to achieve readability of the CCC Action Plan the actions from SECAP are presented in summarized manner (b-2.1.1). Their contribution to achieving the climate neutrality are already taken into account as part of analysis of existing strategic documents.

B-2.1.1: Description of action portfolios – actions from existing strategies		
Fields of action	Portfolio description	
	List of actions	Descriptions
Energy Systems	***1.1. Introduction of gradual restriction of the use of high-emission fuels and open combustion heating devices***	The measure envisages the gradual restriction until 2030 of the use of high-emission fossil fuels (coal and liquid fuels) for heating on the territory of Sofia Municipality. For the implementation of the action, a LEZ ordinance has been adopted on local level.
	1.2. Reduction of the emissions factor of the heat supplied by "Toplofikatsiya Sofia" EAD, including taking into account the possibilities for use of renewable energy sources	The action provides for the reduction of the value of the heat emissions factor of district heating by at least 5% by 2030 through implementing energy efficiency measures in the heat energy production and transmission and by including the use of renewable energy sources.
	1.3. Creation of procedures, rules and model for the construction of heat pump installations that utilize the heat of shallow waters, geothermal energy and the	The action aims at supporting the wider the wider penetration of water-based that are twice more efficient than aero-thermal ones and provide a high seasonal conversion factor above 5. The action will help to make the procedures easier and to develop a model for the wastewater energy use in the sewerage system and its

B-2.1.1: Description of action portfolios – actions from existing strategies		
	energy of the sewerage systems wastewater	use in private sites. The analytical part of the guide to be produced will also provide the location of the suitable areas in Sofia, with high groundwater or surface water sources that are suitable for heating and cooling of buildings and supply of domestic hot water.
	1.4. Creation of rules and a model of public-private partnership to ensure the wider penetration of RES in the municipal building stock	Creation of rules and a model of public-private partnership to ensure the wider penetration of RES in the municipal building stock. Action aims at attracting private investment through public-private partnerships for accelerating the introduction of new and more efficient technologies and for ensuring their good management and operation.
	1.5. Creation of spatial map of RES sites by type of technology	The measure proposes the development of a spatial map of the sites with RES by technology types in order to monitor the development of the sector, promote its potential and plan the measures in this direction. The creation of the map will help to analyze the applicability of the technologies by districts and territorial units and plan the measures for their development.
	1.6. Practical guide preparation related to the regulatory and other requirements and principles for the establishment of renewable energy communities	The action aims at acceleration of the process of establishment of renewable energy communities as well as establishment of consumers of self-produced electricity which are supported in the European RES Directive. The development of a practical manual aims to provide information and examples of such projects implementation and the benefits for the participants in the models.
Energy Systems	***1.7.Establishment of a unified register for the energy performance of the new buildings on the territory of Sofia Municipality, including the production of energy from renewable sources***	The action provides for the creation of a unified online register of the energy performance of the new buildings in Sofia Municipality in compliance with the EEA requirements and of internal rules for the timely data entry by the responsible persons that will allow the municipality to have clear and with high level of accuracy information for the estimation of the energy consumption of the new buildings and the renewable energy used
	1.8. Implementation of renewable energy installations in already renovated municipal buildings	The action envisages installation of appropriate RES for covering the own needs of energy in the already renovated municipal buildings for achieving greater reductions in the energy costs and greenhouse gas emissions.
	1.9. Introduction of a system for monitoring the energy and water consumption, including that from renewable energy sources and street lighting	The measure envisages the introduction of a system for monitoring energy and water consumption on the territory of Sofia Municipality, including from renewable energy sources and street lighting. This system aims to ensure effective energy management in municipal buildings, enabling the implementation of energy efficiency measures and guaranteeing the sustainability of energy-saving results. For this purpose, a database will be designed, and information on the municipal building stock will be digitized. Monitoring will also cover installations using renewable energy sources. Additionally, the system will gradually be extended to outdoor public lighting to optimize maintenance and

B-2.1.1: Description of action portfolios – actions from existing strategies		
		reduce losses related to technical issues or illegal connections.
	1.10. Implementation of pilot and demonstration projects for the construction of zero-energy and plus-energy buildings	The measure involves the construction of a zero-energy municipal building and a plus-energy municipal building for demonstration purposes. Detailed monitoring of the results will be carried out in these buildings, and the achieved effects will be promoted within the community. These sites will be built according to the needs of Sofia Municipality for the construction of new facilities. The most suitable types of buildings for pilot projects, from the perspective of attracting public attention, are accommodation facilities for vulnerable groups or institutions for children.
	1.11. Pilot areas development with zero-energy consumption and transition to plus energy consumption	This measure aims to encourage private and/or public-private projects to develop pilot areas with zero energy consumption and transition towards a positive energy balance. This will be achieved through integrated measures of energy efficiency, renewable energy production, smart electrical and thermal grids, electricity and heat storage systems, energy cooperation, cogeneration, and other methods. The objective is to create neighborhood models to promote sustainable energy behavior in areas planned for future development or under renovation.
	1.12. Gradual replacement of the street lighting fixtures with LED ones	The measure involves the gradual replacement of 90% of the existing street lighting fixtures in Sofia Municipality with high-efficiency LED lighting by 2030. Of the 102,506 fixtures installed in 2019, only 11.86% were LED. Thus, 80,000 fixtures using various light sources will be replaced with high-efficiency LED fixtures. All new segments of the public lighting system will also be equipped with high-performance LED lights.
	1.13. Gradual replacement of the liquid fuel-fired boilers with heat pump or gas/pellets boilers	This measure aims to gradually replace liquid fuel-fired boilers with gas, pellet boilers, or heat pumps in municipal buildings of Sofia Municipality, mainly located in peripheral areas. The goal is to improve energy efficiency and reduce fuel consumption while maintaining good thermal comfort. The management of boilers and installations will also be improved to reduce energy consumption, with expected savings in energy and financial costs, as well as an improvement in air quality.
Mobility & transport	***2.1. Gradual increase of the share of electricity from renewable energy sources to meet the needs of the public and the interdepartmental transport***	This measure involves a gradual increase in the share of electricity derived from renewable energy sources (RES) to meet the energy needs of public and interdepartmental transport in Sofia Municipality. Due to the high national emission factor for electricity, increasing the share of RES will significantly reduce greenhouse gas emissions. The target is to reach a 50% share of electricity from renewable sources by 2030, although this percentage may be adjusted based on interim greenhouse gas inventories, investments in "green" electricity production, and the development of a regulatory framework that allows "green" energy produced at one location to be used at another

B-2.1.1: Description of action portfolios – actions from existing strategies		
	2.2. Provision of access to the data for the actual annual mileage and the fuels used by the registered vehicles on the territory of the municipality	This measure aims to provide access to data on the actual annual mileage and types of fuels used by vehicles registered in Sofia Municipality. The data is collected during mandatory annual technical inspections. The measure involves notifying the Ministry of Transport and Information Technology and Communications to establish the necessary prerequisites for data collection and sharing. This data will help improve the accuracy of greenhouse gas emissions calculations from private road transport on the territory of Sofia Municipality.
	2.3. Creation of favorable conditions for the construction of "green" electric charging stations, including through public-private partnerships	This measure aims to create favorable conditions for the construction of "green" electric vehicle charging stations powered by renewable energy sources. Sofia Municipality plans to support these projects by providing areas for building installations that generate electricity from renewable sources. The measure includes legislative initiatives to introduce requirements for charging stations to enable customers to use "green" electricity. It also involves creating a regulatory framework to allow investors to produce renewable energy for their needs, even if located far from the charging stations, thereby supporting public-private partnership projects in this domain
	2.4. Gradual replacement of the fleet of the interdepartmental transport with electric ones	This measure involves the gradual replacement of existing or new light-duty vehicles used for interdepartmental transport with electric cars in Sofia Municipality. These vehicles will be charged with "green" electricity according to a developed schedule. The initiative aims to reduce greenhouse gas emissions, increase the use of renewable energy, improve air quality, and lower operating and maintenance costs. By 2030, at least 60 electric vehicles are expected to be in use as part of this measure
	2.5. Development of general guidelines for the inclusion of climate change adaptation when assigning transport infrastructure projects	This measure involves reviewing existing practices and improving procedures for developing transport infrastructure projects to ensure gradual adaptation to climate change. Sofia Municipality or municipal companies will be provided with general instructions for integrating climate change adaptation considerations during the project preparation phase. This approach aims to reduce vulnerabilities and enhance resilience against climate risks in transport infrastructure projects
	2.6. Transport systems capacity assessment related to climate change	This measure involves an in-depth study of the adaptation capacity of all entities in the transport sector within Sofia Municipality. It includes reviewing existing rules and practices for data collection related to transport infrastructure, the availability of documents and guidelines for climate change adaptation, staff availability, and guidelines to manage climate change effects. The aim is to improve coordination, information, and communication between those responsible, leading to a better response to climate change impacts on transport

B-2.1.1: Description of action portfolios – actions from existing strategies		
	2.7. Study on the activities for the transport infrastructure conditions improvement related to the specific climate risks	This measure involves conducting specialized studies to assess specific risks and vulnerabilities for the rehabilitation and modernization of various types of transport infrastructure, such as roads, railways, sidewalks, bicycle paths, subways, bridges, and drainage facilities. The studies will consider the impacts of specific climate risks and focus on integrating green elements like trees and shrubs in infrastructure design. This will help in regulating temperature, managing rainwater, reducing noise, and retaining dust, thereby enhancing resilience against climate change
	2.8. Transport hubs protection from overheating	This measure focuses on protecting transport hubs and secondary service centers in Sofia from overheating. It involves implementing bio-air-conditioned territorial and nature-based technological solutions, such as small green areas, large woody vegetation, and bus shelters that support climbing vegetation resistant to heat, drought, and pollution. The approach includes bioclimatic urban design and using materials that reduce direct sunlight and solar energy retention, along with systems to capture and use moisture for cooling during extreme heat.
	2.9. Socio-demographic groups adaptive capacity increase by improving the public transport system accessibility and provision of air conditioning in the vehicles	This measure aims to improve the adaptive capacity of socio-demographic groups to climate change by enhancing the accessibility of the public transport system and installing air conditioning in public transport vehicles. By 2030, all buses and trolleybuses in Sofia's public transport system should be air-conditioned, and the share of air-conditioned trams and metro trains should also increase. Improved accessibility and connectivity are essential for supporting the social inclusion of economically vulnerable groups, given their lower adaptive capacity
Waste & circular economy	***3.1. Introduction of a system of incentives to increase the separate collection of municipal waste at source***	The separate collection of municipal waste directly at the source in Sofia Municipality. This includes the separate collection of bio-waste from households in multifamily residential buildings. Depending on the system chosen by the municipality, specific incentives will be formulated. The initiative is part of a comprehensive approach to enhance waste management practices and reduce greenhouse gas emissions by promoting recycling and separate waste collection
	3.2. Expansion of the system for food waste separate collection	This measure aims to expand the system for the separate collection of food waste in Sofia Municipality. A module for registering food waste "suppliers" could be developed within the existing Waste Management Information System. This would include identifying more sites that generate food waste, creating an interactive map of registered suppliers, and optimizing collection and transportation schedules. The goal is to increase the amount of separately collected food waste, ensuring better utilization at waste treatment facilities and reducing greenhouse gas emissions from landfilling.

B-2.1.1: Description of action portfolios – actions from existing strategies		
	3.3. Introduction of a system for data collection on the morphological composition of the waste entering the landfills for accurate greenhouse gas emissions calculation	This measure aims to introduce a system for periodic morphological and physical-chemical studies of waste entering landfills in Sofia Municipality. The goal is to accurately calculate the amount of greenhouse gases emitted from the landfills. Understanding the waste's composition, particularly the biodegradable fractions, is essential for assessing landfill gas generation potential. This measure will help to provide accurate data for greenhouse gas emissions reporting and management
	3.4. Introduction of a system for separate collection of bio-waste from households	This measure aims to gradually introduce a system for the separate collection of bio-waste from households in Sofia Municipality. In accordance with the Waste Management Act and the Ordinance on the Separate Collection of Bio-waste, this initiative involves developing terms of reference, commissioning an external consultant to design the system, and selecting a contractor to supply necessary containers. The separate collection of bio-waste and unpolluted recyclable waste will significantly increase recovery rates and reduce greenhouse gas emissions from waste.
Green infrastructure & nature-based solutions	***4.1. Strategic spatial planning of new and reconstruction of existing elements of the green and blue systems and infrastructure***	This measure involves the development of a concept, spatial planning, and pre-investment studies, along with action plans for forming and developing the green and blue systems in Sofia Municipality. It focuses on creating green wedges, green belts, green collars, and ecological corridors to regulate the microclimate, manage water runoff, and enhance access to green spaces. The goal is to adapt to climate change by improving and expanding parks, gardens, and water elements throughout the city
	4.2. Creation of a plan supporting the long-term tree vegetation and other green areas watering in conditions of prolonged summer and autumn droughts	This measure focuses on the operational planning of the needs for watering long-term woody vegetation and green areas in Sofia Municipality under conditions of prolonged summer and autumn droughts. The plan aims to ensure that trees and shrubs receive adequate water during critical phases of their development in unfavorable climatic conditions. Sofia Municipality has initiated actions to develop the Terms of Reference for these activities to prevent deterioration and loss of long-term tree vegetation
	4.3. Development of expert catalogues of trees and other plant species suitable for urban landscaping and agricultural crops and varieties suitable for use in agriculture given the expected future climatic conditions	This measure involves the creation of expert catalogues of suitable tree and plant species for urban landscaping, as well as agricultural crops and varieties that are appropriate for the anticipated future climatic conditions in Sofia Municipality. The catalogues will consider soil specifics and other environmental factors, such as shading, irrigation availability, groundwater levels, and potential allergenic effects. These guidelines aim to ensure that urban and agricultural green spaces are resilient to climate change and can thrive under evolving conditions
	4.4. Creation of "blue-green" arches for coolness	This measure involves developing and implementing small-scale solutions, known as urban acupuncture, to enhance urban adaptation to climate change. It focuses

B-2.1.1: Description of action portfolios – actions from existing strategies		
	in urban environment and blue and green acupuncture	on creating integrated spaces with water and greenery, in the form of "blue-green" arches, in public areas prone to heat islands. The initiative includes detailed assessments of the urban environment, microclimatic characteristics, and the use of nature-based solutions to optimize cooling effects and improve urban comfort in Sofia
	4.5. Landscape measures to accelerate trees growth	This measure focuses on implementing landscape techniques to enhance the growth rate and productivity of tree crowns in urban areas with challenging conditions, such as shallow soils or southwestern exposures. The approach involves improving soil composition, using compost and natural fertilizers, and optimizing the structure of tree massifs and accompanying vegetation. These efforts aim to increase the resilience of urban greenery, enhance the microclimate, and boost the carbon sequestration potential of the city's green areas
Built environment	***5.1. Creation of preconditions for the renovation of buildings to the highest levels of energy performance and the construction of new buildings with zero-energy consumption and plus energy buildings***	This measure aims to create favorable conditions for renovating buildings to the highest levels of energy performance and constructing new buildings with zero or positive energy consumption. Sofia Municipality plans to introduce new incentives aligned with energy and climate policies to promote high-efficiency building renovations and the construction of nearly zero-energy and plus energy buildings. The initiative will help reduce greenhouse gas emissions, enhance energy savings, and increase the use of renewable energy in Sofia's building stock
	5.2. Introduction of a requirement for all new municipal buildings to be built up to the "nearly zero energy building" level	This measure mandates that all new municipal buildings in Sofia Municipality meet the "nearly zero energy building" (nZEB) standards as defined by the national regulations. Starting from 2021, these standards require new buildings to have very high energy efficiency with a significant share of energy consumption covered by renewable sources. By incorporating this requirement into public procurement contracts, Sofia aims to avoid future reinvestments for improving energy performance and aligns with its goals of reducing greenhouse gas emissions and promoting sustainable building practices
	5.3. Creation of a local ecolabel/certificate and rules for the buildings, using renewable energy, awarding	This measure requires that all new municipal buildings in Sofia Municipality be constructed according to the national definition of "nearly zero-energy buildings" starting in 2021. This requirement aligns with the Energy Efficiency Directive and the National Plan for Nearly Zero-Energy Buildings. The goal is to ensure that new municipal buildings achieve high energy efficiency and incorporate renewable energy sources, preventing the need for future costly retrofits to improve energy performance. This measure involves creating a local ecolabel or certificate to promote the use of renewable energy in buildings. The ecolabel will provide recognition for buildings that utilize renewable energy sources, supporting the broader adoption of such

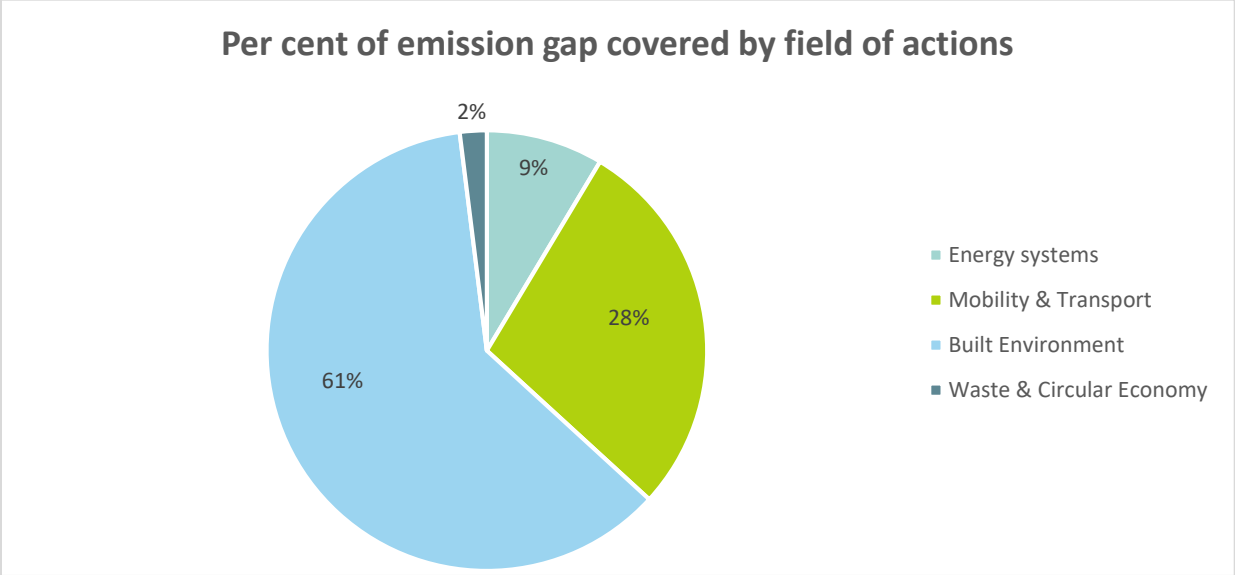
B-2.1.1: Description of action portfolios – actions from existing strategies		
		practices. The measure also includes the development of rules and guidelines for awarding this certificate, contributing to the analysis and planning in the field of energy use
	5.4. Residential buildings renovation	This measure involves a phased program for renovating residential buildings in Sofia Municipality to achieve higher energy efficiency levels. The goal is to renovate buildings with a total area of 3 million square meters by 2030. The renovation is supported by financial instruments such as the National Decarbonization Fund, FLAG Fund, and European Investment Bank, as well as co-financing by citizens and loans from commercial banks. The program aims to reduce greenhouse gas emissions by 40% per capita by 2030 compared to 2007 levels and to achieve an 800 GWh reduction in final annual energy consumption.
	5.5. Gradual renovation of the residential buildings to the highest cost-effective levels	This measure involves the gradual renovation of residential buildings in Sofia Municipality to the highest cost-effective energy efficiency levels, focusing on achieving energy classes between "A" and "B." The renovation process will include energy audits and the application of comprehensive energy-saving measures. The aim is to maximize energy savings and reduce greenhouse gas emissions, aligning with the objectives of the Long-Term Strategy for the Renovation of the National Building Stock by 2050. Financial support will come from various sources, including the National Decarbonization Fund, the FLAG Fund, and private co-financing by citizens and commercial loans
	5.6. Gradual certification and energy renovation of the municipal buildings to the highest cost- effective level	This measure aims to renovate all municipal buildings in Sofia Municipality to the highest cost-effective energy performance levels rather than just meeting the minimum regulatory requirements. The renovation will focus on deep energy efficiency improvements, ensuring substantial reductions in greenhouse gas emissions and energy costs. The plan involves conducting energy audits to identify cost-effective solutions and seeking various funding sources, including grants and energy performance contracts, to achieve these renovations by 2030
	5.7. Development of a roadmap for the use of buildings roof areas for climate-related activities	This measure involves creating a roadmap for the use of building rooftops in Sofia for activities related to climate change mitigation and adaptation. Roofs could be used for renewable energy production, landscaping, or covered with reflective coatings to increase albedo and reduce heat absorption, thus mitigating the urban heat island effect. The measure includes identifying suitable areas in the city and prioritizing the implementation of specific technologies or combinations based on research and the characteristics of the rooftops
	5.8. Introduction and compliance with the spatial planning indicators for maximum % of ingestion	This measure involves the introduction of spatial planning indicators that ensure a maximum percentage of surface absorption and a minimum percentage of permeability for urban areas in Sofia Municipality. It also

B-2.1.1: Description of action portfolios – actions from existing strategies		
	and minimum % of permeability of the urban surfaces; complementation of the structural indicator for minimum obligatory landscaped yard area	includes the addition of a structural indicator for a mandatory minimum landscaped yard area. The goal is to improve urban planning regulations to reduce climate vulnerabilities by enhancing green infrastructure and maintaining sufficient permeable surfaces for better water management and environmental sustainability
	5.9. Protection of the tall buildings facades from overheating	This measure involves protecting the facades of tall public and multifamily residential buildings from overheating through technological improvements, such as specific facade details and coatings, before, during, or after energy efficiency renovations. It also includes the combination of tall woody vegetation near southern and western facades, vertical and roof landscaping, restoration of green areas, and improvement with permeable pavements. These efforts aim to reduce the negative thermal effects on buildings, improve thermal comfort, and mitigate the urban heat island effect in Sofia

The actions covering the gap of 41% are summarized in table B-2.1.2 and as Individual action outlines (B-2.2.1). The table below presents in summarized manner the contribution of envisaged actions by field of action to cover the emission gap. It is calculated as 40% of total emissions or 1 619 526.96 tCO2e. As it could be seen from the data below, about 6% of the emission gap is not covered yet. However, some of the envisaged actions that could have significant effect on the emission level in Sofia are subject of further data collection and estimation. These actions are the introduction of both Low Emission Zones - for transport and for household heat, and the digitalization of construction sector.

Field of actions	Emissions tCO2e
Energy systems	136 895,00
Mobility & Transport	449 214,00
Built Environment	975 070,00
Waste & Circular Economy	31 463,00
TOTAL	**1 592 642,00**

The figure below demonstrates Sofia's municipality plans to target the biggest emissions contributors, namely buildings and transport.



A summary of the actions and impact planned to address residual emissions (B-2.3).

B-2.1.2: Description of action portfolios – actions addressing emissions gap		
Fields of action	Portfolio description	
	List of actions	Descriptions
Energy System	***1.1. Establishment and management of LEZ – household heating within the entire territory of Sofia Municipality***	A ban on solid fuel heating will be introduced in 9 districts of Sofia Municipality in January 2025, and by 2029, this ban will apply to the entire municipality. Approximately 32,000 households currently use solid fuel for heating. Sofia has initiated a program to replace these heating systems with environmentally friendly alternatives, with 8,343 households already participating and 15,476 new appliances installed. Funding is secured for a second phase to replace an additional 10,815 systems. The program will also support socially disadvantaged households by piloting photovoltaic systems for self-sustained energy production. The ultimate goal is to assist the remaining households in transitioning to cleaner heating solutions, thereby reducing their carbon footprint.
	1.2. Implementation of small hydropower plants at water supply network of Sofia Municipality	Installation of small hydropower plants within Sofia's water distribution network to produce renewable energy. The project is expected to generate 11,933 MWh of electricity annually, reducing the need for grid electricity and cutting greenhouse gas emissions.
	1.3. Installation of PV panels on municipal water and wastewater sites	Installation of photovoltaic (PV) panels on the water and wastewater infrastructure of Sofia Municipality, expected to generate 3,710 MWh of renewable electricity annually.
	1.4. Roll out of energy communities	Creation of 30 energy communities in Sofia, with an average installed capacity of 100 kWp per community. The initiative will promote the adoption of renewable energy sources by citizens, SMEs, and NGOs, producing 3,600 MWh of electricity annually, with a corresponding reduction in CO2 emissions.

