The Green City Action Plan

EBRD GREEN CITIES

Sofia, Bulgaria

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Contents

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Glossary

Term	*Definition*
Biodiversity	The number and types of plants and animals that exist in a particular area (ecosystem).
Brownfields	A city area that has been used in the past for factories or offices and that could now be used for new building development.
Geothermal energy	Renewable, clean power derived from Earth's thermal energy
Green corridor	A thin strip of land, often within an urban environment, that provides habitat for wildlife and its movement. Common green corridors include railway embankments, river banks and roadside grass verges.
Green infrastructure	Interconnected, strategically planned network of natural and semi-natural areas, which is designed to deliver a wide range of ecosystem services.
Green procurement	A procedure by which public authorities seek to obtain products, services and works with reduced environmental impact throughout their lifecycle, instead of products, services and works with the same essential function that would otherwise be provided / Purchasing products and services that cause minimal adverse environmental impacts. It incorporates human health and environmental concerns into the search for high quality products and services at competitive prices.

Term	*Definition*
Green walls	Wall that is comprised of plants grown in supported vertical systems that are generally attached to an internal or external wall, in some cases freestanding.
Greenfield	Parks, gardens, green areas forest parks, green spaces in residential complexes, outdoor landscaping..
Open green space	Publicly available space, partly or completely covered with grass, trees, shrubs or other vegetation. It includes parks and community gardens.
Pocket park	A small public park
Retrofitting	Improving existing infrastructure (e.g. power plants, buildings) with new technology (e.g. energy efficient equipment)
Solar energy	Energy that uses sun power to produce electricity.
Solid fuels	A solid substance used for fuel, such as coal or wood
Solid recovered fuel	Fuel produced by shredding and stabilising/ dehydrating solid household waste, typically consisting of combustible components of household solid waste.
Wastewater	Waters, including rainwater, contaminated by production, economic, agricultural and domestic activities, as well as waters from sewage systems of settlements and resorts.

Executive summary

This Green City Action Plan (GCAP) sets out Sofia Municipality's actions to create a **"green, clean municipality, full of life".** It aims to achieve an improvement in the state of the environment, including visible, tangible improvements to the physical environment, air quality and better management of the natural capital within the Municipality.

We have the responsibility to protect the environment and will use this Plan to make Sofia a clean and green municipality, where natural capital is valued and preserved in response to the needs of the population. Our ambitious plan looks to ***deliver seventeen key actions over the next 3-5 years*** across five priority sectors. Each of these actions seeks to make improvements in these sectors in order to enhance the overall state of the environment. The GCAP tackles the following challenges:

- **Residential heating**. Sofia Municipality has large number of households using solid fuels and low-efficient heating systems, which lead to poor air quality during the winter.
- **Housing and communities**. Sofia Municipality has an advanced solid waste management system with a mechanical and biological treatment plant and production of solid recovered fuel from residual waste. However, waste generation is high and therefore awareness campaigns promoting reduction of material consumption and increase in recycling are required.
- **Land use and planning**. Sofia Municipality has extensive open green space. However, the share of green space in some regions is lower or is not evenly distributed, especially in residential estates in northern city parts.
- **Green-blue infrastructure**. The water supply network needs to be upgraded and not all areas are currently connected to the wastewater sewage network. Expected extreme weather events due to climate changes, such as flash and surface floods will put extra pressure on the water system.
- **Transport.** Sofia Municipality currently has a large share of private vehicles with high emissions, contributing to air pollution. We need to continue enhancing walking and cycling paths in order to encourage more people to undertake active modes of transport.

Vision and Strategic Objectives of GCAP

This plan will bring following benefits to Sofia Municipality

1. Air quality improvement and greenhouse gas emissions reduction.
2. Health benefits from improved physical activity and mental wellbeing of Sofia Municipality's residents.
3. Ecosystems restoration from restored green spaces, corridors and riverbanks.
4. Improved quality of urban space, bringing opportunities for higher land value and tourism growth.

Green, clean municipality, full of life

Sofia Municipality will achieve visible, tangible improvements to the city's physical environment, by improving green spaces throughout the city and increase their share by integrating green infrastructure throughout the city and creating space and places for all ages. Sofia Municipality will become a clean municipality with improved air quality through measures to shift to active travel, public transport, to promote cleaner vehicles and to reduce fossil and solid fuel usage for heating. The municipality will use its natural resources responsibly- it will improve waste and wastewater collection and treatment. The GCAP's green and clean measures will be designed and managed to restore the municipality's biodiversity.

Actions

The GCAP consists of seventeen core actions and a number of supporting actions across each of the five priority sectors. Each action has been designed to build on activities that Sofia Municipality has already undertaken and all align to the strategic objectives shown in Figure 1. The actions include a mix of capital investment programmes and projects, as well as supporting policies, legislative and regulatory measures.

The list of prioritised actions are shown in Figure 1.

Putting GCAP into practice

GCAP must be embedded into the core organisational structure and processes within the relevant divisions in Sofia Municipality. Since many actions are interlinked, it is necessary to use a collaborative approach. Given that the Plan will sit alongside Sofia Municipality's other strategic documents which have similar aims and objectives, care will be taken to ensure efficiencies are made when possible. Each action will be delivered by the relevant specialized directorate and the overarching responsibility for coordination and annual reporting to measure GCAP actions against targets and to hold regular meetings to ensure that projects are kept on track will remain within the Climate, Energy and Air Department.

Monitoring of the GCAP will be undertaken on two levels:

- **Plan implementation monitoring** – a coordination body will be set up to monitor the Plan implementation. The coordination body will assign each GCAP action to a responsible department.
- **Plan impact monitoring** –the GCAP impact will be reported annually. This will be to evaluate whether the delivery of the actions is achieving their intended outcome and contributing to the successful delivery of the strategic objectives of the GCAP.

Figure 1.Strategic Objectives. The three pillars have one overarching strategic objective and a number of medium –term targets to achieve the objective.

Green strategic objectives	SO1. Sofia Municipality will achieve visible, tangible improvements to the city's physical environment and preserve biodiversity levels with particular focus on:	SO1.A Improve green spaces throughout the city and increase their share
		SO1.B Integration of green infrastructure throughout the city
		SO1.C Promote transit-oriented development
Clean energy strategic objectives	SO2. Sofia Municipality will improve air quality and reduce its carbon footprint.	SO2.A Increase the share of public transport usage
		SO2.B Promote cleaner vehicles
		SO2.C Improve energy efficiency within buildings
		SO2.D Increase the percentage of renewable energy used and lower use of solid fuels for building heating
Responsible resource use strategic objectives	SO3. Sofia Municipality will improve the surface water management and build resilience to future climate change risks.	SO3.A Reduce dependence on surface water: improve vulnerability during an extended drought
		SO3.B Ensure that the city is resilient to future climate change risks
	SO3. Sofia Municipality will optimize waste collection and treatment and reduce the amount of landfill waste, specifically focusing on:	SO3.C Increase recycling rates
		SO3.D Encourage the reuse of materials

Table 1. Green City Action Plan Actions

ID	Short-term actions	Strategic Objectives	Implementing body	CAPEX and development costs (EUR – 2019 cost – € '000s)[1]	Net changes to annual OPEX (EUR – 2019 cost – € '000s)
Energy					
E.01	Improvement of municipal building energy efficiency programme	SO2.C	Sofia Municipality: "Housing and Public Construction, Heat Energy and Energy Efficiency" Directorate	(74,275)	2,309
E.02	Public lighting renewal	SO2.C	Sofia Municipality: "Transport Infrastructure" Directorate	(178,076)	6,143
E.03	Geothermal energy development	SO2.D	Sofia Municipality: "Territorial Planning" Directorate	(13,101)	(85)
Housing and communities					
H.01	Housing inter-block area improvements	SO1.A, SO1.B	Sofia Municipality: "Territorial Planning" Directorate and "Green System" Directorate	(535)	(431)
H.02	Energy efficiency measures in multifamily residential buildings	SO2.C	Sofia Municipality: Architecture and Urban planning Division, Climate and energy department	(117,014)	14,111
H.03	Community repair and reuse centre buildings	SO3.C, SO3.D	"Waste management" Directorate	(94)	(73)
H.04	Pocket parks in dense residential neighbourhoods	SO1.A, SO1.B	Sofia Municipality: "Territorial Planning" Directorate and "Green System" Directorate	(1,464)	(43)
Urban planning					
U.01	Transit-oriented development	SO1.A, SO1.B, SO1.C, SO2.A	Sofia Municipality: Chief Architect and "Territorial Planning" Directorate	(128)	N/A
U.02	Brownfield regeneration	SO1.A, SO1.B	Sofia Municipality: Chief Architect, "Territorial Planning" Directorate and "Green system" Directorate	(867)	(34,351)

[1] Bracketed numbers are additional expense and the non-bracketed numbers are debit amounts. They are not revenue generation but cost savings.

ID	Short-term actions	Strategic Objectives	Implementing body	CAPEX and development costs (EUR – 2019 cost – € '000s)	Net changes to annual OPEX (EUR – 2019 cost – € '000s)
Blue- green infrastructure					
BG.01	Climate change risk assessment and flood model	SO3.B	Sofia Municipality: "Emergency Help and Prevention" Directorate, "Engineering Infrastructure" Directorate and "Climate, Energy and Air" Directorate, Division Architecture and Urbanization, Sofproekt	(187)	N/A
BG.02	Green corridor protection, enhancement and development	SO1.A, SO1.B, SO3.B	Sofia Municipality: Chief Architect, "Territorial Planning" Directorate and "Green System" Directorate	(32,695)	(24,598)
BG.03	Surface water management	SO3.A, SO3.B	Sofia Municipality: "Emergency Help and Prevention" Directorate, "Engineering Infrastructure" Directorate and "Climate, Energy and Air" Directorate, Division Architecture and Urbanization, Sofproekt	(26,661)	(246)
BG.04	Optimize recycling and waste management in the construction sector	SO3.C, SO3.D	"Waste management" Directorate, Directorate and "Green system" Directorate	(7,758)	8,382
Transport					
T.01	Promote cycling and walking	SO2.A	Sofia Municipality: Chief Architect, "Transport Infrastructure" Directorate and "Territorial Planning" Directorate	(8,969)	N/A
T.02	Tram renewal programme	SO1.C, SO2.A	Sofia Municipality: "Transport" Directorate and "Stolichen Electrotransport" EAD (private commercial company owned by the Municipality)	(340,884)	N/A
T.03	Parking management	SO2.B	Sofia Municipality: "Territorial Planning" Directorate, "Traffic Analysis and Management" Directorate and "Urban Mobility Centre" EAD	(37,689)	(2,568)
T.04	Electric vehicle promotion	SO2.B	Sofia Municipality: "Transport Infrastructure" Directorate	(150)	N/A

Introduction

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1 Introduction

1.1 GCAP ambition & purpose

Context

GCAP's vision is for Sofia Municipality to evolve into a green, vibrant municipality with a clean environment and to use its natural resources sustainably. This plan is coordinated with the ongoing process of preparing the Municipality's vision through the "Vision for Sofia "initiative. To fulfil this vision, the Green City Action Plan (GCAP) has been developed to assess and prioritise the Municipality's environmental challenges and deliver specific actions to address them.

The GCAP has been prepared with the support from the European Bank for Reconstruction and Development (EBRD) and it follows the GCAP methodology, developed by EBRD together with expert input from the Organisation for Economic Co-operation and Development (OECD), and Local Government for Sustainability (ICLEI). It is in line with various international agreements and conventions aimed to counteract the worsening of the quality of environment (such as the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Convention) or the Paris Agreement), as well as in compliance with the relevant strategic documents at municipal, regional and national level at the time of the plan's writing.

Purpose

The purpose of the GCAP is to present the evidence base for identifying, determining and updating the priority of environmental challenges, which Sofia Municipality faces and to set a plan of action to overcome them by realising an environmentally-enhanced vision for the municipality. The GCAP will help Sofia Municipality secure investment into priority environmental infrastructure projects and will identify relevant policy actions that can be implemented in order to improve the city's environmental quality. It also delivers a complex system for monitoring and verification of the Plan, for communicating the actions, and engaging with key stakeholders and the wider community.

Limitations

This document has been prepared using data collected according the EBRD methodology and the results are limited to the availability of environmental data (e.g. certain data is not available at all neither at local, nor at national level, i.e. lack of recent data, as well as in some cases the available data is in a different format). The analysis is based on data which has been received by the GCAP project team within the limited time available to collect. In some cases, data assessed as weak may actually be of higher quality, but was not available to the GCAP team at the time of data collection.

The financial assessment of actions is only an indicative cost. After the plan's approval, a further feasibility study including detailed costings will be needed for each action.

Structure of the GCAP

The GCAP has been structured into six sections as briefly described below:

Section 1: Introduction, provides an introduction to the GCAP and presents the purpose of the plan, the GCAP structure overview and a review of the plan's alignment with other Municipality plans and strategies.

Section 2: Methodology, summarises the methodology for developing the green city actions, as well as the vision and strategic objectives.

Section 3: City Baseline, highlights key results from the findings of the technical report and the political framework report.

Section 4: Green City Vision and Strategic Objectives, are set out based on the findings of the City/ Municipality baseline.

Section 5: Green City Actions, presents the Green City actions and policy measures in each of the following sectors:

- Energy
- Housing and Communities
- Urban Planning
- Blue-green infrastructure
- Transport

Section 6: Monitoring, Reporting and Verification (MRV) provides the guidelines for monitoring, reporting and verification of the data for the report purposes. It sets out the tools for measuring the effectiveness of GCAP implementation in relation both to actions taken and outcomes achieved.

Two Appendices are attached to this document:

- A1: Action Prospectus – outlining the actions taken as part of the GCAP;
- A2: Financial mechanisms – outlines financing mechanisms available for each action.

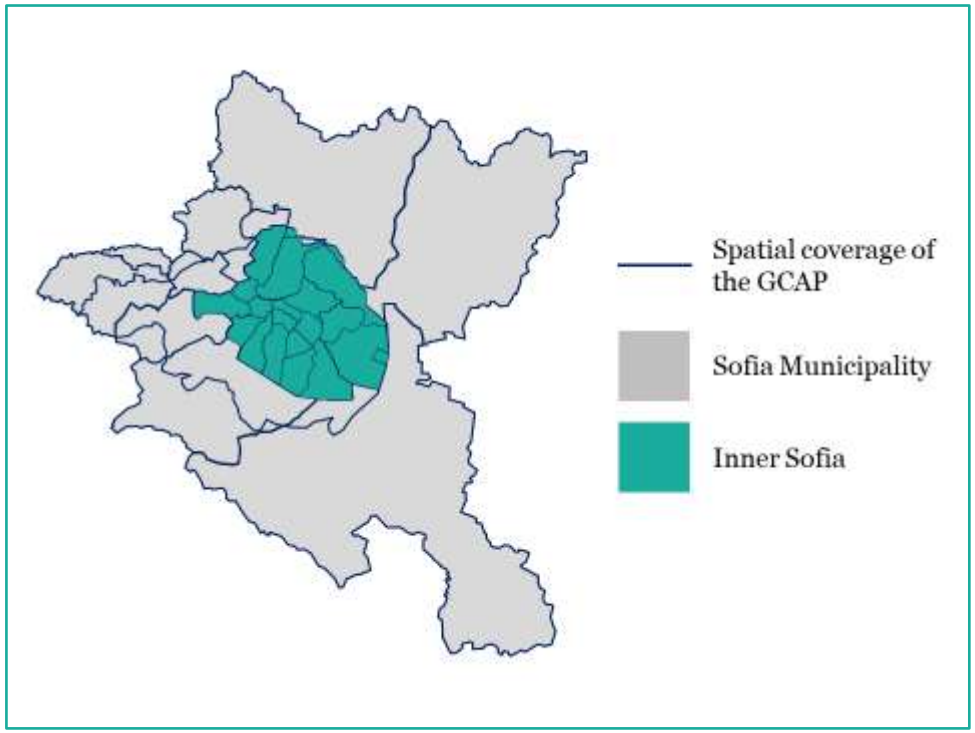
GCAP spatial coverage

Sofia Municipality is the largest economic centre in Bulgaria and the most densely populated district in the country. Sofia Municipality is inhabited by a population of 1.32 million. Besides accommodating approximately 18% of the total Bulgarian population, Sofia Municipality attracts a substantial number of commuters from the nearby cities on a daily basis. Sofia Municipality consists of 4 towns and 34 villages. According to the Law on the territorial division of Sofia Municipality and big cities, the territory of the Municipality is divided into 24 administrative districts.

Sofia Municipality is situated in Western Bulgaria, in Sofia Valley that is surrounded by the Balkan Mountains to the North. South of the city is the Vitosha Mountains, a mountain massif which is one of the symbols of the city. Unlike most European capitals, Sofia does not have any large rivers or bridges, but is surrounded by comparatively high mountains on all sides, where numerous small mountain springs are located.

Sofia's geographical location significantly influences the green development of the Municipality, as its location in the Sofia valley results in limited air flow and frequent fog which explains the air quality challenges. The mountain belt that surrounds the Municipality acts as a geographical boundary and limits the spatial development, especially in a southerly direction. As a result, Sofia's housing density is high in the central districts and gradually decreases to the peripheral districts. The residential districts at the outskirts of the city, developed in the recent years, have limited green public spaces. On the minicipal terittory are several brownfield /industrial areas, which need renovation. The GCAP aims at analysing those city-specific geographical issues and providing the Municipality with guidelines of how to enhance the green development.

Figure 2. Map showing the spatial coverage of the GCAP actions and policy measures



Alignment with existing plans, programmes and strategies

Table 2. Sofia Municipality's existing plans, programmes and strategies as of 2019

Sofia Municipality's existing plans, programmes and strategies	***Aims and objectives of the plan /programme/ strategy***	***GCAP related strategic objectives***
„Program of atmospheric air quality management of Sofia Municipality for the period 2015-2020. - emission reductions and the achievement of established PM10 fine particulate matter standards (AQM Program)	• Reduce the air pollution levels on the Municipality's territory for the period 2015-2020; • Comply with EU Air Quality Directive standards for Particulate Matters; • Reduce human health risks; • Reduce pollution from transportation and residential heating, construction works, sanding and cleaning activities; • Define measures for improving air quality.	• Increase the share of public transport usage; • Promote cleaner vehicles; • Improve energy efficiency within buildings; • Increase the percentage of renewable energy used and lower use of solid fuels for building heating.
Climate Change Adaptation Strategy for Sofia Municipality and its respective Action Plan	• Identify potential risks for the Municipality, caused by climate change; • Define measures for adaptation, addressing the main risks and prepare Sofia Municipality for climate change. Measures for adaptation include: • Enrich green spaces between buildings and maintain street lightning; • Inform the population in a timely manner of forecast events and periods with extreme temperatures, storms, floods; • Increase the number of projects and incentives for energy efficiency improvement in buildings; • Optimise transport connectivity; • Consider renovation, maintenance and optimisation of the water supply system in order to reduce water losses; • Acquire new territories for landscaping (e.g. Vartopo Park, Hidropark Iskar, East Park).	• Improve green spaces throughout the city and increase their percentage; • Integration of green infrastructure throughout the city; • Increase the share of public transport usage as means of transport; • Improve energy efficiency within buildings; • Increase the percentage of renewable energy used and lower use of solid fuels for building heating; • Reduce dependence on surface water: improve vulnerability during an extended drought.
Sustainable Energy Development Action Plan for Sofia Municipality 2012-2020	The long-term goal of the Plan is to implement energy efficiency actions and measures for end consumers and reach 22%CO_2 emissions reduction by 2020.	• Improve energy efficiency within buildings; • Increase the percentage of renewable energy used and lower use of solid fuels for building heating.

Sofia Municipality's existing plans, programmes and strategies	*Aims and objectives of the plan /programme/ strategy*	*GCAP related strategic objectives*
Waste Management Program of Sofia Municipality 2015-2020	The general long-term goal of the program is the efficient use of waste as a resource and a decrease in waste generation. Several strategical objectives will contribute to the achievement of the long-term goal: • Reduce harmful impact of waste by preventing its generation and encourage its re-use; • Increase recycled and recovered waste ; • Implement waste management that guarantees a clean and safe environment; • Involve the public in waste management.	• Increasing recycling rates; • Encourage the reuse of materials.
Strategy for the exploitation of the potential of hydrothermal resources on the territory of Sofia Municipality	• Develop knowledge for territorial hydrothermal resources; studies and preparation for exploration of the thermal zones; • Launch and develop projects for the creation of hydrothermal centres and establishments of various functional types and categories; • Manage and preserve hydrothermal resources, water sources and facilities which have not been utilized for many years.	• Increase the percentage of renewable energy used and lower use of solid fuels for building heating.
Municipality Plan for Development of Sofia Municipality (2014-2020)	The major strategic targets, covering sectors related to the GCAP are the following: • Strategic target 1 – Increased competitiveness through a balanced development of an intelligent, sustainable and inclusive economy. – Priority 1.3. Low-carbon emission economy. Increase energy efficiency by 27% by 2020. • Strategic target 2 – Integrated spatial development and development of the municipal centre to the polycentric system of the big cities in the EU. – Priority 2.1. Technical infrastructure projects; – Priority 2.2. Returning to the polycentric model of development in the South Western Region of Bulgaria by supporting the utilisation of own resources of the other municipalities in the region; – Priority 2.3. Sustainable tourism development by utilising the natural and cultural goods of the Municipality; – Priority 2.4. Adapting to climate change and reducing the risk of natural disasters.	• Improve energy efficiency within buildings; • Increase the percentage of renewable energy used and lower solid fuels for building heating • Promote the densification of the city; • Integration of green infrastructure throughout the city; • Improve green spaces throughout the city and increase their percentage share

Sofia Municipality's existing plans, programmes and strategies	*Aims and objectives of the plan /programme/ strategy*	*GCAP related strategic objectives*
Sustainable urban mobility strategy 2019-2035	The common goals of the plan include: • Reduce the negative impact of transport on people's health and environment; • Increase the attractiveness of the urban environment and ensure better quality of life; • Implement transport innovations and reinforce local mobility and economics; • Improve the safety and security of the passengers and all participants in the traffic; • Achieve an integrated and accessible transport system.	• Increase the share of public transport as a means of transport; • Promote cleaner vehicles.
Program for the Utilisation of Hydrothermal Resources of Mineral Water on the Territory of Sofia Municipality	Main objective: • Sustainable use of mineral water resources in the territory of Sofia Municipality through long-term conservation of the available water resources.	• Reduce dependence on surface water: improve vulnerability during an extended drought.
Integrated Urban Development Plan of Sofia (2014 – 2020)	• Priority 1. Humanise and renovate the urban environment; • Priority 2. Develop an economy, based on knowledge, innovation and creativity; • Priority 3. Preserving the authenticity and increasing the viability of the city centre; • Priority 4. Conservation and efficient use of natural resources.	• Improve green spaces throughout the city and increase their share; • Integration of green infrastructure throughout the city; • Improve energy efficiency within buildings • Increase recycling rates; • Encourage the reuse of materials.
Strategy for Development of the Engineering Infrastructure at the Territory of Sofia Municipality, Part "Water supply, Sewerage, River Bed Corrections" for the Period 2008-2020	Main objectives: • Develop the water supply system, securing the necessary water volume and quality of the drinking water and industrial water for the population and the industry; • Improve the quality of surface water and groundwater, as well as the environment, through sewerage network construction and contemporary facilities for wastewater treatment; • Achieve balanced, good-quality and sustainable living environments by inclusion of the river beds as a harmonious element of the living environment.	• Reduce dependence on surface water: improve vulnerability during an extended drought; • Ensure that the city is resilient to future climate change risks.

