Bucharest

Green City Action Plan

GCAP
BUCHAREST

PRIMĂRIA MUNICIPIULUI BUCUREŞTI

EBRD GREEN CITIES

European Bank
for Reconstruction and Development

GCAP BUCHAREST

Green city action plan

Prepared for

PRIMĂRIA MUNICIPIULUI BUCUREŞTI

Prepared by

LDK CONSULTANTS

KOMMUNAL KREDIT PUBLIC CONSULTING

Trinomics

Financed by

EBRD GREEN CITIES

June 2025

Disclaimer

This report was prepared by Trinomics in association with KPC and LDK for the benefit of the Municipality of Bucharest. Any views, opinions, assumptions, statements and recommendations expressed in this document are those of the authors and do not necessarily reflect the official policy or position of the City of Bucharest.

The European Bank for Reconstruction and Development (EBRD), as the EBRD Shareholder Special Fund (SSF), or the City of Bucharest do not accept any responsibility whatsoever with regard to any claims of any nature by any third party relating, directly or indirectly, to EBRD's role in selecting, engaging or monitoring Trinomics and its associates and/or as a consequence of using or relying upon the services of Trinomics and its associates.

This report has been funded by the EBRD Shareholder Special Fund (SSF).

Contents

List of Abbreviations

ADIGIDMB	Intercommunity Development Association for Integrated Municipal Waste Management in Bucharest
AVL	Automated Vehicle Location
ATU	Administrative territorial unit
BIR	Bucharest-Ilfov Region
BTMS	Bucharest transport management system
CAPEX	Capital Expenditures
CCC	Climate Change Contract
CDW	Construction and demolition waste
CHP	Combined Heat and Power
DHC	District Heating and Cooling
DHS	District Heating System
DSO	Distribution System Operator
EBRD	European Bank for Reconstruction and Development
EED	Energy Efficiency Directive
EIB	European Investment Bank
EPC	Energy Performance Certificate
EPR	Extended Producer Responsibility
EV	Electric vehicle
GCAP	Green City Action Plan
GCBM	General Council of Bucharest Municipality
GIS	Geographic Information System
GM	General Mayor
GUP	General Urban Plan
IoT	Internet of Things
IUDS	Integrated Urban Development Strategy for Bucharest
LC	Local councils
LPA	Local public administration

MARSRB	Municipal Administration for the Retrofitting of Seismically Risky Buildings
MBT	Mechanical Biological Treatment
MDPWA	Ministry of Development, Public Works and Administration
MEWF	Ministry of Environment Water and Forests
MO	Ministerial Order
MRDPAEF	Ministry of Regional Development Public Administration and European Funds
MSW	Municipal Solid Waste
N.A.	Not applicable
NARW	National Administration of Romanian Waters
OPEX	Operating Expenditures
RES	Renewable Energy Sources
PHEV	Plug-in hybrid electric vehicle
PPP	Public Private Partnership
RDF	Refuse-derived Fuel
SEP	Stakeholder Engagement Plan
SIDU	Integrated Urban Development Strategy
STB	Societatea de Transport București (Bucharest Transport Company)
SuDS	Sustainable Drainage Systems
TA	Technical Assistance
TC	Technical Committee
TSO	Transport System Operator
TOD	Transit Oriented Development
TPBI	Inter-community Development Association for Public Transport Bucharest-Ilfov
ZUP	Zonal Urban Plan

List of Tables

List of Figures

Executive Summary

Arc de Triomphe

The city of Bucharest is the capital city of Romania, a European Union Member State since 2007. The city hosts around 2 million people[1], being divided into **six administrative units, referred to as sectors or districts**. Each sector is managed by a mayor and a Local Council, having specific local competencies. In addition to the six local administrations, Bucharest is governed by the General Municipality, led by the General Mayor and the General Council consisting of 55 councillors.

This **Green City Action Plan (GCAP)** for Bucharest was developed under the umbrella of the **European Bank for Reconstruction and Development (EBRD) Green Cities programme** – a programme which assists cities in building more sustainable living conditions for their citizens. Bucharest has joined the EBRD Green Cities Programme in 2022, next to five other Romanian cities[2] and more than 60 cities in the whole EBRD Green Cities network. The programme takes a broad approach to identifying and prioritising cities' environmental challenges which are addressed through infrastructure investments, policy measures, regulations and guidelines, leading to this GCAP. Thus, the elaboration of the Bucharest GCAP has followed the EBRD GCAP Methodology of the EBRD Green Cities programme[3] by identifying and prioritizing the environmental challenges, on the base of which the strategic goals were formulated and actions were developed to achieve these goals.