	1.5. Introduction of a temperature band for heating/ cooling terminal buildings	Optimization of heating and cooling systems by introducing a minimum temperature of 19°C for heating and a maximum of 26°C for cooling in terminal buildings, improving energy efficiency and reducing energy costs. This intervention will improve energy efficiency and reduce fuel and electricity consumption by 1,354 MWh annually.
	1.6. Construction of photovoltaic (solar) farm	A three-phase solar farm project at Sofia Airport, which, upon completion, will have a capacity of 20 MW, which will cover approximately 38% of the airport's annual electricity consumption in the first stage. The solar farm is expected to produce 14,100 MWh annually, providing electricity to the airport and reducing emissions by up to 9,619 tCO2e.
	1.7. Implementation of a heating/cooling system	Installation of a heating and cooling system using renewable energy sourced from Sofia's sewer network. This system will produce 26,280 MWh/year of renewable energy, replacing conventional grid electricity and reducing GHG emissions by 12,200 tCO2e annually.
Mobility & transport	***2.1. Sofia at a new speed – complete renewal of public transport fleets***	A comprehensive programme for renewal of Sofia's public transport – replacement of old inefficient tram and trolley fleets and adjacent infrastructure, and replacement of 220 old polluting buses by new ones on NG and diesel. The programme also include refurbishment of infrastructure and installing new charging and traction stations, and purchase on new modern, more efficient and less polluting special machines for addressing public transport needs.
	2.2. Promotion of cycling as an alternative mode of transportation	Promotion of cycling as a sustainable urban transport mode through the development of a safer and more interconnected cycling network, which will reduce traffic congestion, improve air quality, and promote healthier lifestyles. This initiative is expected to reduce CO2 emissions by 37,761 tCO2e by increasing the the cycling across the city.
	2.3. Installation of a new charging infrastructure for recharging electric vehicles using recovered electrical energy	Installation of 12 energy storage devices and 13 charging stations for public and private electric vehicles, utilizing recovered electrical energy from the city's electric transport network. This will enable the efficient use of recovered energy from Sofia's electric public transport, saving 876 MWh and reducing emissions by 16,020 tCO2e annually
	2.4.Sustainable transportation for people with disabilities	Introduction of a specialized transportation service for people with disabilities, utilizing electric buses. The service will be accessible via a dedicated platform, enabling users to book personalized trips according to their needs and reduce diesel consumption by 216,000 liters per year, resulting in a reduction of 3,500 tCO2e annually.
	2.5. Establishment and management of LEZ for transport vehicles	Establishment of a Low Emission Zone (LEZ) for motor vehicles in Sofia's busiest areas to improve air quality by reducing the number of the most polluting vehicles.

	2.6. Lease/Purchase of new vehicles for the Sofia Airport	A total of 32 high-emission vehicles were replaced with electric ones in 2023, including an electric ambulift and a shuttle bus for transporting passengers between terminals. This resulted in fuel savings of approximately 430 MWh per year, reducing CO2 emissions by 145 tCO2 annually, though electricity usage will slightly increase emissions.
	2.7. Sofia Airport ground lighting system software upgrade	Software upgrade for Sofia Airport's ground lighting system to enable remote control, centralized monitoring, and dimming of apron areas, reducing energy consumption by 335 MWh annually and cutting CO2 emissions by 140 tCO2e.
	2.8.Apron flood LED lighting at Sofia Airport	Replacement of the apron lighting system at Sofia Airport with LED floodlights, reducing the total energy consumption savings of 926 MWh and a reduction in emissions by 382 tCO2e.
	2.9.Replacement of t2 lighting system with energy efficient one at Sofia Airport	Modernization of the lighting system at Terminal 2 with energy-efficient LED lighting, expected to save 1,195 MWh of electricity annually and reduce CO2 emissions by 478 tCO2e after full implementation.
Waste & circular economy	***3.1. EE for waste treatment***	Installation of a photovoltaic system at Sofia's waste treatment plant to meet 60% of its energy needs, resulting in financial and environmental benefits, producing 11,520 MWh of renewable energy annually and reducing CO2 emissions by 5,852 tCO2e.
	3.2. Expanding the municipal food waste collection system	Expansion of the food waste collection system by adding 5,000 new bins. Collected waste will be used in a gasification plant to produce electricity, generating 13,500 MWh of energy and reducing emissions by 5,858 tCO2e annually.
	3.3. Recycling for tomorrow	Improvement of Sofia's waste collection and recycling system through regulatory changes and the development of mobile collection centers for municipal solid waste. The goal is to increase recycling rates and reduce waste sent to the treatment plant by 10% annually. The initiative will reduce the volume of waste sent to treatment plants and increase recycling, reducing emissions by 19,753 tCO2e annually.
Built environment	***4.1. Retrofitting the municipal buildings***	Energy renovation of municipal buildings through the installation of photovoltaic systems and energy efficiency measures. The program includes an investment plan for gradual implementation. Also the program aims to achieve a 30% reduction in energy consumption and reduce CO2 emissions by 211,908 tCO2e.
	4.2. Introduction of Energy Management System in municipal buildings	Implementation of an energy management system in municipal buildings, enabling automated control of energy flows and devices, resulting in a 20% reduction in energy consumption and cut emissions by 14,130 tCO2e.
	4.3. Sustainable street lighting	Rehabilitation of Sofia's street lighting infrastructure by replacing existing lighting with LED technology and installing control systems to reduce energy consumption by up to 60% lowering CO2 emissions by 83,312 tCO2e.
	4.4. RES in private buildings	Sofia Municipality aims to support the renovation of 400 residential buildings to improve energy efficiency, with a

		focus on solar energy production. The initiative is expected to reduce emissions by 704,452 tCO2e.
	4.5. Optimization of HVAC via BMS in terms of times of operation (minimized flow during night hours)	Optimization of HVAC systems at Terminals 1 and 2 by reducing airflows during night hours, in line with the building management system (BMS) to reduce energy consumption without affecting passenger comfort saving 335 MWh of energy annually and cutting CO2 emissions by 231 tCO2e.
	4.6. Replacement of street lighting (Landside) for Terminal 1 & 2	Replacement of street lighting for the approach road to Terminals 1 and 2 with high-efficiency LED lamps, reducing electricity consumption.
	4.7. Switching off partially LED lighting on covered car park (Terminal 2) during night hours and installation of motion sensors	Installation of motion sensors and optimization of LED lighting in the covered car park at Terminal 2 to reduce energy consumption during night hours.
	4.8. Airfield Ground Lighting LED replacement - all runway and taxiway center and edge lights	Replacement of the airfield ground lighting with LED lights, resulting in significant energy savings for runway and taxiway lighting systems. Sofia Airport plans to replace 2,850 apron lights with energy-efficient LEDs, reducing power usage from 206.6 MW to 82.7 MW. This change will save 545.5 MWh of energy annually and cut CO2 emissions by 218 tons per year, with implementation expected by 2026.
	4.9. Terminal 1 reutilization	Repurposing parts of Terminal 1 for office space and leasing it to third parties, resulting in a 30% reduction in electricity consumption and saving 1,616 MWh annually, reducing CO2 emissions by 599 tons by 2030.
	4.10 Enabling Digitalisation in the Construction Sector	The project aims to accelerate the adoption of advanced digital technologies in the construction sector by providing tailored services to SMEs and public organizations, facilitating the green transition.
	4.11 INSPIRenov: Financial Schemes for Providing Innovation in the Energy Renovation	Development of a blended financing scheme combining grants and loans to support energy-efficient renovation of residential buildings, increasing private sector investment and reducing reliance on public funding.

3.2.1 Individual action outlines

3.2.1.1 Actions addressing emissions gap

B-2.2.1: Individual action outlines		
Action 1.1		
Action outline	Action name	**Establishment and management of Low Emission Zone – household heating**
	Action type	Legal proceedings
	Action description	A ban on the use of solid fuel for heating is introduced in the territory of 9 out of a total of 24 districts in the Sofia Municipality from January 2025. From 2029, it will be prohibited to use solid fuel for heating in the entire municipality. The total number of households that are heated with solid fuel is approximately 32 thousand. Sofia took measures to help households by implementing a program for free replacement of solid fuel heating appliances with environmentally friendly ones. At the moment, the first phase of the program has been completed, where appliances have been replaced in 8,343 households and a total of 15,476 ecological ones have been installed. Funding has been secured for a second phase to replace a further 10,815. The construction of photovoltaic systems for self needs of socially disadvantaged households is being pilot. The electricity produced will have an emission factor of 0. The program will be upgraded to help the rest 1/3 of identified households also to switch to an environmentally friendly way of heating and reduce their carbon footprint.
Reference to impact pathway	Field of action	Energy system
	Systemic lever	Governance & Policy
	Outcome	Replaced 32,000 solid fuel heaters
Implementation	Responsible bodies/person for implementation	Sofia Municipality
	Action scale & addressed entities	Municipal scale
	Involved stakeholders	
	Comments on implementation – consider mentioning resources, timelines, milestones	
Impact & cost	Generated renewable energy (if applicable)	6 900 MWh
	Removed/substituted energy, volume, or fuel type	150 000 MWh
	GHG emissions reduction estimate (total) per emission source sector	To be calculated

	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	35 000 000 Euro

Action 1.2.		
Action outline	Action name	***Implementation of small hydropower plants at water supply network of Sofia Municipality***
	Action type	Technical intervention
	Action description	Production of renewable energy by small HPP from the water distribution network of Sofia Municipality leading to reduction of GHG emissions
Reference to impact pathway	Field of action	*Energy systems / Circular Economy*
	Systemic lever	*Technology/infrastructure*
	Outcome	*Reduction of GHG emissions*
Implementation	Responsible bodies/person for implementation	Sofiyska voda AD/ Stanislav Stanev
	Action scale & addressed entities	Sofia Municipality water cycle – Sofiyska voda AD
	Involved stakeholders	Sofia Municipality, Electrohold (for grid connection), hydropower plant technology providers
	Comments on implementation – consider mentioning resources, timelines, milestones	Urban development plan is in place Detailed design, procurement and implementation has to be performed Estimation is the project to require 24 months following initiation
Impact & cost	Generated renewable energy (if applicable)	11 933 MWh/year
	Removed/substituted energy, volume, or fuel type	11 933 MWh/year (substituted electrical energy produced from the national energy mix)
	GHG emissions reduction estimate (total) per emission source sector	8 150 tCO2e
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	Subject to further technical, financial and administrative feasibility

Action 1.3.		
Action outline	Action name	***Installation of PV panels on municipal water and wastewater sites***
	Action type	Technical intervention
	Action description	
Reference to impact pathway	Field of action	*Energy Systems/Circular Economy*
	Systemic lever	*Technology/infrastructure*
	Outcome	*Reduction of GHG emissions*

Action 1.3.		
Implementation	Responsible bodies/person for implementation	Sofiyska voda AD/Stanislav Stanev
	Action scale & addressed entities	Sofia Municipality water cycle – Sofiyska voda AD
	Involved stakeholders	Sofia Municipality, Electrohold (for grid connection), hydropower plant technology providers
	Comments on implementation – consider mentioning resources, timelines, milestones	Detailed design, procurement and implementation has to be performed Estimation is the project to require 18 months following initiation
Impact & cost	Generated renewable energy (if applicable)	3710 MWh/year
	Removed/substituted energy, volume, or fuel type	3 710 MWh/year (substituted electrical energy produced from the national energy mix)
	GHG emissions reduction estimate (total) per emission source sector	2 534 tCO2e
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	Subject to further technical, financial and administrative feasibility

Action 1.4.		
Action outline	Action name	***Roll out energy communities***
	Action type	Technical intervention
	Action description	Bulgarian Green Building Council will support the municipality in regard the promotion of RES by establishing 30 energy communities. The first phase will be the preparatory work that includes: • Selection of suitable sites for the installation of photovoltaic panels, • Preparation of techno-economic analyses, • Development of a model contract for energy communities. Based on the above the second phase will be to publish invitations to attract members of the energy communities and targeted communication campaign. The final phase will be the construction of the PV plants and the administration of the energy communities.
Reference to impact pathway	Field of action	Energy systems
	Systemic lever	Technology/Infrastructure
	Outcome (according to module B-1.1)	Increased share of RES; GHG reduction

Action 1.4.		
Implementation	Responsible bodies/person for implementation	Bulgarian Green Building Council
	Action scale & addressed entities	Territory of Sofia Municipality
	Involved stakeholders	Citizens, SMEs, NGOs, Sofia municipality
	Comments on implementation – consider mentioning resources, timelines, milestones	The aim is to establish 30 energy communities on the territory of the city (average installed capacity 100 kWp per community)
Impact & cost	Generated renewable energy (if applicable)	3600 MWh/y
	Removed/substituted energy, volume, or fuel type	3600 MWh/y of conventional electricity
	GHG emissions reduction estimate (total) per emission source sector	1750 tCO2e
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	2,6 M EUR, of which 2,4 M EUR attracted from the community members; (875 EUR/kWp)

Action 1.5.		
Action outline	Action name	***Introduction of a temperature band for heating/ cooling terminal buildings***
	Action type	Technical intervention (Optimisation of heating/cooling)
	Action description	1. A temperature band to set a minimum temperature of 19°C for heating Terminal 2; 2. A temperature band to set a maximum temperature of 26°C for cooling the premisses of Terminal 1 & 2. This will allow to use the cooling system more effective, use free cooling during night hours and also avoid cooling the terminal building too much, especially in spring and autumn when the nights are cold, and days can be quite warm and sunny, but also at night when the outside temperature is moderate and simple air exchange can help to cool the buildings. The building management system combined with the already existing temperature sensors is serving as an enabler for this measure.
Reference to impact pathway	Field of action	Energy and fuels
	Systemic lever	Building management system (BMS)
	Outcome (according to module B-1.1)	Optimize the energy consumption for cooling and fuel consumption for heating

Action 1.5.		
Implementation	Responsible bodies/person for implementation	SOF Connect Management / Technical / HVACG&A
	Action scale & addressed entities	Company - SOF Connect
	Involved stakeholders	-
	Comments on implementation	Pending
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	1. 534 MWh fuel savings 2. 820 MWh energy savings
	GHG emissions reduction estimate (total) per emission source sector	1. 101 tCO2e 2. 343 tCO2e
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 1.6.		
Action outline	Action name	***Construction of photovoltaic (solar) farm***
	Action type	Production of green energy for own purposes
	Action description	Due to the slow decarbonization of the Bulgarian grid Sofia Airport decided to become producer of a large share of its electricity consumption. Therefore, the airport will build a solar farm at three stages: 1. Solar farm with a peak performance of 5 MW. This allows the airport to source approximately 38% of its annual power demand. 2. Solar farm with a peak performance of 5 MW with 10 MWh battery storage. Due to the overcapacity in terms of power sourcing during daytime it is important to include storage technologies. Furthermore, the Sofia Airport will have the opportunity to provide some of the electricity to the grid and to third parties at the airport. 3. Solar farm with a peak performance of 10 MW with 10 MWh battery storage – same as stage two.
Reference to impact pathway	Field of action	Energy system
	Systemic lever	Technology/inrastructure
	Outcome (according to module B-1.1)	Reduction of the use of grid electricity, providing electricity to the grid and to third parties at the airport
Implementation	Responsible bodies/person for implementation	SOF Connect Management / Technical / Electric
	Action scale & addressed entities	Company - SOF Connect

Action 1.6.		
	Involved stakeholders	Designers /Suppliers / Contractors
	Comments on implementation	1. Stage one – technical project finalizing, the implementation on site expected to start in 2025 2. Stage two – planned for 2036 3. Stage 3 - planned for 2036
Impact & cost	Generated renewable energy (if applicable)	20 MW upon completion of all stages
	Removed/substituted energy, volume or fuel type	1. Stage one - 7.100 MWh 2. Stage two - 7.200 MWh 3. Stage three - 14.100 MWh
	GHG emissions reduction estimate (total) per emission source sector	1. Stage one - 2.839 t CO2 2. Stage two - 2.292 t CO2 (*the emissions reduced for provision of electricity to the grid not included*) 3. Stage three - 4.488 t CO2 (*the emissions reduced for provision of electricity to the grid not included*)
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 1.7		
Action outline	Action name	***Implementation of a heating/cooling system***
	Action type	
	Action description	
Reference to impact pathway	Field of action	*Energy Systems/Circular Economy*
	Systemic lever	*Technology/infrastructure*
	Outcome (according to module B-1.1)	*Production of renewable energy from the sewerage network of Sofia Municipality and avoidance of GHG emissions*
Implementation	Responsible bodies/person for implementation	Sofiyska voda AD/ Stanislav Stanev
	Action scale & addressed entities	Sofia Municipality sewerage system – Sofiyska voda AD
	Involved stakeholders	Sofia Municipality, Electrohold (for grid connection), heating/cooling systems technology providers
	Comments on implementation – consider mentioning resources, timelines, milestones	Selection of appropriate location Detailed design, procurement and implementation has to be performed

Action 1.7		
		Estimation is the project to require 36 months following initiation
Impact & cost	Generated renewable energy (if applicable)	26 280 MWh/year
	Removed/substituted energy, volume, or fuel type	18 400 MWh/year (substituted electrical energy produced from the national energy mix)
	GHG emissions reduction estimate (total) per emission source sector	12 200 CO2e
	GHG emissions compensated (natural or technological sinks)	
	Total costs and costs by CO2e unit	Subject to further technical, financial and administrative feasibility

Action 2.1.		
Action outline	Action name	***Sofia at a new speed – complete renewal of public transport fleet***
	Action type	
	Action description	Sofia aims to make public transport a preferred alternative for getting around and to increase the share of cycling and walking. The overall goal is that by 2035, 80% of all journeys will be made with sustainable forms of transport, and only 20% with private cars. For this purpose, the city administration plans to invest in replacing the old depreciated and polluting vehicles with new and comfortable ones, which will attract more and more passengers and help protect the environment. It is planned to focus on trams, dual trolleybuses and ensure an optimal energy mix between electricity, diesel and CNG. The purchase of 150 trams, 75 dual trolleybuses, 220 buses (diesel and CNG) and 60 electrical buses (50 fast charging and 10 standard) is planned. Also construction of the necessary charging stations, purchase of specialized cars for repair and reconstruction of infrastructure.
Reference to impact pathway	Field of action	Mobility and transport
	Systemic lever	Technology/Infrastructure
	Outcome (according to module B-1.1)	increase the number of journeys with public transport

Action 2.1.		
Implementation	Responsible bodies/person for implementation	Sofia municipality
	Action scale & addressed entities	Territory of Sofia Municipality – public transport
	Involved stakeholders	Sofia Municipality, Stolichen Elektrotransport EAD, Stolichen Autotransport EAD
	Comments on implementation – consider mentioning resources, timelines, milestones	
Impact & cost	Generated renewable energy (if applicable)	
	Removed/substituted energy, volume, or fuel type	
	GHG emissions reduction estimate (total) per emission source sector	407 808 tCO2e
	GHG emissions compensated (natural or technological sinks)	
	Total costs and costs by CO2e unit	550 M EURO

Action 2.2.		
Action outline	Action name	***Promotion of cycling as an alternative mode of transportation***
	Action type	Technical intervention
	Action description	Promoting cycling as a good alternative in urban environment is one of the strategies of Sofia Municipality to improve the quality of air, the health and life expectancy index of the population, including the reduction of carbon emissions. If more people have the opportunity and choose to cycle in the city, this would lead to significant benefits for society as a whole. Cycling can contribute to less congestion, cleaner air, an attractive and vibrant urban environment and, last but not least, a healthier lifestyle. One of the key factors that largely determines the choice to travel by bicycle is safety. Creating favourable conditions for cycling is related to creating a dense network of safe and interconnected cycling routes. At the moment, in Sofia there are approximately 350 km built and those in the process of planning and construction. However, the proportion of trips by bicycle is fairly low. This is because, on the one hand, the bicycle network in the city territory is not well connected and there are very few bicycle routes that are really

Action 2.2.		
		convenient, safe, comfortable and attractive for cyclists. On the other hand, there are too many points of conflict with car traffic. Within this activity, (1) a bicycle infrastructure standard will be created, (2) new bicycle routes and infrastructure will be built, and (3) information and education campaigns will be organized. This will attract more cyclists and help protect the environment and improve human health as well as will contribute to the reduction of carbon footprint.
Reference to impact pathway	Field of action	Mobility and transport
	Systemic lever	Technology/infrastructure
	Outcome (according to module B-1.1)	Increased share of the trips by bicycle and reduced CO2 emissions
Implementation	Responsible bodies/person for implementation	Sofia municipality/ Citizens & Businesses
	Action scale & addressed entities	The entire territory of Sofia Municipality
	Involved stakeholders	Sofia Urban Mobility Center , NGOs defending the development of cycling infrastructure, Air for Health Association, citizens and visitors
	Comments on implementation – consider mentioning resources, timelines, milestones	
Impact & cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume, or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	37 761 tCO_2e
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	17,5 M EUR

Action 2.3.		
Action outline	Action name	***Installation of a new charging infrastructure for recharging electric vehicles using recovered electrical energy***
	Action type	Technical intervention
	Action description	The project consists of two components: 1. Delivery and installation of 12 energy storage devices based on supercapacitors; 2. Delivery and installation of 13 charging stations supplying public electric transport and private electric cars, incl. charging points at depots and along the public transport routes. The facilities will be connected to the electric network of Stolichen Electrotransport EAD, which provides power for trolleybuses and

Action 2.3.		
		trams. The charging stations are intended to provide charging for both passenger and light-duty electric vehicles of private and legal entities, as well as for electric buses, part of the city's public transport network. In order to increase the efficiency of the recuperative modes of Stolichen Electrotransport EAD, it is planned to design and build an accumulating system for more efficient absorption of the recovered electrical energy from the electric vehicles operated by the company. The system provides for installation and management according to a specific algorithm of 12 storage devices based on supercapacitors in the rectifier stations (TIS), feeding the contact network of the ground urban electric transport. It is planned to build also 13 charging stations for fast charging, each of which will have 5 charging points. This is an infrastructure facility for alternative fuel
Reference to impact pathway	Field of action	Energy system/Mobility&transport
	Systemic lever	Improving energy efficiency
	Outcome (according to module B-1.1)	Energy savings of more than 876 MWh per year.
Implementation	Responsible bodies/person for implementation	Sofia Municipality, Sofia Urban Mobility Center and Stolichen Electrotransport EAD
	Action scale & addressed entities	Infrastructure and facilities of the company providing electric transport within the entire territory of the city
	Involved stakeholders	Sofia Municipality, SUMC, Stolichen Elektrotransport EAD, public transport passengers, electric car owners
	Comments on implementation – consider mentioning resources, timelines, milestones	N/A
Impact & cost	Generated renewable energy (if applicable)	5256 MWh
	Removed/substituted energy, volume, or fuel type	876 MWh/a
	GHG emissions reduction estimate (total) per emission source sector	16 020 tCO_2eq/a
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	7,5 M EUR

Action 2.4.		
Action outline	Action name	***Transportation for people with disabilities***
	Action type	Social innovation
	Action description	Sofia Municipality is constantly working for the inclusiveness of people with disabilities. To tackle this challenge, a comprehensive approach is required. The strategic vision focuses on inclusive mobility for people with disabilities, taking into account their physical and mental capabilities as well as their social and economic backgrounds. This approach is based on the innovative concept of "Mobility as a Right" (MaaR). The project introduces a new service, Sofia Special Transit Door-to-X, for citizens with disabilities – a specialized transportation service from point A to point B, which is different from traditional public transportation. **Objective** - The aim of the service is to provide safe and reliable transportation for people with disabilities from their starting point (door) to various destinations that may vary according to the passenger's needs. This type of service is designed to be highly flexible and convenient, offering personalized routes and travel times. **Service Implementation** - The service will be carried out using specialized electric buses equipped for the needs of people with disabilities. **Request Management Platform** - Requests will be managed through a specialized platform, providing citizens with various needs the opportunity to book their trips. They can specify the day and time, the desired destination, the final stop, and other details. **Accessibility:** The service will be available to people with disabilities (including students, elderly individuals, and others), both residents of Sofia and those visiting the city for health, educational, or other reasons. The platform will also provide information about available services for people with disabilities offered within the municipality of Sofia.
Reference to impact pathway	Field of action	Mobility & Transport
	Systemic lever	Technology/infrastructure; social innovation
	Outcome	Lower consumption and emissions, electrification, RES exploitation, awareness
Implementation	Responsible bodies/person for implementation	Sofia municipality
	Action scale & addressed entities	Municipality scale.
	Involved stakeholders	Municipal Transport Department and Municipal Company "Lozana"

Action 2.4.		
	Comments on implementation – consider mentioning resources, timelines, milestones	Procurement of: –25 electric buses with special equipment for the disabled –a software platform and mobile application for the use of specialized transport for disabled people
Impact & cost	Generated renewable energy (if applicable)	
	Removed/substituted energy, volume, or fuel type	216,000 litres per year of diesel
	GHG emissions reduction estimate (total) per emission source sector	3 500 tCO2eq
	GHG emissions compensated (natural or technological sinks)	
	Total costs and costs by CO2e unit	4,5 M EUR

Action 2.5.		
Action outline	Action name	***Establishment and management of Low Emission Zone for transport***
	Action type	
	Action description	The establishment of Low Emission Zone (LEZ) for motor vehicles through the busiest parts of the city in Sofia is one of the measures in the "Complex program for improving the quality of atmospheric air in the territory of the Sofia Municipality for the period 2021-2026". The introduction of the zone is regulated by an Ordinance of the Municipal Council. The zone was introduced in December 2023, but it will actually start functioning from December 2024 in the central part of the city. The zone is expected to expand in 2029, covering most of the urbanized territory. To ensure the effective implementation of the zone and its sustainability, the following are planned: 1. Measures for introduction and management of LEZ: • Signaling the LEZ's boundaries; • Control of compliance with restrictions; • Monitoring and analysis of LEZ effectiveness; • Active communication. 2. Measures to ensure the sustainability of LEZ: • Construction of buffer parking lots; • Expansion of the network of charging stations; • Development of a program for recycling old cars.