Creating the Green City Action Plan

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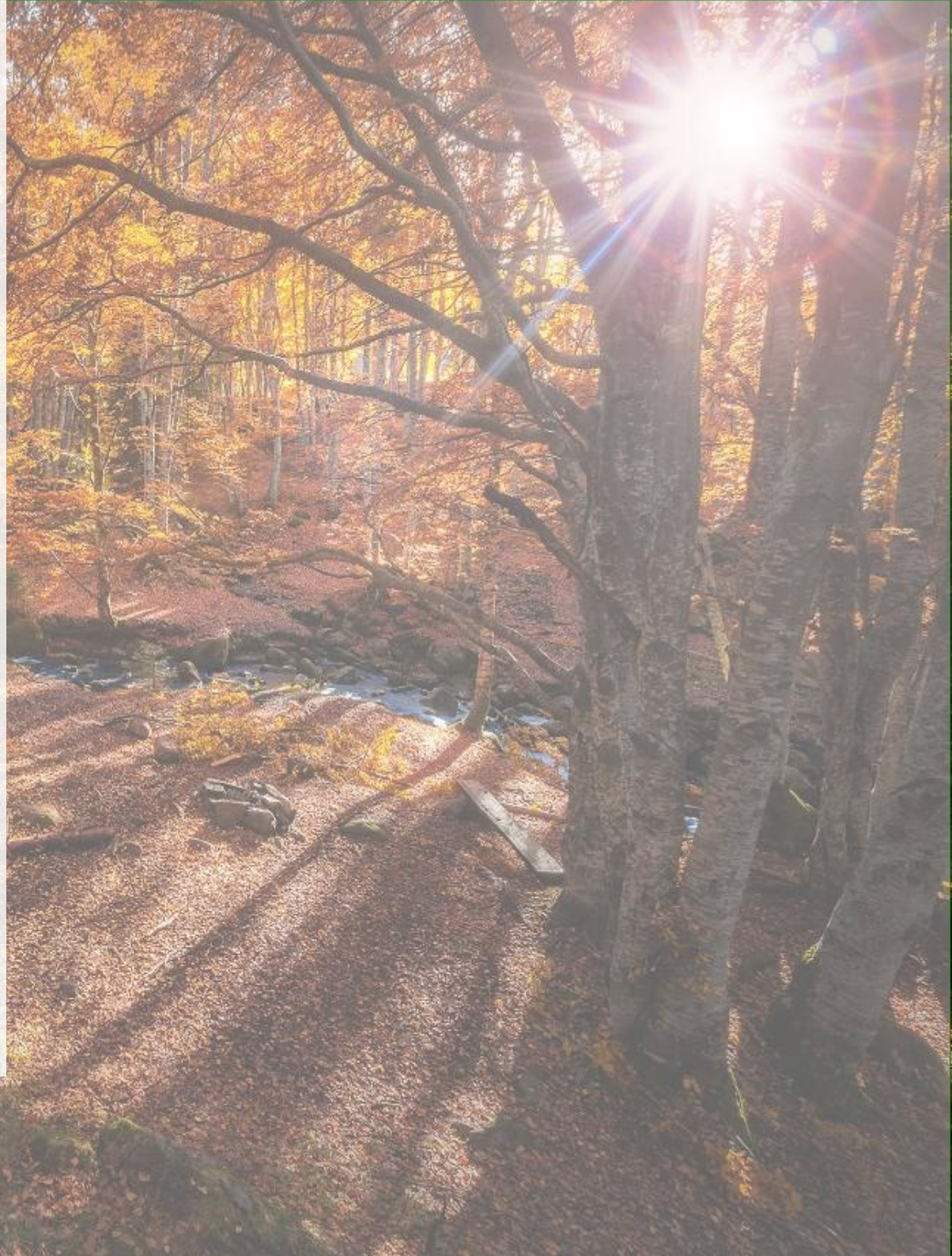


2 Creating the Green City Action Plan

2.1 The GCAP creation approach

GCAP preparation

The GCAP methodology sets out four main steps in the process, described below. With this document GCAP finalises step 2 of the methodology by presenting a summary of the results from the baseline assessment of the Municipality and sets out the vision, strategic objectives and short term actions for Sofia Municipality.

Step 1 Green City Baseline: What is the current state of the environment?

Step 2 Green City Action Plan: Where do we want to go and how do we get there?

Step 3 Green City Implementation: How do we operationalise the plan and what resources are available to assist?

Step 4 Green City Reporting: What have we been able to achieve – and how?

Selecting and developing actions

A key part of the GCAP document is the identification of several actions which Sofia Municipality will implement over the next 1-5 years. The actions within this Plan have been designed to address the challenges identified in the baselining phase and have been specifically identified from the following three activities:

- **Technical assessment of environmental indicators** – A technical assessment in accordance with the EBRD methodology was undertaken of various state, pressure and response indicators. Indicators were ranked using a traffic light system and a trend analysis was undertaken to assess if the indicator was improving or worsening. The actions within the GCAP have been selected to address the worst performing indicators, i.e. where there is greatest possibility for environmental improvement.
- **Assessment of the politics and socio-economic baseline** – A baseline assessment of the politics and socio-economic state of Sofia was undertaken. This analysis determined where the Municipality had the power, ability and financial capability to implement environmental actions. It also identified key stakeholders and competent bodies responsible for different infrastructure groups.
- **Stakeholder engagement process** – Results have been collected from both the kick-off meeting and the prioritisation mission in order to ensure that stakeholder views have been expressed within the assessment of actions. The engagement process has been undertaken to verify the challenge areas and to identify where suggested actions could have the greatest impact.

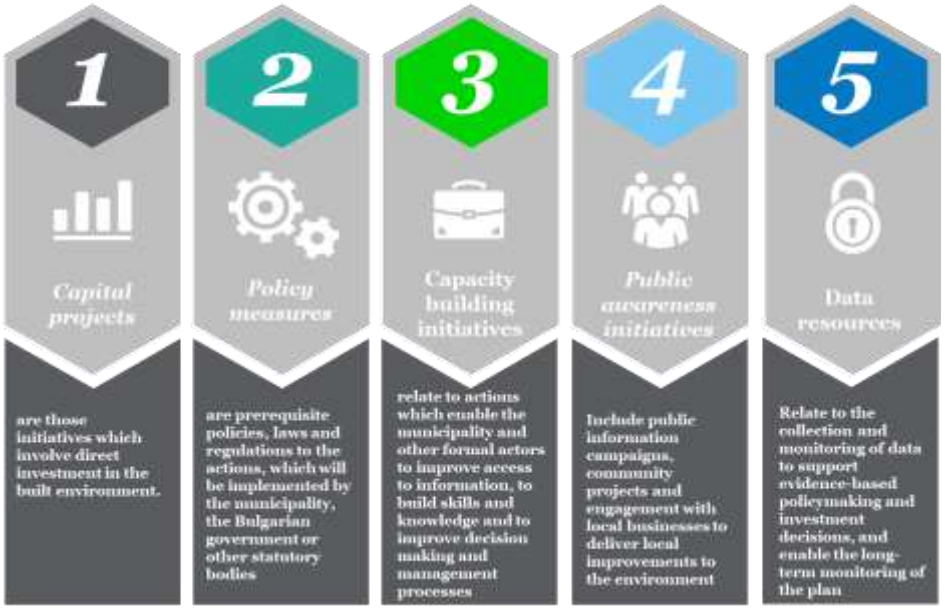
Based on these three information sources we established a long list of current and planned actions for Sofia Municipality across the five priority sectors. Each of the actions was then assessed according to their ease of implementation and their relative scale of impact to create a shortlist of three to four priority actions per priority sector (Figure 3). The result of this assessment is a priority list of actions, aligned with the strategic objectives for a green, clean and full of life city vision. Further details on the prioritisation of actions can be found in Chapter 5 Summary of actions.

Types of actions

The types of actions listed within this document follow the GCAP methodology issued by EBRD (see figure overleaf)

Some additional actions have been identified, which are considered beneficial for the proposed policy measures implementation, which support Sofia Municipality's long-term green vision. Although these actions are not provided as main to this GCAP, they are included after the GCAP actions within a Supporting Actions sub-section (refer to Chapter 4 Green city/ municipality vision and strategic objectives).

Figure 3. Types of actions



Long-term vision, medium-term targets and short-term actions

Within each strategic objective topic section, the overall GCAP vision was translated into a long-term vision statement reflecting the Municipality's ambition over the next 10-15 years (i.e. 2020-2035) (refer to Chapter 3 City Baseline).

The long-term strategic objectives have in turn been converted to a set of medium-term (5-7 years) targets against which we can establish whether Sofia Municipality is making progress towards the long-term vision. These medium-term targets have been taken where possible from the EBRD methodology. EBRD indicators which align to each of the strategic objectives have been selected and the target for "good performance" has been chosen as a target. Where it has not been possible to align Sofia Municipality's proposed targets to the indicators within the EBRD methodology, we have identified other references for the proposed target values based on global verified datasets.

Short-term actions, which are actions that the Municipality can implement over the next 1-3 years, are designed to achieve the medium-term targets and long-term objectives. They are set out in the form of a timeline indicating the key steps needed to enable each action to be implemented. As noted above, these actions are proposed as linked packages of measures which combine data and information gathering, policies and legislation change and capital and operational investment in the municipality's infrastructure and environment.

Benefit assessment of actions

The actions presented in the GCAP have the potential to achieve a range of environmental, social and economic benefits to Sofia Municipality. Potential carbon dioxide emission and air pollution benefits were quantified for each action, while other benefits were assessed qualitatively. The calculation methods for different types of benefit are described below. Unless otherwise stated, benefit estimates were quantified on an annual basis as of the year when the action is planned for completion. The benefits assessment uses the same scope/scale of action as the cost estimation.

Green infrastructure benefits

The potential carbon dioxide and air pollutant benefits resulting from green infrastructure were calculated based on the estimated increase in green space cover in green corridors, pocket parks and inter-block areas, and the estimated carbon dioxide and air pollutant reduction per m^2 of tree cover.

Energy benefits

The carbon dioxide and air pollutant emission reductions resulting from energy efficiency actions and switching to cleaner heating systems were calculated based on the expected thermal energy savings and the carbon dioxide and air pollutant emission factors of the replaced fuels. Energy savings were calculated based on information from previous energy efficiency programmes in Bulgaria. For heating efficiency improvements, we assumed a share of the savings was taken for improvement in comfort by residents experiencing fuel poverty. Geothermal energy benefits were estimated based on potential displacement of higher emission energy sources.

The carbon benefits resulting from the street lighting programme were calculated based on the expected electricity savings and the carbon dioxide emission factor.

Transport benefits

The transport sector has a robust cost-benefit analysis which was conducted for the Sustainable Urban Mobility Plan (SUMP) development, which was in an advanced draft at the time of the benefits analysis. Therefore, the benefits from the transport sector were estimated based on the modelled future mode shift in the SUMP, with additional modelling by Arup for switching to electric vehicles. The estimated potential reduction in total trips made with cars was used to calculate the benefits, based on the carbon dioxide and air pollutant emission factors of the replaced vehicles.

Other benefits

In addition to the quantified benefits, other potential benefits include improved health, climate change resilience, social inclusion, community cohesion, air quality improvements, land value increases, increased wellbeing, biodiversity conservation, reduced flood risk, economic growth and investment, mobility access to services, amenity value and many more. These benefits are described qualitatively in the benefits assessment chapter.

Financial and economic assessment

For each intervention shortlisted for Sofia Municipality, an appraisal has been made of its potential costs and also sources of financing available. The core components of the assessment were:

- **Upfront capital costs**: For interventions with a capital investment element, expected costs were estimated with reference to current or recent historical benchmarks. Cost levels were tailored to Sofia Municipality when necessary, such as through adjusting price data over five years old for inflation, converting from foreign currencies and amending investment requirements to reflect relative labour costs, if an international comparison was used.
- **Upfront development costs**: For interventions with research expenditure or capitalised development costs, current and recent historical benchmarks have been used or estimates based on standard inputs, such as local labour costs. These were also adjusted for inflation and converted from foreign currencies when local comparatives were not readily available.
- **Net change to annual operating expenditure**: For interventions with ongoing operating or other recurring costs, such as public incentive schemes, the net financial impact was estimated. This took into account the various components of each intervention, and a net position has been provided after additional costs and efficiency savings have been taken into account. Note that externalities for the wider Sofia Municipality economy have not been costed, although there will be positive externalities arising from many of the proposed interventions.
- **Financing mechanisms**: A variety of potential financing approaches was identified for Sofia Municipality, and the viability was assessed for each intervention. These mechanisms vary from large to medium-scale investment by public institutions, to medium to small-scale investment by private or part-private funding sources. The viability of introducing regulation and enforcement to bypass the need for public funding was considered as part of this assessment.

The results of these assessments is presented in Chapter 5 below. They demonstrate that the financing requirements for these diverse interventions vary greatly, but that all projects proposed have at least one financing source that would be a good match. On this basis all listed interventions may be considered for financing. All are capable of being financed individually or as part of a single integrated delivery plan.

City baseline

3

3 City baseline

3.1 Socio-economic baseline and development policies

Sofia Municipality operates within economic, social and financial boundaries which are important to consider for the GCAP implementation. This section summarises these areas and lists the key GCAP opportunities and constraints. Full details of the social economic and local governance baseline for Sofia Municipality can be found below.

Sofia has a strong foundation to implement the Green City Action Plan.

- There is a **suite of existing environmental legislation** at a national level which promotes the development of green infrastructure projects. The Municipality has experience in working within this legislation and is well equipped for the GCAP. Furthermore, the strategic goals of the GCAP are well aligned to the existing set of legislation and strategical documentation.
- In terms of **local governance** Sofia Municipality already has existing action plans and policies that complement the GCAP. However, infrastructure within Sofia is not entirely owned by the Municipality, so Sofia authorities will need to consider how they will work with stakeholders to implement and fund joint projects.
- **Sofia Municipality has a young population** that is likely to support actions which will improve citizens' quality of life by making the city greener and climate resilient. Furthermore, **Sofia has numerous environmental NGOs operating on the Municipality's territory**, which contribute to a greener city development, complementing the GCAP aims.
- The Municipality is **receiving greater autonomy to manage policies and budget at local level**. This will aid in the adoption of the GCAP at the Municipality level as it will allow greater autonomy to identify and develop specific projects within the GCAP as well as identifying their own funding sources.
- **Sofia Municipality is in a strong financial position** given that it has the ability to raise its own revenue at local level and relies minimally on fiscal transfers from the central government (30% from budget). What is more, Sofia has a strong credit rating and is already receiving investments from international donors. This gives Sofia the financial autonomy to seek multiple finance sources for projects within the GCAP.

Local governance

Administrative structure: Sofia Municipality is one of 265 municipalities in Bulgaria and is the biggest municipality in terms of population. It has a Mayor and a Municipal Council (61 people), which are the local self-government bodies of the respective territory and are elected for a period of four years. Deputy Mayors and the Chief Architect divided into different sectors support the Mayor in the execution of their responsibilities.

Competencies: At the time of the GCAP preparation, division "Green System, ecology and land preservation", accountable for environmental protection, consists of several Directorates responsible for: waste management, climate, energy and air quality, environment, land and forests, and green systems. This is a prerequisite for expertise and specialisation and will have positive impact on the GCAP. Nevertheless, the coordination between the different directorates might be complex, which is a challenge in terms of GCAP implementation. An especially dedicated environment division - "Green system, ecology and land preservation", consisting of several Directorates responsible for waste management, climate, energy and air, environment, lands and forests, and green systems. This is a prerequisite for expertise and specialisation and will have positive impact on the GCAP. Nevertheless, the coordination between the different directorates might be complex, which is a challenge in terms of GCAP implementation.

Societal context

Demographics: One of the main issues The Republic ofBulgaria faces is the ageing population. As of 31 December 2017, the number of people above the age of 65 represented 21% of the total population, which is an increase of 0.3%, compared to 2016. Sofia Municipality has the biggest population – 1,325,429 inhabitants as per data from 31 December 2017. There is a trend of population increase of 0.3% and the proportion of people over the age of 65 in Sofia is the lowest in the country – 17.2%. This trend is due to immigration both from other big Bulgarian cities, as well as smaller cities and rural areas.

There are strong social and economic disparities among the regions in the Republic of Bulgaria. Several bigger economic centres generate relatively large GDP and have a high concentration of employees. Sofia is the biggest economic centre, where the socio-economic conditions are better relative to other regions.

Access to urban services: The water supply and sewerage infrastructure covers about 70% of the Municipality's population. The share of citizens connected to water treatment plants has increased from 93.5% in 2010 to 96.1% in 2014. When it comes to heating, most of the households use thermal power plants, but there is a disproportionate allocation between the different city districts. For example, the highest percentage of people using TPPs is 80% in Sredets, Izgrev, Lyulin, Mladost, Studentski, Nadezhda, Ilinden and Vazrazhdane districts. In Kremikovtsi, and Bankya there is no centralized district heating system and therefore there is no technical possibility for the residents to join it. The waste collection covers 100% of the Municipality's population.

Citizen engagement/NGOs: More than 5,000 NGOs are currently registered on the territory of Sofia Municipality, which is more than 1/3 of all NGOs operating in the country (total of 14,600).

Economic context

Economic growth: Sofia is the biggest city economy in Bulgaria, as it provides about 40% of the country's GDP. The Municipality's economy is export-oriented and accounts for 1/3 of national exports. Due to the strong export market and increasing final consumption in the last few years, Sofia Municipality's economy continues to expand faster than in many EU capitals. The capital's GDP growth outpaced the national average GDP growth by more than twice. In 2017 the GDP of Sofia Municipality reached 35.2 billion BGN and GDP per capita is 26,690 BGN. The average total income per household member during the second quarter of 2018 is BGN 1,474 and showed an increase of 8.7% compared to the same quarter of 2017.

Labour force: Sofia Municipality has young and educated population, being one of the few cities in The Republic of Bulgaria with population growth. In the period 2003-2016, the total population in the Municipality grew by 10% and the labour force has increased by 24.09% since 2003. The unemployment rate has decreased by almost a third over the past four years and at the end of 2017 was just 3.8 %, well below the national average of 6.2 %.

Major industries: Sofia Municipality has great manufacturing traditions and the main focus of the capital is the establishment of high-value added production. Over six industrial and logistics parks are located in or around the Municipality, including the biggest economic zone in the region – Sofia-Bozhurishte. The IT sector is one of the fastest growing sectors, with the current share of 5.7%, of the Municipality's economy, which is growth of over 50% since 2011. The IT sector in Sofia Municipality is almost entirely export oriented and comprises 2.1% of the total exports of Bulgaria, a 78% growth since 2011.

Municipal finance

Table 3. Responsibilities for infrastructure construction and maintenance for, service delivery and project financing.

Infrastructure group	*Responsibility for funding*
Transport	Deputy Mayor of Transport and Transport infrastructure
Water	Sofisyska Voda AD (Through a concession contract with the Municipality)
Domestic Waste	Municipality responsibility who contract external companies for waste collection and transportation, municipal waste collection and transportation company, . and other waste activities and Municipal enterprise for recycling and disposal
Heating	Toploficacia Sofia EAD (a municipal entity)
Electricity	Private energy company

1. Bulgaria has experienced decentralisation and municipalities like Sofia experienced greater ability to collect their own-sources of revenue. As a result, Sofia Municipality now obtains only 30% of its budget from fiscal transfers[2]. This demonstrates its relatively high budgetary autonomy both with respect to direct spending and its ability to raise debt for project implementation.
2. Sofia Municipality is able to generate revenue from various taxes and fees/charges. Approximately 42% of the total revenue comes from own-source revenues including property taxes, other local taxes, municipal fees and penalties.

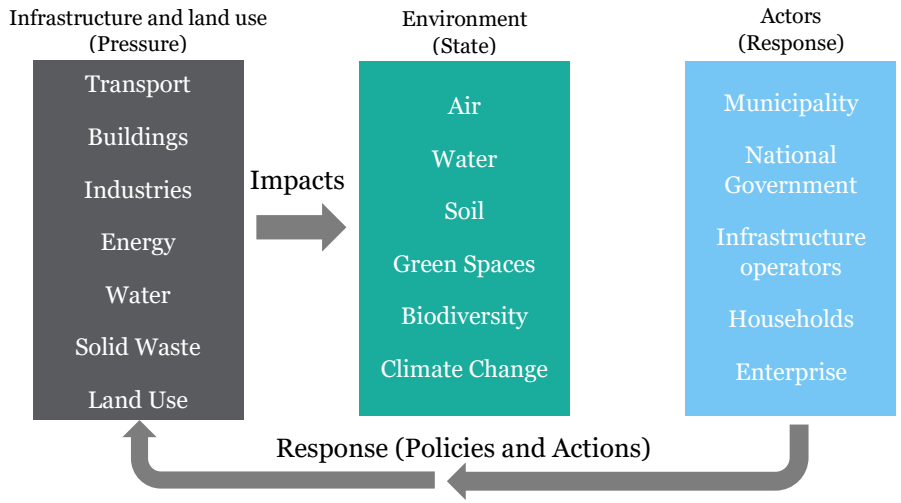
[2] Sofia Municipality (2018): Budget of Sofia Municipality for 2018.

3. Sofia Municipality not only allocates expenditure within its budget for the operational functions, but also allocate funds for large scale capital expenditure programmes. This indicates that the City is forward thinking and keen to invest in its infrastructure.
4. Sofia Municipality has experience in implementing financing (grants and loans) for the implementation of infrastructure projects. However, Bulgarian municipalities are limited in terms of loan financing under the Municipal Debt Act.

3.2 Environmental baseline

This section summarises the results from the baseline data collection and technical assessment stage. Together with the Political Framework Report, this information provides the evidence base from which the priorities for the GCAP were identified and actions were subsequently developed.

Figure 4.



The technical assessment process for the Sofia GCAP was based on the Green Cities Programme Methodology (GCAP Methodology) which was prepared in 2016 by OECD and ICLEI for EBRD.[3] The GCAP methodology sets out a schedule of 129 benchmarked indicators which together can provide an overall profile of the City's environmental and urban systems. The indicators are classified in the categories of "Pressure", "State" and "Response" in accordance with the "Pressure-State-Response" framework within the GCAP Methodology (see **Error! Reference source not found.**).[4] The framework includes anthropogenic activities that exert *pressures* on the urban environment and change its *state* in terms of environmental performance. It also identifies how society *responds* to these changes through policy, investment and behaviour, thus mitigating or exacerbating the pressures caused by human activities.

The purpose of these indicators is to enable the GCAP project team, working with Municipality staff and stakeholders, to undertake a rapid but evidence-based evaluation of the key issues and challenges for Sofia. The conclusions on issues and challenges provide the basis for agreeing the shortlist of key priority themes to address in the GCAP.

Data for a total of 83 indicators was collected. Quantitative data and qualitative information was obtained from a range of sources, including government departments and agencies, Sofia Municipality and utility and public service companies. Sources included published reports and data, as well as data from direct communications with the relevant bodies. At the end of the data collection period local experts and the Municipality staff provided advice and judgement for the data gaps in order to achieve a comprehensive assessment of Sofia's key issues and challenges.

Air quality

Air quality is a cross-cutting environmental challenge posing a considerable risk to public health. In Sofia Municipality, air pollution is caused primarily by transport and domestic heating and is accentuated by the geographical location of the Municipality. The main pollutants that have not been complied with the annual average and the number of exceedances of the annual average per calendar year are dust particles., but air quality has shown an improving trend over recent years.