The **Bucharest GCAP** is a **step-by-step guide** for the General Council and the Local Councils of the six sectors of the city, for the private sector and for urban practitioners to address the environmental challenges through "hard" actions, such as infrastructure investments and "soft" actions, such as policies, guidelines, campaigns, capacity building, etc. The document takes a **comprehensive and integrated approach** to addressing the environmental challenges stemming from six sectors that form the urban ecosystem, namely **land use, transport, waste management, water and wastewater, energy, and buildings**. It is supported by digital tools, and it accounts for cross-cutting themes that encompass social and economic inclusion, gender and vulnerable population, climate and urban resilience. Together with other initiatives such as the Mission 100 platform, as well as strategies and plans such as the Sustainable Urban Mobility Plan and Integrated Urban Development Strategy, the Bucharest GCAP will contribute to a sustainable urban development of the city and will facilitate it twin green and digital transition.

Based on a thorough technical analysis and extensive stakeholder consultations, the Bucharest GCAP will enable the city materialise its **Green City Vision by 2040** which is to *become a green and comfortable city to live in, with clean air and good public transport, alongside non-motorised transport infrastructure to allow travel in the day-to-day life, friendly with its inhabitants and visitors, caring for its most vulnerable citizens, with plenty of welcoming and vibrant public spaces, governed by all concerned administrative authorities working together in an integrated manner and in collaboration with the citizens, the private sector and the NGOs, using an expanded digital infrastructure and database system.*

To accomplish the Green City Vision, a set of strategic goals for the abovementioned pressure sectors have been developed in accordance with the EBRD GCAP Methodology. These are presented in Table 1.

[1] National census of Population and Households from 2021: https://bucuresti.insse.ro/populatia/
[2] These are: Craiova, Iași, Mediaș, Timișoara and Alba-Iulia.
[3] https://www.ebrdgreencities.com/assets/Uploads/PDF/GCAP_2-1_Methodology_January2022.pdf

Table 1: Bucharest Green City Strategic Goals

Sector	Strategic goal
Governance and strategic planning	Elaborate and implement governance models, strategies and plans to address the needs for investments and soft measures that make the urban environment more resilient to climate and other natural shocks
Urban transport	Increase the quality, extent, reliability, safety and inclusiveness of the network of public transport service, while encouraging, through appropriate infrastructure, the non-motorised modes of urban transportation
Energy	Consolidate the power grid to cope with the increasing demand and enhance the share of renewable energy consumed in the city, for electricity, heating and cooling of the buildings
Solid Waste	Reform the waste management system in terms of governance and infrastructure to ensure that the city follows closely the EU targets on municipal waste at national level
Buildings	Increase the energy efficiency of buildings and decrease the share of fossil fuels in district heating production, along with improving the related information to offer transparency about the energy performance of the building stock
Water	Ensure access to utility networks at 100%, while modernising and improving the performance of the existing utility networks to protect the surface water bodies and promote a sustainable water resources management. Development and implementation of Nature Based Solutions (Sustainable Urban Drainage Systems) in order to decrease the urban flooding risk.
Land use and open space	Improve the use of urban land to address the high population density by ensuring access to high-quality green public spaces in all residential areas and to all categories of population
Air quality	Collect and use reliable data to understand the sources of pollution particles as a strategy for curbing pollution where it originates

Bucharest GCAP consists of **32 prioritised actions**. Of these, **19 are "hard" investment actions**, **10 actions are a combination of investment and policy**, whereby the investments require legal frameworks, and **3 are "soft" policy actions**. Table 2 provides an overview of the composition of the actions per sector.

It is estimated that around **EUR 1.3 billion** is needed for implementing the "hard" investment actions, circa **EUR 4.8 billion** for the investment actions that also include the development of the

policy framework for their implementation, and approximately **EUR 19 million** for the "soft" policy actions. This adds up to a total GCAP CAPEX budget of approximately **EUR 6.1 billion** covering a 5-year period. The largest amount, i.e. over 90% of the finances needed for implementing the GCAP actions, is proposed to be sourced by EU funds and programmes. These are the **Recovery and Resilience Plan, InvestEU, the Cohesion Funds, Horizon Europe, LIFE Programme**. Other funding options include **International Financial Institutions**, such as the EBRD or **Public-Private Partnerships**. The financial instruments through which the money can be channelled include **grants, loans, green municipal bonds, sustainability-linked bonds, but also Technical Assistance (TA) instruments**. Only a small amount, i.e. less than 10% will be sourced from the municipal budget, while the operating costs will be almost exclusively based on the municipal budget and on the budgets of the utility companies.