Action 2.5.		
Reference to impact pathway	Field of action	Mobility & Transport
	Systemic lever	Governance & policy; Social innovation;
	Outcome	Improved quality of ambient air; reducing the number of the most polluting cars in the city
Implementation	Responsible bodies/person for implementation	Sofia municipality
	Action scale & addressed entities	Territory of Sofia Municipality
	Involved stakeholders	Citizens, regional municipality administration, municipality transport companies
	Comments on implementation – consider mentioning resources, timelines, milestones	
Impact & cost	Generated renewable energy (if applicable)	
	Removed/substituted energy, volume, or fuel type	
	GHG emissions reduction estimate (total) per emission source sector	To be calculated
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	20,8 M EUR

Action 2.6.		
Action outline	Action name	**Lease/Purchase of new vehicles**
	Action type	Reduction of fuel used for vehicles
	Action description	1. A total of 32 high-emission vehicles are replaced with new electric vehicles. In 2023 a total of 32 vehicles were gradually removed from the fleet, through the purchase of 32 new electric cars respectively. 2. New electric ambulift - to carry disabled passengers was put into operation 3. New electric shuttle bus – for transportation of passengers between Terminal 1 and Terminal 2 (landside)
Reference to impact pathway	Field of action	Fuel (vehicles)
	Systemic lever	Technology
	Outcome (according to module B-1.1)	Reduced consumption of fuel for mobile sources
Implementation	Responsible bodies/person for implementation	SOF Connect Management / Transport and Fuels / Tendering and Purchases
	Action scale & addressed entities	Company - SOF Connect
	Involved stakeholders	Suppliers
	Comments on implementation	
Impact & cost	Generated renewable energy (if applicable)	-

Action 2.6.		
	Removed/substituted energy, volume or fuel type	~430 MW/year from reduced fuel consumption
	GHG emissions reduction estimate (total) per emission source sector	1. 99 t CO2/year from reduced fuel consumption 2. *Note: the carbon emissions for electricity will increase by 30 t of CO2year.* 3. 1.2 t CO2/year from reduced fuel consumption 4. 45 t CO2/year from reduced fuel consumption *Note: the carbon emissions for electricity will increase by 13.6 t of CO2/ year.*
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 2.7.		
Action outline	Action name	***Ground lighting system software upgrade***
	Action type	Reduction of electricity consumption
	Action description	Upgrading includes remote controlling, centralized monitoring system, as well as the possibility of grouping/de-grouping spotlights, switching or dimming of some apron areas. There are 750 sodium damp lights with a wattage of 400 W or 600 W each installed to light Sofia Airports Apron. Multiplied with an average of 4.400 operation hours annually this results in an energy consumption of approx. 1.650.000 kWh. The new software will allow Sofia Airport to reduce the apron ground lightings energy consumption by 20 %.
Reference to impact pathway	Field of action	Energy
	Systemic lever	Technology
	Outcome (according to module B-1.1)	Optimize the usage of the apron ground lighting to significantly reduce the systems electricity consumption
Implementation	Responsible bodies/person for implementation	SOF Connect Management / Technical / Electric
	Action scale & addressed entities	Company - SOF Connect
	Involved stakeholders	Suppliers
	Comments on implementation	Pending
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	335 MWh from reduced electricity consumption
	GHG emissions reduction estimate (total) per emission source sector	140 t CO2 from reduced electricity consumption

Action 2.7.		
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 2.8.		
Action outline	Action name	***Apron flood LED lighting***
	Action type	Reduction of electricity consumption
	Action description	The flood lighting system of the airport is equipped with a total of 750 high pressure sodium spotlights which require 375 kW of electric power. Replacement of the existing lamps with LED goes along with the reduction of lamps - the apron flood LED lighting will have a total of 158 LED lights
Reference to impact pathway	Field of action	Energy
	Systemic lever	Technology
	Outcome (according to module B-1.1)	Savings from the reduction of electrical consumption of each individual light and from the implementation of centralized lighting control system
Implementation	Responsible bodies/person for implementation	SOF Connect Management / Technical / Electric
	Action scale & addressed entities	Company - SOF Connect
	Involved stakeholders	Suppliers / Contractors
	Comments on implementation	Project ongoing, the implementation on site expected to start by the end of 2024
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	926 MWh/year from reduced electricity consumption
	GHG emissions reduction estimate (total) per emission source sector	382 t of CO2/year from reduced electricity consumption
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 2.9.		
Action outline	Action name	***Replacement of T2 lighting system with energy-efficient one***
	Action type	Reduction of electricity consumption
	Action description	The measure encompasses the whole lighting system of T2. The total number of installed and operated lighting fixtures is 7.353 with an average of 4.400 annual service hours the consumption is at 1.993 MWh. While new LED technology saves about 60% in energy consumption. Modernization and

Action 2.9.		
		reconstruction of existing lighting systems is planned by replacing it with modern high performance LED lighting units. The measure is characterized by higher initial investment but low operating costs. It will be implemented in stages in the period 2022 - 2032.
Reference to impact pathway	Field of action	Energy
	Systemic lever	Technology
	Outcome (according to module B-1.1)	Savings from the reduction of electrical consumption of each individual light and from the implementation of centralized lighting control system
Implementation	Responsible bodies/person for implementation	SOF Connect Management / Technical / Electric
	Action scale & addressed entities	Company - SOF Connect
	Involved stakeholders	Suppliers / Contractors
	Comments on implementation	Implemented in stages in the period 2022 - 2032
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	1195 MWh from reduced electricity consumption after full implementation of the measure by the end of 2032
	GHG emissions reduction estimate (total) per emission source sector	478 t of CO2 from reduced electricity consumption after full implementation of the measure by the end of 2032
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 3.1		
Action outline	Action name	***EE for waste treatment***
	Action type	
	Action description	The Sofia's waste treatment plant is developing programme for reducing the amount of electricity it uses for waste treatment and own needs. The core measure is the construction of a photovoltaic system on the territory of the plant to meet the electricity needs. The energy produced will be used for own needs, providing financial and environmental benefits for the plant. With their flexibility and ability to integrate with the electricity grid, photovoltaic systems provide a sustainable way to produce electricity and reduce carbon emissions.
Reference to impact pathway	Field of action	Energy system
	Systemic lever	Infrastructure
	Outcome	Meeting 60% own electricity needs

Action 3.1		
Implementation	Responsible bodies/person for implementation	Sofia Waste Treatment Plant
	Action scale & addressed entities	Waste Treatment Plant of Sofia Municipality
	Involved stakeholders	Sofia Municipality; ME “Waste Treatment Plant”
	Comments on implementation – consider mentioning resources, timelines, milestones	
Impact & cost	Generated renewable energy (if applicable)	11 520 MWh/y
	Removed/substituted energy, volume, or fuel type	
	GHG emissions reduction estimate (total) per emission source sector	5 852 tCO2
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 3.2		
Action outline	Action name	***Expanding the municipal food waste collection system***
	Action type	Waste management
	Action description	Expanding the system for food waste collection from the households by increasing with 5 000 the number of brown bins in the municipality. The collected food waste is fed to a gasification installation for sin gas production and subsequent production of electricity.
Reference to impact pathway	Field of action	Circular Economy, Energy Systems
	Systemic lever	Governance & policy, Technology
	Outcome	100 % increase the collected food waste.
Implementation	Responsible bodies/person for implementation	Planning and Management of Waste Activities Directorate of Sofia Municipality
	Action scale & addressed entities	Municipal scale
	Involved stakeholders	Households
	Comments on implementation – consider mentioning resources, timelines, milestones	The project is to be completed by the end of 2025.
Impact & cost	Generated renewable energy (if applicable)	13 500 MWh
	Removed/substituted energy, volume, or fuel type	
	GHG emissions reduction estimate (total) per emission source sector	5 858 tCO2e

Action 3.2		
	GHG emissions compensated (natural or technological sinks)	
	Total costs and costs by CO2e unit	2.5 M EURO

Action 3.3		
Action outline	Action name	***Recycling for tomorrow***
	Action type	Waste management
	Action description	Sofia Municipality will upgrade the system for separate collection of waste at the source, which is a basic principle in waste management. In this way, costs will be saved and benefits for the environment and the local economy will be realized. Two main activities will be implemented. 1. Regulatory amendments that will allow packaging recovery organizations to be twice more efficient then now in collecting the packaging waste stream; 2. Developing a municipal network of moveable centers and sites for separate collection at source of municipal solid waste - paper, cardboard, plastics, textiles, glass, metals, consumer electronics, white goods, batteries, and household hazardous wastes. All collected waste will be recycled. The municipality will continue with organizing campaigns to promote recycling among citizens. 30 t recycled waste – 10% less waste to Sofia Waste Treatment Plant per year
Reference to impact pathway	Field of action	Waste and circular economy
	Systemic lever	Infrastructure, governance & policy, learning and awareness
	Outcome	Increasing the waste recycled
Implementation	Responsible bodies/person for implementation	Sofia municipality, Sofia Waste treatment plant
	Action scale & addressed entities	Municipality scale
	Involved stakeholders	Packaging recovery organizations, citizens
	Comments on implementation – consider mentioning resources, timelines, milestones	
Impact & cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume, or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	19 753 tCO2e

Action 3.3		
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	2.5 M Euro

Action 4.1.		
Action outline	Action name	***Retrofit municipality buildings***
	Action type	Technical intervention
	Action description	The energy renovation of municipal buildings is a measure that will achieve environmental and financial benefits for the Sofia Municipality. Based on an analysis and survey of all buildings, they will be allocated to separate target groups according to the measures provided, including the construction of photovoltaic systems for own consumption. The analysis will also take into account the impact of climate change on vulnerable groups. As a result, an investment program will be prepared, which will begin to be implemented consistently. Depending on the groups, appropriate forms of financing will be sought - grants, loans, own funds, contracts with a guaranteed result.
Reference to impact pathway	Field of action	Built Environment
	Systemic lever	Infrastructure
	Outcome	Number of retrofit municipality buildings; 30% saved energy consumption
Implementation	Responsible bodies/person for implementation	Sofia Municipality
	Action scale & addressed entities	Territory of Sofia Municipality
	Involved stakeholders	Sofia Municipality, Regional Administrations
	Comments on implementation – consider mentioning resources, timelines, milestones	
Impact & cost	Generated renewable energy (if applicable)	
	Removed/substituted energy, volume, or fuel type	
	GHG emissions reduction estimate (total) per emission source sector	211 908 tCO2e
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	150 M Euro

Action 4.2.		
Action outline	Action name	***Implementation of energy management***
	Action type	
	Action description	Introduction of energy management in municipal buildings with the following sample modules: 1. Overview - general view of all connected objects with the accumulated consumed and produced energy for a given period, currently used and produced power and status of the devices. 2. Analysis - analysis of historical data, detection of energy losses or unexpected consumption, comparison of energy consumption of devices, etc. 3. Automations & Control - creating simple rules for controlling air conditioners, lighting, etc. upon occurrence of a certain event (exceeded consumption, certain time range, etc.), as well as the possibility of manual control of several types of devices. 4. Reports - creation of reports and filters based on location, floor, group of consumers, departments, etc. Ability to automatically send reports when a certain event or day of the month occurs, search for saved reports, etc. 5. Alarms - a list of informational, warning or alarm messages according to the type of equipment and preset threshold values. Possibility of historical references, adding a comment when the alarm is resolved, etc.
Reference to impact pathway	Field of action	Built Environment
	Systemic lever	Technology/infrastructure
	Outcome	20% saved energy consumption
Implementation	Responsible bodies/person for implementation	Sofia municipality
	Action scale & addressed entities	Municipal buildings
	Involved stakeholders	Regional municipal administrations; schools and kindergartens, healthcare municipal buildings
	Comments on implementation – consider mentioning resources, timelines, milestones	
Impact & cost	Generated renewable energy (if applicable)	
	Removed/substituted energy, volume, or fuel type	

Action 4.2.		
	GHG emissions reduction estimate (total) per emission source sector	14 130 tCOe
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	15.4 M EUR

Action 4.3.		
Action outline	Action name	***Street lighting renewal***
	Action type	Technical intervention
	Action description	Implementation of energy saving measures related to the rehabilitation of municipality street lighting. This include complete mapping of street lighting infrastructure, replacement of street lighting units with new LED one's and consoles; replacement of electrical panels for street lighting; supply and installation of equipment for control center for monitoring and control of street lighting; staff training.
Reference to impact pathway	Field of action	Built Environment
	Systemic lever	Technology/infrastructure
	Outcome	Up to 60% reduction of electric power consumption from street lighting
Implementation	Responsible bodies/person for implementation	Sofia Municipality
	Action scale & addressed entities	Territory of Sofia Municipality
	Involved stakeholders	Sofia Municipality, ME"Ulichno Osvetlenie" (Street Lighting managing company)
	Comments on implementation – consider mentioning resources, timelines, milestones	
Impact & cost	Generated renewable energy (if applicable)	
	Removed/substituted energy, volume, or fuel type	
	GHG emissions reduction estimate (total) per emission source sector	83 312 tCO2e
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	2.5 M Euro

Action 4.4.		
Action outline	Action name	***Retrofit of residential buildings***
	Action type	Technical intervention
	Action description	The main efforts of Sofia Municipality are aimed at reducing energy needs in residential buildings. Achieving the ambitious goals by 2030 necessitates the implementation of an aggressive and proactive policy. Efforts will focus on existing residential buildings, as new ones are with energy class 'A' or 'B'. The municipality's minimum goals are to support the renovation of 400 residential buildings. The strategy includes: 1. Further development of the existing Center for Energy Efficiency - Sofia and its transformation into a preferred place for information and assistance to the owners of residential properties for the implementation of energy efficiency measures. The center will develop an active information program to popularize financing opportunities among interested parties and for their technical support in the preparation of the project file; 2. Creation of a network of experts responsible for energy efficiency in regional administrations. The regional administration is closest to the citizens. The creation of a network of experts, their training, development and support will support the process of preparing project files; 3. Preparation of a projects pipeline - identification of potential residential buildings; helping owners' associations to prepare successful projects; a. Identification of the potential of building roofs for the production of solar energy on the territory of the entire municipality. The data will be with open access with the aim of assisting residential buildings in identifying appropriate energy efficient measures; 4. Active engagement with stakeholders at the national level to secure appropriate funding opportunities. The Sofia Municipality can assist in designing workable financing requirement, proposing amendments in programing documents and regulatory framework, analyzing the EE measures implementation and giving valuable feedback to financing authorities.
Reference to impact pathway	Field of action	Built Environment
	Systemic lever	Infrastructure

Action 4.4.		
	Outcome	Reduced electricity consumption
Implementation	Responsible bodies/person for implementation	Sofia Municipality
	Action scale & addressed entities	Municipal scale
	Involved stakeholders	Regional municipality administration, Center for EE – Sofia, national responsible institutions
	Comments on implementation – consider mentioning resources, timelines, milestones	
Impact & cost	Generated renewable energy (if applicable)	
	Removed/substituted energy, volume, or fuel type	
	GHG emissions reduction estimate (total) per emission source sector	704 452 tCO2e
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 4.5.		
Action outline	Action name	***Optimization of HVAC via BMS in terms of times of operation (minimized flow during night hours)***
	Action type	Reduction of buildings energy consumption
	Action description	An optimization to reduce the air flows of the HVAC systems in the premises of Terminals 1 & 2 will allow to reduce the buildings energy consumption. This will not affect the comfort of passengers inside the building but optimize the air flow according to the passenger numbers in the Terminal.
Reference to impact pathway	Field of action	Energy
	Systemic lever	BMS
	Outcome (according to module B-1.1)	Optimize the energy consumption for cooling
Implementation	Responsible bodies/person for implementation	SOF Connect Management / Technical / HVACG&A
	Action scale & addressed entities	Company - SOF Connect
	Involved stakeholders	-
	Comments on implementation	Pending 2025
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	335 MWh energy savings after full implementation of the measure by the end of 2025

Action 4.5.		
	GHG emissions reduction estimate (total) per emission source sector	231 t CO2 after full implementation of the measure by the end of 2025
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 4.6.		
Action outline	Action name	***Replacement of street lighting (Landside) for Terminal 1 & 2***
	Action type	Reduction of electricity consumption
	Action description	The exterior lighting system of the approach road to Terminal 2 and the business car park is realized by steel lighting columns located on both sides. The luminaires are sodium lamps with installed power of 250 W and 150 W, the total installed power is 44.9 kW. System control is automatic and manual depending on the time zone. The luminaires work 100 % simultaneously, the system control not providing for any other mechanism or operational organization. Total average annual working hours equal to 4 400. The existing street lighting systems for the approach road to Terminals 1 & 2 and the service parking area are planned to be modernized and reconstructed by replacing them with modern high-efficiency LEDs lamps with installed power of 150 W and 80 W while preserving the technical infrastructure and system management.
Reference to impact pathway	Field of action	Energy
	Systemic lever	Technology
	Outcome (according to module B-1.1)	Savings from the reduction of electrical consumption
Implementation	Responsible bodies/person for implementation	SOF Connect Management / Technical / Electric
	Action scale & addressed entities	Company - SOF Connect
	Involved stakeholders	Suppliers / Contractors
	Comments on implementation	Ongoing
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	133 MW/year
	GHG emissions reduction estimate (total) per emission source sector	53 t CO2/year
	GHG emissions compensated (natural or technological sinks)	N/A

Action 4.6.		
	Total costs and costs by CO2e unit	TBD

Action 4.7.		
Action outline	Action name	***Switching off partially LED lighting on covered car park (Terminal 2) during night hours and installation of motion sensors***
	Action type	Reduction of electricity consumption
	Action description	Utilizing the capabilities of the building management system combined with motion sensors includes remote controlling, centralized monitoring system, as well as the possibility of grouping/ ungrouping spotlights, switching or dimming of some of the parking's unused areas. With all these new possibilities to optimize the usage of the car parks lighting it is possible to significantly reduce the systems energy consumption
Reference to impact pathway	Field of action	Energy
	Systemic lever	Technology
	Outcome (according to module B-1.1)	Savings from the reduction of electrical consumption
Implementation	Responsible bodies/person for implementation	SOF Connect Management / Technical / Electric
	Action scale & addressed entities	Company - SOF Connect
	Involved stakeholders	Suppliers / Contractors
	Comments on implementation	Pending 2026
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	200 MW energy savings after full implementation of the measure by the end of 2026
	GHG emissions reduction estimate (total) per emission source sector	80 t CO2 emission savings after full implementation of the measure by the end of 2026
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 4.8.		
Action outline	Action name	***Airfield Ground Lighting LED replacement - all runway and taxiway center and edge lights***
	Action type	Reduction of electricity consumption
	Action description	The current apron guidance lighting is equipped with a total of 2.850 lighting spots. They use 206,6 MW. The LED replacement is foreseen to be one on one, the new lighting

Action 4.8.		
		system will have a power of 82,7 MW. 4.400 hours of lighting on an annual basis.
Reference to impact pathway	Field of action	Energy
	Systemic lever	Technology
	Outcome (according to module B-1.1)	Savings from the reduction of electrical consumption
Implementation	Responsible bodies/person for implementation	SOF Connect Management / Technical / Electric
	Action scale & addressed entities	Company - SOF Connect
	Involved stakeholders	Suppliers / Contractors
	Comments on implementation	Pending 2026
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	545,5 MWh/year energy savings
	GHG emissions reduction estimate (total) per emission source sector	218 t CO2/year
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 4.9.		
Action outline	Action name	***Terminal 1 reutilization***
	Action type	Reduction of electricity consumption
	Action description	Parts of Terminal 1 will be used as office space for SOF Connect, while the vast majority will be rented out to third parties working at the airport. This will result in major drops in Scope 1 & 2 emissions since Terminal 1 is due to its age one of the biggest sources for emissions under the control of SOF Connect. As an assumption for the reduction of electricity consumption is 30% due to the fact that many systems of the building will still need to be in service. The reduction in emissions will mainly occur because of the lower energy consumption of other building utilization compared to a Terminal.
Reference to impact pathway	Field of action	Buildings
	Systemic lever	Technology
	Outcome (according to module B-1.1)	Savings from the reduction of electrical consumption
Implementation	Responsible bodies/person for implementation	SOF Connect Management / Technical
	Action scale & addressed entities	Company - SOF Connect
	Involved stakeholders	-
	Comments on implementation	Pending 2030

Action 4.9.		
Impact & cost	Generated renewable energy (if applicable)	-
	Removed/substituted energy, volume or fuel type	1616 MWh by the end of 2030 energy savings
	GHG emissions reduction estimate (total) per emission source sector	599 t CO2 by the end of 2030
	GHG emissions compensated (natural or technological sinks)	N/A
	Total costs and costs by CO2e unit	TBD

Action 4.10		
Action outline	Action name	**Enabling Digitalization in the Construction Sector**
	Action type	Digital Europe
	Action description	The EDICS boosts the adoption of advanced digital technologies in the construction sector by offering customized services to SMEs and public organizations, addressing their specific needs and challenges in the green transition. It also serves as a connector to the broader EDICS network and a wide array of digitalization services across Europe
Reference to impact pathway	Field of action	Construction sector/circular economy/green transformation
	Systemic lever	Digital transformation
	Outcome (according to module B-1.1)	EDICS project aims to establish and develop a European Digital Innovation Hub for the Construction Sector (EDICS) in Bulgaria. This hub will bring together expertise, networks, and resources to provide customized digitalization services tailored specifically to the construction sector. The EDICS will serve as a one-stop shop for SMEs and public organizations seeking to digitalize their operations, assisting them in evaluating their digital maturity and offering services that best match their unique needs and challenges. These services will include "test before invest," acceleration support, access to financing, and the creation of synergies with international networks and platforms to help scale up innovations developed locally.
Implementation	Responsible bodies/person for implementation	Bulgarian Construction Chamber, Chamber of Architects in Bulgaria, Lyuben Karavelov Higher School of Construction, Institute on mechanics – BAS, Bulgarian Association for Project Management in Construction, Cleantech Bulgaria, Planex, Geostroy, Baumit Bulgaria, Esry-Bulgaria, University of Architecture Civil Engineering and Geodesy