Air pollution from vehicles and vehicle fuel efficiency

Road transport is an important contributor to air pollution in Sofia Municipality. Diesel vehicles, which are a known source of particulate emissions, make up 41% of the total number of passenger cars.[5] The average car age is 16 years, and over half of all vehicles have an efficiency standard below Euro IV.[6]

Air pollution from domestic heating and other sources

One of the main anthropogenic sources of PM_{10} emissions is domestic heating, mainly due to the use of non-efficient heaters and low-quality solid fuels and wood with high

[3] EBRD (2016). Green Cities Programme Methodology. May 2016. Available at: https://www.ebrdgreencities.com/news-events-and-publications

humidity. With the January 2019 amendments to the Clean Air Act, prerequisites for the development of national standards for the quality of domestic heating fuels were created. In this regard, an Ordinance on the requirements and control of wood used for domestic heating has been developed and is to be adopted and an Ordinance on the quality requirements of solid fuels used for domestic heating is to be adopted. Some waste materials for domestic heating have also been identified.

Transport

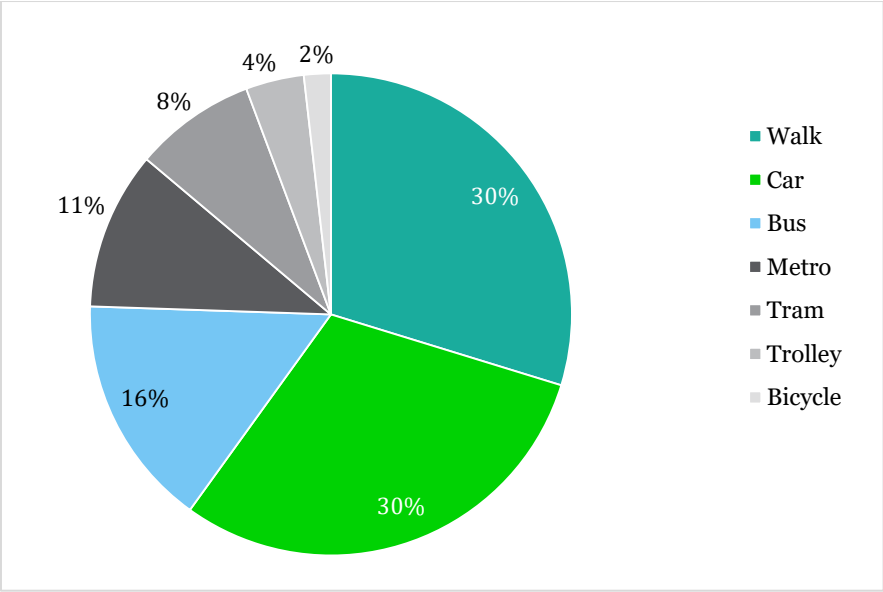
Travel data and modal split

The projected share of trips in Sofia Municipality in 2020 by each transport mode is shown in the next figure.[7] Public transport from all modes makes up 38% of all trips. The share of automobile traffic (30%) has steadily increased over the past 25 years due to a growing economy and population, and a growing motorisation rate.

Parking availability and cost plays a major role in traffic management. The Municipality uses paid parking area policies to control the extent of parking and to create an incentive to use public transport.[8]

The share of full electric cars is relatively low, although the percentage of cars run by electric, hybrid fuel cells, LPG and CNG vehicles together make up around 5% of all cars and are increasing their share.[9] According to a pilot study conducted by Vision for Sofia, the mode share of public transport in central Sofia is significantly higher than the city overall.[10]

Figure 5. Transport mode split for Sofia Municipality (projection for 2020). Source: Draft Sustainable Urban Mobility Plan for Sofia, 2019 - 2035



[7] Sustainable Urban Mobility Plan, 2019-2035.
[8] Vision for Sofia.
[9] Sustainable Energy Development Action Plan, Inventory of CO_2 emissions.
[10] Study on traffic transit through central urban area, provided by Sofia Municipality in February 2019, Vision for Sofia.

Public transport

There is an extensive public transport network in place in Sofia Municipality, with a density comparable to other developed European cities of similar size and territory. Surveys indicate that in previous years public transport has been unpopular as an alternative to private car travel due to the low frequency of vehicles of some bus lines, low travel speeds, old and unattractive vehicles, inflexible ticketing system, and the need for alignment of the bus lines with the metro system.[11] However, current initiatives to improve the use of public transport are ongoing, including investment, awareness campaigns and the extension of the Metro. The third Metro line is being built and further extensions are planned for subsequent years. These actions are likely to improve the attractiveness of public transport. According to a pilot study conducted by "Vision for Sofia", access by public transport to places of work is also limited in certain parts of the city. The "Vision for Sofia" study also confirms the need for further alignment between the Metro and other public transport modes, as well as improvement to and expansion of the existing network.[12]

[11] Sustainable Urban Mobility Plan (SUMP) interim report 2019, Sofia Municipality.
[12] Study on access with public transport to work place, provided by Sofia Municipality in February 2019, Vision for Sofia.
[13] "Low" is defined under the EBRD benchmark as below 15 km per 100,000 population.
[14] Transport Department, Sofia Municipality, from the Vision for Sofia report.

The finalisation of the Sustainable Urban Mobility Plan (SUMP) places Sofia Municipality in a strong position to take forward measures to promote active public transport and to apply better management approaches to reduce vehicle traffic and mitigate its impacts. This document provides a detailed assessment of opportunities to reduce the environmental and socio-economic impact of transport and increase the use of sustainable transport modes.

Cycling and walking

The coverage of bicycle paths is lower than the benchmark values,[13] with only 4km of path per 100,000 population.[14] The existing network of bicycle routes is not sufficiently integrated, comfortable and safe, which inhibits growth in cycling; it currently constitutes only 2% of mode share. In 2017, the share of pedestrian travel was almost 30%, up from just over 20% in 2011. According to a pilot pedestrian study, conducted by "Vision for Sofia", there are also areas of the city which require greater pedestrian connectivity.[15]

Energy

Electricity generation

Bulgaria's electricity network is primarily supplied by a mix of coal (43%) and nuclear (35%) power, with the remainder from renewables (hydro, wind and solar – 17% in total) and other fossil fuels (5%). Coal and nuclear output have been broadly steady in the past decade while solar and wind installations have been driving growth in renewables. [16] In Sofia Municipality itself, renewable electricity installations are estimated at 2 MW of solar PV (installed on public buildings) and 4 MW of other renewable energy sources.[17]

Through the activities from the Sustainable Energy Action Plan for Sofia Municipality (SEAP), the Municipality's long-term goal is to implement energy efficiency actions and measures for end consumers and reach 22% CO_2 emissions reduction by 2020. Awareness campaigns to promote renewable energy facilities in both private and municipal buildings have been initiated at the national and municipal level, however so far the implementation of building-integrated renewable energy sources in the municipality is low.

[15] Study on the pedestrian connectivity on the territory of Sofia, provided by Sofia Municipality in February 2019, Vision for Sofia.
[16] IEA 2018. Electricity generation by fuel – Bulgaria. Data for 2016. Available at https://www.iea.org/countries/Bulgaria/
[17] Sofia Municipality response to 2018 CDP questionnaire

Heating supply

Sofia Municipality is served by an extensive district heating network powered by natural gas; heating for other buildings comes from gas and solid fuels. The coverage and quality of the heat network is improving slowly through a programme of pipe infrastructure renewal, but challenges remain to provide an efficient, affordable and reliable service. Tariffs for district heating are perceived as socially unaffordable for part of the population. This has led to customer disconnections and a shift to other forms of heating (e.g. solid fuel) and falling revenues for district heating company Toplofikacia Sofia EAD. Over the longer term, renewal and expansion of the heat network will help to reduce the use of solid fuel heating. In the shorter term, the EU has initiated a programme to encourage switching from solid fuel use to cleaner alternatives.

[18] Sofia Municipality, Waste Management Department.
[19] Data provided by Sofia Municipality, Waste Management Department.

Energy efficiency in buildings

A large part of Sofia Municipality's housing stock consists of energy inefficient panel multifamily blocks. These are usually characterised by poorly insulated outer walls, and are in need of energy renovation in terms of the surrounding building elements and heating systems. Problems related to the deterioration of many of these buildings have accumulated over the years, due to lack of funding for improvements and maintenance. Most buildings lack cooling and ventilation systems, leading to reduced living comfort in the summer months.

Waste

Waste generation, collection and recycling

Sofia's Municipal Solid Waste (MSW) generation rate has seen reductions since the implementation of its Waste Management Program for the period 2015-2020. In recent years the municipality has successfully taken steps towards the processing of MSW, recycling, composting, Waste-To-Energy (WTE) and significantly reduced the proportion of MSW sent to landfill. In 2016 the breakdown of collected MSW comprised 55% recyclable waste, 29% organic waste and 16% non-recyclable waste.[18]

Waste treatment

Sofia Municipality has an advanced solid waste management system with a mechanical and biological treatment plant and production of solid recovered fuel (SRF) from residual waste. For the purpose of recovery, some of the city's SRF is hauled to cement plants between 100 and 450 km from Sofia, which does not maximise the value of the SRF and creates additional impacts through road transport. Sofia Municipality has planned the construction of a new WtE facility (using SRF), which will generate electric power and heat in a combined way.

Waste disposal

Between 2015 and 2016, the percentage of household waste disposed to landfill reduced significantly from 45% to 16%.[19] There are three landfill sites for household waste on the territory of Sofia Municipality: the Sadinata, Dolni Bogrov and Suhodol facilities. The remaining life of the Dolni Bogrov landfill is thought to be only 2 years, while the Sadinata facility has a remaining capacity for 17 years.[20] Investments are in place to introduce two new cells at the Sadinata landfill site. The remaining lifetime is also likely to be extended

[20] Data provided by Sofia Municipality, Waste Management Department.

with the planned introduction of the WtE facility, which will also further reduce the amount of landfilled waste to around 10%. Further actions are also needed to restrict illegal waste dumping.

Awareness campaigns promoting the reduction of material consumption and waste generation and the reuse and recycling of packaging, paper, plastic and other waste are in place but are not sufficient.[21] However, the provided data suggests that Sofia Municipality's population is becoming increasingly aware of the need to recycle and reduce waste generation and people are increasing their efforts to support and participate in the established separate waste collection systems.

Water

Water consumption

Effective monitoring of water supply and consumption is in place in Sofia Municipality, and stable trends of sustained low water consumption can be found. The level of water consumption is acceptable, although an improving trend over the past two years appears to be in reverse.[22] Metering and billing for water use is regulated and all water users are obliged to have water meters installed.

Efficiency of water infrastructure

The water supply network is in need of upgrade. There are areas within the territory of Sofia Municipality where interruptions of water supply are common, while maintenance of pipes in the city centre is infrequent. Non-revenue water is also relatively high, although this has been reducing in recent years.[23] Data on water losses indicates a stable trend of improvement which is mainly due to the investments in the rehabilitation of the water supply infrastructure and construction of new infrastructure.

Wastewater treatment

Wastewater drainage and treatment on the territory of Sofia Municipality is currently provided through two wastewater treatment plants (WWTPs) – Voyniagovtsi and Kubratovo (the latter in need of reconstruction and modernisation). There are also areas within Sofia Municipality (in particular the Southern and Northern territories) without a municipal sewer network. In these areas, wastewater is collected in septic pits.

Water quality

The concentrations of biochemical oxygen demand (BOD) in Sofia's rivers have reduced in recent years, however the concentrations of ammonium (NH4) remain relatively high, putting pressure on biodiversity and ecosystems[24]. Water pollution is largely due to the lack of sewerage systems in certain parts of the city, which collect in the north part of the City. The main drinking water sources are located upstream and are well protected against potential pollution.

Drainage

Surface water drainage is in place in most areas of Sofia Municipality but storm sewers are not provided in the peripheral areas of the Municipality. Though recorded flood events are rare in the territory of Sofia Municipality, the existing sewer system in some parts of the city is incapable of collecting and conveying rainwater from intense rains, which results in some local flooding. The frequency of local floods due to the insufficient capacity of the sewer system is increasing, with the latest incident recorded in June 2018.[25] The

[21] Data provided by POVVIK.
[22] Data provided by Sofia Municipality.
[23] Data provided by Sofiyska Voda (Sofia Water Company).

[24] The concentrations of BOD are approaching the green benchmark of the GCAP methodology, however NH4 levels remain above the red threshold of the GCAP methodology.
[25] Data provided by POVVIK.

Municipality has a Flood Protection Plan, which is part of the overall Emergency Protection Plan and was last amended in 2018.

Land use and biodiversity

Land use

Sofia Municipality's population density is higher than other major cities in the region such as Bucharest and Belgrade but remains low in comparison to other capital cities in Europe such as Vienna, Rome and Amsterdam. Density is regulated in the Sofia Spatial Development Act, which includes restrictions on construction intensity in different zone types, though some flexibility is allowed through detailed spatial plans.

Green space

Sofia Municipality has an extensive open green area with a ratio of 167 hectares per 100,000 inhabitants, however, the accessible green space within some parts of the city is limited.[26] The quality of green spaces is also inconsistent. Some large parks are well maintained while other areas, such as inter-block spaces in residential quarters, need improvement.

Brownfield land and new development

Sofia Municipality contains many brownfield sites, such as the former steel facility and along railway lines, many in need of regeneration. Policy towards brownfield regeneration is being developed, as a number of planning documents have set objectives towards development of new high-tech zones. Regeneration of these sites would be a key opportunity to improve the use of land and to protect and enhance green space and biodiversity.

Biodiversity and ecosystems

Systems for local monitoring of green space, biodiversity and ecosystems in Sofia Municipality should be developed. Data on green spaces and biodiversity is available nationally and for the Municipality as a whole, but not at the district scale, which would provide a clearer picture of citizens' access to nature and the quality of ecosystems. Sofia Municipality, under Vision for Sofia, has procured a biodiversity mapping and inventory study at the municipal level. Wildlife information outside protected areas and NATURA 2000 sites is available but is not systematised.[27] Mapping and assessment of ecosystem services are not carried out at the municipal level.

Soil contamination

The data indicates that Sofia Municipality's soils contain heavy metals and organochlorine compounds, due to the prolonged emissions of heavy metals into the air, as a result of the operation of the Kremikovtsi metallurgical complex, which is now closed. There are currently only two monitoring points in Sofia Municipality suggesting that improved monitoring of soil contamination is needed.[28]

Urban planning

With Sofia Municipality's increasing population in the last decade and the new development and traffic that has come with that growth, adopted standards of development need to be revised. Public open spaces experience increased pressure due to the constant inflow of population and increased number of commuters to the city.

In addition, the green infrastructure system is developing in a disproportionate territorial manner; it is underdeveloped in the northern part of the city and new neighbourhoods. Appropriate measures should be introduced to protect and enhance green space in new built up areas.

[26] Data provided by Green system, Ecology and Land Use Department, Sofia Municipality, Bulgaria. Directorate Green System.

[27] NATURA 2000. Available at: natura2000.moew.government.bg

[28] Directorate Environment.

Climate change

Climate change mitigation

The annual CO2 emissions in Sofia Municipality are relatively low at 3.87 tonnes/a per capita, compared to other EU cities and the wider world.[29] For example, New York City's per capita GHG emissions, were 6.1 tCO2 in 2015, though the American average is around 19 tCO2 per capita.[30] Data reported to the Carbon Disclosure Project indicates that the majority of emissions come from stationary energy use Scope 2 emissions (indirect emissions from the generation of purchased energy), followed by stationary energy generation Scope 1 (direct emissions from owned or controlled sources) emissions[31,32] make up three quarters of the Municipality's wide emissions and are a priority for climate mitigation.

The annual CO2 emissions show a reduction between 2011 and 2015 from 5.8 to 5.1 million tonnes/a, however this is not sufficient to draw any conclusions on Sofia Municipality's awareness of and actions to mitigate climate change. There is extensive data collected for the past year's climate relating to number of heatwaves, solar radiation, temperature profiles and rainfall. Greater understanding of future risks could be gained through the comparison of these historic events against appropriate benchmarks and acquisition of downscaled climate change projection data. Data should be compared with European level projections on climate at a minimum.

Climate change adaptation

Heat waves, flash and surface floods, extreme hot days and forest fires have been identified as priority challenges for Sofia Municipality. In addition, extreme winter conditions and extreme cold days are currently affecting the city and should be addressed through specific measures. Sofia Municipality has a dedicated strategy for climate change adaptation with an additional action plan- The Climate Change Adaptation Strategy 2017 [33] This identifies two main objectives: to identify potential risks for the Municipality, caused by climate change; and to define measures for adaptation, addressing the main risks and prepare the city and its citizens for climate changes. Adaptation measures envisioned in the strategy cover areas, such as green space improvement, energy efficiency in buildings, and optimisation of transport connectivity.

Conclusion on environmental baseline challenges and issues

This review of the environmental baseline, which summarises the more extensive review process carried out during development of the GCAP, has brought out a number of key themes relating to environmental quality and the impact of urban systems of the city upon the environment and people. These themes are developed in the next chapter through the Green City Vision and Objectives for Sofia Municipality.

[29] Sofia Municipality and CPD 2018 questionnaire
[30] New York City (2015). Available at: https://www.dec.ny.gov/docs/administration_pdf/nycghg.pdf
[31] CPD 2018 questionnaire
[32] Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from the generation of purchased energy. Scope 3 emissions are all indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions. From Greenhouse Gas Protocol. Available at: https://ghgprotocol.org/sites/default/files/standards_supporting/FAQ.pdf
[33] Climate Change Adaptation Strategy 2017.

Green city/ municipality vision and strategic objectives

4

4 Green city/ municipality vision and strategic objectives

4.1 Vision statement

Our team proposal for the GCAP Vision Statement for is:

Sofia Municipality: a green, clean municipality, full of life

Sofia Municipality will achieve visible, tangible improvements with opportunities to turn parts of its urban areas into green oases, integrate green infrastructure throughout the city and create a city with spaces and space for all ages. Sofia Municipality will become a clean city with improved air quality by means of measures to switch to public transport, promote cleaner vehicles and reduce solid fuels for domestic heating. The Municipality will use its natural resources responsibly. The collection and treatment of waste and wastewater will be optimized. The GCAP objectives related to the cleanliness and greenery aspects will be implemented in such a way as to guarantee the conservation of biodiversity in the Municipality. Each of the key words of the vision sets the shape of the GCAP's strategic objectives.

The targets for each strategic objective have been aligned to the benchmark for high indicators within the EBRD methodology, and to the EU targets. Furthermore, each of the strategic objectives has been aligned to existing national targets and programs and have been designed to complement existing efforts to improve the environmental state of Sofia Municipality.

Figure 6. Strategic objectives

Green strategic objectives	SO1. Sofia Municipality will achieve visible, tangible improvements to the city's physical environment and preserve biodiversity levels; with particular focus on:	SO1.A Improve green spaces throughout the city and increase their share
		SO1.B Integration of green infrastructure throughout the city
		SO1.C Promote transit-oriented development
Clean energy strategic objectives	SO2. Sofia Municipality will improve air quality and reduce the city's carbon footprint	SO2.A Increase the share of public transport usage
		SO2.B Promote cleaner vehicles
		SO2.C Improve energy efficiency within buildings
		SO2.D Increase the percentage of renewable energy used and lower use of solid fuels for building heating
Responsible resource use strategic objectives	SO3. Sofia will improve the surface water management and build resilience to future climate change risks	SO3.A Reduce dependence on surface water: improve vulnerability during an extended drought
		SO3.B Ensure that the city is resilient to future climate change risks
	SO3. Sofia Municipality will optimize waste collection and treatment and reduce the amount of landfill waste; specifically focusing on:	SO3.C Increase recycling rates
		SO3.D Encourage the reuse of materials

Sofia Municipality will achieve visible, tangible improvements to the City's physical environment and preserve biodiversity levels.

Introduction

This theme encompasses the quantity and quality of green spaces, protection of biodiversity, as well as achieving a visible, tangible improvement to the city's physical environment. The particular focus is on improving green spaces throughout the city and increasing their quantum, integrating green infrastructure throughout the city, promoting the densification for a more efficient use of space and creating more green space. Achieving such an objective will have multiple benefits including, better storm water storage, carbon sequestration, urban heat mitigation, improved air quality, reduced energy demand, provision of recreational spaces and biodiversity protection.

Strategic objectives

SO1.A Improve green spaces throughout the city and increase their share

The ultimate goal is to transform Sofia Municipality into a green municipality which is visually appealing to residents and visitors and contributes to the environmental objectives. The Municipality has a good open green space ratio, even though there is need to expand the provision of green space particularly in improving the quality of existing green space. The objective will be to improve green spaces between intercity blocks, part of which are in need of transformation and are currently poorly maintained paved areas often used for car parking. Furthermore, there is opportunity to develop and restore existing brownfield land to enhance green space and green corridors, in turn improving biodiversity

SO1.B Integration of green infrastructure throughout the city and Municipality

The ultimate goal is to transform Sofia Municipality into a green municipality which provides vital ecosystem services for the residents and visitors. In particular, this objective seeks to introduce measures for the provision of green spaces on existing buildings and infrastructure, through the provision of green walls and roofs. The results from the baseline study indicated that there are only a few buildings (residential and commercial) with vegetative layers installed on roofs and therefore there is room for improvement.

SO1.C Promote transit-oriented development

The long-term vision for this objective would be to create a compact sustainable city and municipality with the most efficient use of land, promotion of the use of public transport and expansion of green spaces where possible. Although the baseline results have shown that population density within Sofia Municipality is relatively low compared to other European cities, there are increasing growth pressures from an increasing population which is putting additional pressure on the development, considering that itis surrounded by mountains and its boundaries are geographically limited especially in a southerly direction. Therefore, Sofia Municipality will need to consider how to accommodate this population growth in the future. A transit-oriented improvement approach would concentrate development around public transport hot spots. This could have specific benefits for Sofia Municipality, including lower transport energy consumption since people will travel less between home and their workplace. It would also encourage more people to use public transport and would therefore reduce the reliance on private car usage

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Strategic objective 2

Sofia Municipality will improve air quality and reduce its carbon footprint.

Introduction

This strategic objective seeks to improve the air quality within Sofia Municipality whilst also reducing its carbon footprint. Air quality within Sofia Municipality has been gradually improving over the years, yet one of the pollutants does not comply with European and national legislation due to natural and anthropogenic factors. Firstly, Sofia Municipality will seek to reduce air pollution and the release of greenhouse gas emissions from transport by encouraging an increase in the uptake of public transport and the promotion of cleaner vehicles. Secondly, Sofia Municipality will seek to improve energy efficiency within buildings and increase the percentage of renewable energy used and lower the use of solid fuels for building heating, which currently contributes to air pollution in the city.

Strategic objectives

SO2.A. Increase the share of public transport usage

The aim is to achieve a 70% share of public and active transport by 2026 which will seek to reduce the amount of journeys taken by cars within the Municipality. Specifically, this will include renewing the rolling stock and introducing an integrated ticketing system. According to the modal split the share of public transport in Sofia Municipality is about 38% which is relatively low. The use of private vehicles causes both congestion and air pollution within the city. Therefore, by upgrading the quality of the tram network, for example, this mode of transport should become more desirable and people will switch to this mode of transport which will decrease the number of cars on the road and improve air quality.

SO2.B. Promote cleaner vehicles

The long-term vision is to remove all polluting vehicles from the road network in Sofia Municipality in order to reduce the levels of air pollution and reduce the associated health risk. Specifically, the target is to ensure that diesel cars make up less than 20% of the total car fleet by 2026. The average age of car fleet in Sofia Municipality is high at circa 16 years, which is nearly double the EU average. One way to tackle this is the promotion of more electric vehicles in Sofia Municipality which do not emit polluting gases. This would reduce fine particulate matter particles in the air and improve air quality, having a positive impact on its residents' health.

SO2.C. Improve energy efficiency within buildings

The long-term vision is to improve energy efficiency across both municipality owned and privately owned buildings, in order to reduce carbon emissions and overall energy consumption. Energy efficiency in buildings has been identified as one of the main challenges for the Municipality, particularly within energy inefficient panel multifamily blocks of housing. Actions have been identified to improve energy efficiency within both those buildings owned by the Municipality, as well as stimulating energy efficiency measures for private housing.