Action 4.10		
	Action scale & addressed entities	Providing tailored services to SMEs and the public sector that address their specific needs and challenges in the green transition, while also serving as a link to the broader EDIH network and the extensive range of digitalization services available across Europe.
	Involved stakeholders	Branch organizations, business networks for clean technologies, educational institutions, leading companies in the field of construction, innovation, project management, building materials production and information technologies.
	Comments on implementation	▪ Support the development of digital strategies; ▪ Provision of research and expertise; ▪ participates in the organization of events and forums related to digitization in the sector; ▪ Support technology transfer, innovation and e-governance for SMEs and the public sector in protecting intellectual property and developing digital skills through training and certification centers.
Impact & cost	Generated renewable energy (if applicable)	
	Removed/substituted energy, volume or fuel type	
	GHG emissions reduction estimate (total) per emission source sector	To be calculated
	Total costs and costs by CO2e unit	To be calculated

Action 4.11		
Action outline	Action name	**INSPIRenov: FINancial Schemes for Providing Innovation in the Energy Renovation**
	Action type	Blended Financing Scheme Development
	Action description	The INSPIRenov project aims to develop and implement a blended financing scheme to support energy-efficient renovation of residential buildings in Bulgaria. This scheme combines grants and loans, facilitated by a risk-sharing mechanism and secured by loan guarantees. The goal is to increase private sector investment, reduce reliance on public funding, and provide sustainable financing options for energy renovations in multifamily residential buildings.
Reference to impact pathway	Field of action	Energy Efficiency Renovation in Residential Buildings

Action 4.11		
	Systemic lever	Financial Mechanisms and Market Development
	Outcome (according to module B-1.1)	The project is expected to enhance the capacity for large-scale energy renovations by creating a viable financial model that balances grants and loans, encouraging both private and public investment. It targets a significant increase in the renovation rate of residential buildings, contributing to national and European energy efficiency goals and reducing greenhouse gas emissions.
Implementation	Responsible bodies/person for implementation	In Bulgaria: Cleantech Bulgaria (CTBG): Coordinator Ministry of Regional Development and Public Works (MRDPW): Key partner responsible for co-developing the financing scheme Sofia Development Association (SDA): Engages stakeholders and manages Pathfinder for Innovation Working Groups Bulgarian-Austrian Consulting Company (BACC) Bulgarian Facility Managers Association (BGFMA) Support from other countries: GESB (Hungary) and EKYL (Estonia)
	Action scale & addressed entities	National level, focusing primarily on the Bulgarian residential building stock, particularly multifamily buildings.
	Involved stakeholders	Public authorities, financial institutions (including commercial banks); Professional facility managers' Homeowners and homeowner associations; Energy audit companies
	Comments on implementation	The project involves a collaborative approach through the formation of Pathfinder for Innovation Working Groups (PIWG) and intensive stakeholder engagement. A key focus is on adaptability and replicability of the financing model across different EU countries facing similar challenges in energy renovation.
Impact & cost	Generated renewable energy (if applicable)	Estimated at 14 GWh/year from the inclusion of renewable energy measures in at least 15% of renovated buildings
	Removed/substituted energy, volume or fuel type	Not explicitly calculated, but significant reductions are anticipated based on the renovation measures improving energy efficiency in residential buildings.
	GHG emissions reduction estimate (total) per emission source sector	Expected reduction of approximately 42,000 tCO2-eq/year based on the renovation of 400 buildings with an average reduction of 0.035 tCO2-eq per square meter per year
	Total costs and costs by CO2e unit	**Total estimated investment**: €180 million for the renovation of 1.2 million square meters at an estimated cost of €150 per square meter

Action 4.11		
		Cost per unit of CO2e reduction: Not specifically detailed in the documents, but the financial model aims to maximize the cost-effectiveness by balancing grant and loan components.

B-2.3: Summary strategy for residual emissions

The residual emissions currently comes as a difference between the possible target to be achieved and the net-zero balance.
Total emissions that are not accounted for in this Action Plan: 804 889,64 tCO2e/a (19%)

The proposed interventions included in the Action Plan reflect the city's priority actions to achieving climate neutrality. These depends on the implementation capacity of the municipality and the focus is mainly on those interventions for which Sofia is directly accountable. However, we have a continuous policy for broadening the scope of intervention in order to reduce the emissions that are currently not accounted for in this version of the Climate Neutrality Action Plan. We are actively communicating the private sector to encourage them and explore the possibility to implement additional interventions.

The Net-Zero City Action Plan brings together all major interventions planned by the Municipality to achieve climate neutrality by 2030. The activities and proposals described in this plan complement the priority projects from local strategies and were estimated to reduce together the GHG emissions to a target level of 81%.

Offsetting measures are already being implemented by Sofia Municipality including actions with major carbon sinks (rehabilitation and/or expansion of the existing parks, green areas, planting of numbers of new trees and creating a green belt around the city).

Considering that achieving climate-neutrality is a joint effort for the entire community, private companies will be continue to be a close partner of the city on the path to climate neutrality, both as sources of technological innovations and also through implementing ESG and carbon neutrality strategies. Thus contributing to the offsetting of a considerable share of residual emissions.

The strategy of the city for offsetting the remaining emissions will be based on the following compensation options:
- further development of the green system for managing the absorption of CO2 within the city boundaries
- develop forests as natural sinks around the city for managing the sequestration of carbon
- soil management to improve topsoil and the ability of the soil to sequester carbon
- support and participation in climate-related projects not only at local but also at regional and national level involving third parties.

The actions in industrial sector and the actions not yet quantified or not included (see section B1.1 Impact pathways) may contribute to decrease the offset needs, boosting the savings in IPPU, mobility and buildings sectors.

3.3 Module B-3 Indicators for Monitoring, Evaluation and Learning

Module B-3 “Indicators for Monitoring, Evaluation and Learning” contains a selection of indicators to monitor and evaluate progress along the selected impacts pathways and fields of action described in Module B-1. as well as a monitoring and evaluation plan, i.e., metadata on each indicator selected, in addition to milestones and timeline. More specifically:

- An overview table listing the indicators selected per outcome and impact including targets and evaluation points (B-3.1);
- A metadata table for each indicator selected (B-3.2).

B-3.1: Impact Pathways (Indicators)						
Outcomes/ impacts addressed	Action/ project	**Indicator No.** (unique identified)	Indicator name	Target values		
Target year				2026	2028	2030*
(List early changes/ late outcomes and impacts to be evaluated by indicator)	(List action/ pilot project if applicable)	(Indicate unique identifier)	(Insert indicator name)	(List one value per indicator)	(List one value per indicator)	(List one value per indicator)
Stationary energy (Energy system & built environment) • Reduced consumption of conventional fuels • Increased share of renewable energy in the final energy consumption by introducing RES • Established procedures and rules for energy communities • Retrofitting the municipal buildings,	1.2. Implementation of small hydropower plants at water supply network of Sofia Municipality 1.3. Installation of PV panels on municipal water and wastewater sites 1.4. Roll out of energy communities 1.5. Introduction of a temperature band for heating/ cooling terminal buildings 1.6. Construction of photovoltaic (solar) farm 1.7. Implementation of a heating/cooling system	BL_PR_GHG_EL	GHG emissions from private buildings and facilities (Electricity consumption) (% vs baseline)	30%	55%	81%
		BL_PR_MWH_EL	Annual electricity consumption for private buildings and facilities (MWh)	1 158 517	2 123 949	3 127 997
		BL_PR_CO2_LQ	GHG emissions from private buildings and facilities (Liquid fuel consumption) (% vs baseline)	40%	60%	82%
		BL_PR_CO2_SD	CO2 emissions from private sector (Natural gas consumption) (% vs baseline)	40%	60%	85%
		BL_PUB_CO2_EL	CO2 emissions from public buildings and facilities (Electricity consumption) (% vs baseline)	30%	50%	70%

B-3.1: Impact Pathways (Indicators)						
Outcomes/ impacts addressed	Action/ project	**Indicator No.** (unique identified)	Indicator name	Target values		
Target year				2026	2028	2030*
including schools, kindergartens, health care centers and hospitals • Introducing Energy Management Systems and Building management systems • Introducing RES in private buildings • Make public lighting greener & more sustainable	5.4. RES in private buildings 5.5. Optimization of HVAC via BMS in terms of times of operation (minimized flow during night hours)					
	5.1. Retrofitting the municipal buildings 5.2. Introduction of Energy Management System in municipal buildings	BL_PUB_MWH_EL	Annual electricity consumption for public buildings (Electricity) (MWh)	4 891	8 152	11 413
		BL_PUB_CO2_LQ	CO2 emissions from public buildings and facilities (Liquid fuel consumption) (% vs baseline)	40%	65%	95%
	5.6. Replacement of street lighting (Landside) for Terminal 1 & 2 5.7. Switching off partially LED lighting on covered car park (Terminal 2) during night hours and installation of motion sensors 5.8. Airfield Ground Lighting LED	BL_MLIGHT_MWH_EL	Annual electricity consumption of Public Street Lighting (MWh)	13 667	22 778	31 889

B-3.1: Impact Pathways (Indicators)						
Outcomes/ impacts addressed	Action/ project	**Indicator No.** (unique identified)	Indicator name	Target values		
Target year				2026	2028	2030*
	replacement - all runway and taxiway center and edge lights					
Transport & Mobility	2.1. Sofia at a new speed – complete renewal of public transport fleets 2.2. Promotion of cycling as an alternative mode of transportation 2.3. Installation of a new charging infrastructure for recharging electric vehicles using recovered electrical energy 2.4.Sustainable transportation for people with disabilities 2.5. Establishment and management of LEZ for transport vehicles 2.6. Lease/Purchase of new vehicles for the Sofia Airport	TRS_PUB_CO2_LQ	CO2 emissions from Public transport (liquid fuel) (% vs baseline)	30%	50%	70%
		TRS_PUB_CO2_NG	CO2 emissions from Public transport (Natural gas) (% vs baseline)	25%	40%	60%
		TRS_MUN_CO2_LQ	CO2 emissions from municipal transport vehicles (liquid fuel) (% vs baseline)	30%	60%	80%
		TRS_PR_CO2_LQ	CO2 emissions from private sector vehicles (liquid fuel) (% vs baseline)	15%	25%	40%

B-3.1: Impact Pathways (Indicators)						
Outcomes/ impacts addressed	Action/ project	**Indicator No.** (unique identified)	Indicator name	Target values		
Target year				2026	2028	2030*
	2.7. Sofia Airport ground lighting system software upgrade 2.8.Apron flood LED lighting at Sofia Airport 2.9.Replacement of t2 lighting system with energy efficient one at Sofia Airport					
Waste	3.1. EE for waste treatment	WST_PUB_CO2_DIS	CO2 emissions from waste disposal (% vs baseline)	35%	50%	70%
	3.2. Expanding the municipal food waste collection system	WST_CO2_IN_TR	CO2 emissions from waste treatment within city boundaries (% vs baseline)	30%	45%	60%
	3.3. Recycling for tomorrow	WST_CO2_OUT_TR	CO2 emissions from waste treatment out of city boundaries (% vs baseline)	10%	25%	40%

**The final monitoring of the indicators for 2030 will be done in 2032 after the final inventory of GHG emissions is completed.*

3.3.1 Stationary Energy

B-3.2: Indicator Metadata - BL_PR_GHG_EL	
Indicator Name	GHG emissions from private buildings and facilities (Electricity consumption)
Indicator Unit	tCO2 e/y
Definition	CO2 emissions from residential buildings using electricity for heating
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Building sector
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Building energy efficiency
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	National Statistical Institute, Sustainable Energy Development Agency, Sofia Municipality, Private consumers
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	TBD
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata – BL_PR_MWH_EL	
Indicator Name	Annual electricity consumption for private buildings and facilities
Indicator Unit	MWh/y
Definition	Electricity consumption in MWh from residential buildings
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Building sector
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-

B-3.2: Indicator Metadata – BL_PR_MWH_EL	
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Building energy efficiency
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Sofia Municipality
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	TBD
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata – BL_PR_CO2_LQ	
Indicator Name	GHG emissions from private buildings and facilities (Liquid fuel consumption)
Indicator Unit	t CO2 e/year
Definition	CO2 emissions from liquid fuel consumption in Private Buildings
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it measure?	Building sector
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Building Energy Efficiency
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	NSI, Sofia Municipality, private consumers

B-3.2: Indicator Metadata – BL_PR_CO2_LQ	
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	TBD
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata – BL_PR_CO2_SD	
Indicator Name	CO2 emissions from Private Sector (Solid fuels consumption)
Indicator Unit	t CO2e/y
Definition	CO2 emissions from solid fuels usage in Private Sector
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Building sector
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Building Energy Efficiency
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	NSI, Sofia Municipality, private consumers
Is the data source local or regional/national?	Local

B-3.2: Indicator Metadata – BL_PR_CO2_SD	
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	-
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata – BL_PUB_CO2_EL	
Indicator Name	CO2 emissions from Public Buildings (Electricity consumption)
Indicator Unit	tCO2e/y
Definition	CO2 emissions from Public Sector Electricity usage in Buildings
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Building sector
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Building Energy Efficiency
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Sofia Municipality, municipal entities and municipal companies, national administrations
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	-
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata – BL_PUB_MHW_EL	
Indicator Name	Electricity consumption of Public Buildings (Electricity)
Indicator Unit	tCO2e/y
Definition	CO2 emissions from Public Sector Electricity usage in Buildings
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Building sector
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Building Energy Efficiency
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Sofia Municipality
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	-
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata- BL_MLGHT_MWH_EL	
Indicator Name	Electricity Consumption of Public Street Lighting
Indicator Unit	MWh/year
Definition	MWh from Municipality Lighting Electricity usage
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Building sector (Municipality Lighting)
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Building Energy Efficiency
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	

B-3.2: Indicator Metadata- BL_MLGHT_MWH_EL	
Expected data source	Sofia Municipality, Ulichno osvetlenie EAD (Street lighting Ltd)
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	-
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata – BL_PUB_CO2_LQ	
Indicator Name	CO2 emissions from Public Buildings (Liquid fuels)
Indicator Unit	tCO2e/y
Definition	CO2 emissions from Public Sector Diesel usage in Buildings
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Building sector
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Building Energy Efficiency
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	-
Data requirements	
Expected data source	NSI, Sofia Municipality, private consumers
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	

B-3.2: Indicator Metadata – BL_PUB_CO2_LQ	
Deliverables describing the indicator	-
Other indicator systems using this indicator	-

3.3.2 Transport Sector

B-3.2: Indicator Metadata – TRS_PUB_CO2_LQ	
Indicator Name	CO2 emissions from Public Transport (Liquid fuel)
Indicator Unit	tCO2e/y
Definition	CO2 emissions from Diesel consumption in Public transport vehicles
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it measure?	Public Transport
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Sustainable transport
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	-
Data requirements	
Expected data source	Sofia urban mobility center , Stolichen Avtortransport EAD
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	TBD
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata – TRS_PUB_CO2_NG	
Indicator Name	CO2 emissions from Public Transport (CNG)
Indicator Unit	tCO2e/y
Definition	CO2 emissions from CNG consumption in Public transport vehicles
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it measure?	Public transport (Gasoline usage)

B-3.2: Indicator Metadata – TRS_PUB_CO2_NG	
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Sustainable transport
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Sofia Municipality
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	TBD
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata – TRS_MUN_CO2_LQ	
Indicator Name	CO2 emissions from municipal transport vehicles (liquid fuel)
Indicator Unit	tCO2e/y
Definition	CO2 emissions from municipal fleet using liquid fuels
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it measure?	Transport sector
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Sustainable transport
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Sofia Municipality
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	TBD
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata – TRS_PR_CO2_LQ	
Indicator Name	CO2 emissions from Private Sector vehicles (liquid fuels)
Indicator Unit	tCO2e/y
Definition	CO2 emissions from private fleet using liquid fuels
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	yes
If yes, which emission source sectors does it measure?	Transport Sector – private vehicles
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Sustainable transport
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Road transport administration Executive Agency, Ministry of Interior
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	TBD
Other indicator systems using this indicator	-

3.3.3 Waste

B-3.2: Indicator Metadata – WST_PUB_CO2_DIS	
Indicator Name	CO2 emissions from Municipal Waste Disposal
Indicator Unit	tCO2e/y
Definition	CO2 emissions from Municipal Waste Disposal
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Waste sector (Waste Disposal)
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Waste Management

B-3.2: Indicator Metadata – WST_PUB_CO2_DIS	
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Sofia Municipality, ME “Waste Treatment Plant”, NEEA
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	-
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata – WST_CO2_IN_TR	
Indicator Name	CO2 emissions from treatment of Municipal Waste within city boundaries
Indicator Unit	tCO2e/y
Definition	CO2 emissions from Municipal Waste treatment within city boundaries
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Waste sector (Waste Disposal)
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Waste management
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Sofia Municipality, ME “Waste Treatment Plant”, NEEA
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	-
Other indicator systems using this indicator	-

B-3.2: Indicator Metadata – WST_CO2_OUT_TR	
Indicator Name	CO2 emissions from treatment of Municipal Waste out of city boundaries
Indicator Unit	tCO2e/y
Definition	CO2 emissions from Municipal Waste treatment out of city boundaries
Calculation	Based on GPC and GHG emissions Baseline Inventory methodology
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Public Sector (Diesel usage)
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Sustainable transport
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Sofia Municipality
Is the data source local or regional/national?	Local
Expected availability	Available annually
Suggested collection interval	Annually
References	
Deliverables describing the indicator	-
Other indicator systems using this indicator	-

4 Part C – Enabling Climate Neutrality by 2030

4.1 Module C-1 Governance Innovation Interventions

This module details the city´s governance innovations for achieving city climate neutrality by 2030, describing innovations in institutional design, in leadership, and in collaborative and outreach processes, whether they are inter-organizational or internal to the key organizations responsible for the city´s climate neutrality target.

C-1.1: Description or visualization of the participatory governance model for climate neutrality

Sofia's approach to achieving climate neutrality by 2030 relies on an integrated governance model that aligns existing city administration structures with broader collaborative efforts involving multiple stakeholders. This model incorporates innovative governance structures and participatory processes to ensure comprehensive engagement across sectors and levels of government, as well as with non-government actors.

The governance model integrates various interventions to enhance coordination, improve decision-making, and foster community involvement. These interventions are designed to overcome systemic barriers and capitalize on opportunities identified in the city's climate action strategy. Key elements of Sofia's participatory governance model include:

Permanent Climate Neutrality Unit:

The existing Climate Neutrality Transition Unit will be transformed into a Permanent Climate Neutrality Unit within Sofia Municipality and will serve as a dedicated entity within Sofia Municipality to oversee and coordinate all climate actions. This unit is central to the city's efforts to ensure alignment and coherence across various departments and external stakeholders. By providing a dedicated structure, the unit facilitates horizontal collaboration among municipal departments and vertical integration with regional and national authorities. This approach helps streamline decision-making processes, allocate resources efficiently, and maintain consistent policy implementation. The unit enhances organizational cohesion and ensures that climate actions are consistently aligned across multiple sectors and governance levels.
Also improves the effectiveness of climate mitigation efforts and supports sustainable urban development.

One-stop Shop for Energy Efficiency

The One-stop Shop for Energy Efficiency represents a key initiative to support citizens and businesses in adopting energy-saving measures. By offering a centralized platform for information on energy efficiency, financial incentives, and support programs, the one-stop shop addresses the challenges related to information accessibility and complexity. This initiative also serves as a hub for engaging the public in energy-saving practices, thereby contributing to Sofia's broader sustainability goals. The shop encourages collaboration between municipal departments, NGOs, and energy service companies, fostering a community-driven approach to energy efficiency.

Energy Managers in Municipal Buildings

This initiative involves appointing dedicated energy managers to oversee and optimize energy use in municipal buildings, including schools and administrative offices. These managers are tasked with overseeing energy use, identifying opportunities for savings, and implementing best practices for energy management. This initiative helps to reduce energy consumption and operational costs while demonstrating leadership in sustainable practices. It also creates a feedback loop within the governance model, where data collected and lessons learned can inform broader policy and strategy adjustments.

Green Public Procurement

Green Public Procurement (GPP) is an innovative strategy that integrates environmental considerations into the purchasing decisions of Sofia Municipality. By prioritizing sustainable goods and services, GPP leverages the city's purchasing power to drive market demand for eco-friendly products and reduce the environmental footprint of municipal operations. This initiative encourages collaboration across various municipal departments and with external suppliers, promoting a circular economy and supporting Sofia's climate neutrality objectives. It also serves as a model for other cities, showcasing how public procurement can be a powerful tool for sustainable development.

Collaborative Mechanisms and Stakeholder Engagement:

The governance model emphasizes the importance of stakeholder engagement and public participation in achieving climate neutrality. Sofia employs several mechanisms to involve a broad range of stakeholders:

- **Horizontal and Vertical Collaboration:** The model ensures effective coordination across municipal departments and alignment with higher levels of government. This multi-level governance approach facilitates the integration of local climate actions with national and regional policies, enhancing the overall impact of Sofia's climate strategy.
- **Partnerships and Networks:** Sofia actively engages with NGOs, academic institutions, business associations, and other non-governmental actors. These partnerships are crucial for driving innovation, mobilizing resources, and fostering a collaborative environment that supports climate action.
- **Citizen Participation:** Engaging citizens is a core element of the governance model. Sofia uses various tools, including public consultations, and educational campaigns, to ensure that residents are informed, involved, and supportive of climate initiatives. Digital platforms, such as the One-stop Shop for Energy Efficiency, also play a key role in facilitating citizen engagement and providing accessible information on sustainability practices.

Sofia's governance model directly addresses key barriers and leverages opportunities. For example:

- **Centralized Coordination:** The Permanent Climate Neutrality Unit addresses the barrier of fragmented efforts by providing a dedicated structure for coordination, enhancing overall effectiveness and ensuring sustained action towards climate neutrality.
- **Market Stimulation:** Green Public Procurement takes advantage of the opportunity to use municipal purchasing power to encourage market demand for sustainable products, contributing to emission reductions and promoting the circular economy.
- **Access and Engagement:** The One-stop Shop for Energy Efficiency addresses barriers related to information access and resource availability, supporting broader adoption of energy-efficient measures and contributing to the impact pathway of reducing greenhouse gas emissions.

By integrating these innovative governance structures and participatory processes, Sofia is committed to achieving climate neutrality through inclusive, effective, and sustainable climate action.

C.1.2: Relations between governance innovations, systems, and impact pathways					
Intervention name	**Description**	**Systemic barriers / opportunities addressed**	**Leadership and stakeholders involved**	**Enabling impact**	**Co-benefits**
Transformation of the Transition Unit into a Permanent Climate Neutrality Unit	Transition Unit will be established as a permanent entity within Sofia Municipality. This unit will oversee all efforts towards achieving climate neutrality, including the execution of the Climate City Contract, action plans, and investment strategies. By actively involving key stakeholders, the unit will ensure thorough planning and effective implementation of climate actions across all sectors.	Need for long-term commitment and sustained coordination of climate actions; Lack of continuity in climate governance.	• Sofia Municipality • Ministry of Environment and Waters • Ministry of Energy • Ministry of Transport and Communications • Ministry of Innovation and Growth • Sofia City Council, • NGOs, Business Associations	Ensures long-term institutional commitment and strategic oversight of climate actions; Facilitates integrated planning and stakeholder engagement across sectors.	Improved governance structure for climate action, enhanced coordination among city departments and stakeholders sustained focus on achieving climate neutrality goals.
One-stop shop for Energy Efficiency	Establishment of a centralized resource hub for information on energy efficiency measures, including consultations, technical support, and access to financing. This service simplifies the process for citizens and businesses to implement energy-saving measures and install renewable energy technologies.	Simplifies access to information and financial resources, promoting wider adoption of energy-efficient practices.	Sofia Municipality, Ministry of Regional Development, energy companies, banks, NGOs	Facilitates the adoption of energy-efficient practices, reduces emissions, and lowers energy costs by providing clear guidance and support. Increases awareness and adoption of energy-efficient practices.	Reduced energy consumption, lower GHG emissions, and economic savings for citizens and businesses.
Green Public Procurement	Introduction of green procurement policies to require the purchase of environmentally friendly products and services. This includes criteria for	Leverages public procurement to drive sustainability and innovation; Addresses the need for reduced environmental	Sofia Municipality, procurement departments, suppliers, public organizations	Promotes sustainable development, reduces carbon footprint, and stimulates the market for	Supports circular economy, reduces emissions, fosters green innovation, and

C.1.2: Relations between governance innovations, systems, and impact pathways					
Intervention name	**Description**	**Systemic barriers / opportunities addressed**	**Leadership and stakeholders involved**	**Enabling impact**	**Co-benefits**
	energy efficiency, use of sustainable materials, and minimization of waste throughout the product lifecycle.	impact in municipal operations.		green products.	achieves cost savings.
Energy Managers in Municipal Buildings	Appoint dedicated Energy Managers in municipal buildings, including schools and kindergartens, to monitor energy use, conduct audits, implement efficiency measures, and provide training on sustainable practices. This initiative aims to optimize energy consumption and reduce costs, leading to significant financial savings and improved energy efficiency.	• High energy consumption and costs in public buildings. • Lack of awareness and utilization of energy management services. Opportunity to reduce municipal energy expenditure and improve building conditions.	Sofia Municipality Municipal facility management; educational institutions. Energy Service Companies (ESCOs).	• Achieves significant energy savings and emission reductions in municipal buildings. • Fulfils EU and national energy efficiency obligations. • Enhances operational efficiency and sustainability awareness among staff.	Lower energy bills, reduced emissions, and enhanced comfort in public buildings. Supports the creation of green jobs and local expertise.

4.2 Module C-2 Social Innovation Interventions

This module details the social innovation initiatives undertaken by Sofia Municipality to foster community engagement, promote sustainable practices, and overcome systemic barriers. These initiatives aim to leverage social dynamics such as entrepreneurship, social awareness, mobilization, cohesion, and solidarity to support the city's climate neutrality goals. Below is an overview of key interventions, their objectives, stakeholders, and expected impacts.

Table C.2.1: Relations between social innovations, systems, and impact pathways

Intervention name	Description	Systemic barriers / opportunities addressed	Leadership and stakeholders involved	Enabling impact	Co-benefits
Eco-Pavilions for Waste Separation and Recycling	Interactive spaces across Sofia to educate citizens about recycling and waste management, encouraging active participation in sustainable practices.	Addresses low public awareness and engagement in recycling; Leverages opportunity for community involvement in sustainability.	Led by the Directorate for Planning and Waste Management Activities; collaboration with local schools, NGOs, and community organizations.	Increases recycling rates and fosters a culture of sustainability within the community.	Improves waste management, reduces landfill use, enhances environmental awareness, and promotes civic engagement.
Workshops and Information Campaigns on Sustainable Practices	A series of workshops and campaigns aimed at educating various demographics on sustainability topics such as energy efficiency, waste reduction, and climate action.	Overcomes lack of knowledge and engagement in sustainability practices; leverages educational opportunities.	Led by the Directorate for Climate, Energy, and Air; partners include educational institutions, NGOs, and private sector entities.	Enhances public understanding and adoption of sustainable practices, fostering a more engaged and informed citizenry.	Reduces energy consumption and waste, supports community cohesion, and promotes environmental stewardship.
Green Job Training Programs	Provides training for local residents in green skills, such as sustainable construction, renewable energy installation, and energy auditing.	Addresses skill gaps and unemployment; leverages opportunity to create green jobs and stimulate local economy.	Led by Sofia Municipality; collaboration with local vocational schools, universities, Employment, Training and businesses.	Builds capacity for sustainable development within the local workforce, supporting long-term economic resilience.	Creates employment opportunities, fosters economic growth, and accelerates the transition to a green economy.

C-2.2: Description of social innovation interventions

Sofia Municipality implement several social innovation interventions to address the systemic barriers and opportunities related to achieving climate neutrality. These initiatives are designed to foster public engagement, enhance community resilience, and support sustainable development practices.

The Eco-Pavilions for Waste Separation and Recycling address barriers related to low public engagement and awareness in recycling by providing interactive, educational spaces that encourage sustainable waste management practices. By encouraging community-led sustainability actions, the Eco-Pavilions aim to increase recycling rates and promote a culture of environmental responsibility among residents.

Workshops and Information Campaigns on Sustainable Practices will also be a crucial intervention, targeting the current lack of public knowledge and engagement in climate actions. These workshops will offer practical learning opportunities on topics such as energy efficiency, waste reduction, and climate adaptation. By empowering citizens with the necessary knowledge and skills to make environmentally conscious decisions, these initiatives will help build a more sustainable and informed community.

Green Job Training Programs help bridge skill gaps in the workforce and leverage opportunities for economic growth through the creation of green jobs. These programs prepare residents for careers in sustainable industries, supporting both economic and environmental goals.

To ensure inclusivity, these initiatives are designed with a focus on accessibility for marginalized groups. The Eco-Pavilions will be strategically located in diverse neighborhoods to engage a broad audience, ensuring that everyone has the opportunity to participate in sustainable practices. The Green Job Training Programs will specifically target unemployed or underemployed individuals, equipping them with valuable skills that are in high demand within the green economy, thereby fostering both economic and social resilience.

For long-term impact and scalability, these interventions will be fully integrated into Sofia's comprehensive climate strategy, with strong and continuous support from the municipality. A system of continuous monitoring and evaluation will be implemented to refine these programs, ensuring their effectiveness and relevance over time. Successful initiatives will be scaled up through additional funding, strategic partnerships, and public-private collaborations. By actively involving local communities from the very beginning, the city aims to create sustainable, lasting impacts, with regular feedback loops allowing for adjustments based on evolving community needs and preferences.

5 Outlook and next steps

This section should draw any necessary conclusions on the CCC Action Plan above and highlight next steps and plans for refining the CCC Action Plan as part of the Climate City Contract in future iterations.

Plans for next CCC and CCC Action Plan iteration

The Climate City Contract, as "live" document is subject to a continuous improvement iterative process and is planned to be reviewed in the next two years. The next steps to be taken in the process of reviewing and improving the document comprise:

1. Review and adjustment of the portfolios so that they reflect even more accurately the ambition of the climate action plan and the associated capital and investment needs.
2. Select actions - initiatives and projects included in the Action Plan to identify possibilities in view of ensuring their financing and adequate implementation.
3. Deepen the interdepartmental and multi-level collaboration in order to improve coordination and increase effectiveness for advancing smoothly the implementation of both Climate Action Plan and Climate Investment Plan
4. Search for additional specific commitments from various entities and organizations for obtaining their formal commitment within the framework of the CCC, through signing of Letters of Intent/Support, to support and collaborate in the achievement of the objectives and goals established therein.
5. Strict follow-up of the monitoring and evaluation plan in view of indicators, data collection method and monitoring reporting requirements.
6. Collection of baseline data on the key indicators identified in the M&E plan, in order to establish a basis for comparison and analysis.
7. Analysis of reference indicators and degree of progress in achieving emission reduction targets.
8. Review of the CCC based on the results of the evaluation process, including assessment of the effectiveness of the monitoring and evaluation process and identification of areas for improvement.
9. Produce 1st iteration considering the findings and outcomes from the implementation and monitoring process.
10. Repeat the process from 1 to 8
11. Produce 2nd iteration considering the findings and outcomes from the implementation and monitoring process
12. Repeat the process from 1 to 8
13. Collection of data for the Final GHG Inventory
14. Final GHG Inventory showing the achieved 81%+ target for reduction of GHG emissions vs baseline

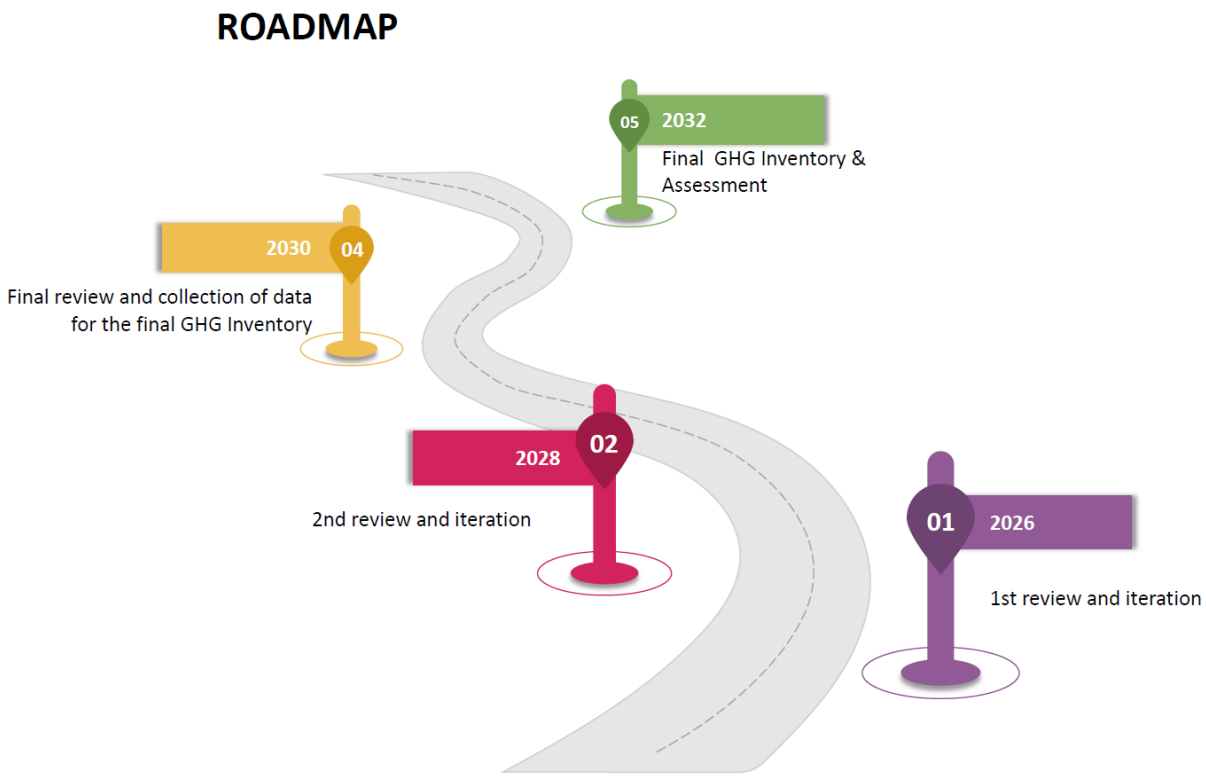
The deadlines shown below are indicative and may be modified and adapted during the course of the years, with a maximum deadline of 2 years for a 2nd version of the CCC, 4 years for the 3rd version of the CCC and 6 years for completion of the CCC and production of Final GHG Inventory.

C-2.2: Planned Timeline for CCC Review and Iteration

Num	Tasks	Start date	Final date
T1	Review and adjustment of the portfolios	M1	M6
T2	Specification of the initiatives and projects included in the Action Plan	M1	M6
T3	Deepen the interdepartmental and multi-level collaboration	M1	M6
T4	Search for additional specific commitments	M1	M12
T5	Strict follow-up of the monitoring and evaluation plan	M6	M12
T6	Collection of baseline data on the key indicators	M12	M18

T7	Analysis of reference indicators and degree of progress	M18	M20
T8	Review of the CCC based on the results of the evaluation process	M20	M23
Milestone 1	1st iteration – 2nd version of CCC	M24	M24
T11	Repeat the process from T1 to T8	M25	M47
Milestone 2	2nd iteration – 3rd version of CCC	M48	M48
T13	Repeat the process from T1 to T8	M49	M71
T14	Collection of data for the Final GHG Inventory	M72	M96
Milestone 3	Final GHG Inventory showing the achieved 81%+ target for reduction of GHG emissions vs baseline	M90	M96

The roadmap for achieving our goal to become climate-neutral and smart city is shown in the below figure.



6 Annexes

6.1 GHG Inventory of Sofia Municipality for 2022

INVENTORY OF GREENHOUSE GAS EMISSIONS

CITY OF SOFIA

25/07/2024

PROJECT TEAM

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SUMMARY

Sofia Municipality has undertaken an inventory of greenhouse gas (GHG) emissions for the year 2022, aligning with its commitments under the Covenant of Mayors European initiative and the Compact of Mayors Global Platform. This inventory utilized methodologies from the Sustainable Energy Action Plans (SEAPs) guidelines, specifically Part II on Basic Emissions Inventory, the Global Protocol for GHG Emissions Inventory, and the IPCC's 2006 Guide for National GHG Inventories.

The inventory encompasses several sectors: residential, tertiary and municipal buildings, equipment and facilities, industry and construction, agriculture and forestry, accidental emissions from natural gas supply, transportation (road, rail, and aviation), and waste and wastewater management. Data was gathered from municipal sources as well as numerous public and private organizations. It includes all 24 administrative regions within the municipality.

In terms of energy consumption, the total for the municipality reached 10,060,567 MWh in 2022, a reduction of 12% from 11,437,985 MWh in 2018.
Regarding emissions, the total for 2022 was 4.2 million tons of CO2-equivalent, down from 4.6 million tons in 2018, reflecting a decrease of 8%.

Households (43%), industry (21%), road transport (16%) and trade and services (13%) being, in that order, the prominent sources of emissions.

INTRODUCTION

Global climate change is the phenomenon that will cause the greatest upheaval in human history. The origins of this phenomenon are well documented: according to the Intergovernmental Panel on Climate Change (IPCC), greenhouse gas (GHG) emissions from human activities are the main cause of this change (IPCC, 2021). The combustion of fossil fuels in industry and transport, as well as the destruction of natural areas, such as deforestation and soil mineralization, are the main culprits.

The increase in the concentration of greenhouse gases in the atmosphere is unbalancing the planet's energy balance by preventing solar and infrared radiation from escaping into space. This imbalance leads to an average rise in global temperature and disrupts climate events and phenomena.

In its latest report (2021), the IPCC stresses that climate change is becoming more widespread, accelerating and intensifying, while efforts to limit the rise in average temperature to 1.5°C by 2100 are not enough: in 2022, the rise was already 1.2°C.

In SOFIA, climate change is already having an impact: shorter winters, longer droughts and extreme weather events such as heat waves and heavy rain. These phenomena pose a risk to the survival of human society as a whole, and are disrupting our daily lives because of the disasters they cause: summer flooding, loss of agricultural yields which is exacerbating price rises, deaths linked to heatwaves, the emergence of climate refugees, loss of biodiversity, the emergence of new diseases, etc.

In response to this situation, Bulgaria and its capital Sofia have set targets for reducing greenhouse gas emissions, following the signing of the Paris Climate Agreement in 2015. By 2030, Sofia aims to have reduced its emissions by 80% compared with 2018, a significant reduction for the European capital.

Initiatives in Sofia include expanding public transport infrastructure, promoting the use of renewable energy, improving the energy efficiency of buildings, and creating new green spaces to help absorb carbon emissions. These measures are essential to mitigate the impacts of climate change and protect the city and its inhabitants from its future effects.

Well aware that municipalities have responsibilities in the fight against climate change, the city of Sofia first carried out an initial inventory of GHG emissions based on 2015 data. This inventory, made public in 2017, was carried out as part of the Climate Municipality program and included only the inventory of GHG emissions from energy consumption by municipal activities. Based on this inventory, Sofia drew up a GHG emissions reduction action plan in 2017. At the same time, it adopted its first Sustainable Development Plan in 2018, developed in collaboration with local organizations.

In 2018, Sofia undertook a second GHG emissions inventory. This inventory showed modest but encouraging progress, reflecting initial efforts to reduce its emissions by improving public transport infrastructure, encouraging energy efficiency in municipal buildings, and increasing public awareness.

Currently, the 2022 assessment shows significant progress with a notable reduction in GHG emissions. Sofia's initiatives include expanding public transport infrastructure, promoting the

use of renewable energy, improving the energy efficiency of buildings, and creating new green spaces to help absorb carbon emissions.

These measures are essential to mitigate the impacts of climate change and protect the city and its residents from its future effects.

Sofia's ongoing efforts and targeted actions aim to demonstrate a strong commitment to sustainability and resilience in the face of future climate challenges.

1 Content of the project

The GHG emissions inventory for Sofia Municipality was prepared through a systematic process involving five key steps:

1. Source identification: The inventory covered sectors consistent with previous GHG emissions inventories for Sofia Municipality.

2. Methodology selection: Approaches were chosen to align with the Covenant of Mayors requirements, the Global Protocol, and IPCC guidelines, including the latest national inventory guidelines.

3. Data collection: Primary data was gathered from municipal sources, official inquiries to institutions and organizations, and questionnaires sent to municipal enterprises, companies, and buildings. Data was verified and corrected as needed.

4. Emission factor selection: Standard IPCC emission factors were primarily used, supplemented Country-specific emission and conversion factors where appropriate.

5. Calculation tool development: Transparent and systematic MS Excel-based tools were created for automated GHG emissions calculations. These tools, containing all necessary data and factors, were provided to Sofia Municipality for use in future inventories.

This approach ensures a comprehensive and consistent method for quantifying GHG emissions across various sectors in Sofia Municipality, facilitating accurate reporting and future comparisons.

2 Methodology

The direct GHG emissions inventory is only based on final energy consumption within the municipality, including electricity, heat, solid fuels, and renewable energy sources

The project conducted a comprehensive greenhouse gas (GHG) emissions inventory, encompassing:

- Direct CO_2 emissions from stationary and mobile combustion within the municipality
- Indirect emissions from heat and electricity consumption, regardless of production location
- Other direct emissions, including gas leakage in distribution and solid waste treatment process

Emissions from products or food consumed in the territory of Sofia were not considered in that inventory.

To calculate CO2 emissions, we have taken the following steps:

<u>Methodology for Stationary sources:</u>

- Quantification of fuel consumption: we have begun by determining the amount of each fuel type used, typically measured in mass or volume units (e.g., tons, liters, or cubic meters).
- Conversion to energy units: we have used net calorific values (NCVs) to convert fuel quantities into energy units, usually gigajoules (GJ) or megawatt-hours (MWh). The NCV is specific to each fuel type and represents the amount of heat released during combustion...
- Individual GHG emissions calculation: we have multiplied the energy values by appropriate emission factors for each greenhouse gas (GHG). These factors are expressed in t CO2/MWh, kg CH4/MWh, kg N20/MWh vary depending on the fuel type and combustion technology. We have performed separate calculations for carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions using their respective emission factors.
- Conversion to CO2 equivalent: we have used the Global Warming Potential (GWP) of each gas to convert CH4 and N2O emissions into CO2 equivalent. The GWP values represent the warming effect of each gas relative to CO2 over a specific time horizon (usually 100 years).

<u>Methodology for Road transport:</u>

- Identification of vehicle population: this includes vehicle type (motorcycle, car, truck), depollution category and number
- Quantification of average yearly mileage in the city per each type of vehicle
- Individual GHG emissions calculation: we have multiplied the mileage by appropriate emission factors for each greenhouse gas (GHG). These factors, are expressed in g CO2/km, g CH4/km and g N2O/km.
- Conversion to CO2 equivalent: we have used the Global Warming Potential (GWP) of each gas to convert CH4 and N2O emissions into CO2 equivalent.

Uncertainty and precision:

The global uncertainty of this greenhouse gas (GHG) inventory is a composite of two primary sources of uncertainty. The first component stems from the emission factor, which typically carries an uncertainty level of 1 to 2 percent. This relatively low uncertainty is due to the well-established scientific methods used to determine emission factors. The second component, however, introduces a more variable level of uncertainty and is linked to the process of data gathering. This aspect of uncertainty is highly dependent on the specific emission source being measured and the capabilities and methods employed in collecting the relevant data. We will give more detailed information when dealing with each specific source.

3 Conversion and emission factors

This section presents the conversion and emission factors that have been cited in the methodology and have served throughout the inventory calculation.

Net Calorific Value:

Data Sources: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1

Fuel	GJ/t	MWh/t
Anthracite coal – other sectors	25,5	7,1
Anthracite coal – industry	25,5	7,1
Black coal – (bituminous coal)	22,3	6,2
Black coal – (bituminous coal)	22,3	6,2
Lignite `– other sectors	7,0	1,9
Lignite `– other sectors	7,0	1,9
Briquettes and brown coal – other sectors	9,5	2,6
Propane-butane (LPG)	46,0	12,8
Gas oil / Diesel fuel	42,0	11,7
Petrol	42,5	11,8
Fuel oil	40,0	11,1
Natural gas	58,1	16,1
Gasoline	44,2	12,3
Refeused Derived Fuel	11,9	3,3

Table 1

Global warming potential:

Each gas has a unique atmospheric lifetime and its own heat-trapping potential, known as the Global Warming Potential (GWP). With a GWP of 1, carbon dioxide (CO_2) is the reference gas against which other gases are compared. GWP is a relative measure of the warming effect that the emission of one kilogram of a GHG has at the tropospheric surface compared with the warming effect of the emission of one kilogram of carbon dioxide (CO2).
The following Global Warming potential have been considered to convert CH_4 and N_2O emissions into CO_2 eq emissions.

Greenhouse gas	Chemical formula	Global warming potential (GWP)
Carbon dioxide	CO2	1
Methane	CH4	25
Nitrous oxide	N2O	298

Table 2

Emission factors: DATA Sources : IPCC Nr 6 report for CO2 emission factors, BGR inventory 2024 - 2022

Stationary sources:

Energy	tCO_2/MWH	kg CH_4/MWh				kg N_2O/MWh			
		Households	Industry	Services	Agriculture & forestry	Households	Industry	Services	Agriculture & forestry
Anthracite coal	0,35	1,080	0,036	0,036	1,080	0,0054	0,0054	0,0054	0,0054
Black coal (bituminous coal)	0,34	1,080	0,036	0,036	1,080	0,0054	0,0054	0,0054	0,0054
Lignite	0,36	1,080	0,036	0,036	1,080	0,0054	0,0054	0,0054	0,0054
briquettes and brown coal	0,35	1,080	0,036	0,036	1,080	0,0054	0,0054	0,0054	0,0054
Propane-Butane (LPG)	0,23	0,018	0,004	0,018	0,018	0,0004	0,0004	0,0004	0,0004
Gas oil / Diesel fuel	0,27	0,019	0,009	0,029	0,015	0,0005	0,0054	0,0015	0,1015
Petrol	0,26	0,019	0,009	0,029	0,015	0,0005	0,0054	0,0015	0,1015
Fuel oil	0,26	0,019	0,009	0,029	0,015	0,0005	0,0054	0,0015	0,1015
Natural gas	0,20	0,018	0,004	0,018	0,018	0,0004	0,0004	0,0004	0,0004
Biomass	0,36	1,080	0,104	1,044	0,376	0,0144	0,0144	0,0144	0,0051
Wood	0,40	1,080	0,104	1,044	0,375	0,0144	0,0144	0,0144	0,0051

Table 3

Electricity:

We agreed with Sofia that this inventory should be made using the emission factor for electricity at country level. As a consequence, we have taken the 2021 activity based emission factor proposed by the Covenant of Mayor report "CoM-Emission-factors-for-national-electricity-2024".

	tCo2 eq/MWh
Electricity	0,508

Table 4

Heat energy :

Emission factor for heat energy has been calculated using the share of energies used to produce the heat. These data have been provided by the city of Sofia. Heat energy is most exclusively produced from natural gas and from a minor quantity of Diesel fuel

	t CO2/MWH	kg CH4/MWh - 2022	kg N2O/MWh 2022
Heat	0,20	0,0036	0,0004

Table 5

Transports :

Road Fuel based:

	tCO2/MWh	**kg CH4/MWh**	**kg N_2O/MWh**
Gasoline	0,26	0,04	0,005
Diesel oil	0,27	0,00	0,010
Liquefied petroleum gases (LPG)	0,24	0,04	0,009
Gaseous fuels	0,20	0,04	0,002

Table 6

Road mileage based:

	CO2 g/km			**CH4 g/km**			**N2O g/km**		
Vehicle category	2007	2011	2015	2007	2011	2015	2007	2011	2015
Cars									
Gasoline	226	224	220	0,089	0,073	0,064	0,017	0,011	0,01
Diesel	223	223	220	0,016	0,012	0,01	0,003	0,004	0,006
LPG	195	192	187	0,069	0,064	0,058	0,01	0,012	0,012
CNG	189	190	188	0,099	0,102	0,096	0,003	0,003	0,003
Light trucks									
Gasoline	370	358	346	0,096	0,078	0,049	0,023	0,02	0,022
Diesel	273	269	259	0,014	0,01	0,006	0,004	0,006	0,007
Heavy-duty vehicles									
Gasoline	510	510	510	0,14	0,14	0,14	0,006	0,006	0,006
Diesel	684	665	649	0,096	0,079	0,066	0,017	0,016	0,015
Motorcycles	101	98	97	0,178	0,16	0,148	0,002	0,002	0,002

Table 7

Rail:

Railway transportation	tCO2/MWh	kg CH4/MWh	kg N_2O/MWh
Diesel oil	0,27	0,01	0,10

Table 8

4 Sources of emissions

The direct GHG emissions inventory is based on final energy consumption within the municipality, by the following sectors:

- Households: residential
- Trade and services buildings: Privately owned service sector buildings (e.g., offices, banks, SMEs, retail, hospitals)
- Municipal buildings
- Industrial activities
- Agriculture and forestry
- Private and commercial vehicles
- Municipal fleet
- Public transports
- Rail
- Public lighting

According to the definition of the Global Protocol , flights with take-off and landing during the same flight on the territory of the municipality (for example local helicopters, small planes , training flights, etc.) should also be taken into account in the inventory. Due to the very limited number of such flights at Sofia airport, emissions from air transport have not been considered.