SO2.D. Increase the percentage of renewable energy used and lower solid fuel use for building heating

This strategic objective consists of two elements. Firstly, it seeks to make improvements to the district heating network in order to promote the connection of new or old users to the network, therefore reducing the number of households using solid fuels for heating and increasing the percentage of renewable energy used within the Municipality. This will be achieved through the exploration and development of geothermal energy as an alternative heat source. Both elements will improve air quality and reduce the carbon footprint of the Municipality.

Strategic objective 3

Sofia Municipality will improve surface water management and build resilience to future climate change risks. Sofia Municipality will improve the environment through optimization of waste collection and treatment and reduce the amount of landfill waste.

Introduction

This strategic pillar is concerned with the responsible use of resources, particularly relating to water use and waste management. Sofia Municipality will work with businesses and companies in the utility sector to improve drinking water quality through investment and will improve the local environment through optimized waste collection and management and reducing the amount of landfill waste.

Strategic objectives

SO3.A. Reduce dependence on surface water: improve vulnerability during an extended drought

The long-term vision for this objective is to reduce dependence on surface water in order to increase resilience to potential extreme weather events such as droughts. Water storage figures indicate an almost complete dependence on surface water, which could imply vulnerability in the event of an extended drought. To mitigate this potential problem, the aim is to use alternative water sources. This could include water sensitive urban design solutions such as domestic rainwater tanks and water reuse ("greywater") systems.

SO3.B Ensure that the Municipality is resilient to future climate change risks

The long-term vision is to ensure that the entire municipality is resilient to future risks from climate change. Data from the baseline assessment indicates that Sofia Municipality has a number of serious climate related risks with a likelihood of increasing in intensity in the future, including heat waves, flash /surface floods, extreme hot days and forest fires. These should be addressed as a priority through climate change adaptation actions and building resilience. The actions suggested in this plan build on those within the existing Climate Change Adaptation Strategy from 2016.

SO3.C Increase recycling rates

Over the next 10-15 years, Sofia Municipality will build its economy around circular economy principles, using resources efficiently and recycling and reusing most of its waste produced. The results from the baseline assessment show that Sofia Municipality has seen the amount of waste going to landfill decrease to 16% in 2016 and that recycling rates are relatively high across the municipality. This is a positive trend and therefore this strategic objective seeks to further expand the already achieved to specifically improve recycling rates. The focus of this objective will be around improving household waste collection to make recycling easier for residents.

SO3.D Encourage the reuse of materials

An integral part of reducing waste and achieving principles of the circular economy is the reuse of materials. According to the EU waste hierarchy, reuse of materials should be considered a priority before looking at recycling and recovery opportunities. Although solid waste generation has been reduced, further work could be undertaken to encourage the reuse of materials. Specifically, it is proposed that community repair and reuse centres buildings will be established to provide facilities for households and commercial businesses to reuse materials.

Summary of actions

5

5 Summary of actions

Introduction

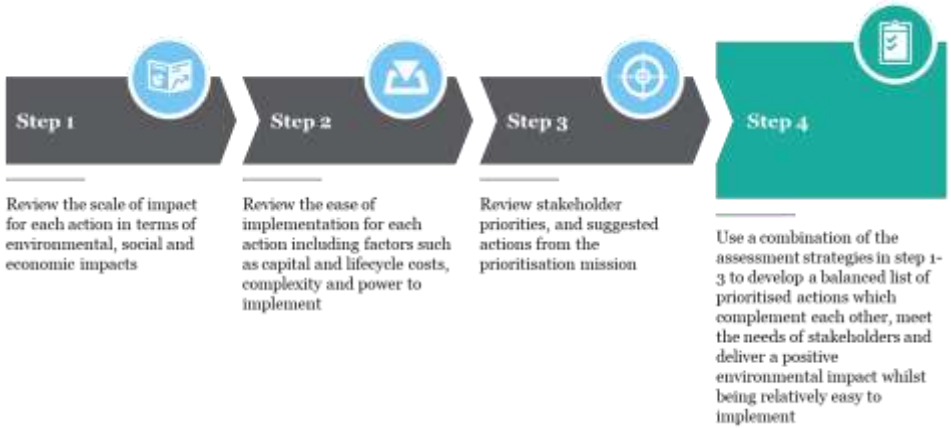
The baseline assessment has identified several challenge areas for Sofia Municipality. Seventeen short-term actions have been chosen to address these challenges areas and to achieve the medium and long-term vision of the GCAP as described in section 4. A diagram shown in section 6 depicts how each of the actions links to the strategic objectives. Each of the actions have been selected through the prioritisation process (Figure 7), whereby a long list of potential actions was identified across the five sectors and then scored according to three factors:

- **Ease of Implementation** – Each action was scored according to how easily the action could be implemented by Sofia Municipality. This covered factors such as upfront capital investment, long-term operating costs, the power and capacity of the municipal authorities to complete. It was important to select those actions that were within the control of Sofia Municipality and those where realistic funding mechanisms could be created.
- **Scale of impact** – Each action from the long list is scored against its potential scale of environmental, social and economic impact. It was important to select actions that have a large scale environmental impact whilst delivering social and economic benefits.
- **Stakeholder feedback** – Finally, the shortlist of actions is reviewed with stakeholders to ensure that it meets their priority needs for the Municipality.

This section of the report, first sets out the key challenges for each sector, before then presenting the key actions which will address these challenges. The actions have been supported by a financial assessment, a benefits assessment and a timeline for delivery of each action.

A detailed breakdown of each action can be found in Appendix 1: Action prospectuses, where the financial breakdown is given alongside key stakeholders, relevant policies and a timeline for each action.

Figure 7. Steps within the prioritization process for selecting a shortlist of actions



5.1 Energy

Main Challenges

The baseline analysis has highlighted that there are several challenges within the energy sector in Sofia Municipality:

- **The choice of energy source in buildings** is crucial to **air quality**. **Energy poverty** needs to be studied at municipal level and potential solutions need to be identified.
- The **district heating system** is an essential part of the energy system of the city, but the ageing infrastructure leads to customer disconnections. Renewal of the grid is relatively slow (1% per year).
- There is **insufficient data on energy consumption** in buildings and industries to accurately assess the energy baseline.
- A large part of the housing stock consists of **energy inefficient multifamily blocks** of houses which need to be retrofitted and are dependent on the national residential policy.
- The city has few renewable electricity or renewable heat installations. Further investigation and incentives are needed to scale up activity by the public and private investors.

What is ongoing?

The Sustainable Energy Development Action Plan for Sofia City; its long-term goal is to implement energy efficiency actions and measures for end consumers and reach 22%CO_2 emissions reduction by 2020.

This Plan is complemented by a large scale national programme for energy efficiency in residential buildings which was launched by the Ministry of Regional Development and Public Works in 2015, targeting multi-family houses. The first phase of this program has been completed and the Ministry is expected to announce when and under what conditions it will continue to run. The Municipality is working on two major European projects for the decommissioning of old, inefficient and non-environmentally friendly heating appliances and the introduction of more environmentally friendly alternatives.

Significant progress has also been made towards improving the district heating network. Toplofikacia Sofia have undertaken investigations to implement and construct co-generation installations in Zemlyane and Lyulin. Toplofikacia are also renewing the pipework and substations across the network.

Actions

Based on the key challenges identified above, there are three priority actions which are to be delivered under the GCAP. A summary of the actions is provided in the table below and a detailed action description for each action is in Appendix 1: Action prospectuses: Action prospectuses.

The actions have been chosen to complement each other, and should all be relatively easy for Sofia Municipality to implement whilst still having a big environmental impact. The introduction of energy efficiency measures across a number of different areas has been identified as a priority theme for Sofia Municipality. Exploring the geothermal potential within Sofia Municipality will also be important in providing alternative energy sources.

ID	*Action*	*Description*	*Status*
E.01	Improvement of municipal building energy efficiency programme	This action will Improve and upgrade the existing energy efficiency programmes in municipal buildings. This includes improving the collection and reporting of energy consumption data, securing funding to expand building retrofitting, and identifying opportunities for implementing building-integrated renewable heating systems.	Complements actions in the sustainable energy action plan for Sofia
E.02	Public lighting renewal	This action relates to implementation of an energy efficiency programme for lighting in public spaces and parks across Sofia Municipality.	Complementary
E.03	Geothermal energy development	This action is to undertake further studies to explore Sofia Municipality's natural geothermal activity potential to develop projects providing an alternative source of heat for buildings.	Complementary

Supporting actions

Alongside the core actions there are a number of supporting actions which will allow those actions to be developed, implemented and monitored:

Action	*Description*	*Status*
Regular collection of data on electricity and heating/cooling consumption for buildings and industries	This will enable Sofia Municipality to monitor the effectiveness of energy efficiency measures and carbon emissions. This data will need to be collected from a number of sources, some beyond the Municipality's direct control (privately owned buildings and industry). A study should be undertaken to assess how best to collect this data.	The Municipality is currently considering this action

5.2 Urban Planning

Main Challenges

Based on the baseline assessment of Sofia Municipality and various stakeholder consultations, the following were identified as priority challenges relevant to the urban planning sector:

- There is a need to incentivise the creation of new public open spaces, green infrastructure and improved urban planning in the **northern part** of the City of Sofia and **new neighbourhoods**.
- **Sofia has extensive areas of vacant land and previously developed ("brownfield") sites** within the Municipality Data on the amount and condition of this land is limited and an effective policy framework is needed to guide development towards these sites in favour of urban sprawl.
- Data collection on **biodiversity, ecosystems, land use and soil contamination monitoring** indicate a need for improvement.

What is ongoing?

Sofia has around 9000ha of open space in the urban part of the city, of which 1200ha are in accessible large open spaces (public parks, forests and gardens). A further 1700ha of open space are found within apartment housing areas (inter-block areas).[34] We are building on this foundation of green infrastructure to improve the amenity and biodiversity quality of existing spaces and also creating new open spaces.

Urban planning is an important area for prioritising actions for the GCAP. There are multiple plans issued by Sofia Municipality which guide urban planning, including the Vision for development of Sofia 2050, which is a step towards a new urban planning masterplan. However, the detailed spatial plans for specific urban territories are frequently amended, which leads to over construction in different parts of the Sofia Municipality. Therefore, by setting appropriate actions there is a real opportunity to conserve existing green space and to expand green areas across the Municipality to enrich biodiversity.

The Urban Master Plan of Sofia was adopted in 2005 and amended in 2009. The Urban Development Plan for Sofia Municipality 2014-2020 was adopted in 2014.

Actions

Within the urban planning sector two prioritised actions have been chosen as they will have a large scale positive environmental impact. Each of the two actions is identified as a priority area by stakeholders. Promoting development on brownfield sites through policy and investment has been chosen as a prioritised action as it is considered to induce a highly positive environmental impact. Encouraging transit-oriented development has been chosen as it will have a high impact whilst being relatively easy for Sofia Municipality to implement. Details of each action can be found in Appendix 1: Action prospectuses.

ID	*Action*	*Description*	*Status*
U.01	Transit-oriented development	This action promotes transit-oriented development (TOD) within the Municipality where new development will be directed towards public transport nodes. This action is designed to maximise ridership of the public transport system and reduce the need for residents to own or use private motor vehicles.	New action
U.02	Brownfield regeneration	This action will assess and prepare for the regeneration of brownfield land sites in Sofia Municipality. For example, the railway corridor. This includes the preparation of a survey and register of relevant sites, and activities to promote the funding, development and management of appropriate sites.	New action

[34] Vatseva et al. 2016. "Mapping Urban Green Spaces Based On Remote Sensing Data: Case Studies in Bulgaria And Slovakia," Proceedings of the 6th International Conference on Cartography and GIS, 13-17 June 2016, Albena, Bulgaria.

5.3 Housing and Communities

Main Challenges

Based on the baseline assessment of Sofia Municipality and various stakeholder consultations, several challenges were identified across green spaces, energy efficiency and waste management.

- The extensive **apartment inter-block open spaces** that need to be maintained in order to **promote biodiversity and become recreational places.**
- There are only a few buildings (residential) with **vegetative layers installed on roofs**.
- **Energy efficiency is a major challenge,** particularly for energy inefficient panel multifamily blocks of apartments.
- Although waste generation and the amount of waste going to landfill are decreasing, **more could be done to improve awareness for waste prevention and increase reuse and recycling rates.**

What is ongoing?

Green spaces

Sofia's apartment inter-block areas total some 1700ha across the city. In 2011, Sofia Municipality launched the "Green Sofia "programme, which aims at renovating green areas among residential buildings with the active participation of the residents, in order to transform these spaces into recreational areas. Sofia Municipality provides vegetation, plants, repair materials, tools and machines, which the residents can use free of charge, in order to enrich the green areas in their neighbourhoods. Since the programme launch more than 700[35] green areas are renovated and the "Green Sofia" programme still continues to support citizens. In 2017, Sofproekt published "Analysis on the condition of playgrounds between residential buildings on the territory of Sofia Municipality" as part of Sofia Municipality's priority to create local gardens with playgrounds in the neighbourhoods. The analysis identified possible new locations where such gardens can be constructed, as well as existing green spaces with playgrounds, which can be renovated. As a final step a map was created that shows the current state of the playgrounds in the different districts based on which Sofia Municipality can implement measures.

Energy efficiency

More than 166 buildings on the territory of the Municipality have signed a contract for funding under National Programme for Energy Efficiency of Multi-Family Residential Buildings.[36]

Waste Management

Sofia Municipality implemented its Waste Management Program in 2015, in order to meet the objectives within the National Waste Management Plan introduced in 2014.

Actions

There are three priority action areas that emerge from the prioritisation process for housing and communities: green spaces, energy efficiency and waste management. The following four actions have been chosen on the basis of their high scale of impact and promotion by Sofia Municipality stakeholders. Firstly, both pocket parks and improvements between inter-block areas have been listed as a priority as they are deemed to be a priority by stakeholders and will deliver high levels of impacts. Stakeholders have also identified a need for housing block energy efficiency measures which, according the assessment, will have a high impact despite being trickier to implement. Finally, improving source separation for recycling is considered as priority area within the waste management sector. The assessment process showed that this action would have a high impact and has also been listed as a priority by stakeholders. Stakeholders have also stated a priority to implement an upcycling pilot project, this will be relatively easy to implement and could be a quick win for Sofia Municipality.

[3535] Sofia Municipality, Programme "Green Sofia. Available at: https://www.sofia.bg/web/guest/news/-/asset_publisher/1ZlMReQfODHE/content/id/3081376

[36] Sofia Municipality, https://www.sofia.bg/home/-/asset_publisher/7bpCs4absBl4/content/166-sgradi-v-sofia-sa-s-s-skluceni-dogovori-za-finansirane-za-izp-lnenie-na-energijna-efektivnost?inheritRedirect=false

The GCAP suggests implementing the following five actions within the housing and communities sector. Details of each action can be found in Appendix 1: Action prospectuses.

ID	Action	Description	Status
H.01	Housing inter-block area improvements	This action will improve the quality and appearance of housing inter-block areas, increasing the amount of green space, making them appealing to residents.	New action
H.02	Energy efficiency measures in multifamily residential buildings	This action supports the need for investment in the upgrading of Sofia Municipality's energy efficiency programme.	New action
H.03	Community repair and reuse centre building	This action is to deliver two pilot repair and reuse centre buildings for different items.	Planned action by the Municipality
H.04	Pocket parks in dense residential neighbourhoods	This action seeks to increase the quality of green spaces, through the creation of pocket parks in inter-block areas.	New action

Supporting actions

Alongside these core actions there are a number of supporting actions which will lead to the fulfilment of the main actions:

Action	Description	Status
Collection of and access to green space data	The benchmark values could be aligned with those provided by the World Cities Culture Forum (benchmarks on the percentage of green space within cities).	New action
Information campaign	Awareness campaigns on different waste streams.	New action

5.4 Blue-green infrastructure

Main Challenges

- Data is lacking on the **infrastructure at risk from natural disasters** and should be included in the municipality-wide climate vulnerability assessment.
- Grey water reuse exists in the waste management sector, as rainwater is used to cover technical needs. Data on storm water management, flood management and resilience to disasters is lacking.
- Policies for **business and community** awareness on water use and flood crisis management are in place but could be improved upon.
- Sewage from the city varies widely depending on the source and therefore it is difficult to provide a breakdown of wastewater treatment by building type.

What is ongoing?

Sofia City Council has adopted the Climate *Change Adaptation Strategy 2017* and the associated Action plan 2019-2025 in 2019. There is also an *Urban Development Plan for Sofia Municipality 2014*. The main objectives of the Climate Change Strategy are as follows: determination of vulnerability and potential risks of a change in the climate for Sofia Municipality; and define measures for adaptation to climate change, connected with the reduction of greenhouse gases.

Blue infrastructure: With European funding a Regional Feasibility Study (RFS) is under preparation for Sofia Municipality. The RFS's represent an in-depth analysis of the investment needs of each consolidated Water supply and Sewerage Operation (WSSO) and also contains an analysis for the prioritisation of investment in WSS infrastructure in view of WSSOs' preparation for grant application under OPE 2014-2020. The RFS for the WSSO in Sofia Municipality - "Sofiyska voda" AD is ongoing and based on the funding the most pressing investment priorities in the water supply and sewerage infrastructure on the territory of the municipality will be defined.

Green infrastructure: The Master Plan of Sofia Municipality identifies the green infrastructure system as a priority. Sofia Municipality has to establish a model regarding land ownership since many of the territories designated for landscaping are private property. The Master Plan also envisages the preparation of detailed spatial plans and investment projects for different parks on the territory of the Municipality, such as Borisova Gradina, South park, East park, the plan for Park Lozenets, etc. Sofia Municipality has launched the project "The new forest of Sofia" – an initiative whose main purpose is to transform the deserted municipal terrains near the re-cultivated Suhodol landfill into a forest and create a green filter near Sofia, which aims to improve air quality.

Actions

The three key themes which are apparent across the blue-green infrastructure actions are surface water management, green corridor protection and a climate change risk assessment. Although difficult to implement, green corridor protection and enhancement/development will deliver a high positive impact in terms of an improved ecosystem and conservation of biodiversity levels. Both surface water management and the climate change risk assessment will be easier to implement but will still deliver a relatively high positive impact. The table below explains the actions in further detail.

ID	*Action*	*Description*
BG.01	Climate change risk assessment and flood model	This action seeks to increase knowledge around risks from flooding due to climate change, thus enabling Sofia Municipality to prepare better for the expected climatic change impacts through the implementation of surface water management techniques.
BG.02	Green corridor protection, enhancement and development	This action will be executed via mapping and surveying, including of ownership.
BG.03	Surface water management	This action focuses on improving surface water management, for example in parks and reducing flood risks in river areas.
BG.04	Optimize recycling and waste management in the construction sector	This action will focus on the construction of a new construction and demolition waste management facility in Sofia Municipality.

5.5 Transport

Main Challenges

- The mode share of **high emission cars** is significant which contributes to high particulate matter concentrations.
- The share of **public transport is 38%** of all journeys. Planned investments (e.g. Metro Line 3) will improve this share but challenges remain in the level of comfort and accessibility of the public transport system.
- **Cycling** has a low mode share and the number of kilometres of bicycle path is low and under development.
- In order to promote pedestrian traffic, investment is needed in the improvement of the condition of pavements and removal of physical barriers.
- Data is lacking on the resilience of public transport and emergency systems in **disasters**.

What is ongoing?

Transport is at the centre of a number of Sofia's key municipal plans and policies, such as the Program for Management of Air Quality within Sofia Municipality 2015-2020, the Sustainable Urban Mobility Plan 2019 – 2035 and the General Traffic Organisation Plan. Another key document for the Sofia Municipality transport sector is: Public Spaces and Public Life Report by Jan Gehl, which made recommendations for turning Sofia into a City for People. By working towards these goals Sofia Municipality has the opportunity not only to improve its air quality but also to contribute to the comfort of the citizens when using streets and wider public open spaces.

High-polluting motor vehicles are currently unregulated at national level, and Sofia Municipality has limited power to introduce such regulation. The Municipality is initiating the introduction of eco-stickers for motor vehicles, which allow an entry restriction in certain areas for the most polluting vehicles on days with high pollution.

Actions

The GCAP suggests implementing the following four actions within the transport sector. Details of each action can be found in Appendix 1: Action prospectuses.

ID	Action	Description
T.01	Promote cycling and walking	This action involves improvements to cycling and walking routes in the city, including investments in cycle infrastructure, reallocation of road space for cycle paths, lane separation, design of some junctions and traffic signals, introduction of wider, safer pavements, introduction of cycle parking, zero car zones, new routes avoiding polluted areas, improved signage and wayfinding.
T.02	Tram renewal programme	This action entails preparatory work to improve the tram service. Activities will include the preparation of design studies, and securing of funding and execution of specific measures.
T.03	Parking management	Activities under this action will include an extension of paid parking zones outward from the city centre, the introduction of differential tax for high and low polluting cars, an increase in the efficiency of the utilisation of parking spaces, and the introduction of more park and ride facilities to locations where public transport provision is poor.
T.04	Electric vehicle promotion	Activities under this action will include developing and implementing an EV charging strategy and carrying out a freight and logistics operator survey. Sofia Municipality will support the installation of EV charging infrastructure in car parks and on-street parking spaces.

Supporting actions

Alongside these core actions there are a number of supporting actions which will allow the implementation and monitoring of the core ones:

Action	Description	Status
Surveys to change commuting patterns.	Sofia Municipality will continue undertaking travel surveys to further understand the model split of transport usage. Future polls will be conducted over the same period of the year. This will better inform later efforts to shift behaviour towards less polluting modes.	New action

Roadmap to delivery

6

6 Roadmap to delivery

6.1 Linking actions to strategic objectives

Strategic objective 1 - related Green City/ Green Municipality actions

The two previous sections of the report have presented the strategic objectives and actions. This section of the report shows how they fit together and specifically how each of the actions will achieve the strategic objectives. The following table shows how the long-term, mid-term and short-term objectives will be achieved by each of the actions for the 'green strategic objectives' pillar. It also shows the owner responsible for managing each action under the strategic objective. For more details on each of the actions, please refer to Appendix 1: Action prospectuses.

Table 4.

GCAP Vision for Green Strategic Objectives (2020-2035):				
Sofia Municipality will achieve visible, tangible improvements to the city's its physical environment and preserve biodiversity levels				
Mid-term targets (2020 – 2027)		***Short-term actions (2020 – 2023)***		
Strategic Objective	*Description*	*Action ID*	*Action Name*	*Owner/Responsibility*
SO1.A	Improve green spaces throughout the city and increase their share to more than 50%.	U.02	Brownfield regeneration	Sofia Municipality: "Architecture and Urban Development" Division "Territorial Planning" Directorate and "Green system" Directorate
		U.01	Transit-oriented development	Sofia Municipality: "Architecture and Urban Development" Division and "Territorial Planning" Directorate
		H.05	Pocket parks in dense residential neighbourhoods	Sofia Municipality: "Architecture and Urban Development" Division and "Green System" Directorate
		H.01	Housing inter-block area improvements	Sofia Municipality: "Architecture and Urban Development" Division and "Green System" Directorate
		BG.02	Green corridor protection, enhancement and development	Sofia Municipality: "Architecture and Urban Development" Division and "Green System" Directorate
SO1.B	Integration of green infrastructure throughout the city: Achieve greater	U.02	Brownfield regeneration	Sofia Municipality: "Architecture and Urban Development" Division and "Green System" Directorate
		U.01	Transit-oriented development	Sofia Municipality: "Architecture and Urban Development" Division

	than 50% share of green space areas.	H.04	Pocket parks in dense residential neighbourhoods	Sofia Municipality: “Architecture and Urban Development” Division and “Green System” Directorate
		H.01	Housing inter-block area improvements	Sofia Municipality: “Architecture and Urban Development” Division and “Green System” Directorate
		BG.02	Green corridor protection, enhancement and development	Sofia Municipality: “Architecture and Urban Development” Division and “Green System” Directorate
SO1.C	Promote transit-oriented development: Ensure at least 80% of the population has access to public transport within 15 min walking time.	T.02	Tram renewal programme	Sofia Municipality: “Transport” Directorate and “Stolichen Electrotransport” EAD (private commercial company owned by the Municipality)
		U.01	Transit-oriented development	Sofia Municipality: “Architecture and Urban Development” Division

Strategic objective 2 - related Green City/ Green Municipality actions

The following table shows the long-term, mid-term and short-term objectives and actions for the 'clean strategic objectives' pillar. It also shows the owner responsible for implementing each action under the strategic objective. For more details on each of the actions, please refer to Appendix 1: Action prospectuses.

Table 5.

GCAP Vision for Green Strategic Objectives (2020-2035):				
Sofia Municipality will improve air quality and reduce the city's carbon footprint				
Mid-term targets (2020 – 2027)		***Short-term actions (2020 – 2023)***		
Strategic Objective	*Description*	*Action ID*	*Action Name*	*Owner/Responsibility*
SO2.A	Increase the share of public transport usage: Achieve a 70% mode split for public and active transport modes	T.02	Tram renewal programme	Sofia Municipality: "Transport" Directorate and "Stolichen Electrotransport" EAD (private commercial company owned by the Municipality)
		T.01	Promote cycling and walking	Sofia Municipality: "Architecture and Urban Development" Division and "Transport Infrastructure" Directorate
		U.01	Transit-oriented development	Sofia Municipality: "Architecture and Urban Development" Division
SO2.B	Promote cleaner vehicles: create conditions for reducing diesel vehicles to less than 20% of the total fleet	T.04	Electric vehicle promotion	Sofia Municipality: "Transport and Transport Infrastructure" Division
		T.03	Parking management	Sofia Municipality: "Architecture and Urban Development" Division, "Traffic Analysis and Management" Directorate and "Urban Mobility Centre" EAD and external companies contracted by the Municipality
SO2.C	Improve energy efficiency within buildings: Treat all Municipal buildings and reduce energy consumption by 20% in treated buildings	E.02	Public lighting renewal	Sofia Municipality: "Architecture and Urban Development" Division, "Transport Infrastructure" Directorate and "Green system" Directorate
		E.01	Improvement of municipal building energy efficiency programme	Sofia Municipality: "Housing and Public Construction, Heat energy and Energy Efficiency" Directorate
		H.02	Energy efficiency measures in multifamily residential buildings	Sofia Municipality: "Architecture and Urban Development" Division and "Climate, Energy and Air" Directorate
SO2.D	Increase the percentage of renewable energy used and lower solid fuel use for building heating: create conditions for increasing the share of RES in the total energy consumed – to greater than 20%	E.03	Geothermal energy development	Sofia Municipality: "Architecture and Urban Development" Division

Strategic objective 3 - related Green City/ Green Municipality actions

The following table shows the long-term, mid-term and short-term objectives and actions for the 'responsible resource use strategic objectives' pillar. It also shows the owner responsible for executing each action under the strategic objective. For more details on each of the actions, please refer to Appendix 1: Action prospectuses.

Table 6.

GCAP Vision for Green Strategic Objectives (2020-2035)
Sofia will improve the surface water management and build resilience to future climate change risks
Sofia Municipality will optimize waste collection and treatment and reduce the amount of landfill waste.

Mid-term targets (2020 – 2027)		***Short-term actions (2020 – 2023) Owner/Responsibility***		
Strategic Objective	*Description*	*Action ID*	*Action Name*	*Owner/Responsibility*
SO3.AB	Reduce dependence on surface water: improve vulnerability during an extended drought: Collect data on the annual number of storm water/sewerage overflows per 100km of network length	BG.03	Surface water management	Sofia Municipality: „Emergency Help and Prevention" Directorate, "Engineering Infrastructure" Directorate and "Climate, Energy and Air" Directorate
SO3.B	Ensure that the city is resilient to future climate change risk: Estimated economic damage from natural disasters as a share of GDP is less than 0.5%	BG.03	Surface water management	Sofia Municipality: „Emergency Help and Prevention" Directorate, "Engineering Infrastructure" Directorate and "Climate, Energy and Air" Directorate
		BG.01	Climate change risk assessment and flood model	Sofia Municipality: „Emergency Help and Prevention" Directorate, "Engineering Infrastructure" Directorate and "Climate, Energy and Air" Directorate
SO3.C	Increase recycling rates to 55% (current levels of 51%)	H.03	Community repair and reuse centre buildings	Sofia Municipality: Waste Management Directorate
SO3.D	Encourage the reuse of materials: Reduce the amount of waste generation to below 300 kg/year/capita	H.03	Community repair and reuse centre buildings	Sofia Municipality: Waste Management Directorate

Sector matrix

The following diagram summarises how each of the proposed actions will achieve the strategic objectives.

		Energy			*Housing and communities*				*Urban Planning*		*Blue-green infrastructure*					*Transport actions*		
Pillar	**Strategic objective**	E.01 Improvement of municipal building energy efficiency programme	E.02 Public lighting renewal	E.03 Geothermal energy development	H.01 Housing inter-block area improvements	H.02 Energy efficiency measures in multifamily residential buildings	H.03 Community repair and reuse centre buildings	H.04 Pocket parks in dense residential neighbourhoods	U.01 Transit-oriented development	U.02 Brownfield regeneration	BG.01 Climate changes risk assessment and flood model	BG.02 Green corridor protection, enhancement and development	BG.03 Surface water management	BG.04 Optimize recycling and waste management in the construction sector	T.01 Promote cycling and walking	T.02 Tram renewal programme	T.03 Parking management	T.04 Electric vehicle promotion
SO1. Green strategic objectives	SO1.A Improve green spaces throughout the city and increase their share																	
	SO1.B Integration of green infrastructure throughout the city																	
	SO1.C Promote transit-oriented development																	
SO2. Clean energy strategic objectives	SO2.A Increase the share of public transport usage																	
	SO2.B Promote cleaner vehicles																	
	SO2.C Improve energy efficiency within buildings																	
	SO2.D Increase the percentage of renewable energy used and lower solid fuel use for building heating																	
SO3. Responsible resource use strategic objectives	SO3.A Reduce dependence on surface water: improve vulnerability during an extended drought																	
	SO3.B Ensure that the city is resilient to future climate change risks																	
	SO3.C Increase recycling rates																	
	SO3.D Encourage the reuse of materials																	

6.2 Action timeline

The sequencing of each action is set out on the adjacent page. A high level financial analysis of implementing each action is made and there is a summary of the benefits associated with undertaking the actions.

Each action is expected to start within the next three years, as is prescribed by the EBRD GCAP methodology. Each action will begin with a pre-planning phase which typically includes activities such as feasibility studies, deciding upon financing sources and service delivery. The length of the pre-planning phase has been governed by the magnitude of the preparation work that will need to be undertaken and the amount of planning that has already been done by Sofia Municipality. This is followed by the implementation phase where the action is delivered. For most actions this will be one continuous delivery period. However, for other actions it is anticipated that they will be delivered in smaller parcels of work over the duration of the next 4-5 years. The start date of the actions has been staggered to allow the implementation as a whole to be manageable for the Municipality. Actions which are either a priority or have had pre-existing work undertaken are to be delivered first.

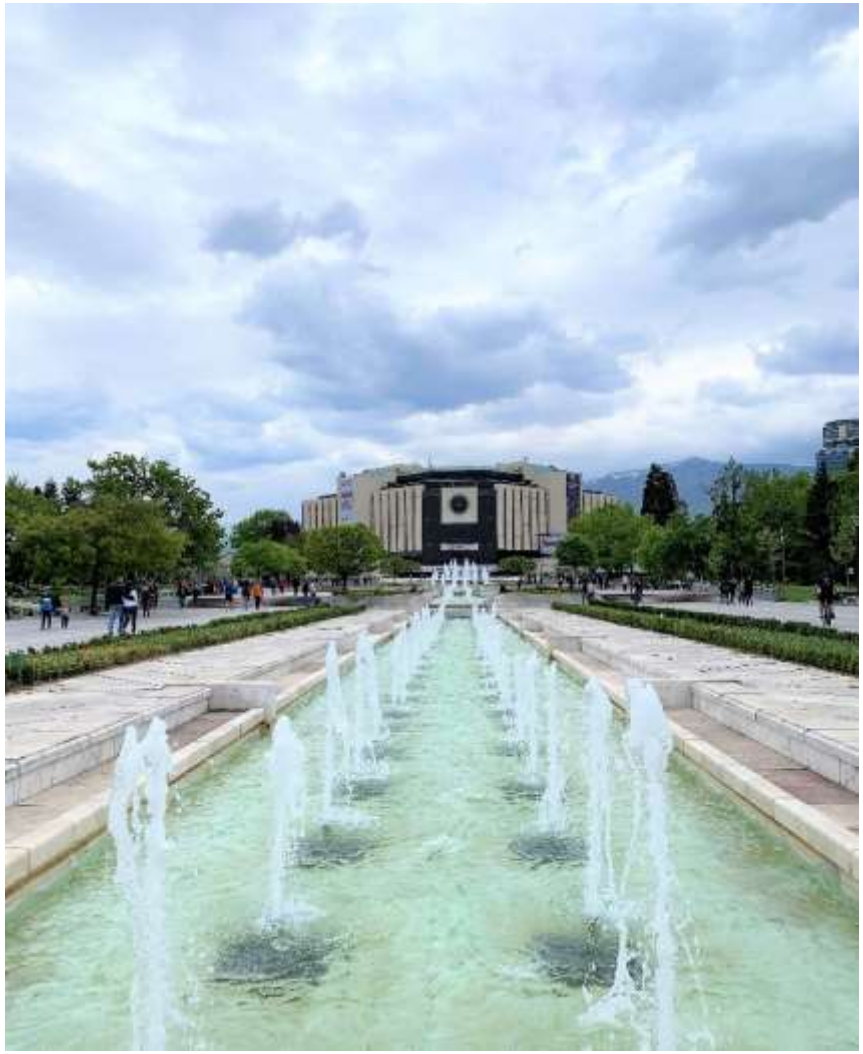


Figure 8. Roadmap to delivering the actions

Table 7. Phasing of actions.

Action	Phasing explanation
E.01	The first year is the preplanning phase. During this phase, energy consumption data will be gathered, sources of finance will be explored and buildings suitable for energy efficiency measures will be identified. The retrofit of buildings will be completed over three years following this pre-planning phase.
E.02	During the first year a feasibility study should be undertaken, simultaneously with exploration of delivery options. Smart lighting programme delivery is planned to start from the following year and is about 3 years long.
E.03	The action doesn't start immediately, but then the first year is assigned to a feasibility study, which is followed by contracting and delivery options for the project. The actual delivery is to be conducted within 2 years.
H.01	The actions are already partly ongoing. Simultaneously, actions take place like: pre-feasibility study, development of delivery and funding models. The delivery of inter-block schemes and following competitions are projected to be 3 years long.
H.02	The first year is assigned to securing funding to support private investment, from national government and EU. In the next three years energy efficiency measures are supposed to roll out.
H.03	The action is estimated to take 3 years. During the pre-planning phase (6 months) an extension to the previous study will be undertaken and another new study commenced to identify potential locations for an upcycling centre. The implementation phase covers 2 pilot centres, with 1.5 years allocated for each.
H.04	A relatively short action. Initial months are dedicated to identification of the areas for pocket parks and set a funding model. The delivery of the parks will take around 3 months each, giving together 18 months for the action.
U.01	The action plan is supposed to take around 2 years: the first year would be spent updating the Sofia Master Plan; from the second year, greenfield development would be restricted and development in proximity of stations would be encouraged through increasing height allowances.
U.02	This action is ongoing beyond GCAP timeframe. Firstly, a survey of brownfield land needs to be conducted (9 months), and then the Sofia Master Plan updated on brownfield development. Next 6 months is preparation of a register of brownfields. The longest action is the promotion of the recreational reuse of the railway corridor.
BG.01	Action consists of 2 actions undertaken simultaneously: commission of 3D model of underground infrastructure and undertaking a full climate change risk assessment. Both actions last a year.
BG.02	A few short-period actions happen together: survey of land and land owners and engaging with them on agreements, conducting studies of ecosystem services value and allocating budget for corridor renewal (12 months together). Sofia tree species survey lasts 18 months. After the pre-planning phase monitoring und updating measures are ongoing beyond GCAP framework.
BG.03	At stage 1, 9 months are assigned to a protection and restoration study of river beds and gullies. Later, 36 months will be spent developing the schemes for restoration. Another 36 months are assigned to conduct a study of the potential for redesign of open spaces into flood storage areas.
BG.04	Pre-planning phase with feasibility study is 1 year. Another year is design of the facility. Procurement of contractor should take 6 months and should be followed by 2-years of facility construction.
T.01	In the first 2 years, 4 activities will be carried out simultaneously. Design of bicycle and pedestrian lanes, revision of national legislation and rules for street design and closure of some streets. Over the next 2 to 5 years the proposed programme will be implemented, promoted and monitored.
T.02	Prior to the start of the project, a feasibility study for the renovation of the tram tracks must be commissioned. Thereafter, there is a two-year phase in which funding and contracting must be secured. Final phase of rollout upgrades goes beyond GCAP.
T.03	Extending paid parking zones is already being undertaken. Over the next 2 years different tax rates for high and low polluting vehicles should be introduced. Introducing other parking measures is scheduled over another 1 year period.
T.04	Within the first year a review of the existing EV charging strategy is planned together with a freight and logistics operator survey. On that basis the next 6 months period is assigned to specify EV charging infrastructure and the implementation of the infrastructure itself over a 5 years period.

6.3 Financial assessment of actions

Assessment approach

Alongside the roadmap to delivery, a financial assessment of each action has been undertaken. Table 8 sets out an initial estimate of capital & upfront development costs for each of the proposed interventions, alongside an assessment of which funding mechanisms are preferable for each measure. The following methods of financing have been analysed:

Table 8. Phasing of actions.

Funding mechanism	*Description*
Multinational development banks	Funding via large development banks
EU public investment funds	Relevant funding via various EU funds
National funds	Funding via central department allocations
Municipality	Funding via mechanisms such as municipal bonds or existing capital project budgets, land assets recycling etc.
Corporate/ off balance sheet by a private operator	Smaller capital projects may be financed, built, controlled and operated by private organisations
Limited resource (project) finance via special purpose vehicle (SPV)	An SPV is created by the Municipality to deliver a specific infrastructure project
Alternative finance	Encompasses sources of new finance and decentralised models of fundraising
Regulations and enforcement by private landowners/businesses	Not a funding source in its essence, but reduces the need for municipal investment by creating municipality-wide legal requirements

For more explanation of the financing approach listed under each column header, please refer to Appendix 2: Financing mechanisms: Financing mechanisms. A RAG (Red Amber Green) rating assessment has been given for each action:

- **Green - Good fit: to be prioritized in further research.** This may be because the finance source is well matched to the scale of the intervention.
- **Amber - Possible fit: to be explored.** This may be because the scale of financing required is too large for this financing mechanism alone or only some eligibility criteria are met under the current measure. Viability may improve, if the intervention is amended to meet funding criteria.
- **Red - Poor fit.** This may be because the scale of the project is too large or small for this type of financing or inapplicable (e.g. the funding is only available for capital projects and the intervention is development expenditure only).

Summary of assessment

Overall, this assessment demonstrates that every proposed intervention has at least one method of financing that is a good fit, and at least one further method that is a possible fit. This is based on recent precedent of projects completed within Sofia Municipality and potential for funding the suggested actions.

Of these financing mechanisms, EU-based public investment funds have been identified as a strong potential. There have been multiple similar projects within Sofia Municipality and the European Union which have used EU funding for similar projects to those in the GCAP. We have identified that finance sources such as national funding is likely to be applicable for fewer projects. Some forms of financing, such as corporate/off-balance sheet funding by a private operator or alternative finance, may be appropriate to the content of many of the interventions. They are, however, of limited use for some due to the large scale of upfront investment required or the absence of future cost savings needed to justify private-sector involvement.

For each intervention an indicative capital cost has been provided, and also the net effect the intervention may have on current operating expenditure. Whilst these place-based urban enhancements will result in new operating expenses, some of them can be offset via energy efficiency cost savings from other interventions if introduced as part of a coordinated programme of investment. It should also be noted that many of these projects also have significant positive externalities which may improve economic growth and wellbeing within Sofia Municipality. Brownfield redevelopment, for instance, will have high operating costs for the life of the development corporation, but its activities should catalyse major private sector investment in the redeveloped area.

These costs are an initial estimation based on preliminary assessment of available information. During the implementation of the GCAP, further financial analysis should be undertaken for each action.

Table 9. Financial assessment of actions

		Scale of financing (EUR – 2019 cost – nearest thousand)		Methods of financing								
	GCAP Action	Capital & upfront development expenditure	Net change in operating expenditure annually	Multilateral development bank	EU funding	National	Municipality (obshtini)	Corporate/ off balance sheet by a private operator	Limited resource (project) finance via SPV	Alternative finance	Regulations and enforcement for private landowners/ businesses
Energy	E.01 Improvement of municipal building energy efficiency programme	(74,275,000)	2,309,000								
Energy	E.02 Public lighting renewal	(178,076,000)	6,143,000								
Energy	E.03 Geothermal energy development	(13,101,000)	(85,000)								
Housing and communities	H.01 Housing inter-block area improvements	(535,000)	(431,000)								
Housing and communities	H.02 Energy efficiency measures in multifamily residential buildings	(117,014,000)	14,111,000								
Housing and communities	H.03 Community repair and reuse centre buildings	(94,000)	(73,000)								
Housing and communities	H.04 Pocket parks in dense residential neighbourhoods	(1,444,000)	(43,000)								

		Scale of financing (EUR – 2019 cost – nearest thousand)		Methods of financing								
	GCAP Action	Capital & upfront development expenditure	Net change in operating expenditure annually	Multilateral development bank	EU funding	National	Municipality (obshtini)	Corporate/ off balance sheet by a private operator	Limited resource (project) finance via SPV	Alternative finance	Regulations and enforcement for private landowners/ businesses
Urban planning	U.01 Transit-oriented development	(128,000)(	N/A								
	U.02 Brownfield regeneration	(867,000)	(34,351,000)								
Blue-green infrastructure	BG.01 Climate changes risk assessment and flood model	(187,000)	N/A								
	BG.02 Green corridor protection, enhancement and development	(32,695,000)	(24,598,000)								
	BG.03 Surface water management	(26,661,000)	(246,000)								
	BG.04 Optimize recycling and waste management in the construction sector	(7,758,000)	8,382,000								
Transport	T.01 Promote cycling and walking	(8,969,000)	N/A								
	T.02 Tram renewal programme	(340,884,000)	N/A								
	T.03 Parking management	(37,689,000)	(2,568,000)								
	T.04 Electric vehicle promotion	(150,000)	N/A								

6.4 Benefit assessment of actions

Introduction

This section presents the assessment of benefits which Sofia Municipality expects to receive from the implementation of the actions in the GCAP. The benefits were assessed for each action and are presented as an integrated assessment for each benefit. The actions in the energy, buildings, transport and green infrastructure sectors are expected to lead to reductions in air pollution and greenhouse gas emissions. The energy efficiency programmes and geothermal energy will improve thermal comfort and reduce energy costs, while the renewal of the district heating network will support the expansion of the customer base, switching homes away from solid fuels.

Increasing the number of cyclists and pedestrians and increasing access to and quality of green spaces will deliver health benefits from the improved physical activity and mental wellbeing of the Municipality's residents. In addition, the restoration of green spaces, green corridors and rivers will support the restoration of ecosystems. The urban planning, housing and community, and green and blue infrastructure actions will also support an improved quality of place, bringing opportunities for increased economic development and support the growth of tourism.

Energy savings, comfort and reduced fuel poverty

The improved thermal comfort resulting from the residential block energy efficiency measures will lead to reduced energy consumption, which will translate to reduced fuel poverty over time. The residential block energy efficiency measures could provide thermal energy savings of 296,200 MWh/a across 80 % of the residential blocks, once all buildings have been retrofitted.[37]

The expansion of the municipal building energy efficiency programme to retrofit the remaining 570 municipal buildings is estimated to deliver thermal energy savings of 52,200 MWh/year once all the buildings have been retrofitted[38]. Savings could be invested into other measures such as human resources development, as well as in recreational spaces, which will contribute to additional benefits over time.

The geothermal energy development project is based upon the assumption that the use of geothermal resources would be applied to municipal buildings not connected to the district heating network. These buildings currently use around 59% gas oil, 30% natural gas, 9% fuel oil and 2% coal.[39] Based on twenty installations each with a capacity of 400 kW, this measure could lead to thermal energy savings of 14,400 MWh/a.

A public lighting renewal programme could reduce street lighting electricity consumption by 21,300 MWh/a or 50% of total consumption.[40] This will enable Sofia Municipality to invest the savings in other municipal projects, bringing further benefits in the long run.

Table 10. Energy savings

ID	Action	Energy savings	Unit
E01	Improvement of municipal building energy efficiency programme	52,200	MWh/a
E02	Public lighting renewal	21,300	MWh/a
E03	Geothermal and solar energy development	14,400	MWh/a
H02	Energy efficiency measures in multifamily residential buildings	296,200	MWh/a
	Total	384,100	MWh/a

[37] Based on expected energy savings from the Bulgaria National Residential Energy Efficiency Programme and building data from the National Statistical Institute.

[39] Based on the Sustainable Energy Development Action Plan 2012-2020.
[40] Based on energy consumption data submitted by Sofia Municipality.

Air quality

The proposed actions will contribute to improved air quality.

The expansion of green spaces will provide natural cooling and reduce air pollution. The green corridors are expected to cover a total area of 28 km², reducing air pollution by 8,400 kg$PM_{2.5}$/year and 25,700 kgNO_2/year. Brownfield regeneration and housing inter-block areas improvements are estimated to reduce air pollution by 300 kg$PM_{2.5}$/a and 800 kgNO_2/a.[41]

The municipal building and housing block energy efficiency programmes will reduce the district heating demand, which will have positive impact on air quality from the natural gas plant Toplofikacia EAD.[42] The energy efficiency municipal programme for buildings will also contribute to improved air quality by supporting households in switching from solid fuels to cleaner alternatives such as heat pumps, biomass boilers and solar thermal systems, reducing air pollution by 1,000 kg$PM_{2.5}$/year and 17,400 kgNO_2/a.

The geothermal energy action will also contribute to improved air quality by helping consumers to limit or entirely switch away from the use of solid fuels for heating, reducing air pollution by 400 kg$PM_{2.5}$/year and 6,700 kgNO_2/a.