In addition to emissions coming from final energy consumption, two additional sources of emissions have been considered:

- Incidental emissions linked to natural gas distribution
- Emissions from waste treatment

4.1 Households

GHG emissions from households include energy consumption for heating, air conditioning and hot water, electricity used for household appliances.

For Natural gas, Electricity and Heat Energy we were able to collect data consumption from Sofia Households.

For other fuels, it has only been possible to gather consumption data à country level.
We have then used the following structure of households heating in Bulgaria and Sofia to allocate fuel consumption to Sofia city.

Inhabited dwellings by type of energy used for heating

	Bulgaria - total	Bulgaria - %	Sofia Municipality - total	Sofia Municipality - %	Share Sofia over country
Inhabitat Dwellings - total amount[2]	**2 430 802**		**467 500**		19,2%
Central heating	345 373	14,2	246 419	52,7	71,3%
Natural gas from a central source	66 309	2,7	15 408	3,3	23,2%
Electricity	1 241 423	51,1	224 327	48,0	18,1%
Diesel fuel	1 658	0,1	453	0,1	27,3%
Propane-Butane	20 348	0,8	2 665	0,6	13,1%
Coal	125 227	5,2	7 645	1,6	6,1%
Wood	944 332	38,8	23 218	5,0	2,5%
Others	149 034	6,1	23 632	5,1	15,9%

[1]When collecting the information, respondents were able to indicate more than one answer.

Table 9

As a result, the energy consumptions per type of fuel that have been used for the inventory are the following ones.

Fuel	Bulgaria	Sofia
Anthracite coal (t)	4 001,00	244,26
Black coal (t)	71 203,00	4 346,88
Lignite and brown coal (t)	3 583,00	218,74
Briquettes (t)	-	-
Wood (TJ)	26 082,53	641,28
Propane-Butane (t)	15 539,00	2 035,16
Gas oil /diesel fuel (t)	1 044,00	285,24

Table 10

Fuel	Bulgaria	Sofia
Natural gas(MWh)*		359 279,00
Électricity (MWh)	11 969 685,00	2 206 959,79
Heat energy(MWh)	3 575 035,00	2 880 581,80
Biomasse(TJ)**	26 804,45	N/A

Table 11

Based on these energy consumptions and using emission factors for stationary sources (**table 3**) the results for emissions are the following.

Fuel Sofia	tCO2	tCH4	tN2O	tCO2eq	Biogenic CO2
Anthracite coal	611,77	1,87	0,01	661,23	
Black coal	9 157,50	29,04	0,15	9 926,79	
Lignite	153,54	0,46	0,00	165,62	
Briquettes and brown coal	-	-	-	-	
Wood	71 821,70	192,38	2,57	5 573,88	71 821,70
Propane-Butane LPG	5 907,09	0,47	0,01	5 921,58	
Gas oil /diesel fuel	887,07	0,06	0,00	889,12	
Heat energy	581 784,06	10,37	1,04	582 352,89	
Électricity	-	-	-	1 121 135,57	
Natural gas	72 559,99	6,47	0,13	72 760,21	
Biomasse	-	-	-		
Total	742 882,72	241,11	3,90	1 799 386,89	

Table 12

With a total of **1 799 386 tons of CO_2 eq,** households are the biggest source of emission of the city (42%) and show an increase by 4% compared to 2018, mainly due to a 3% increase of energy consumption, especially driven by electricity (+10%), which emission factor is higher than any other fuel used by households (see table 4) that does not compensate the reduction of coal use.

Let's note that CO_2 emissions linked to Wood combustion are not included in the total inventory, as required by the Covenant of Mayor methodology, and is reported separately as biogenic CO_2.

4.2 Trade and services

For solid and liquid fuels, as for households, we were able only able to gather data at Country level. Allocation at Sofia level has been done using same heating structure table (table 9).

Fuel consumption for trade and services sector

	BULGARIA	SOFIA
Fuel	**2022**	**2022**
Anthracite coal (t)	338	21
Black coal (t)	2 173	133
Lignite and brown coal (t)	735	45
Briquettes (t)	25	2
Wood (TJ)	355	9
Propane-Butane (1000 t)	11 157	1 461
Gas oil / Diesel fuel (t)	20 542	5 613
Fuel oil (t)	954	261

Table 13

For Natural gas, central heating and electricity, we were able to collect data at SOFIA level but as an aggregated consumption for trade & services and industries sectors.

In 2018 GHG inventory, the calculation of the share of consumption for each sector had been made based on the share of electricity consumption for trade & services and industry.
Without any better data we have decided to keep the same splitting rule: 54% for industry and 46% for trade and services.

Sofia	MWh
Natural gas	262 954
Électricity	761 192
Heat energy	429 537

Table 14

Based on these energy consumptions and using emission factors for stationary sources (table 3) the results for emissions are the following.

Fuel	tCO2	tCH4	tN2O	tCO2eq	Bio genic CO2
Anthracite coal	51,68	0,01	0,00	52,05	
Black coal	279,47	0,03	0,00	281,53	
Lignite	31,50	0,00	0,00	31,71	
Briquettes and brown coal	1,41	0,00	0,00	1,42	
Wood	977,47	2,53	0,03	73,68	977,47
Propane-Butane	4 241,29	0,34	0,01	4 251,69	
Gas oil / Diesel fuel	17 454,26	1,93	0,10	17 531,91	
Fuel oil	764,21	0,09	0,00	767,65	
Natural gas	53 106,11	4,73	0,09	53 252,65	
Électricity	-	-	-	386 685,51	
Heat energy	86 752,53	1,55	0,15	86 837,35	
Total	163 659,93	11,20	0,40	549 767,16	

Table 15

With a total of **549 767 tons of CO_2 eq,** Trade and services represents 13% of the emission of the city and show a decrease by 13% compared to 2018, mainly due to a 11% decrease of energy consumption, especially driven by electricity (-25%).

Let's note that CO_2 emissions linked to Wood combustion are not included in the total inventory, as required by the Covenant of Mayor methodology, and is reported separately as biogenic CO_2.

4.3 Municipal buildings

This sector includes all type of buildings owned or managed by the city: Administrative offices, schools, libraries, community centers, etc.
For this sector it was possible to access directly to fuel consumptions, provided by the city services. Unfortunately, due to the timing to gather data, we could only have access to fuel consumption for 63 buildings which is for sure underestimating the real total consumption of that sector.

Collected energy consumption on 63 buildings

Sofia	Quantity (t)	MWh
Électricity		7 045,14
Heat energy		12 109,95
Diesel fuel	18,00	209,84

Table 16

To improve the assessment of these emissions we had access to the total rooftop area for Sofia buildings, with some details on their usage.

We the calculated the average energy efficiency in MWh/m2 per type of usage, based on the data gathered on the 63 buildings where energy consumption was available.
Multiplying energy efficiency by the area allowed us to estimate an extrapolated energy consumption for all city buildings.

Extrapolated energy consumption for all city buildins

Sofia	Quantity (t)	MWh
Électricity		16305
Heat energy		55807
Diesel fuel	18,00	209,84

Table 17

Based on these energy consumptions and using emission factors for stationary sources (**table 3**) the results for emissions are the following.

Municipal buildings emissions

Fuel	tCO2	tCH4	tN2O	tCO2eq
Électricity	-	-	-	8 282,82
Heat energy	11 271,16	0,20	0,02	11 282,18
Diesel fuel	55,98	0,00	0,00	56,11
Total	11 327,14	0,20	0,02	19 621,11

Table 18

With a total of **19621 tons of CO_2 eq,** municipal buildings represent a minor part of Sofia emissions (~0,5%).

Due to the lack of data on that sector, the total emissions for municipal buildings are clearly still a bit underestimated despite our methodology to extrapolate the data we were not able to collect. However, looking back at 2018 inventory (45512 T CO_2 eq), even with full data set, municipal buildings emission would remain a minor source.

4.4 Industry and construction

For solid and liquid fuels, as for households, we were able only able to gather data for industry at Country level. According to NSI, Sofia industry represents 22% of total industrial activity in Bulgaria. We have then used this 22% share to calculate the energy consumption for Sofia city industry based on consumption at country level.

Fuel consomption by Industry and construction

Fuel	Bulgaria	Sofia
Anthracite coal (t)	194 692	42 975
Black coal (t)	165 296	36 486
Lignite	780	172
Briquettes (t) and brown coal (t)	33	7
Wood (TJ)	201	44
Propane-Butane (t)	44 446	9 811
Gas oil / Diesel fuel (t)	80 171	17 696
Fuel oil (t)	28 210	6 227

Table 19

For Natural gas, central heating and electricity, as already explained in trade and services section, we have calculated the energy consumption based on the share of consumption for industry: 54%

Sofia	MWh
Natural gas	308 685
Électricity	893 573
Heat energy	504 239

Table 20

Based on these energy consumptions and using emission factors for stationary sources (table 3) the results for emissions are the following.

Fuel	MWh	tCO2	tCH4	tN2O	tCO2eq	Bio genic C02
Anthracite coal	304 156,53	107 634,91	10,95	1,64	108 398,10	
Black coal	225 700,32	76 864,50	8,13	1,22	77 430,83	
Lignite	332,38	120,85	0,01	0,00	121,69	
Briquettes and brown coal	19,22	6,75	0,00	0,00	6,79	
Wood	12 349,27	4 979,23	1,28	0,18	85,11	4 979,23
Propane-Butane	125 354,56	28 475,54	0,45	0,05	28 500,27	

Gas oil / Diesel fuel	206 303,16	55 033,43	1,87	1,11	55 412,20	
Fuel oil	69 185,12	18 256,57	0,63	0,37	18 383,59	
Natural gas	308 684,68	62 341,96	1,11	0,11	62 402,86	
Électricity	893 573,16	-	-	-	453 935,16	
Heat energy	504 239,03	101 839,92	1,82	0,18	101 939,50	
Total	2 649 897,43	455 553,66	26,25	4,87	906 616,11	

Table 21

With a total of **906 616 tons of CO_2 eq,** represents 21% of the emission of the city and is the second biggest source of emission.
It shows a decrease by 12% compared to 2018.

Let's note that $C0_2$ emissions linked to Wood combustion are not included in the total inventory, as required by the Covenant of Mayor methodology, and is reported separately as biogenic CO_2.

4.5 Agriculture and forestry

This sector includes local agricultural and forestry activities, which contribute to GHG emissions through the consumption of fossil fuels for agricultural machinery and heated greenhouses.

In terms of data we were here again only able to access energy consumption for agriculture at country level.

According to NSI, agriculture activity in Sofia is accounting for 1,44% of Bulgaria agriculture total Gross Value Added. We then decided to apply this ratio to Bulgaria total energy consumption for agriculture.
With this assumption, energy consumption in structured as follows:

Fuel	Bulgaria	Sofia
Anthracite coal (t)	2 161	31,01
Black coal (t)	16 575	237,88
Lignite(t)	4 582	65,76
Briquettes (t) and brown coal (t)	50	0,72
Wood (TJ)	47	0,67
Propane-Butane (t)	1 599	22,95
Gas oil / Diesel fuel (t)	129 656	1860,80
Fuel oil (t)	44	0,63

Table 22

Based on these energy consumptions and using emission factors for stationary sources (**table 3**) the results for emissions are the following.

Fuel	tCO2	tCH4	tN2O	tCO2eq	Bio Genic CO2
Anthracite coal	77,68	0,24	0,00	83,96	
Black coal	501,14	1,59	0,01	543,24	
Lignite	46,16	0,14	0,00	49,79	
Briquettes and brown coal	0,66	0,00	0,00	0,72	
Wood	75,31	0,07	0,00	2,04	75,31
Propane-Butane	66,61	0,01	0,00	66,77	
Gas oil / Diesel fuel	5 786,89	0,33	2,20	6 451,32	
Fuel oil	1,85	0,00	0,00	2,07	
Total	6 556,31	2,37	2,21	7 199,91	

Table 23

With a total of **7200 tons of CO_2 eq,** isa very minor source of emission (~0,1%) of the city and remains quite stable compared to 2018.
Here again $C0_2$ emissions linked to Wood combustion are not included in the total inventory, as required by the Covenant of Mayor methodology, and is reported separately as biogenic CO_2.

4.6 Private and commercial vehicles

Private vehicle emissions in Sofia encompass a wide range of sources, including all private and commercial vehicles operating within the city limits. This category includes cars, motorcycles, light-duty vehicles, and heavy-duty vehicles. The total number of vehicles in Sofia has been provided by the office for vehicle registration, offering a comprehensive overview of the city's vehicular landscape. It is important to note that emissions calculation **do not include vehicles entering the city area but registered outside Sofia**: these data were not available at the time of the project.

The composition of Sofia's vehicle fleet plays a crucial role in understanding the city's air quality challenges and the potential impact of emission reduction measures. With an average vehicle age of 13 years, which is older than the EU average, Sofia faces significant challenges in terms of vehicular emissions.

In order to assess the age of each vehicle population, the office for vehicle registration has also provided the the EURO standards of each vehicle, that indicates the emissions performance of vehicles.

Sofia Vehicle population (651 707 vehicles)

TYPE OF VEHICLE	FUEL	ENVIRONMENTAL STANDARDS							
		norm start	1992	1997	2001	2006	2009	2015	
		EURO 0	EURO 1	EURO 2	EURO 3	EURO 4	EURO 5	EURO 6	OTHERS
Motorcycles	GASOLINE	2	127	411	1772	845	33	2	4718
	DIESEL	0	0	1	0	0	0	0	2
	ELECTRIC	0	0	0	0	0	0	0	28
Cars	GASOLINE	13	361	8617	24443	74120	28219	35637	110751
	DIESEL	12	188	4698	40021	69258	36887	32452	64030
	LPG	0	0	1	4	31	246	37	13
	NATURAL GAS	0	0	0	6	68	671	859	32
	ELECTRIC	0	0	0	0	3	20	31	1271
Light trucks	GASOLINE	2	361	48	302	2257	4873	6048	1415
	DIESEL	7	141	1050	5739	9100	17027	20710	14755
	LPG	0	0	0	0	2	2	0	1
	NATURAL GAS	0	0	0	5	42	115	462	63
	ELECTRIC	0	0	0	0	0	8	2	60
Heavy trucks	DIESEL	3	54	401	2191	3475	6502	7908	5635

Table 24

Due to the lack of current data on average urban mileage, an extrapolation was performed using available data from 2007, 2011, and 2015. This extrapolation helped estimate the current urban mileage for vehicles in Sofia.

We checked these extrapolations with the data we had on total average mileage (urban + non urban) making sure that the ration in urban condition was reasonable.

TYPE OF VEHICLE	FUEL	TOTAL NUMBER	ANNUAL URBAN MILEAGE (km)	AVERAGE ANNUAL MILEAGE PER VEHICLE (km)
Motorcycles	GASOLINE	7 908	3 637 680	460
	DIESEL	3	-	-
	ELECTRIC	28	33 936	1 212
Cars	GASOLINE	282 161	553 882 043	1 963
	DIESEL	247 546	1 116 927 552	4 512
	LPG	332	2 139 408	6 444
	NATURAL GAS	1 636	20 613 600	12 600
	ELECTRIC	1 325	1 404 500	1 060
Light trucks	GASOLINE	15 306	37 790 514	2 469
	DIESEL	68 529	373 894 224	5 456
	LPG	5	-	
	NATURAL GAS	687	-	
	ELECTRIC	70	78 540	1 122
Heavytrucks	DIESEL	26 169	168 580 698	6 442

Table 25

As explained in introduction, we have used emission factors coming from previous studies (see table 7 below). And we have considered the following assumptions:

- Vehicles up to EURO 4 (2006) : we would use 2007 emission factors
- EURO 5 Vehicles: we would use 2011 emission factors
- EURO 6 Vehicles: we would use 2015 emission factors
- Vehicles in “other” category: we would use an average emission factor calculated based on 2007 to 2015 emission factors

As emission factors variation along the years is very small (<<3%), the resulting precision remains acceptable, knowing that the main uncertainty is coming from the extrapolation of average urban mileage.

	CO2 g/km			CH4 g/km			N2O g/km		
Vehicle category	2007	2011	2015	2007	2011	2015	2007	2011	2015
Cars									
Gasoline	226	224	220	0,089	0,073	0,064	0,017	0,011	0,01
Diesel	223	223	220	0,016	0,012	0,01	0,003	0,004	0,006
LPG	195	192	187	0,069	0,064	0,058	0,01	0,012	0,012
CNG	189	190	188	0,099	0,102	0,096	0,003	0,003	0,003
Light trucks									
Gasoline	370	358	346	0,096	0,078	0,049	0,023	0,02	0,022
Diesel	273	269	259	0,014	0,01	0,006	0,004	0,006	0,007
Heavy-duty vehicles									
Gasoline	510	510	510	0,14	0,14	0,14	0,006	0,006	0,006
Diesel	684	665	649	0,096	0,079	0,066	0,017	0,016	0,015
Motorcycles	101	98	97	0,178	0,16	0,148	0,002	0,002	0,002

Table 7

As we did not have emission factors for LPG and CNG Light Trucks, we have decided not to take this population into account due to the negligeable size of this population.

For electrical vehicle, as electricity is being distributed through power stations, we have applied the emission factor for electricity production (table 4).

Based on these assumptions the resulting emissions are described in the following table:

Private vehicles emissions

Vehicle type	Fuel	tCO2	tCH4	tN2O	Total tCO2 Eq
Motorcycles	GASOLINE	362	1	0	380
	ELECTRIC				0
Cars	GASOLINE	124 067	44	8	127 440
	DIESEL	248 347	15	4	250 025
	LPG	410	0	0	421
	NATURAL GAS	3 894	2	0	3 963
	ELECTRIC				18
Light trucks	GASOLINE	13 438	3	1	13 746
	DIESEL	99 637	4	2	100 370
	ELECTRIC				1
Heavy trucks	DIESEL	112 077	13	3	113 212
	Total	602 231	81	18	609 574

Table 26

With a total of 609 574 tons of CO_2 eq, Private vehicles are the third largest source of emission (14%) of the city. The total amount of emission shows a reduction of 29% compared to 2018 mainly due to the huge reduction of the number of vehicles (-23%) registered in Sofia. This data should be checked and consolidated for the next inventory update, in order to confirm the trend.

Another aera of improvement would be to try and gather data about vehicles entering the city area each day, while being registered outside the city.

4.7 Municipal

Municipal fleet emission calculation encompasses all vehicles owned by the municipality and used by municipal agents.

As fuel is being distributed by the municipality, it was easy to access directly to the total quantity of fuel consumed.

Municipal fleet fuel consumption

	FUEL	Quantity (t)
Cars	GASOLINE	112
	DIESEL	80
	LPG	0
	NATURAL GAS	8
	Elecrtic	
Light trucks	GASOLINE	151
	DIESEL	115
	LPG	26
	NATURAL GAS	6
	Elecrtic	
Heavy-duty vehicles	GASOLINE	29
	DIESEL	582
	LPG	-
	NATURAL GAS	0
	Elecrtic	

Table 27

Using the fuel consumptions and the emission factors for “Road fuel based” (table 6), we found the following emissions.

	FUEL	tCO2	tCH4	tN2O	tCO2eq
Cars	GASOLINE	354,25	0,05	0,01	357,56
	DIESEL	251,82	0,00	0,01	254,61
	LPG	0,91	0,00	0,00	0,92
	NATURAL GAS	25,01	0,01	0,00	25,23
	Elecrtic				
Light trucks	GASOLINE	478,50	0,07	0,01	482,98
	DIESEL	360,66	0,01	0,01	364,65
	LPG	78,40	0,01	0,00	79,62
	NATURAL GAS	19,41	0,00	0,00	19,59

	Elecrtic				
Heavy-duty vehicles	GASOLINE	90,89	0,01	0,00	91,74
	DIESEL	1 830,35	0,03	0,07	1 850,64
	LPG	-	-	-	-
	NATURAL GAS	0,49	0,00	0,00	0,49
	Elecrtic				
	total	3 490,69	0,19	0,11	3 528,03

Table 28

With only **3 528 tons of CO_2 eq**, the municipal fleet is a negligeable source of CO_2 emissions compared to private vehicles.

4.7 Public transport

Public transport encompasses all transportation means used to transport passengers during the day within the city limits: busses, trolley-busses, trams and metro.
For those transportation we were able to directly access to fuel consumption, as follows:

Fuel consumption for Public transport

Energy type	Total energy amount (MWh)
Diesel	67 593
CNG	134 330
Electricity Bus + trolley	26 386
Electricity rail	69 582

Table 29

We then applied the emission factors for "Road fuel based" (table 6) and the emission factor for electricity production (table 4).

Here below are the resulting emissions for the sector:

Public transport emissions

Energy type	tCO2	tCH4	tN2O	tCO2eq
Diesel	18 232,76	0,28	0,65	18 434,83
CNG	27 013,85	6,03	0,29	27 252,14
Electricity Bus + trolley				13 404,09
Electricity rail				35 347,66
Total	45 246,61	6,31	0,95	94 438,71

Table 30

With a total of **94 438 tons of CO_2 eq**, public transports only represent 0,22% of total emissions with a little increase of 7% compared to 2018. That shows an increase in the use of public transportation, which is a good thing, globally.

4.8 Rail transport

Rail transportation emissions take into account emissions coming from the use of trains within the city boarders.

Sofia city is using in the same time, electric trains and diesel trains.
We were able to access directly to fuel distributed for rail usage.

For Diesel Fuels, we collected total quantities and we had to calculate the share of fuel consumed within the city limit. To do so we multiplied the total amount of fuel by the ratio between route length in the city and total route length (4,1 %).

Fuel consumption for Rail transport

	FREIGHT		Passengers	
	Quantitty (t)	Energy (MWh)	Quantitty (t)	Energy (MWh)
Diesel	14,48	168,76	22,07	257,29
Electricity		8 385,74		16 912,99

Table 31

We then applied the emission factors for "Road fuel based" (table 6) and the emission factor for electricity production (table 4).

Emissions for Rail transport

	Freight				Passengers				Total			
	tCO2	tCH4	tN2O	tCO2eq	tCO2	tCH4	tN2O	tCO2eq	tCO2	tCH4	tN2O	tCO2eq
Diesel	45,02	0,00	0,02	50,26	68,63	0,00	0,03	76,62	113,65	0,01	0,04	126,88
Electricity				4 259,96				8 591,80				12 851,76
Total	45,02	0,00	0,02	4 310,22	68,63	0,00	0,03	8 668,42	113,65	0,01	0,04	12 978,64

Table 32

With only **12 978 tons of CO_2 eq**, the rail transport is a negligeable source of CO_2 emissions compared to other public transports, while increasing by 20% compared to 2018, mainly due to an increase energy consumption (traffic increase) and the increase of electricity emission factor compared to 2018.

4.9 Public lighting and traffic lights

This sector was very simple to assess as we had direct access to electric energy consumption for lighting and traffic lights.
The results are as follows.

Emissions for public lighting and traffic lights

Fuel	MWh	tCO2 eq
	45	23
Electricity	555,38	142,13

Table 33

4.10 Accidental emissions from gas distribution

The assessment of the GHG emissions linked with gas distribution was prepared according to the 2006 IPPC methodology, using emission factors of 0.051 kg CO_2/1000m^3 and 1.1 kg CH_4/1000 m^3 delivered natural gas. The total quantities of natural gas delivered on the territory of Sofia Municipality, according to the data of Overgas Networks AD are used as primary data.

Accidental emissions

Total gaz consumption (m3)	t CO2 emissions	t CH4 emissions	t CO2 eq Emissions
455 078 852	23	501	12538

Table 34

Accidental emissions have been divided by 2 since 2018, with a direct link with total amount of gas distributed that has also been divided by 2.

4.11 Waste

This sector was the most difficult to assess.
We only had access to the total amount of waste collected (304 894 tons) and the percentage of waste recycled per type of waste.

We also had the total amount of waste going for Refused Derived Fuel (RDF) to be incinerated in Cementery outside the city borders.

No indication on the morphology of RDF was available, nor the type of technology used to incinerate the RDF.

We then decided to use average pessimistic values for Net Calorific Value and for Emission factor for RDF that we found in the literacy.

With those assumptions, that leave a great place for uncertainty, the results for waste emissions are the following.

Emissions from RDF incineration

	Quantity t	Net Calorific Value	Energy MWh	Emission factor t CO2/MWh	CO2 eq (t)
RDF	79 809	3,3	263369	0,75	197 527

Table 35

5 General results

The table below shows a synthesis of the emissions per sector, their share of the total and the variation compared to 2018.

	2022 EMISSIONS				2018 Emissions		
	tCO2	tCH4	tN2O	TCO2 Eq	TCO2 Eq	Varation	Share
Households	671 061,02	241,11	3,90	1 799 386,89	1 722 827,00	4%	42%
Industry	450 574,44	26,25	4,87	906 616,11	1 031 517,00	-12%	21%
Trade and serrvices	162 682	11	0	549 767	634 456	-13%	13%
Agriculture and forestry	6 481	2	2	7 200	7 309	-1%	0,17%
Municipal buildings	11 271	0	0	19 565	45 512	-57%	0,46%
Municipal and traffic lights				23 142	20 849	11%	1%
Road transport	650 969	88	19	672 193	947 233	-29%	16%
Rail transport	114	0	0	48 326	10 371	366%	1%
Gas leakage	23	501		12 538	22 897	-45%	0,296%
waste (RDF)				197 527	162 963	21%	5%
TOTAL	1 953175	869,71	30,24	4 236 261,28	4 605 934,00	-8%	

Table 36

Total emissions have been reduced by 8% compared to 2018.

The next table show the share of each sector in the total.
Households, industry, road transport and trade and services being, in that order, the prominent sources of emissions.

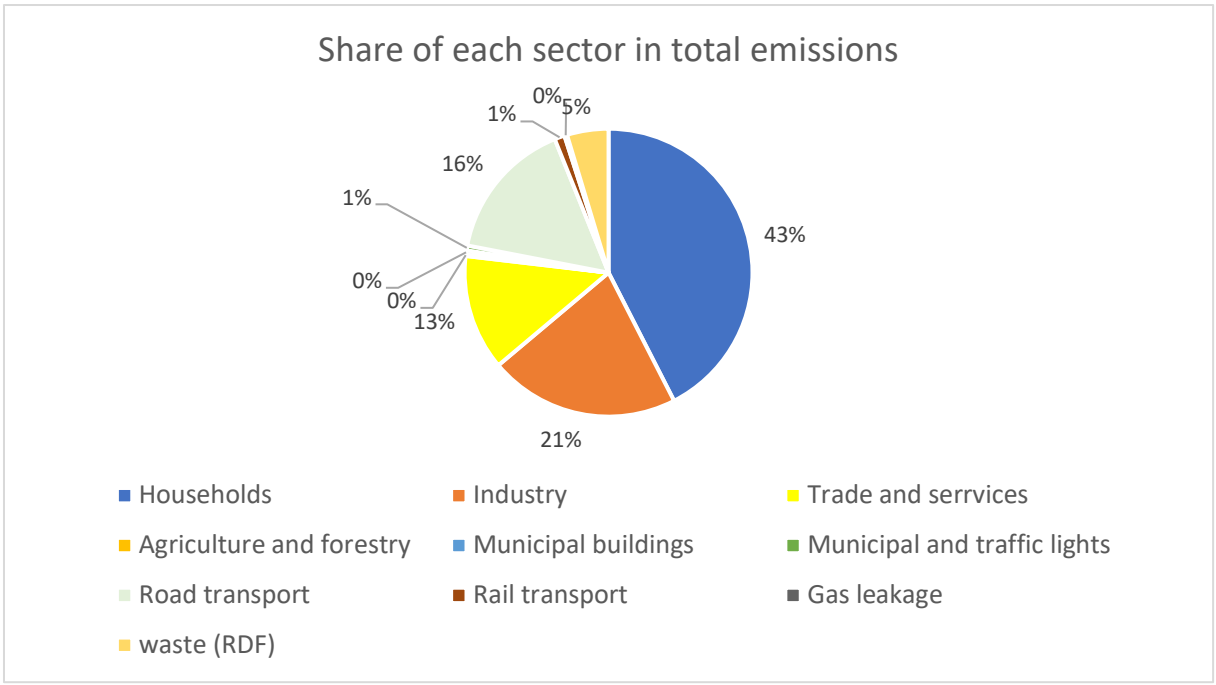

Table 37

Levers to reduce Sofia Carbon footprint should consequently be found in priority on these 4 sectors.

Next table shows the energy consumption per type of fuel and their respective share.

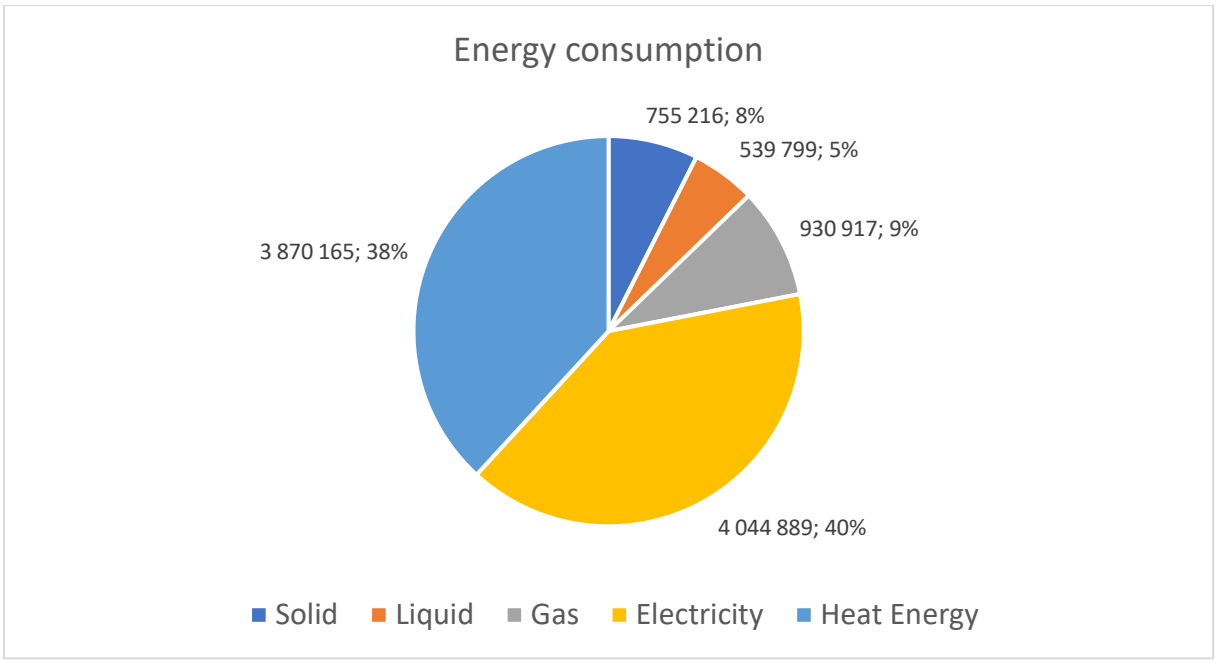

Table 38

Most used fuels are undoubtedly Electricity (first) and Heat energy (second). Liquid, solid, and gaseous fuels seem to have been reduced a lot but that hides the reality.

Indeed, there is two issues there:

1- Heat energy is prominently produced with Natural gas which is a fossil fuel.
2- Electricity appears to be produced with a very inefficient process. The consequence is that electricity emission factor (0,508 t/MWh) is by far worse than any other fuel emission factor, even fossil fuels. The more electricity is consumed, the more the C02 inventory increases

Some Levers to be studied

1- Try to improve the way electricity is produced in order to reduce the CO2 emissions each time sectors stop fossil fuels to use electricity
2- For households:
    a. work on improving building isolation in order to reduce the total demand for energy
    b. Improve efficiency of devices used by the dwellings and shift from fossil to electricity (provided that point 1 has been treated)
3- Trade and services: same levers as households
4- Transports:
    a. Promote the use of public transportation
    b. Promote shared usage of vehicles: current average number of passengers by car is 1,2
    c. Organize clean delivery of goods within the city to reduce the number of kilometers with light or heavy Diesel trucks.

NET ZERO CITIES

EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

Climate City Contract

2030 Climate Neutrality Commitments

Climate Neutrality Commitments of Sofia City

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1 Introduction

Introduction

Sofia is an old European city rich in history and cultural heritage, with historical artefacts, green parks, and beautiful natural surroundings with diverse flora and fauna that make up the city's rich biodiversity, as well as modern buildings. A significant part of the territory is occupied by post-socialist residential areas, characterized by massive residential blocks.

It's a challenge and a mission of the local government to transform the city into a modern, innovative, resilient and sustainable one.

Based on Sofia's consistent policy of becoming a cleaner, greener, and more livable city, the Mayor of Sofia decided in 2022 to participate in the European Commission's invitation to become one of the 100 European cities committed to achieving climate neutrality and becoming smart cities by 2030. This decision is the result of continuous work in various sectors in collaboration with academic institutions, private companies, and local stakeholders.

Our motivation for participating in the EU Mission "100 Climate-Neutral and Smart Cities by 2030" is based on our ambition to improve the urban environment and achieve our goal of climate neutrality for the sustainable well-being of our community. Our participation in the Cities Mission also provides broad access to good practices and innovations in dealing with the adverse effects of climate change and better adaptation to its impact. This is an ambition we deserve.

The municipality's commitment to climate neutrality is not a new development. As early as 2011, the mayor signed the Covenant of Mayors (CoM), setting a target to reduce emissions by 22% by 2020, in line with EU policies at the time. In 2015, a letter of commitment was also signed with the Global Covenant of Mayors for Climate and Energy (GCoM).

In 2022, the final GHG inventory for year 2020 reported according to the requirements of the CoM following the SEAP 2012-2020 of Sofia, showed that Sofia had even exceeded the set target and achieved a 24,7% reduction in GHG compared to the levels of the base year 2007. This was the reason for setting a new ambitious target for reducing emissions by at least 40% up to 2030 and committing to climate neutrality by 2050.

Sofia has a full library of strategic documents setting goals and plans in various sectors having great impact on climate neutrality and green transition, major of them being:

- **The Vision for Sofia** – a comprehensive urban sustainable development strategy covering all sectors of life
- **The Sustainable Urban Mobility Plan** setting the vision and goals in the sector of transport and mobility
- **The Waste Management Program** defining the goals and ways of achieving a better waste management system and reducing the waste.
- **The General Urban Planning Master Plan of Sofia**, setting the requirements on urban planning and land use
- **The Environmental Management Program** defining the sustainable solution to environmental problems and improving the state of the environment in order to ensure a good quality of life for the residents of the municipality and minimize the risks to human health.

The outstanding strategic document of Sofia bringing forth the commitment to reduce GHG emissions by 40,6%; to reduce energy consumption and to increase the share of RES in final consumption up

to 2030 is the **Sustainable Energy and Climate Action Plan** (SECAP) that is complemented by all above mentioned strategic documents.

In recent years, the importance of environmental efforts has gradually become an important priority for Sofia Municipality, and today the strategic documents related to the development of the city of Sofia also include the implementation of specific measures to ensure sustainable development of the city, including waste management, improving the quality of ambient air, water, forests and planned afforestation, turning parks and open urban spaces into desirable recreation areas, preserving the city's green system, etc.

On the road to climate neutrality Sofia had implemented quite a number of initiatives and projects funded mainly by European and own funds. All projects and solutions for climate neutrality actions are science-based and supported by the academic society in Sofia via two scientific councils established within the municipality – a Scientific Council on Ambient Air Quality Improvement and a Scientific Council on Climate and Climate Change.

Thanks to the collaboration with scientific and academic communities, several important research documents have been created in Sofia Municipality, which have been developed with scientifically based solutions to issues related to climate neutrality.

- A research on the good practices to tackle the effects of the Urban Heat Island developed in cooperation with Sofia University in 2019
- An investigation of the solar potential of the rooftops of municipal buildings made in 2020 by the Sofia University using innovative technologies installed on drones
- A strategic model to reduce the effect of the UHI and a Master plan for the planting and protection of street trees developed in 2021 by the University of Forestry

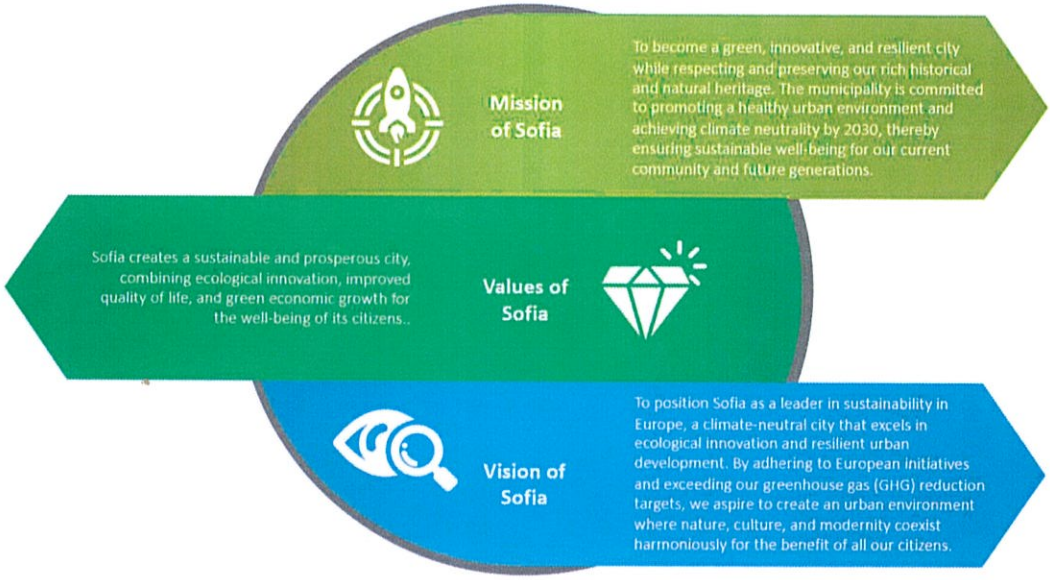
However, by joining the Mission, we see an opportunity to draw new ideas and benefit from the best practices of participating cities, as well as to have unlimited access to knowledge and expertise at the European and global levels. In this way, Sofia will rank among the leading cities in applying opportunities to tackle the challenges of climate change and transferring the accumulated knowledge to other cities in Bulgaria and around the world.

Additionally, the financial opportunities and expertise that the Mission provides through the established Capital Hub will help Sofia to better utilize available resources and secure additional funding on its path to climate neutrality.

2 Goal: Climate neutrality by 2030

Goal
SM has sought to strike a balance by enacting policies to allow the city to catch up to the European and global economic and industrial leaders while retaining its identity as a millennial historical and green city. This strategic vision has been put forward and championed by the local government. The continued priorities have been transport and mobility, waste treatment, ambient air quality, open green spaces, and digitalization and innovation.

Sofia, a city committed to achieving climate neutrality by 2030, within the framework of the EU Mission "100 Climate-Neutral and Smart Cities by 2030"



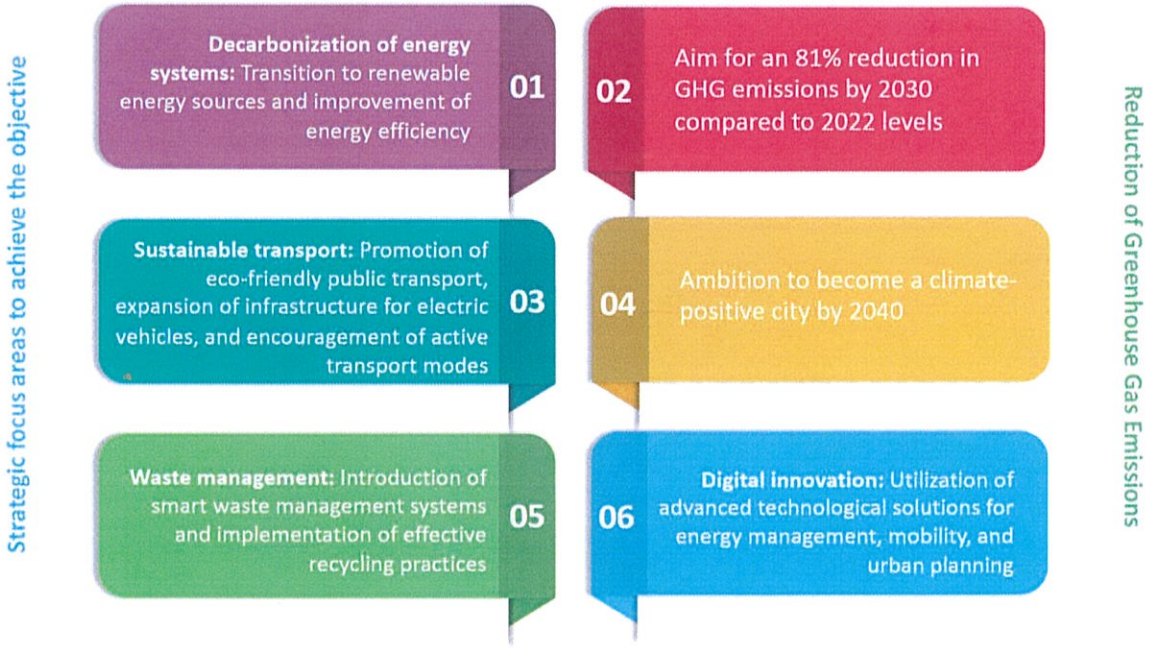
As mentioned above, in 2015, becoming a member of the GCoM and complying with the policy requirements of the initiative, Sofia had developed and adopted a Sustainable Energy Action Plan for the period 2012-2020, under which four inventories of the GHG emissions had been made – in 2011, in 2015, and in 2018. The final inventory for reporting the implementation of the SEAP 2012-2020 was prepared in 2022 for the year 2020. In 2021, the preparation of Sustainable Energy and Climate Action Plan of Sofia Municipality 2021-2030 (SECAP 2021-2030) started with a baseline inventory for year 2018. The plan was adopted in December 2021, setting the target of min. 40,6% GHG emissions reduction by 2030 (target year), compared to the levels in 2007 (base year). This target was set for the entire administrative territory of the municipality and was in full compliance with the EU targets. The target covers all sectors considered by the Mission Cities and Scope 1 and Scope 2 as per the Global Protocol. Gases for which the inventory had been prepared include CO_2, CH_4 and N_2O and the emissions had been calculated in tCO_2e.

Inventories of GHG in Sofia Municipality exclude the ETS facilities within the city, except for the district heating that is the major source of heat energy in the city.

The Municipality of Sofia, considers the ambitious goal of becoming climate-neutral by 2030 not only as a response to the global climate crisis and European policy requirements and restrictions but also as a chance to foster a sustainable, healthier, greener, and equitable city for all its residents.

Our commitment to climate neutrality by 2030 is expressed in our declared participation in the EU Mission for "100 Climate-Neutral and Smart Cities by 2030" and encompasses the entire territory of Sofia Municipality. Sofia Municipality is committed to reducing greenhouse gas emissions by 81% from the baseline level and, considering that 52% of the city's territory is green, we believe that the city can achieve its high ambitions.

SOFIA OBJECTIVE : CLIMATE NEUTRALITY BY 2030



The main areas to focus on in Sofia Municipality are the transport, stationary energy (buildings), and waste. However, we are well aware that the emissions from some sectors cannot be fully addressed by 2030. For these areas, we plan to develop a strategy, outlining the strategic actions to tackle these sectors by 2050.

Our commitment extends beyond the simple reduction of GHG. Our vision for Sofia Municipality in 2030 is for the city to be a green, innovative & digital hub; a centre of pure & renewable energy and sustainability; a preferred destination for investment of high added-value in high tech sectors; an attractive destination to live & work, promoting diversity & inclusion, with a preserved, sustainable urban environment; a strong partner, with a long-term consistent policy of commitment to global efforts for sustainability and against climate change. Our main goals are to transform the city of Sofia into:

- A climate neutral city - by implementing the highest standards in terms of energy efficiency and transforming the energy mix towards the use of energy from renewable sources with an emphasis on shared energy production and consumption at the local level
- A resource-efficient city – development in compliance with the principles of the circular economy with an emphasis on the protection of the environment and biodiversity and the creation of comfortable and healthy environment for the citizens
- An adaptive city - increasing the adaptation capacity to deal with the negative impacts caused by climate change, by developing the regulatory framework and institutional capacity, attracting the attention of the public and business, implementing environmentally friendly solutions for adaptation and increasing the possibilities for prevention and improvement of preparedness and response to extreme climate events

The co-benefits of our actions for climate-neutrality will also influence the equitable distribution of the results and ensure the future generations will inherit a healthy and sustainable city on a green, resilient and sustainable planet. The improvement of energy efficiency and promotion of renewable energy will help the households and businesses in reducing their energy costs.

Furthermore, reducing fossil fuels will also benefit the air quality in the city, providing a healthier environment for people, which has direct social and economic benefits.

In addition, we are dedicated to transforming Sofia into a smart city by using innovative technologies and ensuring reliable data and digitalization to improve the quality of life, sustainability, and efficiency of urban activities and services.

Our commitment to climate neutrality by 2030 is a proof of our decisiveness to tackle climate change and ensure a safer and brighter future for the city community.

Together with the local stakeholders, we see the ambitious goal to reach at least 80% reduction of GHG emissions by preparing the Climate Action Plan as the basis for finding solutions and competencies for building a greener, low-carbon future.

On our journey we are led by several key principles such as ***integrity, innovation, accountability, transparency, and partnership***. We believe co-creation is a must for achieving our goals as well as engaging multiple actors and citizens, and implementing systemic and demand-driven actions. We consider the monitoring and joint learning will guarantee measurable results from our actions and will make our progress transparent.

In the field of governance, on the road towards climate neutrality, we are considering the role of the transition team to grow into constant monitoring body focusing on planning, managing and monitoring actions for climate neutrality. This unit, under the supervision of the Mayor, will target the implementation and improvement of the Climate Neutrality Action Plan of the city of Sofia. We are considering to create a new tool for monitoring and reporting as well as closer relation of the team with the local community via digital media like dedicated platforms and sub-sites. This innovative approach will ensure that our city is ready to tackle the challenges ahead and to seize the opportunities that come with the transition to a climate-neutral future.

Due to the turbulent political events in the country characterised by several subsequent national elections campaigns and considering the fact that just before submission of the CCC of Sofia Municipality new elections will be held, most probably the national government commitment will be attached to Sofia's contract after submission, but before the end of the year 2024.

We believe the national government elected will embrace the opportunity to commit to Sofia's CCC since the actions of the biggest city in the country are of vital importance for achieving the national goals in view of climate neutrality, energy efficiency and circular economy.