The actions in the Sustainable Urban Mobility Plan (SUMP) are expected to facilitate a shift away from cars towards public and active transport, reducing the proportion of trips travelled by cars from to 30% to 24% by 2030. Over half of cars currently have a Euro standard below 4, and reducing the trips made by cars will give rise to substantial reductions in air pollutant emissions by 6,700 kg$PM_{2.5}$/year and 121,000 kgNO_2/a. [43]

The GCAP complements the tram, cycling and pedestrian actions in the SUMP, providing high quality trams, cycle lanes and pedestrian routes, and supporting measures such as cycle parking. In addition, the GCAP includes an action to facilitate electrification of road vehicles, which will reduce air pollutant emissions by 3,400 kg$PM_{2.5}$/a and 63,000 kgNO_2/a.[44]

Table 11. Particulate matter ($PM_{2.5}$) benefits

ID	Action	$PM_{2.5}$ savings	Unit
E01	Improvement of municipal building energy efficiency programme	1,000	kg$PM_{2.5}$/a
E03	Geothermal and solar energy development	400	kg$PM_{2.5}$/a
U02	Brownfield regeneration	200	kg$PM_{2.5}$/a
H01	Housing inter-block area improvements	100	kg$PM_{2.5}$/a
H02	Energy efficiency measures in multifamily residential buildings	1000	kg$PM_{2.5}$/a
BG02	Green corridor protection, enhancement and development	8,400	kg$PM_{2.5}$/a
SUMP	Sustainable Urban Mobility Plan contributions	6,700	kg$PM_{2.5}$/a
T04	Electric vehicle promotion	3,400	kg$PM_{2.5}$/a
	Total	21,200	kg$PM_{2.5}$/a

[41] Air pollutant emission factors based on a study which assessed air pollution removal by trees in public spaces using the iTree Eco model.
[42] Air pollutant emission factors based on Air Pollutant Inventory Guidebook 2016 from the European Environment Agency.
[43] For the transport sector, emission factors based on medium sized petrol and diesel cars, and an efficiency standard split of 26% Euro 1, 21% Euro 2, 11% Euro 3, 22% Euro 4 and 20% Euro 5 and 6, based on data from Sofia Municipality.
[44] Based on global projection estimates from Bloomberg New Energy Finance.

Table 12. NO_2 benefits

ID	Action	NO_2 savings	Unit
E01	Improvement of municipal building energy efficiency programme	17,400	$kgNO_2/a$
E03	Geothermal and solar energy development	6,700	$kgNO_2/a$
U02	Brownfield regeneration	600	$kgNO_2/a$
H01	Housing inter-block area improvements	200	$kgNO_2/a$
H02	Energy efficiency measures in multifamily residential buildings	88,100	$kgNO_2/a$
BG02	Green corridor protection, enhancement and development	25,700	$kgNO_2/a$
SUMP	Sustainable Urban Mobility Plan contributions	121,000	$kgNO_2/a$
TO4	Electric vehicle promotion	63,000	$kgNO_2/a$
	Total	322,700	$kgNO_2/a$

Climate change mitigation

The actions presented in the GCAP are expected to contribute to substantial greenhouse gas emissions reductions, across a number of sectors.[45]

Table 13. CO_2 benefits

ID	Action	Value	Unit
E02	Public lighting renewal	12,800	tCO_2/a
E01	Improvement of municipal building energy efficiency programme	12,900	tCO_2/a
E03	Geothermal and solar energy development	4,000	tCO_2/a
U2	Brownfield regeneration	500	tCO_2/a
BG02	Green corridor protection, enhancement and development	21,000	tCO_2/a
H01	Housing inter-block area improvements	100	tCO_2/a
H02	Energy efficiency measures in multifamily residential buildings	113,500	tCO_2/a
SUMP	Sustainable Urban Mobility Plan contributions	36,100	tCO_2/a
T04	Electric vehicle promotion	12,900	tCO_2/a
	Total	213,800	tCO_2/a

[45] Carbon emission factors for energy based on UK Government Conversion Factors for greenhouse gas (GHG) reporting, for transport based on SUMP emission factors and for green spaces based on iTree.

The energy and buildings actions, including the expansion of the municipal building energy efficiency programme, the geothermal and solar energy development project, the district heating renewal and the Energy efficiency measures in multifamily residential buildings, will lead to emissions reductions of 159,700 tCO_2/a once all actions have been implemented.

Brownfield site regeneration will entail 0.7 km^2 of railway corridors to be converted to parkland, which is estimated to sequester 526,200 $kgCO_2/a$[46].

The inter-block areas will be enriched with pocket parks and landscaping. Assuming the delivery of five pocket parks, this action is estimated to provide carbon benefits of 3,600 $kgCO_2/a$, while the area improvement works are expected to provide carbon benefits of 124,700 $kgCO_2/a$.

The green corridors are estimated to provide carbon sequestration benefits of 21,000 tCO_2/a. In addition, the provision of green corridors and surface water management will support Sofia Municipality in adapting to climate change. The climate change risk assessment will enable climate risks understanding and take appropriate action, which in turn will improve the resilience of the Municipality to the shocks and stresses it faces.

The cost-benefit assessment prepared for the SUMP predicted carbon savings of 397,200 tCO_2 from 2020 to 2030 due to the mode shift away from cars. The additional carbon benefits due to the electric vehicles expected as a result of the improved charging infrastructure are expected to bring a further 129,000 tCO_2 from 2020 to 2030, assuming an uptake of electric vehicles of 5% by 2025 and 14% by 2050 in line with global market projections.[47]

The regeneration of the disused rail line is expected to lead to carbon benefits of 489,000 kgCO2/a. In the long run, the regeneration of the identified brownfield sites will lead to additional carbon benefits.

Improved quality of place, health and wellbeing

The inter-block area improvements and pocket parks are expected to lead to improved quality of place, health and wellbeing for residents. Coupled with appropriate infrastructure, access to more green spaces in the inter-block areas can encourage more active behaviours such as walking and cycling, with associated benefits for health and wellbeing.

Green spaces are also known to provide natural cooling, bringing air quality benefits and opportunities for biodiversity. Climate resilience may also be boosted through the creation of additional flood risk capacity.

Improved access to these spaces and improved bicycle and pedestrian infrastructure will also encourage active lifestyles. The mode share of cycling is expected to rise to 9% by 2030, which will facilitate significant health benefits to Sofia Municipality's citizens.

Biodiversity and ecosystems

The restoration of urban park land is expected to lead to improved habitats for wildlife and plants, improving the protection of species. Restoration of the river may also lead to improved habitats for aquatic ecosystems.

These actions will deliver a range of benefits through protected and enhanced ecosystem services, including urban cooling, amenity and recreation, support for pollinators and flood resilience.

Land value and tourism

The green corridors and the protection and restoration of the river are expected to improve the quality and attractiveness of space around the river for residents and tourists, providing opportunities to increase tourism.

The regeneration of brownfield sites is expected to provide opportunities to increase land and property values due to the added value of high quality green spaces. In the long run, this could lead to increased revenues for Sofia Municipality.

Transit-oriented development will enhance ridership and create economic value by concentrating residential, retail and commercial development around metro stations. It will also reduce the need for vehicle trips, bringing energy savings and air quality and congestion benefits compared with a dispersed approach to new development.

[46] The figure is obtained from assumptions about typical spacing of tree planting, based on guidance and internal design experience of Arup, along with estimates of GHG CO2 emissions reduction from tree planting taken from published scientific literature. The resulting values are: Area: 0.7km2 (7km x 100m strip); Spacing of trees: 7.5m x 7.5m; Total number of trees: 12,000; CO2 Sequestration rate: 0.75 kg/m2/year; Total CO2 emissions benefit: 526,200kg CO2/yr

[47] Based on global projection estimates from Bloomberg New Energy Finance.

Monitoring, Evaluation and Verification

7

7 Monitoring, Evaluation and Verification

This chapter outlines the Monitoring, Evaluation and Verification (MEV) framework for the GCAP. It is important to monitor and evaluate both the progress of implementing the GCAP and also the impact of its actions. This chapter sets out the governance and steps necessary to achieve both of these aspects and to evaluate progress against the strategic objectives and vision.

Monitoring the implementation of the GCAP

Implementation monitoring of the GCAP should be embedded in the core organisational structure and processes within the relevant departments of Sofia Municipality. This is necessary to ensure that a collaborative approach is taken, as many of the GCAP actions are interlinked.

- **Organisation**: The lead department to monitor the implementation of the GCAP is "Climate, Energy and Air" Directorate.
- **Scheduling and Resourcing**: For each GCAP action a responsible department will be assigned. The Director within each department will define the employees, responsible for each action, which will collect data on indicators and provide information on each action's progress.
- **Budgeting and Work Authorisation**: Each department will set the budgets and timescales for delivering the actions assigned to them, with guidance from the GCAP.
- **Reporting & Monitoring**: The experts will provide regular updates on the progress of each action (according to the set timescales and budget) to the coordination body.
- **Change management**: The results of the monitoring will inform the planning of the subsequent stages of each action. When necessary, amendments will be made to the timescales and resources.

Monitoring the impact of the GCAP

Purpose: The purpose of monitoring and evaluating the results of the actions is to understand whether they meet the targets and to draw lessons from the successes.

Responsible actors: The coordination body will nominate an MEV coordinator who will be responsible for overseeing the implementation of the GCAP actions. Each department should identify responsible employees who will be responsible for monitoring the progress of relevant actions within their department, determining appropriate stakeholders for data collection and review, approving reports and feeding back results to the MEV coordinator.

Baseline: The GCAP baseline analysis of indicators across the Pressure-State-Response framework serves as a reference document for all monitoring activities related to the GCAP actions. Where data is missing or incorrect it is recommended that Sofia Municipality seeks to collect this data.

Objectives and targets: For each action, the objectives and targets it aims to achieve should be determined and time bound.

Set up monitoring scheme: Each indicator should be assigned to the appropriate department or a relevant responsible body who will have responsibility for ensuring monitoring. The chosen experts should ultimately be responsible for reviewing the data collected, ensuring that it is complete, credible and traceable. At this review stage, the experts should consult with relevant departments in the Municipality to fill any information gaps if necessary and gain a wider understanding of the data.

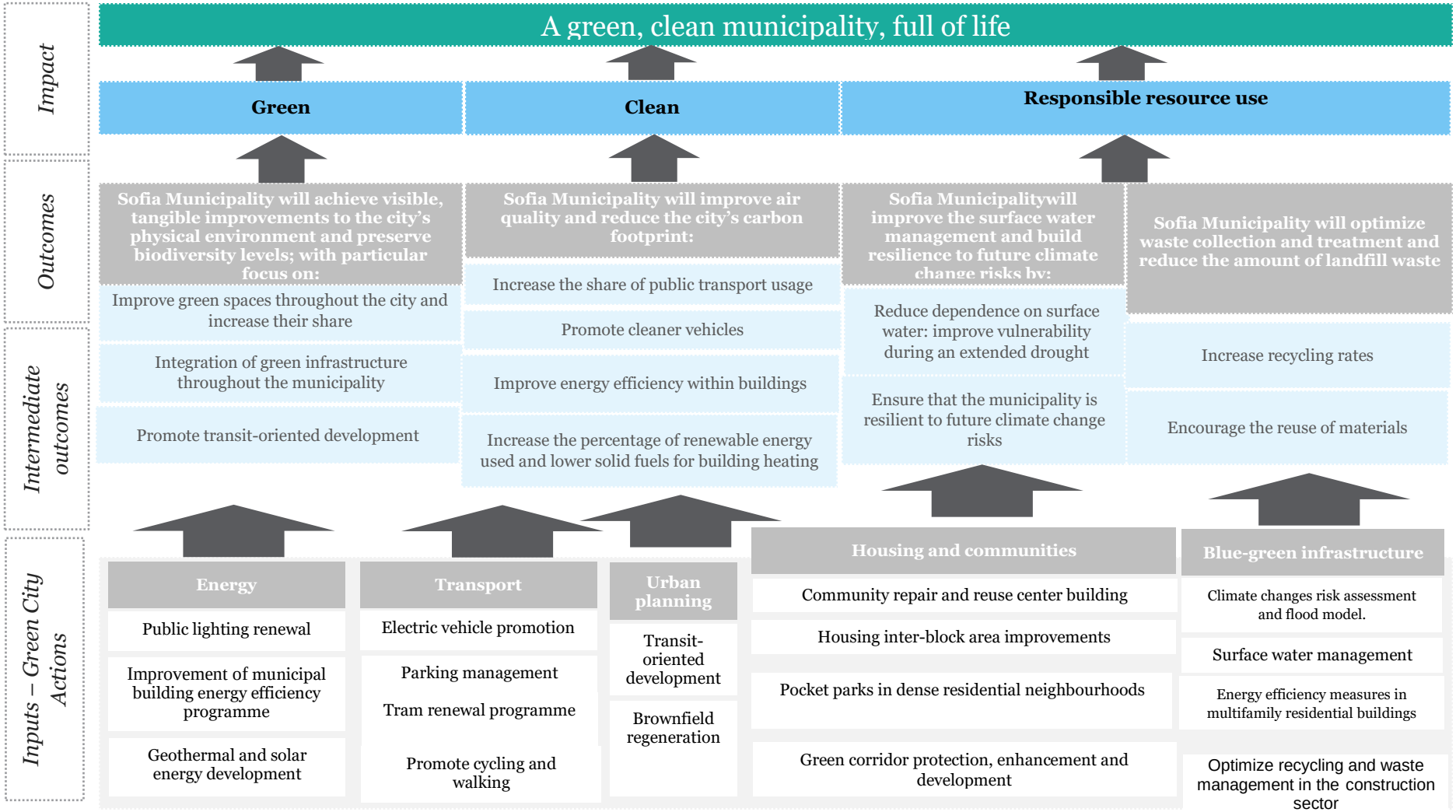
Implementation monitoring: Progress against indicators should be reported in a similar way to the baseline analysis as specified by EBRD. This plan should be re-evaluated at the end of year 1 and adjusted if necessary.

Evaluation: Each action will be evaluated by Sofia Municipality in relation to the data collected on the indicators. The analysis will include reviewing the set targets for each action, analysing the data collected throughout the project and evaluating it against the set benchmarks for each project.

Monitoring scheme

Achieving positive impact

Each of the actions has been planned to contribute to achieving one or more of the strategic objectives (see the log frame set out below). This diagram shows how each of the actions will achieve the mid-term strategic objectives and then ultimately the long-term objectives for Sofia Municipality to become green, clean municipality full of life.



Monitoring framework

Guidance

This section gives examples of monitoring frameworks for several of the green city actions. The framework provides a guide for measuring both the implementation and the impact of the GCAP. This uses the Pressure-State-Response indicators of the GCAP. Note that some indicators are applicable to multiple actions, highlighting the importance of collaboration between directorates responsible for their indicators to avoid data being collected twice. Following this framework, the implementation and impact indicators can be used to benchmark progress and successes against other Green Cities under the EBRD framework.

This section refers to Annex 5 of the EBRD GCAP Methodology which details the red-amber-green (RAG) ratings and benchmarking boundaries for pressure, state and response indicators.

Example monitoring frameworks

The tables below give an example of how each of the actions could be measured at an operational level (action indicators and targets) and how they can be measured at an impact level (strategic objective indicators and targets). This activity should be developed for the entire set of actions when implementing the actions.

Table 14.

	H.05. Pocket parks in dense residential neighbourhoods	***Indicator(s)***	***Target within GCAP timeframe***
Action	Creating small areas of green space that are ultra-local to where people live	Is the action delivered on time?	Deliver action to budget & timeframe agreed by coordination body
		Is the action delivered to budget?	
Impacted strategic objectives	Improve green spaces throughout the city and increase their share	Open green space area ratio per 100 000 inhabitants *GCAP Methodology State Indicator 6*	> 10 Hectares per 100 000 inhabitants
	Integration of green infrastructure throughout the city	Share of green space areas within urban limits *GCAP Methodology State Indicator 6.1*	> 25 % of urban space

	BG.03 Surface water management	***Indicator(s)***	***Target within GCAP timeframe***
Action	Implement river restoration and amenity schemes that will enhance flood protection	Is the action delivered on time?	Deliver action to budget & timeframe agreed by coordination body
		Is the action delivered to budget?	
Impacted strategic objectives	Reduce dependence on surface water	Reduce vulnerability during an extended drought	N/A
		Water exploitation index	< 20% score
	Ensure that the city/ municipality is resilient to future climate change risks (e.g. flash floods)	Estimated economic damage from natural disasters (floods, droughts, earthquakes etc.) as a share of GDP *GCAP Methodology State Indicator #9*	< 0.5 percent of GDP
		Percentage of public infrastructure at risk *GCAP Methodology State Indicator #9.1*	< 10% of public infrastructure
		Percentage of households at risk *GCAP Methodology State Indicator #9.2*	< 10% of households

	E.03. Geothermal energy development	*Indicator(s)*	*Target within GCAP timeframe*
Action	Implement geothermal heating systems in buildings	Is the action delivered on time? Is the action delivered on budget?	Deliver action to budget & timeframe agreed by coordination body
Impacted strategic objectives	Improve energy efficiency within buildings	Annual CO_2 equivalent emissions per capita *GCAP Methodology State Indicator 8*	< 5 tonne/year/capita
		Annual CO_2 emissions per unit of GDP *GCAP Methodology State Indicator 8.1*	<0.35 tonne/USD$ of GDP
		Electricity consumption in buildings *GCAP Methodology Pressure Indicator 14*	< 47 kWh /m2
		Heating/cooling consumption in buildings, fossil fuels *GCAP Methodology Pressure Indicator 15*	< 104 kWh /m2
	Increase the percentage of renewable energy used and lower solid fuel use for building heating	Annual CO_2 equivalent emissions per capita *GCAP Methodology State Indicator 8*	< 5 tonne/year/capita
		Annual CO_2 emissions per unit of GDP *GCAP Methodology State Indicator 8.1*	<0.35 tonne/USD$ of GDP
		Proportion of total energy derived from RES as a share of total city energy consumption *GCAP Methodology Pressure Indicator 23*	> 20%

Appendices

8

8 Appendices

8.1 Appendix 1: Action prospectuses

E.01. Improvement of municipal building energy efficiency programme

Background and justification

There are over 700 municipal buildings within Sofia Municipality - schools, kindergartens, social institutions, administrative buildings, etc. In more than 120 buildings a full set of energy-saving measures prescribed in the energy audit has been completed, which has led to increased energy efficiency, improved building living comfort, conservation of their construction, CO2 emissions reduction, high energy and financial savings. In 95% of the municipal buildings, at least one measure has been implemented (e.g. replacement of window frames, roof insulation and waterproofing, external wall thermal insulation, replacement of internal heating installations, water heating boilers replacement, etc.) including in buildings without technical passports or energy audits. Renovation works for municipal buildings are carried out annually, including implementation of complete or partial packages of energy saving measures such as installation of thermal power plants from renewable sources according to the needs established by energy audits. There remains significant room for continuing investment and more systematic improvements to both thermal losses and efficiency of building mechanical, hydraulic and electrical systems.

Description

This action will improve and upgrade the existing energy efficiency programmes in municipal buildings. This includes improving the collection and reporting of energy consumption data, securing funding to expand building retrofitting, identifying opportunities for implementing building-integrated cooling systems and renewable heating systems e. g. energy efficiency boilers, heat pumps, biomass heating and solar thermal systems etc. Within retrofitting, activities proposed include the provision of double glazed windows, wall, floor and roof insulation and the provision of energy efficient lighting. Other options to explore include certification, energy management systems and the use of green procurement practices within municipal works.

Key metrics

- Electricity consumption of buildings
- Heating consumption of buildings
- Heating & cooling consumption split
- CO2 emissions from buildings
- Number of buildings retrofitted
- Energy and CO_2 savings from building retrofits
- Building energy performance standards for new buildings and effective enforcement of standards

Phasing of actions

Stage	Description	Timeframe
1	Consolidate and publish energy audit and past energy consumption data, to enable better benchmarking and investment selection. * Actions 1,2,3 are carried out simultaneously	6 months
2	Explore further sources of financing and implement improvement of municipal building energy efficiency programme. * Actions 1,2,3 are carried out simultaneously	6 months
3	Identify buildings where building-integrated renewable heating systems would be appropriate. *Actions 1,2,3 are carried out simultaneously	1 year
4	Retrofit buildings	5-10 years

Stakeholders

1. Sofia Municipality, Directorate for Housing and Public Construction, Heat and Energy Efficiency;
2. the Ministry of Energy and the Agency for Sustainable Energy Development;
3. the Ministry of Regional Development and Public Works;
4. the Ministry of Culture;
5. the Ministry of Education and Science;
6. Headmasters of schools, kindergartens and nurseries

Key regulation and strategic policies

Described below are some of the key regulations and strategic documents, which have to be taken into consideration during the implementation of the action.

1. **Regional (EU regulation):** at a regional level, the Directive 2010/31/EU requires Member States to adopt a long-term renovation strategy that describes measures to (i) support the renovation of the national stock of residential and non-residential buildings, both public and private, into a highly energy efficient and decarbonized building stock by 2050, and (ii) facilitate the cost-effective transformation of existing buildings into nearly zero-energy buildings. The long-term renovation strategy shall set out a roadmap with measures and domestically established, measurable progress indicators, with a view to the long-term 2050 goal of reducing greenhouse gas emissions in the Union by 80-95 % compared to 1990. The roadmap shall include indicative milestones for 2030, 2040 and 2050, and specify how they contribute to achieving the EU's energy efficiency targets. In relation to 2030 targets on energy efficiency, Directive (EU) 2018/ 844 sets EU 2030 headline targets on energy efficiency of at least 32.5 percent. Bulgaria will set indicative national energy efficiency contributions towards the EU 2030 targets in its Integrated National Energy and Climate Plan. Bulgaria has to achieve cumulative end-use energy savings at least equivalent to new savings each year from 1 January 2021 to 31 December 2030 of 0.8 % of annual final energy consumption, averaged over the most recent three-year period prior to 1 January 2019.
2. **National:** Priorities for financing of energy efficiency projects shall be set in line with the rules and the principles of the **National Energy Efficiency Act** and the relevant strategic documents. The highest priority shall be given to the buildings with the poorest energy performance against the minimum energy performance requirements. The existing **National plan for nearly zero energy buildings and National Energy Efficiency Action Plan**, **apply till 2020**.
3. **Municipal:** On municipal level, the **Sustainable Energy Development Action Plan for Sofia Municipality 2012-2020 and the currently developing Sustainable Energy and Climate Action Plan 2021 - 2030**

Financing and delivery mechanism. Types of costs: development and feasibility study costs; energy audit costs and costs for modernization and implementation of effective renewable air conditioning.

- **Type of expenditure:** Development and pre-investment research costs, energy audits costs and buildings modernization and the introduction of highly efficient renewable air conditioning.
- **Capital & upfront development costs** € 74,725,000: include € 29,868,000 for window reconstruction, insulation and lighting in the remaining 570 municipal buildings; € 44,232,000 for renewable air-conditioning systems (using alternating-flow refrigerant / heat pumps based on atmospheric air); € 175,000 other development costs.
- **Changes in operating costs (net):** € 2,309,000 annually saved costs: these include € 1,077,000 energy savings from more efficient use; € 1,231,000 from fuel savings for heating and hot water supply.

- **Suitable methods of financing**: international financial institutions, EU funds and municipal funding. Project financing with limited collateral through special purpose vehicles is worth exploring as a secondary opportunity that is potentially appropriate because of the large scale and reasonably anticipated cash inflows.

E.02. Public lighting renewal

Background and justification

Sofia Municipality is bound by regulation policies at EU and national level to reduce the overall energy consumption. Improving energy efficiency within public lighting is a key way to do this. Many cities have found that lighting investments offer short payback periods that give possibility to reduce the burden on operational costs or borrowing capacity. In addition, investment in new street lighting creates the opportunity to integrate better monitoring equipment for video surveillance, Wi-Fi etc.

Description

This action implements an energy efficiency programme for lighting in public spaces and parks across Sofia Municipality. The action starts with a feasibility study, after that commencing a smart lighting replacement project. The actions include installation of LED luminaires, lighting columns and old cabling upgrades, as all of them are designed to reduce the carbon footprint and the long-term operation costs. Other activities could include installing sensors to reduce usage time, integration with other smart lighting features e.g. air pollution detection, and integration with operating centres.