3 Strategic priorities

Strategic priorities

Our strategic priorities include (1) promoting sustainable transport and mobility, (2) energy renovation of buildings, as well as stimulating digital innovations in energy management in buildings and street lighting, (3) improving waste management and the efficient use of resources. These priorities are in line with and complement our Sustainable Energy and Climate Action Plan, Waste Management Plan, and Sustainable Urban Mobility Plan.

These ambitious goals will lead to real, measurable changes in the energy system and buildings, the transport and mobility system, and the waste management system. They will further reduce greenhouse gas emissions with 41% to cover the established shortfall to 81%.

In achieving this goal, Sofia Municipality needs support, coordination, and joint efforts with all stakeholders. Each plays a key role in this ambitious project by bringing unique perspectives and

essential resources to ensure the success of this transition. Therefore, we will identify additional stakeholders to be involved in fulfilling the commitments to achieve climate neutrality.

National authorities play an important role in advancing climate neutrality by providing the necessary funding, establishing favorable regulations, and coordinating national initiatives with local efforts. At the same time, with a decision of the Council of Ministers in November 2023, Bulgaria joined the Net-Zero Government Initiative – Leading by Example. Ensuring joint actions between local and national authorities will guarantee synergy of efforts and achievement of goals.

The private sector is a driver of innovation and investment in green technologies. By adopting sustainable business practices and collaborating with the municipality, these actors can develop and implement environmentally friendly solutions, stimulating the local economy and contributing to carbon neutrality.

Academic and research institutions provide the scientific knowledge and technological innovations needed to address climate challenges. Their research and development activities are crucial for identifying new solutions, improving existing technologies, and training the next generation of climate leaders.

An important partner for achieving the goals by 2030 are municipal organizations, including public enterprises and municipal management services, as they are responsible for implementing waste management, water supply, and public transport programs. Their participation ensures the sustainable functioning of the city's basic services and contributes to reducing greenhouse gas emissions.

Finally, citizens and non-governmental organizations play a fundamental role in ensuring strong community support and raising awareness of climate issues. Their active participation through civic initiatives, environmental advocacy groups, and community projects is essential for establishing sustainable behavior and strengthening society's resilience to climate change.

In summary, the success of Sofia's climate neutrality project depends on a comprehensive and inclusive approach where each stakeholder contributes significantly. Their collaboration and commitment create a robust and resilient ecosystem capable of leading the capital towards a sustainable and prosperous future.

The main interventions will cover, but not limit to:

1. Promoting Sustainable Transport & Mobility

1.1 Invest in public transport

To enhance sustainable mobility and reduce emissions from the transport sector, Sofia city has adopted a broad investment program with priority to:

- **Electrification and renovation of public transport**: We will invest in a comprehensive electrification program, introducing new electric buses, trams, trolley buses and expand the metro lines that provide clean and efficient transportation options.
- **Diversification and expansion of infrastructure:** We will work to create infrastructure that supports and encourages cycling and walking.

1.2 Electrify municipal and private vehicles

Sofia will

- Promoting the use of electric vehicles (EVs) in municipal structures, organizations, and companies;

- Expanding the city's EV charging infrastructure to facilitate the transition to electric transport;

- Discussing incentives and institutional support to encourage residents and businesses to adopt electric vehicles, contributing to the reduction of emissions and improvement of air quality.

2. Enhancing Building Energy Efficiency

2.1 Phased energy renovation of municipal buildings

Reduce energy consumption in existing buildings, by the introduction of:

- Energy-Efficient Technologies: insulation, efficient lighting, smart heating and cooling systems in existing buildings;

- Energy Audits: to identify areas for improvement and guide retrofit efforts effectively.

- Energy Management Systems: installation of smart metering devises and automated control systems

2.2 Net-Zero Building Standards

Sofia is committed to working together with stakeholders to create regulations that ensure new projects meet the highest standards of energy efficiency and promote the construction of carbon-neutral buildings.

3. Circular Economy and Sustainable Consumption

3.1. Waste Management

Sofia recognizes the importance of waste reduction and the principles of the circular economy and continuously works to improve its sustainable waste management practices in accordance with national and European regulations.

- Waste Reduction and Recycling

We will continue to make efforts to reduce waste generation at the source and promote recycling throughout Sofia Municipality by applying the "polluter pays" principle. We are ready to implement recycling programs to encourage residents and businesses to effectively separate recyclable materials.

We will conduct extensive educational campaigns to raise awareness about waste reduction, recycling, and responsible consumption practices.

3.2 Green Procurements

To further enhance the sustainability of processes, Sofia Municipality will develop, in collaboration with stakeholders, practices for organizing so-called "Green Public Procurement" and will work towards their effective implementation.

The attached Climate Neutrality Action Plan until 2030 provides detailed information on the implementation of the priorities and interventions described above, including timelines, funding sources, and collaboration with stakeholders.

We are collectively dedicated to making Sofia greener, healthier, more resilient, and more sustainable for the benefit of the entire local community and the global environment.

4 Process and principles

Process and principles

1. Process

The systematic process followed strictly the basic framework for effective action planning set out in the Info Kit for Cities, the Climate Transition Map and the Theory of Change Model.

The process of outlining the city's commitments to achieving climate neutrality began back in 2017 when a specialized structure was established in Sofia Municipality—the "Climate, Energy, and Air" Directorate. This directorate is responsible for matters related to policies addressing climate change and air quality.

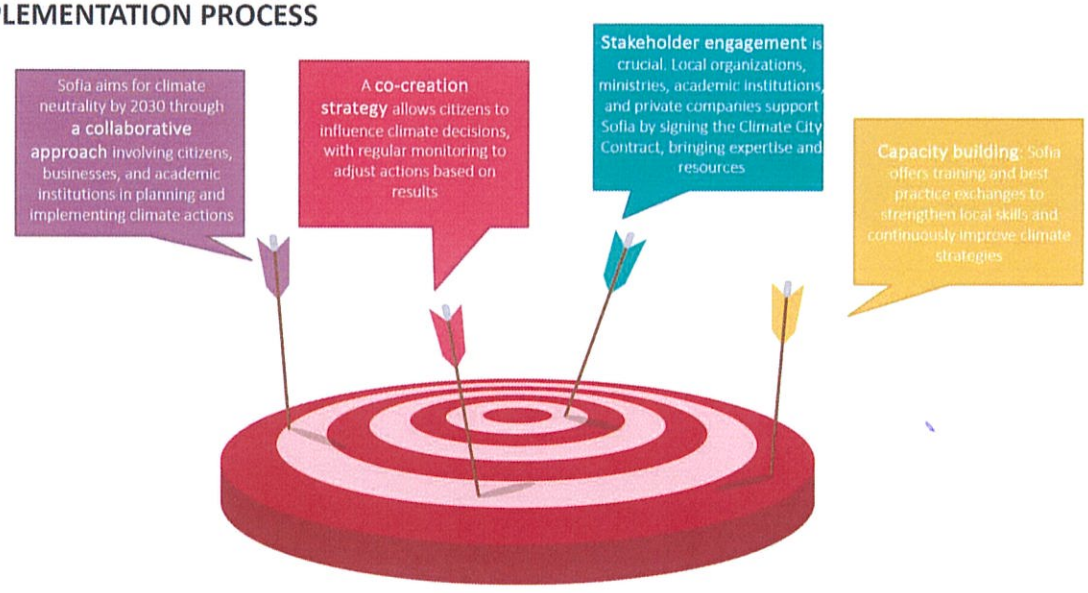
The municipality's efforts are also supported by: the Coordination Unit, which monitors the progress of SECAP 2021-2030 and the implementation of the "Energy Efficiency First" principle; the Scientific Council on Climate and Climate Change, which participates in project discussions and policy development; and the newly established innovative structure. To support the process of developing the Climate Neutrality Contract, a Unit for Transition to Climate Neutrality was formed.

The inclusion of stakeholders is an important step in the process of outlining commitments to increasing climate neutrality. In this direction, a Communication Strategy for SECAP 2021-2030 has been developed and implemented. A one-stop shop has also been created, providing advice and support to citizens regarding energy consumption and savings, energy efficiency, and the use of renewable energy sources (RES). Additionally, the platform "Sofia Chooses" allows citizens to propose and co-design projects and participate in their implementation.

Within the framework of the Climate Neutrality Contract implementation, existing cooperation with various stakeholders will be further expanded, and new partnerships will be created to achieve the ambitious goals.

The process of development and implementation is detailed in Section 1.5 of the attached Climate Neutrality Action Plan. It follows the Transition Map and the Theory of Change of NZC and is based on four pillars:

IMPLEMENTATION PROCESS



In the process of co-creation we organised several meetings with stakeholders and the most important one was the meeting with business representatives where the objectives and targets were discussed broadly and in detail. The result of this meeting was the readiness for engagement in the co-design process and the start of continuous communication. Due to the great delay of starting the activities for developing

the CCC, private stakeholders could not prepare their actions to be included in this first version of the CCC and only few private partners confirmed their commitment by provided a list of actions, which implementation will support the achieving reduction in the carbon footprint of the city – the operator of Sofia Airport (fully within the territory of Sofia City), the operator of the Water Utility in the municipality and CleanTech – a business network that focuses on clean technology, innovation and sustainable development.

2. Monitoring and Management of the Climate Neutrality Contract (CCC)

The monitoring of the Contract's implementation will be based firstly on clear data collection procedures and secondly on procedures for tracking progress in the implementation of the established indicators (detailed in Section 3.3 of the attached Climate Neutrality Action Plan).

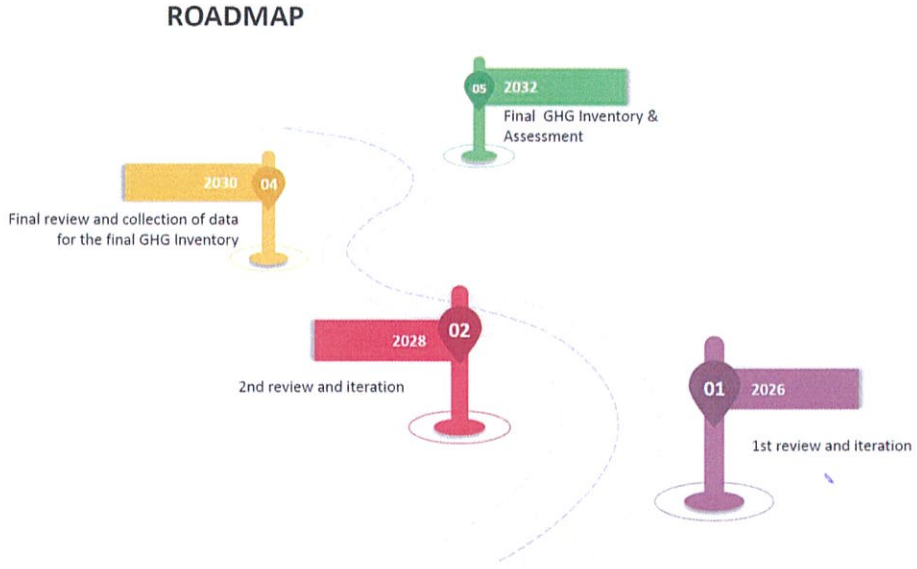
The collected information will be analysed to anticipate potential implementation problems and outline possible approaches to overcome them.

The monitoring process will include:

a. Annual review of action progress and informing the community – An annual review will be conducted to determine the need for updates, depending on the development of the local context, as well as local, national, and European legislation in relation to climate neutrality.

b. Periodic evaluation and review of the results of implemented projects and activities – At least twice a year, or more frequently, monitoring sessions will be organized for the Transition to Climate Neutrality Unit to address any arising issues as quickly and effectively as possible.

c. Regular review of Sofia's Climate City Contract (CCC) by specialized structures and organizing joint sessions between the Transition Unit and the Scientific Council on Climate and Climate Change to address gaps, discrepancies, or incompatibilities with policies and/or regulations, if applicable. The timeline for the periodic review of the CCC is presented in the roadmap below:



The Climate Contract has a horizon until 2050, which is a long-term effort encompassing actions and initiatives across various sectors and with different stakeholders. For this reason, we envision the management of the contract to be organized as follows:

a. The "Climate, Energy, and Air" Directorate in the Sofia Municipality Administration will conduct regular monitoring of the Contract's implementation, maintain continuous communication with stakeholders, and support the work of the "Transition to Climate Neutrality Unit";

b. The existing "Transition to Climate Neutrality Unit" will become a permanent entity with its composition updated to include representatives from the stakeholders who signed the contract. The main responsibilities of the Unit will be to strategically monitor the progress in implementing the planned measures, provide guidance, and propose solutions to any challenges that arise. The Unit will meet regularly, but not less than once every six months;

c. Enhancing the role of the "Scientific Council on Climate and Climate Neutrality" by involving it at the earliest stage in discussions of potential measures for achieving climate neutrality.

3. Principles

Sofia Municipality follows several guiding principles that form the roadmap to the city's climate neutrality and strengthen its role as a model for innovation and pioneering:

Accountability: Conducting periodic reporting to the structures responsible for monitoring and managing the Contract and to the public. We remain open to external evaluation and feedback.

Co-Design/Co-Creation: Engaging stakeholders, including citizens and businesses, in the development and implementation of the Climate Neutrality Contract (CCC) to ensure it meets their needs and priorities. Citizens participate in proposing and selecting specific projects. They are regularly involved in public discussions on actions proposed by the municipality, and businesses are encouraged to take measures for climate change mitigation and adaptation.

Innovation: Utilizing innovative ideas and approaches that can support our path to climate neutrality.

Social Participation: Considering social impact in the planning and implementation of the Contract. This will allow for the identification of barriers to the participation of vulnerable social groups in CCC actions, and our intention is to ensure a just transition for all.

Systematic and Demand-Driven Approach: All proposed actions are integrated systematically and are driven by the needs and priorities of the citizens for their well-being. Our strategy includes integrated interventions.

Monitoring and Joint Learning: Continuous monitoring of implementation, and revision and enhancement of the Contract. It is a "living document" and must be continually reviewed, refined, supplemented, and adapted. Through constant monitoring of the reliability and relevance of the measures, we share what we've learned with other cities and assimilate their lessons, using the opportunity to apply different, better, and more efficient measures if necessary. Therefore, we will continue to improve the established processes and structures that allow for flexible actions and responses.

The purpose of this document is to unite our commitments and provide a roadmap for Sofia Municipality to improve its climate neutrality. In this document, we reaffirm our determination to combat climate change, and it serves as a guide for our ongoing efforts.

We are guided by several key principles such as transparency, accountability, and innovation. We believe in the co-creation of systematic and demand-driven actions. With this, we commit to comprehensive monitoring and joint efforts that ensure our actions will be effective and our progress measurable.

We are fully aware that the Climate-Neutral City Contract is a living document that will be continuously reviewed and periodically updated in view of its effectiveness, accountability to commitments, and the engagement of new stakeholders in accordance with financial and monitoring cycles.

Being fully aware that Sofia Municipality could not achieve all above depicted goals alone, we have engaged few private partners – SOF CONNECT, the operator of Sofia Airport, VEOLIA Sofiyska Voda AD, the WWW utility company in Sofia Municipality region and CleanTech OOD – a business network focused on on clean technology, innovation and sustainable development. Their commitments to support our efforts along climate neutrality path are presented in detail in the Climate Neutrality Action Plan of Sofia annexed herewith.

Our commitments are the result of a co-creation process with local, regional, and national stakeholders, establishing new ways of thinking and working together to achieve climate neutrality by 2030.

Our overall goal is to achieve systemic change in the city, including in the sectors with the highest emissions in the city.

We believe that our commitments will lead to significant change, which will have a positive impact on reducing greenhouse gas emissions in the city of Sofia.

We, the undersigned, commit to joining our efforts to make Sofia Municipality climate neutral by 2030.

We agree with the shared vision and commitments formulated in this document and will contribute to achieving our common goals.

This commitment document and its annexes, which are an integral part of it, have been developed through an iterative process as a dynamic and flexible document that will be subject to monitoring, updating, and modification to review and adjust the commitments, actions, and/or investments necessary to achieve the city's climate neutrality goals. It represents a manifestation of our collective will, shared vision, and firm commitment to a sustainable and climate-neutral future.

5 Signatories

Name of the signatory (organisation)	Sector / Domain / Level of operation[1]	Legal form	Name of the responsible person	Position of the responsible person	Signature
Sofia Municipality	Governance, local level	Municipality - Local government	Mr. Vasil Terziev	Mayor of Sofia Municipality	
Association of commercial building owners in Bulgaria	Built environment, national level	Non-profit organization	Mrs. Tanya Koseva	Chairman of the Board of Directors	
Bulgarian construction chamber	Building and construction, national level	Non-profit organization	eng. Iliyan Terziev	Chairman of the Management Board	
VEOLIA Bulgaria/Sofiyska Voda AD	Water Supply and Wastewater treatment, regional level	Private company/Water Supply and Wastewater Treatment Utility	Mr. Francois Debergh	Country Director Bulgaria & Greece	
SOF CONNECT AD – Airport operator of SOFIA AIRPORT	Transport / Airport Airborne transport, regional level	Private company/Airport	Mr. Jesus Caballero Pinto	Chief Executive Officer	
University of Architecture, Construction and Geodesy	Science & education, national level	University	Assoc. Prof. Dr. Arch. Gichka Kutova-Kamenova	Rector	

[1] Please mention if the organisation is active at local, regional, national, or international level.

University of National and World Economy	Science & education, national level	University	Prof. Dr. Dimitar Dimitrov	Rector	
University of Forestry	Science & education, national level	University	Assoc. Prof. Dr. Hristo Mihaylov	Rector	
Todor Kableshkov University of transport	Science & education, national level	University	Prof. Daniela Todorova, PhD	Rector	
Clean Tech Bulgaria	Innovation & Sustainable development, national level	Private organisation/Business network	Mrs. Mariyana Hamanova	Executive director	
Bulgarian Green Building Council	Science & education for transforming the built environment, national level	Non-profit organization	Ms. Adina Welsh	Chairperson	

Appendix 1: Individual Commitments

Currently only the Association of Commercial Buildings has provided its signed commitment in the form of supporting letter attached below.

The individual commitments of other stakeholders who have signed the Climate Neutrality Contract will be additionally provided.

Association of commercial buildings owners in Bulgaria

Bulgaria, 1000 Sofia
22 San Stefano str., San Stefano plaza

2030 CLIMATE-NEUTRALITY COMMITMENTS

The Association of commercial building owners in Bulgaria (ACBO) is a voluntarily, non-political, and non-governmental organization. Founded in 2013, it incorporates around 50 companies, owners of commercial buildings and associated members (companies involved in the real estate business) with total built-up area of more than 1,000,000 square meters, located in the Republic of Bulgaria, as the majority of the buildings are located in the city of Sofia.

Sofia's climate neutrality ambition by 2030 is a bold yet necessary commitment to ensuring the city's long-term environmental and economic sustainability.

ACBO is committed to contributing to this city-wide goal by focusing on two critical areas: energy savings and waste reduction within commercial buildings in Sofia. ACBO's goal is to promote among its members actions and activities which lead to significant reductions in energy consumption and waste production by 2030, aligning with the city's broader climate neutrality targets. While some areas, such as heritage buildings, may present challenges in achieving full climate neutrality by 2030 due to preservation constraints, ACBO is willing to address these areas beyond 2030, implementing gradual improvements and integrating new technologies as they become viable.

ACBO's commitment is further bolstered by its member organizations, which collectively manage a significant portion of the city's commercial real estate. The Association's efforts aim not only to contribute to reduced GHG emissions but will also promote co-benefits such as improved air quality, enhanced well-being for building occupants, and long-term financial savings through increased energy efficiency.

In order to proactively participate in the achievement of the climate neutrality of city of Sofia by 2030, the ACBO has identified several systemic strategic priorities that will have a profound impact on reducing GHG emissions within Sofia's commercial building sector:

a) *Energy Efficiency Improvements*

- Building Retrofitting: ACBO will spearhead amongst its member an initiative to retrofit existing commercial buildings with energy-efficient technologies, such as LED lighting, smart thermostats, and HVAC systemsv with higher energy effficiency.

- The association will promote the adoption of advanced energy management systems (EMS) across its member buildings. These systems will optimize energy use, reduce waste, and provide real-time data to track progress towards energy reduction goals.

b) *Renewable Energy Integration*

- On-Site Renewable Energy: ACBO will encourage amongst its members the installation of solar panels and other renewable energy sources on commercial building rooftops. This will reduce reliance on fossil fuels and contribute directly to the city's renewable energy targets.

- Green Energy Procurement: The association will explore opportunities for bulk purchasing agreements with green energy providers, enabling members to transition to 100% renewable energy sources more cost-effectively.

c) *Waste Reduction*

- Waste Audits and Reduction Plans: ACBO will promote amongst its members the need of minimizing waste generation at the source and increasing recycling rates.

- Circular Economy Initiatives: The association will promote the adoption of circular economy practices, such as using recycled materials in construction, the use of materials produced in the vicinity of the construction site etc.

d) Stakeholder Engagement and Capacity Building

- Education and Training: The ACBO will encourage its members to participate in d training programs for building owners, managers, and tenants which raise awareness about energy efficiency and waste reduction strategies. Work meetings, presentations and other events in this regard shall be held.

- Collaboration with Government and NGOs: The association will actively collaborate with Sofia's municipal government, NGOs, and other stakeholders to ensure that its efforts are aligned with the city's overall climate action plan. This includes participating in policy discussions, sharing best practices, and contributing to city-wide sustainability initiatives.

d) *Conclusion*

The ACBO is fully committed to supporting Sofia's ambition to become a climate-neutral city by 2030. Being a voluntary organization, the Association can only encourage and support its

members to carry out these activities, and is not able to commit to achieving or reporting specific results in these areas. However, it believes that by continuing to implement the above-mentioned initiatives in this field, in accordance with the Association's capabilities and program, it will have a positive impact and contribute to achieving these goals.

Tanya Kosseva-Boshova,

Chairperson of the Association of commercial building owners in Bulgaria

Appendix 2: Decision of Sofia City Council

СТОЛИЧНА ОБЩИНА

СТОЛИЧЕН ОБЩИНСКИ СЪВЕТ

1000 София, ул. Московска № 33, Тел. 02/93 77 591, https://council.sofia.bg

Р Е Ш Е Н И Е № 4 8 4

на Столичния общински съвет

от 12.09.2024 година

За подписване на Договор за климатична неутралност на град София като един от 100-те климатично неутрални и интелигентни града.

На основание чл.21, ал.1, т.12, т.13 и ал.2 от Закона за местното самоуправление и местната администрация, във връзка с изпълнението на проект „Нет зиро ситис“ (Net Zero Cities)“

С Т О Л И Ч Н И Я Т О Б Щ И Н С К И С Ъ В Е Т

Р Е Ш И :

1. Упълномощава кмета на Столична община да подпише Договор за климатична неутралност.

2. Дава съгласие Столична община да представи Договора за климатична неутралност на Мисията на Европейската комисия - „100 климатично неутрални и интелигентни града на бъдещето до 2030 г.“, в рамките на проект „Нет зиро ситис“ (Net Zero Cities)“.

Настоящото решение е прието на заседание на Столичния общински съвет, проведено на 12.09.2024 г., Протокол № 18, точка 9 от дневния ред, по доклад № СОА24-ВК66-7735/05.09.2024 година и е подпечатано с официалния печат на Столичния общински съвет.

Председател на Столичния общински съвет: **(п)**

Цветомир Петров

5 Signatories

Name of the signatory (organisation)	Sector / Domain / Level of operation[1]	Legal form	Name of the responsible person	Position of the responsible person	Signature
METHODIA AD	IT& telecommunications in energy sector/ international level	Private	Tsvetoslava Kyoseva	CEO of Methodia AD	

[1] Please mention if the organisation is active at local, regional, national, or international level.

5 Signatories

Name of the signatory (organisation)	Sector / Domain / Level of operation[1]	Legal form	Name of the responsible person	Position of the responsible person	Signature
Association for Production Storage and Trading of Electricity (APSTE)	Renewable energy generation, storage and trading.	Non-profit organization	Mr. Nikola Gazdov	Chairman of the Board of Directors	

[1] Please mention if the organisation is active at local, regional, national, or international level.