Key metrics

- Number of high pressure sodium lamps installed
- Number of smart LED lamps installed
- Reduction in street lighting electricity consumption

Phasing of actions

Stage	Description	Timeframe
1	Feasibility study for public lighting renewal including smart equipment for video surveillance, Internet etc. * Actions 1,2 are carried out simultaneously	1 year
2	Explore delivery options for lighting renewal, including Public-Private-Partnership (PPP). * Actions 1,2 are carried out simultaneously	6 month
3	Deliver smart lighting programme	3 years

Stakeholders

1. Sofia Municipality, “Transport Infrastructure” Directorate and “Green System” Directorate

2. Stolichen Electrotransport EAD: other entities who own and operate street light poles such as CEZ Electro Bulgaria AD may be involved in the process to increase the overall positive effects.

3. The Sustainable Cities Fund.

Key regulation and strategic policies

Legislation at national level: **Energy Efficiency Law** The energy efficiency survey of enterprises, industrial and exterior artificial lighting systems aims to identify the specific options for reducing energy consumption and to recommend measures for energy efficiency improvement. All external artificial lighting systems located in a population of more than 20,000 inhabitants shall be subject to mandatory energy efficiency audits.

Plans at municipal level: "Program for Promotion of the Energy Usage from Renewable Energy Sources and Biofuels" 2017-2019, Sustainable Energy Development Plan of Sofia Municipality 2012-2020;

Financing and delivery mechanism

- **Type of expenditure**: Capital costs via the lighting replacement project; development costs for feasibility study.
- **Capital & upfront development costs:** €178,076,000: including f €177,976,000 for lighting replacement project with LED luminaires, light column upgrades and old cabling upgrades, and €100,000 for feasibility study costs.
- **Changes in operating costs (net):** €6,143,000 cost savings annually comprised of efficiency savings from reduced electricity usage by LED bulbs and reduced electricity and heat loss via bulbs/cabling.
- **Suitable methods of financing**: Due to its large scale, high upfront investment and precedent of similar projects, multilateral development bank, EU-based public fund and municipality financing are suitable. Limited recourse project finance via a SPV is worth exploring as a secondary option, a potential fit due to its large scale and reasonable expected income inflows.

E.03. Geothermal energy development

Background and justification

Bulgaria is a geothermally active region and previously there have been active wells providing heat to buildings for space heating and for leisure spas. The country has around 83 MWth of installed capacity, with around 5MWth of that in Sofia City and District[48]. Some wells in the city are no longer active and have been damaged or partially filled in. There is potential for these wells to be reactivated (or re-drilled). Bulgaria has rich geothermal water supply within the temperature range of 20 to 100°C with the main geothermal activity concentrated in the southern part of the country due to the higher water temperature and low water salinity. Temperatures in Sofia are estimated to be around 45°C in wells of 600-700m depth[49].The main geothermal direct-use in the country is for balneology (prevention, treatment and rehabilitation, bathing and swimming pools), space heating and air-conditioning, greenhouse heating, geothermal heat pumps, direct thermal water supply, bottling of potable water and soft drinks and for unspecified industrial use.

Description

This action involves taking advantage of Sofia's natural geothermal activity to develop projects which will provide an alternative source of heat for buildings. In order to avoid network duplication and be effective, geothermal projects should be focused on buildings not connected to the heating grid where an alternative source of energy can be provided. This action will first involve the development of a geothermal feasibility study, followed by the construction of infrastructure for direct-use of the geothermal energy.

Key metrics

- Proportion of heat generated from renewable sources
- Number of buildings supplied with geothermal heat source
- Heating consumption of buildings

Phasing of actions

Stage	Description	Timeframe
1	Feasibility study on geothermal heat, including identifying the appropriate existing or new buildings	1 year
2	Explore contracting / delivery options for geothermal energy utilization projects	6 months
3	Delivery of geothermal energy utilization projects	4 years

[48] Bojadgieva 2015. "Geothermal Update for Bulgaria (2010-2014)," Proceedings World Geothermal Congress 2015, Melbourne, Australia, 19-25 April 2015.
[49] Eng. Vanya Nikolova, pers. comm., 22 January 2019

Stakeholders

1. Ministry of Energy, Sustainable Energy Development Agency
2. Ministry of Environment and Waters
3. Sofia Municipality
4. "Toplofikacia" EAD
5. Other owners and operators of underground infrastructure / utility networks

Key regulation and strategic policies

The paragraphs below highlight some of the key enabling policies that will need to be considered when implementing this action:

National level legislation: Support for geothermal energy development is included within the scope of the RES Law; however, the legal framework that would enable actual implementation of projects is underdeveloped and no working support schemes could be identified. Thus, the implementation rate of geothermal projects seems very low – in 2016 there were no geothermal installations in operation. Additional analysis is required to identify potential bottlenecks/shortcomings in the legal framework.

National level policies: Many mineral water deposits are actually state-owned but have been transferred for long-term management and exploitation to Sofia Municipality. Case specifics should be reviewed before implementing projects to identify conditions for use of the mineral water deposit.

Municipality level strategy: In 2017 with decision of SMC №561/14.09.2017г. "The programme for utilisation of hydrothermal resources of mineral water deposits on the territory of Sofia Municipality" and "The strategy for utilisation of mineral waters potential and geothermal potential on the territory of Sofia Municipality" have been adopted

Financing and delivery mechanism

- **Type of expenditure**: Capital costs for construction of infrastructure for direct-use of the geothermal energy; development costs via feasibility study
- **Capital & upfront development costs**: €13,101,000: Comprised of €13,001,000 for reopening or re-drilling of wells, installation of a mechanical distribution system (of piping, a heat exchanger and controls) and a disposal system, overall covering an area 10% the size of Sofia Municipality's existing district heating network but supplying other buildings. €100,000 is the feasibility study.
- **Changes in operating costs (net):** €85,300 costs annually: Comprised of network operating costs.
- **Suitable methods of financing**: EU-based public fund financing is suitable. Although currently unknown, potential income flows indicate that limited recourse project finance via a SPV is also a good fit. Multilateral development bank and municipality funding are worth exploring as secondary options, although there is less precedent for the funding of this type of project.

H.01. Housing inter-block area improvements

Background and justification

Large residential complexes with multi-family residential buildings are common in Sofia Municipality, these being industrially constructed and with separate inter-block spaces. The landscaping in these inter-block spaces is to be further improved adding more value to biodiversity. The mixed ownership (municipal and private) of some of the inter-block spaces increases the difficulty of implementation of the desired improvements. A good example of improving landscaping in such spaces is Sofia Municipality's "Green Sofia" programme and this action should complement it.

Description

This action is aimed at improving the inter-block spaces. Firstly, a pre-feasibility study should be prepared, followed by community engagement to explore the opinions for targeted improvements. This will be followed by funding models to implement the action and then the scheme's delivery. Example activities include: earthworks/surface water management, planting, seating, sports and play equipment, café spaces, pavements, traffic calming, parking management.

Key metrics

- Area and number of inter-block areas redeveloped
- Area and number of leisure and recreational areas
- Area and number of green spaces developed

Phasing of actions

Stage	Description	Timeframe
1	Pre-feasibility study * Actions 1,2, 3 are carried out simultaneously	12-18 months
2	Engagement with block owners or representative groups to assess appetite for targeted improvement * Actions 1,2,3 are carried out simultaneously	18 months
3	Development of delivery and funding models (including capex and opex) * Actions 1,2,v3 are carried out simultaneously	12 months
4	Deliver inter-block landscape schemes	Ongoing - 3 year gradual implementation
5	Set up competitions and awards to promote schemes	Ongoing - 3 year gradual implementation
6	Grants to community organisations	Ongoing
7	Focus on skills development through training and apprenticeships	Ongoing

Stakeholders

1. Sofia Municipality, Department of Architecture and Urban Planning - Directorates "Spatial Planning" and "Urban and Spatial Planning and Real Cultural Heritage", together with Directorate "Green System, Ecology and Land Use" - Directorate "Green System"
2. Ministry of Environment and Water
3. Ministry of Regional Development and Public Works
4. NGOs and local communities
5. Plot owners
6. Apartment owners in the blocks
7. Biodiversity and town planning experts

Key enabling policies

The proposed "soft" actions are in accordance with the powers of the municipal authorities under the **Law on Spatial Development** and the **Law on the Structure and Construction** of Sofia Municipality.

Financing and delivery mechanism

- **Type of expenditure:** Capital costs via inter-block landscaping schemes; development costs via pre-feasibility study, delivery & funding models, community engagement and skills training; recurring costs via community grants, competitions & awards.
- **Capital & upfront development costs**: €535,000: Comprised of €385,000 for inter-block landscaping, facilities development and skills training across 80% of 2074 residential blocks (2016 figures), 200m² assumed for each block. This total area equates to 33.18 hectares, with a cost of €10,200 per hectare, with improvements made over a four-year period. There is also €150,000 for the feasibility study, community engagement and development of funding & delivery models.
- **Changes in operating costs (net):** €431,000 costs annually: Comprised of €390,000 maintenance and staff costs across these inter-block areas, and €41,000 for grants, competitions and awards.
- **Suitable methods of financing**: Due to its moderate scale and fairly low upfront costs, municipality funding would be a good fit, as would be corporate (off balance sheet) development by a private operator, providing an income stream, such as through service charges. Regulatory changes could be used to ensure changes are implemented by block owners rather than requiring central financing. However, this option may not be popular amongst private owners and residents which may make it difficult to execute. As secondary options, EU-based public investment funds and community crowdfunding could be explored.

H. 02. Energy efficiency measures in multifamily residential buildings

Background and justification

The lack of energy efficiency measures in multifamily residential buildings in the Sofia Municipality leads to high energy bills. The National Program for Energy Renovation of Multifamily Residential Buildings and the implementation of projects funded under the Operational Program "Regions for Growth" 2014-2020 made it possible for owners to improve the energy performance of their homes by providing grants.

Description

This action supports the need for investment in the upgrading of Sofia Municipality's energy efficiency programme. It includes investigation into potential funding options and engagement with relevant stakeholders in the implementation of such programmes. Types of activities include the provision of double glazed windows, wall, floor and roof insulation and the provision of energy efficient lighting. Other options to explore include efficient heating systems (e.g. heat pumps, solar thermal and biomass systems), energy efficient boilers, certification, energy management systems and the use of green procurement practices. Providing systematic information and encouraging owners to implement energy-efficiency measures in their buildings is an opportunity to support the process of renovating multi-family residential buildings.

Key metrics

- Electricity consumption of buildings
- Heating consumption of buildings
- Number of buildings retrofitted
- Heating and electrical energy, and CO2 savings from completing building retrofitting activities
- PM2.5, PM10, SO2, NO2 concentrations limitation

Phasing of actions

Stage	Description	Timeframe
1	Investigate options for securing funding to support private energy efficiency investments * Actions 1,2 carried out simultaneously	12-24 months
2	Encouraging owners to implement energy efficiency measures in multifamily residential buildings * Actions 1,2 carried out simultaneously	12-24 months

Stakeholders

1. Ministry of Regional Development and Public Work
2. The Ministry of Energy
3. Apartment owners and condominium associations
4. Sofia Municipality

Key enabling policies

EU regulation: EU Directive 2010/31 requires Member States to adopt a long-term renovation strategy that describes measures to:

- Support the renovation of the national stock of residential and non-residential buildings, both public and private, into a highly energy efficient and decarbonized building stock by 2050
- Facilitate the cost-effective transformation of existing buildings into nearly zero-energy buildings

Financing and delivery mechanism

- **Type of expenditure:** Capital costs for the building's retrofit and introduction of high-efficiency renewable air conditioning; development costs for the feasibility study, usage audit and its publication.
- **Capital & upfront development costs**: €117,014,000 in 80% of Sofia's 2000 residential blocks.
- **Changes in operating costs (net):** €14,111,000 cost savings annually: Comprised of €6,585,000 electricity savings from new lighting and increased appliance efficiency retrofit and €7,526,000 from heating & hot water fuel savings if a full retrofit was delivered throughout the blocks.
- **Suitable methods of financing**: Due to its large scale, high upfront investment and precedent of similar projects, EU-based public fund and national financing are suitable. Limited recourse project finance via a SPV is also a good fit due to its large scale and high expected income flows. Multilateral development bank financing may be viable secondary option but with less precedent at this scale, alongside regulations and enforcement of measures for private housing block owners.

H.03. Community repair and reuse centre buildings

Background and justification

The waste stream in Sofia Municipality includes many items which may be damaged or no longer needed by the owner, but with the potential for reuse. Establishing a reuse centre could facilitate the repair, refurbishment, reuse and resale of such unwanted items. A previous assessment concluded that an "upcycling centre" would not provide a positive financial return on investment. However, such a centre could provide other benefits such as skills development and employment and a positive environmental impact due to a reduction in the amount of resources consumed.

Description

This action is to deliver two pilot repair and reuse centres during the timescale of the Green City Action Plan. These centres will be places where old items and materials can be repaired, refurbished and then resold. In order to deliver the two pilot centres an extension of the previous study to confirm and evaluate other alternative economic and social benefits from the centre will need to be undertaken. Suitable locations for the centres will then need to be investigated using a community enterprise model.

Key metrics

- Recycling and reuse percentage
- Waste sent to landfill percentage

Phasing of actions

Stage	Description	Timeframe
1	Upgrade and supplement previous study to confirm / evaluate other economic and social benefits of an upcycling centre * Actions 1,2 are carried out simultaneously	3-12 months
2	Investigate and identify potential locations for an upcycling centre using a community enterprise model * Actions 1,2 are carried out simultaneously	6 months
3	Build 2 pilot centres within GCAP timescale	18 months per pilot
		Estimated total: 4 years

Stakeholders

1. Sofia Municipality, “Waste Management” Directorate
2. Ministry of Environment and Water
3. Community Representatives
4. Ministry of Labour and Social Policy

Key enabling policies

EU regulation: the proposed action should be implemented in accordance with EU and national legislation and strategic documents in the area of waste management, such as the Waste Management Act and the National Plan for Waste Management 2014-2020.

Municipal policy: On a municipal level, the implementation of the Waste Management Programme 2015-2020 needs to be taken into account.

Financing and delivery mechanism

- **Type of expenditure**: Capital costs via creation of two pilot centres; development costs via upcycling benefits follow-on study, community engagement and research.
- **Capital & upfront development costs**: €94,000: Comprised of €19,000 for upfront capital investment in two pilot centres, €50,000 for community engagement & research and €25,000 for the upcycling follow-on study.
- **Changes in operating costs (net):** €73,000 costs annually: Comprised of €13,000 centre rental costs and overheads and €60,000 staff costs for two centres.
- **Suitable methods of financing**: Given the small upfront and running costs and direct community interest, alternative financing (community crowdfunding) is a good fit. Corporate (off balance sheet) development by a private operator is also a good fit if an income stream is achieved, such as through sale of upcycled products, whilst municipal funding would also be well suited. EU-based public investment funding is a viable secondary option (e.g. OP Environment 2014-2020)

H.04. Pocket parks in dense residential neighbourhoods

Background and justification

The Municipality's proportion of green space areas within urban limits is low and local green spaces often need improvement. According to the GCAP methodologies, some housing districts offer limited good quality amenity space. For them there are opportunities for selective redesign of parking areas to provide pocket parks and parklets.

Description

This action seeks to increase the quality of green spaces, through the creation of pocket parks. Pocket parks can be defined as locally identified, smaller areas of green space ultra-local to where people live and work. These will increase local amenity and biodiversity values and provide local residents with attractive, shared community and leisure spaces. They will also balance the pressure on the existing larger green areas. The pocket parks will be built upon municipality owned land.

Specific activities within this action include:

- Identify residential districts with the worst level of access to open and amenity space;
- Complete feasibility study to establish most suitable locations for the pocket parks;
- Engage with owners and representative groups to bring about the proposed scheme (including funding model for long-term maintenance);
- Deliver five pocket parks and groups of parklets in dense residential areas with poor access to open and amenity space, together with maintenance agreements.

Key metrics

- Area and number of pocket parks

Phasing of actions

Stage	Description	Timeframe
1	Conduct feasibility study to identify residential districts with the lowest level of access to open amenity space, establish accessibility and ownership of land.	12-18 months

- Area and number of parklets
- Tree cover and inventory
- Accessibility to public to green spaces

2	Engage with owners and representative groups to bring about the proposed scheme	6 months
3	Deliver five pocket parks and groups of parklets in dense residential areas with poor access to open amenity spaces with maintenance agreements	36 months
	Estimated total: 54-60 months, phased	

Stakeholders

1. Sofia Municipality, Architecture and Urban Planning and Green System, Ecology and Land Use Direction
2. District administrations
3. Ministry of Regional Development
4. Civic associations and condominium representatives
5. Business
6. NGOs

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Key enabling policies

The **Spatial Development Act** and **Sofia Municipality Planning and Development Act** with the **Public Procurement Act or the Concession Act.**

Financing and delivery mechanism

- **Type of expenditure**: Capital costs via pocket park and parklet delivery; development costs via location surveying and community engagement.
- **Capital & upfront development costs**: €1,464,000: Comprised of €1,087,000 for five pocket parks of 975m2 size, €307,000 for 200 EV-equipped parklets, and €50,000 for the location, access and land ownership feasibility study and €20,000 for community engagement.
- **Changes in operating costs (net):** €43,000 costs annually: comprised of €37,000 staff costs for groundskeepers and €6,000 for maintenance and landscaping.
- **Suitable methods of financing**: Due to the low upfront and running costs, municipal financing would be a good fit. Corporate (off balance sheet) funding by a private operator would also fit well if an income stream can be produced (such as income from EV charge points) or alternatively introducing regulations mandating these spaces in new developments. Community crowdfunding and EU-based funds are secondary options.

U.01. Transit-oriented development

Background and justification

Sofia Municipality is significantly investing in new public transport, with a new metro line opening and further network extensions planned over the coming decade.

Description

Transit-oriented development (TOD) is a concept of urban planning which directs new development towards public transport nodes. This maximises public transport ridership and reduces the need for residents to own or use private transport.

Key metrics

- Mode split in total and commuting trips
- Accessibility to public transport
- Journey distances and time
- Frequency of public transport
- Measure of urban density
- CO2 emissions from transport
- Concentrations of PM2.5, PM10 and NOx

Phasing of actions

Stage	*Description*	*Timeframe*
1	Update Sofia Municipality Master Plan to reflect a TOD approach.	18 months
2	Restrict greenfield development and increase density and height allowances near stations.	1 year and ongoing
		Estimated total: 2.5 years, ongoing

Stakeholders

1. Sofia Municipality, through the Transport and Transport Communications and Architecture and Urban Planning divisions.
2. Ministry of Regional Development and Public Works
3. Ministry of Environment and Water
4. Business
5. Landowners.

Key enabling policies

The paragraph below highlights some of the key enabling policies that will need to be considered when implementing this action:

Spatial Development Act and **Sofia Municipality Planning and Development Act**.

Financing and delivery mechanism

- **Type of expenditure**: Upfront development costs via redrafting the Sofia Master Plan and altering municipal planning restrictions.
- **Capital & upfront development costs**: €128,000
- **Changes in operating costs (net):** N/A
- **Suitable methods of financing**: Due to its low upfront costs and scale, municipal financing will be the best fit. EU-based public investment funds and national government financing are secondary options to explore, but are less likely to fund municipal government staff time.

U.02. Brownfield regeneration

Background and justification

The Sofia Municipality has many brownfield sites, such as those near the former steel factory (Kremikovtsi) and along railway lines. Regeneration of these sites would be a key opportunity to improve land usage within the municipality and to protect and enhance green space and biodiversity. Although some areas of brownfield land are contaminated or contain the remnants of past activities and need clearing, directing new development to these areas would help increase city density and protect greenfield land from development.

Sofproekt has initiated a project on the identification and mapping of derelict land and old industrial zones with a risk of contaminated and degraded soils. The project aims to develop the Terms of Reference for a research study of contaminated and degraded soils in the Municipality, which should be assigned and developed in the initial phase of updating the general spatial plan. The Municipality is also developing a project for encouraging the recreational use of the non-functioning railway corridor.

Description

This action will assess and prepare for the regeneration of brownfield land sites in Sofia. This includes preparation of a survey and a relevant sites register, activities to promote the funding, and development and management of appropriate sites.

Key metrics

- Total area of brownfield land in the Municipality;
- Total area of brownfield land which has been renewed or regenerated.

Phasing of actions

**completed in a phased nature with cycles each year, over the next 3-5 years*

Stage	Description	Timeframe
1	Revise existing survey of brownfield land with a risk of contaminated and degraded soils	3 months
2	Upgrade survey with derelict land with no risk of pollution with potential for development	9 months
3	Update Sofia Master Plan to focus on brownfield development	1.5 year*
4	Prepare a register of brownfield land with recommendations for development and required remediation activities	6 months*
5	Consider creating a public redevelopment authority for the largest and most complex sites	N/A
6	Feasibility study and analysis for financing the railway corridor redevelopment	1 year*
7	Detailed technical design of the Green Ring	1 year*
8	Implementation of the railway corridor redevelopment	Ongoing beyond GCAP timeframe
	Estimated total: 3 years and ongoing	

Stakeholders

1. Sofia Municipality, Architecture and Urban Planning Division
2. Ministry of Environment and Water
3. "National Company of Industrial Zones" EAD
4. "National Railway Infrastructure Company" EAD.
5. The Ministry of Transport, Information Technology and Communications
6. Landowners
7. NGOs
8. Underground infrastructure / utilities operators.
9. Legal experts

Key enabling policies

The proposed actions are in line with the powers of the municipal authorities as per the Spatial Development Act and Sofia Municipality Planning and Development Act.).

The railway corridor surrounding the Municipality is probably owned by the State as opposed to the Municipality. Therefore, the respective stakeholders within the structure of the national government would need to approve the proposed action

Financing and delivery mechanism

- **Type of expenditure**: Capital costs via railway corridor conversion; development costs via the Sofia Master Plan redrafting & register publication; recurring development corporation costs
- **Capital & upfront development costs**: €867,000: Comprised of €811,000 for conversion of 70 hectares of railway corridor to recreational & parkland use, €50,000 for the brownfield site survey & register publication, €6,000 for the 2 staff redrafting the Sofia Master Plan.
- **Changes in operating costs (net):** €34,351,000 costs annually: Comprised of €33,675,000 of annual budget for a development corporation to fully redevelop a 5 sq. km neighbourhood of the City, and €676,000 for railway corridor staff costs and parkland maintenance.
- **Suitable methods of financing**: Due to its large scale, high upfront investment and precedent of similar projects, multilateral development bank, EU-based public fund and municipality financing are suitable. Limited recourse project finance via a SPV is a good fit if income flows from redevelopment (e.g. building rates) flow back to the SPV, alongside other sources of private real estate finance. National government funding or regulatory changes for railway owners are worth exploring as secondary options.

BG.01 Climate changes risk assessment and flood model

Background and justification

In the context of projected worsening climate change impacts, although there is an Adopted Climate Change Adaptation Strategy for Sofia Municipality and an action plan for it, a thorough flood risk assessment needs to be undertaken in order to avoid the serious effects of climate change on public life, property and citizens. The last major flood in Sofia occurred in 2005. Two floods have occurred since then in 2010 and since then, up to 2017 no floods have been registered. However, the existing sewer system in some parts of the city does not have enough capacity to collect and convey rainwater from intense rains, which results in some local flooding. Due to insufficient capacity in the sewerage system these happen more frequently, the latest registered in June 2018.

Description

This action seeks to increase knowledge around climate change risks and flooding to enable the Municipality to better prepare for the impacts of projected climatic changes through the implementation of sustainable drainage design and surface water management techniques. The analysis will include:

- Full climate change risk assessment;
- Mapping of the river beds;
- Analysis related to the risk of floods and capacity for undertaking high waves.

Key metrics

- Percentage of households at risk from 1 in 100 year and 1 in 500 year flood events
- Total area at risk of 1 in 100 year and 1 in 500 year flood events.
- Level of awareness and preparedness of the public to natural disasters

Phasing of actions

Stage	Description	Timeframe
1	Commission the realisation of a 3D digital model of the underground structure to support the design of surface water management measures, green infrastructure and new building designs) * Actions 1,2 are carried out simultaneously	24 months
2	Conduct a full climate change risk assessment	5 years
		Estimated total: 5 years

Stakeholders

1. Sofia Municipality - Territorial Planning Directorate, Engineering Infrastructure Directorate, Emergency Aid and Prevention Directorate, Climate, Energy and Air Directorate, Environment Directorate, Green System Directorate, Software Project OP - UCP "

2. Ministry of Environment and Water

3. RIEW-Sofia

4. Danube Region Basin Directorate

5. Ministry of Regional Development and Public Works

6. Irrigation Systems EAD - Sofia Branch**.**

Key enabling policies

The proposed action is in line with the powers of the municipal authorities as per the **Water Act and the Disaster Protection Act.**

There are many national, regional and local strategic documents that should be considered when implementing the proposed action. The most important of municipal documents to consult are:

- The plan for protection of the population in case of disasters – Part II **"Protection in Case of Floods"**
- The **Security Strategy of Sofia 2014-2020**
- The **Strategy for Development of the Engineering Infrastructure of Sofia 2017-2025** (water supply, sewage, correction of river beds)
- The **National Strategy for Adaptation to Climate Change**
- The **Third National Action Plan on Climate Change for the period 2013-2020**.

Financing and delivery mechanism

- **Type of expenditure**: Capital cost via creation of a 3D digital water management model of Sofia; development costs via the local climate change risk assessment.
- **Capital & upfront development costs**: €187,000: Comprised of €87,000 for development of a 3D digital water management model using GIS software, and €100,000 for a local climate change risk assessment.
- **Changes in operating costs (net):** N/A
- **Suitable methods of financing**: Given its low upfront costs and specific use to local government, municipal financing will be the best fit. EU-based public investment fund financing may be a secondary option, but there is little precedent for financing this type of intervention.

BG.02. Green corridor protection, enhancement and development

Background and justification

Green corridors have been a feature of the Sofia Master Plan, based on the "town-garden" design concept initiated by German architect Adolf Musman in 1938. There are currently six green wedges - oblong green strips, spreading from downtown Sofia to the mountains south of the City (Vitosha Mountain). Protecting and enhancing these corridors to deliver their full biodiversity and ecosystems services potential is challenging due to land ownership and funding constraints.

Description

This action is designed to protect and enhance green corridors through mapping and surveys. Corridor renewal relates specifically to the greening of disused existing corridors of terrains (e.g. disused rail tracks), which can improve the quality of green spaces and habitats within the city.

Key metrics

- Area of green space per 100,000 inhabitants - determined by the general master plan.
- Proportion of green spaces within urban limits
- Number of trees planted
- Tree inventory
- Quality of habitats

Phasing of actions

Stage	*Description*	*Timeframe*
1	Conduct study of ecosystems services, value of existing corridors and major open spaces (building on Municipality wide work on valuing ecosystem services)	6-12 months
2	Design of green corridor renewal	12-24 months
3	Green corridor renewal	5-10 years
4	Continue to monitor and update protection measures	Ongoing beyond GCAP timeframe
		Estimated total: 2.5 years set up, then ongoing

Stakeholders

1. Sofia Municipality - Architecture and Urban Planning Division
2. Ministry of Environment and Water
3. Ministry of Regional Development and Public Works
4. Ministry of Finance
5. NGOs and local organizations with experience in the field of biodiversity
6. Landowners.

Key enabling policies

As per the Spatial Development Act, Sofia Municipality Planning and Development Act and relevant environmental legislation.

Financing and delivery mechanism

- **Type of expenditure:** Capital costs via renewal of Sofia's seven green corridors; development costs via land ownership mapping, protection agreements engagement, tree survey & the crowdsourcing platform design for the survey.
- **Capital & upfront development costs:** €32,695,000: Comprised of €32,495,000 of urban parkland restoration and facilities improvement across seven green corridors (2803 hectares), at a cost of €12,000 per hectare over four years. This covers restoration of formal gardens and key buildings, better facilities and access, improved habitats for wildlife and plants, and an education programme for schools and the community. €50,000 for ownership mapping, €50,000 for protection agreements engagement and €100,000 for the tree survey and crowdsourcing platform design.
- **Changes in operating costs (net):** €24,598,000 costs annually: Comprised of €24,076,000 for green corridor landscaping and works and €522,000 for groundskeeper staff costs.
- **Suitable methods of financing**: Given its large scale, large upfront and large running costs, multilateral development bank and municipal financing are good fits. Regulations and enforcement for green corridor landowners could also lead to parkland improvement and reduce central financing requirements. EU-based financing is a viable secondary option with less precedent given high operating costs.

BG.03. Surface water management

Background and justification

Research indicates that Sofia Municipality is at risk from the increasing intensity of climate impacts including flash /surface floods. Sofia Municipality also has a large proportion of green area known as the 'green system', which is an aggregate of spatially linked urban green areas, forests and forest parks, protected areas, and water areas including greenery along rivers, making up to 66% of the total area of the Municipality. These river areas have the potential to be restored, protected and redesigned both for amenity and flood protection purposes.

Description

This action focuses on improving surface water management to reduce flood risks to the Municipality and increase the amenity value from local river areas and parks. The action involves a study on river bed and gullies protection. It will then include a rivers and gullies restoration and amenity scheme. Finally, the action involves a study on the potential for redesign of parks and open space to provide additional flood storage during heavy rain events in order to avoid or minimise flooding within the City.

Key metrics

- Annual number of storm water/sewerage overflows per 100km network length
- Total volume of designated flood storage capacity within green spaces in the City
- Total area at risk of 1 in 100 year and 1 in 500 year flood events

Phasing of actions

Stage	Description	Timeframe
1	River beds and gullies protection and restoration study	12-24 months
2	Development of an action plan for Sofia Municipality rivers including mapping and prioritisation	12-24 months
3	River and gullies restoration and amenity schemes	36 months
4	Conduct study on the potential for redesign of parks and open space to provide additional flood storage	36 months
		6 years

Stakeholders

1. Sofia Municipality - Engineering Infrastructure Directorate, Environment Directorate, Emergency Aid and Prevention Directorate, Climate, Energy and Air Directorate

2. Ministry of Environment and Water

3. RIEW Sofia

4. Danube Region Basin Directorate

5. Ministry of Regional Development and Public Works

Local municipal enterprises such as "**Parks and City Gardens"** – which is responsible for the maintenance of the public parks, gardens and green areas in the capital – should also be engaged and **local urban planners and developers** may also be consulted regarding the river design and restoration process. Academic partners may also be involved if information on flood risks is needed to support studies and schemes. Other stakeholders would include the owners and users of the land plots that will be impacted by this action and NGOs Irrigation Systems EAD - Sofia Branch and **Sofisyska Voda**.

Key enabling policies

There are many national, regional and local strategic documents that should be considered when implementing the proposed action. The key documents to consult are: he plan for protection of the population in case of disasters – Part II "Protection in Case of Floods"

- The Security Strategy of Sofia 2014-2020
- The Strategy for Development of the Engineering Infrastructure of Sofia 2017-2025 (water supply, sewage, correction of river beds
- The National Strategy for Adaptation to Climate Change
- The Third National Action Plan on Climate Change for the period 2013-2020.

Financing and delivery mechanism

- **Type of expenditure**: Capital costs via river restoration schemes, associated amenities and additional flood storage; development costs via the rivers protection & restoration study.
- **Capital & upfront development costs**: €26,661,000: Comprised of €24,600,000 for new storage covering 0.5% of Sofia's urban area, 2m depth, €1,961,000 for river bed & bank fixations removal, re-meandering the watercourse and river amenities, and €100,000 for the study.
- **Changes in operating costs (net):** €246,000 costs annually: Comprised of annual maintenance for the extra flood storage. River schemes and amenities may also have operating costs or income, but these will be determined by the results of the study and are not estimated here.
- **Suitable methods of financing**: Due to its large scale, high upfront investment and precedent of similar projects, multilateral development bank, EU-based public fund and municipality financing are suitable. Limited recourse project finance via a SPV is also a good fit if income streams can be derived (e.g. entry fees). National-level funding may be available.

BG.04. Optimize recycling and waste management in the construction sector

Background and justification

Sofia Municipality are searching for sites to house a new construction and demolition (C&D) waste management facility. The situation is that the existing C&D treatment/landfill site is nearing capacity, and that C&D waste arising is expected to increase due to major construction projects.

Description

This action is to undertake a feasibility study for a construction and demolition waste facility site. It also includes the design and construction of the facility, and the procurement of necessary equipment on the site. Specifically, this includes:

- Gatehouse and weighbridge (2 x weighbridges for in and out)
- Office
- Crusher
- Rotating drum
- Picking station for manual separation
- Warehouse (or 3-sided shed) for handling of waste from skip lorries
- Open yard
- Parking and turning space for vehicles

Key metrics

- Total tonnes of C&D waste produced each year.
- Level of recycling (% or tonnes/year) of C&D waste which takes place, and amount disposed of in landfills (tonnes/a)

Phasing of actions

Stage	Description	Timeframe
1	Completion of feasibility study	1 year
2	Design of facility	1 year
3	Procurement of contractor	6 months
4	Construction of facility	2 years

Stakeholders

1. Sofia Municipality: "Waste Management" Directorate
2. Ministry of Environment and Water
3. Executive Environmental Agency
4. Ministry of Regional Development and Public Works
5. Ministry of Labour and Social Policy
6. Construction companies
7. Waste management companies

Key enabling policies

The proposed action should be performed in accordance with EU and national legislation and strategic documents in the area of waste management, such as the Waste Management Act, the National Plan for Waste Management 2014-2020 and National strategic plan for construction and demolition waste management of the territory of the Republic of Bulgaria 2011-2020

On a municipal level, the implementation of the Waste Management Programme 2015-2020 needs to be taken into account.

Financing and delivery mechanism

- **Type of expenditure**: Capital costs via the facility construction costs; development costs via facility feasibility study; and operation income from haulage, landfill fee and aggregate recycling savings.
- **Capital & upfront development costs**: €7,757,649: Comprised of €100,000 for the feasibility study and €7,657,649 for the cost of the design, construction and equipment.
- **Changes in operating costs (net):** €8,381,574 annual net savings from haulage, landfill fee and aggregate recycling savings
- **Suitable methods of financing**: Due to its large scale, high upfront investment and precedent of similar projects, multilateral development bank, EU-based public fund and municipality financing are suitable. Limited recourse project finance via a SPV is also a good fit if income streams can be derived (e.g. entry fees). National-level funding may be available.

T.01. Promote cycling and walking

Background and justification

The healthiest, cheapest and most efficient modes of transport are cycling and walking. However, at present, the existing network of bicycle routes and infrastructure (cycling parking, cycling posts, bicycle rental) is insufficient (the coverage of bicycle paths is low against the benchmark values, with only 4km of path per 100,000 population) and cycling seems to be unpopular as it constitutes a small portion of overall mode share. The condition of pavements and public spaces also does not encourage pedestrian traffic; in many places there are physical barriers to pedestrians. Promoting and prioritising cycling and walking is identified by Sofia Municipality to be central to a green city's transport strategy.

Description

This action involves improvements to cycling and walking routes in the Sofia Municipality, including investments in infrastructure, reallocation of road space for cycle paths, lane separation, and redesign of some junctions and traffic signals, and the introduction of wider, safer pavements, introduction of cycle parking, zero car zones, and new routes avoiding polluted areas and improved signage and wayfinding. New cycling routes encompass a blend of signed routes without dedicated lanes on quieter roads, on-road lanes without segregation and physically segregated lanes on the busiest roads.

Key metrics

- Mode split of cycling and walking
- Total length of cycle lanes
- Number of cyclists and pedestrians per hour at selected monitoring stations
- Number of active cyclists in the Municipality

Phasing of actions

Stage	Description	Timeframe
1	Programme of cycleway and footpath construction, including signage and storage * Actions 1,2,3,4 are carried out simultaneously	2 years
2	Introduce safer junction crossings for cyclists and pedestrians.	2 years
3	Promote revision of national design guide for streets (narrower lanes)	2 years
4	Road and lane closures to give more space and calm routes for walking and cycling	2 years
5	Implement, promote and monitor progress	2.5 years

Stakeholders

1. Sofia Municipality, “Transport and Transport Communications” Division
2. NGOs
3. Ministry of Regional Development and Public Works
4. Ministry of the Interior
5. The public, including relevant NGOs.

Key enabling policies

- The Roads Act
- The Road Crossing Act
- Sofia Master Plan
- Spatial Development Act

Lessons should be derived from the implementation of the **Programme for Development of Cycling Transport on the Territory of Sofia Municipality 2012-2015**. The action should create synergy with the **Sustainable Urban Mobility Plan 2019-2035**.

Financing and delivery mechanism

- **Type of expenditure:** Capital costs via cycle path construction, footpath construction, redesign of road junctions facilitating cycling and pedestrian walking and road closures for the establishment of pedestrian areas; staff costs via revising design guidance.
- **Capital & upfront development costs:** €8,968,000: Comprised of €4,801,000 for 10km of strategic cycle paths development, €1,805,000 for 10km of standard bituminous pavement with kerbing/edgings for development or redesign of pedestrian areas/ alleys/ sidewalks, €2,149,000 for 50 new cycle/pedestrian toucan crossings, €193,000 for 20 road closures for development of pedestrian areas (enclosed with 34 bollards each, which hinder automobile traffic) and €20,000 for revising design guidance.
- **Changes in operating costs (net):** N/A
- **Suitable methods of financing**: Given its large scale municipal infrastructure focus, EU-based public investment fund and municipal finance are the best fit, with precedent from similar schemes. Multilateral development bank financing is a secondary option to explore, but one with less precedent below the €10m threshold.

T.02. Tram renewal programme

Background and justification

Although Sofia Municipality has an extensive public transport network with major investment ongoing for new Metro lines, the fleet of trams and trolleys is relatively old and this leads to falling ridership on the network, and the proportion of people travelling by car is rising.

The tram system needs to be renewed to enhance the speed, comfort, reliability and quality of the service. The tariff system is also insufficiently flexible to enable riders to select alternative routes. Improving these aspects is expected to increase the attractiveness of trams to the public, and therefore increase the mode share of public transport within the Municipality.

Description

This action entails preparatory work to improve Sofia Municipality's tram service. Activities will include the preparation of design studies, funding securing and procuring.

Key metrics

- Mode split of tram use
- Average travel speed on trams
- Number of tram passenger-km
- Tram ticket average fares

Phasing of actions

Stage	Description	Timeframe
1	Prepare design study for renewal of the tram trackwork (to modern international LRT standard gauge) and replacement of rolling stock *Actions 1,2, carried out simultaneously	2 years
2	Secure funding and procure contracts	2 years
3	Rollout upgrades	2.5 years, then beyond GCAP
		3 year set up, ongoing beyond GCAP

Stakeholders

1. Sofia Municipality, "Transport and Transport Communication" Division, Urban Mobility Centre
2. "Stolichen Elektrotransport" EAD

Key enabling policies

National level legislation which should be consulted includes; Environmental Protection Act, Clean Ambient Air Act, Energy from Renewable Sources Act, Climate Change Mitigation Act, Protection from Environmental Noise Act, Road Traffic Act, Spatial Development Demarcation Act with similar projects that were implemented or are currently implemented under OP Regions in Growth 2014 - 2020.

Municipality level plans and policies to be consulted include; the Program for Management of Air Quality, the Climate Change Adaptation Strategy, the Urban Development Plan for Sofia Municipality 2014 - 2020, the Sustainable Urban Mobility Plan, the General Traffic Organisation Plan, and the Urban Environment Report from "Vision for Sofia".

Financing and delivery mechanism

- **Type of expenditure:** Capital costs for tram trackwork replacement, increase and replacement of the rolling stock; costs for tram design study.
- **Capital & upfront development costs**: €340,884,000: Comprised of €102,615,000 for the reconstructions and development of 8 tram tracks and €238,110,000 for the 3 rolling stock replacement projects (122 trams) specified in the Sustainable Urban Mobility Plan of Sofia Municipality (SUMP), and €159,000 for study.
- **Changes in operating costs (net):** N/A
- **Suitable methods of financing**: The large scale and upfront costs of this project make it a good fit for multilateral development bank, EU-based public investment fund and municipal financing. All have precedent in allocating funds to transport infrastructure, and a combination will likely be necessary to achieve the full project. National government funding may also be a secondary option to explore.

T.03 Parking management

Background and justification

Sofia Municipality's motorisation rate is high and rising, in spite of an extensive public transport system. Cars contribute to the poor air quality of the Municipality. One way to control the purchase and use of cars is parking policy.

Paid parking areas in Sofia Municipality play a very influential role for the management of parking demand in the central parts of the Municipality. Increasing their scope could help to dampen the effects of increasing car ownership and contribute to limiting air pollution.

Description

Activities under this action will include an extension of paid parking zones outward from the city centre, the introduction of differential permit pricing for high and low polluting cars (i.e. a congestion charge on high polluting vehicles), and a reduction in the supply of parking spaces where public transport provision is good. The Municipality will also support car sharing schemes by reserving parking spaces for scheme vehicles. "Park and ride" locations may be provided in selected outer locations around the city.

Key metrics

- Number and capacity of paid car parks
- Occupancy of car parks
- Motorisation rate
- Parking charges

Phasing of actions

Stage	Description	Timeframe
1	Extend paid parking zones outward from the city centre	Ongoing
2	Introduce differential permit pricing for high and low polluting cars	2 years
3	Other parking measures including car sharing spaces and 'park and ride' locations.	1 year
		2.5 years, but ongoing beyond GCAP

Stakeholders

1. Sofia Municipality, "Transport and Transport Communication" Division, Urban Mobility Centre EAD
2. NGOs
3. Local Communities

Consultation with **NGOs and local communities** is essential for the success of parking and street management projects.

Key enabling policies

Paid parking regulations are within the power of the municipal council to introduce as per art. 99 of the Road Traffic Act.

The implementation of the proposed action supposes that the parking lots that will be covered by the expansion programme are owned by the municipality and the ownership title is not disputed. However, expropriation procedures for acquisition of private plots may be considered if necessary. It is recommended to consult other stakeholders responsible for traffic regulation with relation to the proposed action (such as the Ministry of Interior).

The proposed action should create synergy / establish demarcation with the "low emission zone" measure under the Clean Ambient Air Act which also aims to reduce transport emissions in city zones. The establishment of a low emission zone is proposed in the Strategic National Air Quality Management Programme 2018-2024.

Financing and delivery mechanism

- **Type of expenditure** - Capital costs for parking spaces; recurring costs from the operation of park & ride schemes, extension of paid parking zones, enforcement of regulations and differential pricing.
- **Capital & upfront development costs** - €37,689,000: Comprised of €15,341,000 for 5 new 1200-space park & ride sites on Sofia's outskirts, and €22,348,000 in land costs to relocate 3000 parking spaces to areas where spaces and public transport provision are lacking.
- **Changes in operating costs (net):** €2,568,000 cost annually: Comprised of €298,000 new income from extension of paid parking zones (pay & display and parking fines), offset by €2,866,000 costs of operating 5 park & ride schemes with buses every 10 minutes.
- **Suitable methods of financing**: Given its large scale municipal infrastructure focus, EU-based public investment fund and municipal finance are the best fit, with precedent from similar schemes supporting urban transport infrastructure and reducing air pollution.

T.04. Electric vehicle promotion

Background and justification

The global electric vehicle (EV) market is growing rapidly as battery performance has increased and costs have fallen. EV ownership can bring major benefits to Sofia Municipality through reduced emissions and noise. It is expected that EV usage will rise.

Description

Activities under this action will include review and implementation of the EV charging strategy in line with the SUMP and carrying out a freight and logistics operator survey. The Municipality will support the building of EV charging infrastructure in car parks and parking spaces.

Key metrics

- Number of electric cars and taxis
- Number of publicly available electric charging vehicles
- CO_2 emissions from transport
- Concentrations of PM2.5, PM10, NOx and CO_3

Phasing of actions

Stage	Description	Timeframe
1	Review of existing EV charging strategy, including procurement route for charging infrastructure investment and delivery * Actions 1,2 are carried out simultaneously	12 months
2	Carry out freight and logistics operator survey	3-12 months
3	Secure agreement(s) with EV Charging Infrastructure delivery partner(s)	6-12 months
4	Deliver EV charging infrastructure	5 years
		Approximately 6 years

Stakeholders

1. Sofia Municipality
2. Ministry of Environment and Waters
3. Ministry of Energy
4. Ministry of Finance
5. Private companies

Key enabling policies

The proposed action must be planned and implemented in accordance with national strategic documents that provide similar measures, including;

- The National Framework for Development of Alternative Fuel Market, which aims to facilitate the implementation on Directive 2014/94/EU
- The material provision of Directive 2014/94/EU - transposed in Ordinance № РД-02-20-2/20.12.2017 - for Planning and Design of Communications and Transport Systems in Urban Areas, adopted by the minister of regional development and public works.
- The proposed action should create synergy / establish demarcation with similar projects that may be financed under the next ESIF programming period.
- The proposed action needs to be carefully planned in consideration of the applicable state aid rules.

Financing and delivery mechanism

- **Type of expenditure**: Development costs via the delivery plan for EV incentives rollout and the city logistics survey.
- **Capital & upfront development costs**: €150,000: Comprised of €100,000 for the delivery plan for EV incentives rollout per the Sustainable Urban Mobility Plan of Sofia Municipality, and €50,000 for the city logistics players survey.
- **Changes in operating costs (net):** N/A
- **Suitable methods of financing**: Given its small upfront costs and narrow municipal focus, municipal financing would be the best fit. Given its purpose of improving urban air pollution and sustainable transport, it may attract EU-based public investment fund financing, and this is a secondary option despite the small scale of the scheme.

8.2 Appendix 2: Financing mechanisms

For funding the proposed interventions of the GCAP, the following finance mechanisms are considered to be most viable:

International financial institutions

Funding via international financial institutions, many of which have infrastructure funds for middle-income nations. Clear candidates for Sofia include the Japan Bank, the International Bank for Reconstruction & Development (IBRD), and the EBRD itself.

European Union

Relevant funding e.g. via the Invest EU fund (sustainable infrastructure & innovation), the Connecting Europe Facility (CEF – transport & energy), European Structural & Investment Funds (ESI), and European Investment Bank framework & investment loans.

National

Funding via central department allocations, infrastructure budgets or the state-controlled Fund of Funds in Bulgaria (FMFIB).

Municipality

Funding via municipal bonds or existing capital project budgets. Asset recycling is also a possibility via sale, lease or sale and leaseback of public assets to create revenue and avoid increasing public debt.

Corporate / on balance sheet by a private operator

Smaller capital projects may be financed, built, controlled and operated by private organisations using public land, avoiding budgetary restrictions by keeping financial liabilities off the public balance sheet.

Limited recourse project finance via a special purpose vehicle (SPV)

An SPV is created by the municipality to deliver a specific infrastructure project. Limited resource financing of the SPV helps to isolate financial risk for the municipality and to free up fiscal space for other projects.

Alternative finance

Alternative finance encompasses new finance sources and decentralised models of fundraising. One relevant approach may be crowdfunding, via which funds are raised from a large number of local donors for a popular public-use capital project, for example new park.

Regulations and enforcement for private landowners and businesses

Not a funding source in its essence, but reduces the need for municipal investment by creating city-wide legal requirements for improvements by private landowners and businesses, e.g. vehicle/building eco standard.