The GCAP actions have the potential to **reduce Greenhouse Gas (GHG) emissions** by an estimated **1,151 $ktCO_2e$ per year**, which represents around 9-10% of the Bucharest current emissions[4]. The highest potential resides with the energy sector which is responsible for 61% of the total estimated GHG emission reduction of the GCAP sectors, mainly due to the decarbonisation of the district heating sector of the city. The second biggest contributor to the reduction of GHG emissions is the urban transport sector, with 21% of the total estimated reductions of the GCAP sectors, mainly due to the switch to a net-zero public transport fleet.

In addition to environmental and climate mitigation benefits, the Bucharest GCAP actions will also have **social and economic benefits**. It is estimated that most actions have the potential to create new jobs, both in the investment phase (e.g. construction, rehabilitation, installation, landscaping works etc.) and on a longer-term basis, in the operation and maintenance phase of the specific investments. In total, estimated **417 new jobs** could be created through the implementation of Bucharest's GCAP. Most jobs will be generated in the energy sector, followed by the solid waste and transport sector. Moreover, the GCAP actions will contribute to reducing gender-based discrimination and harassment and improve economic inclusion of vulnerable groups. This will be accomplished through accessible design and service expansion of public transport fleet, design of the transport stops that is friendly with persons with disabilities, gender-mainstreamed green spaces that account for the different roles of the genders in society, reduction of energy poverty for vulnerable groups, equitable access to clean transport alternatives, good quality renovated housing, cleaner air that improves overall health of city's inhabitants, as well as gender-desegregated data collection to inform further city policies.

This GCAP document concludes with guidance on how to set up the **governance of the implementation** of the GCAP actions and on how to **monitor the GCAP progress and its impact** using a dedicated monitoring tool. This tool will assist the implementing stakeholders, i.e. the action owners, in tracking the implementation and environmental effect of GCAP actions.

[4] This is based on the estimates for business-as-usual emissions of the city from the Policy and Urban Framework report.

Table 2: Overview of Bucharest GCAP Actions

Sector	Action ID	Action title	Action type	Climate action/risk and vulnerability	CAPEX [million EUR]	OPEX (Over 5 years) [million EUR]	Estimated carbon emission reduction (Annual tCO_2e)	Estimated jobs created
Urban transport	UT 1	A net-zero emissions public transport fleet and associated infrastructure	Investment	Directly targeted	450	N.A.	134,200	5
	UT 2	LEZ with air quality monitoring systems	Policy/Investment	Directly targeted	15	N.A.	65,700	15
	UT 3	Implementation of the Velo Master Plan	Investment	Directly targeted	150	N.A.	3,000	10
	UT 4	Modern and accessible public and intermodal transport and public transport stops	Investment	Directly targeted	70	N.A.	18,000	10
	UT 5	Optimization and prioritization of public transport through the development of Intelligent Transport Systems	Investment	Directly targeted	70	N.A.	4,200	0
	UT 6	EV public charging network	Investment	Directly targeted	25	N.A.	16,250	18
	UT 7	Intermodal mobility Hubs and Park & Ride Facilities	Policy/Investment	Directly targeted	200	N.A.	3,000	14
Energy	E 1	Decarbonisation of district heating (planning, investments and programmes)	Policy/Investment	Directly targeted	3,484	7	708,120	95
	E 2	Energy Manager at municipal level	Human resources/ Policy	N.A.	976	0.455	included in E 1	5
	E 3	Map of electricity grid risks	Policy	Directly targeted	0.78	N.A.	included in E 1	2
Solid Waste	SW 1	Mechanical-biological treatment facility for mixed municipal waste	Investment	Directly targeted	150	175	40,700	25
	SW 2	Infrastructure for separate collection of municipal waste	Investment	Directly targeted	14	7.65	included in SW 1	25
	SW 3	CDW recycling facility	Investment	Directly targeted	5	3.75	included in SW 1	15
	SW 4	Biological treatment facility for biowaste	Investment	Directly targeted	15	15	20,000	12
	SW 5	Compliant landfill	Investment	Some elements	15	30	included in SW 4	0
	SW 6	“Pay-as-you throw” schemes for the six districts	Policy	Some elements	18	3.475	included in SW 4	8
Buildings	B 1	Energy audits and proactive measures for existing buildings	Policy/ Investment	Directly targeted	4.45	5.15	39,150	5

Sector	Action ID	Action title	Action type	Climate action/risk and vulnerability	CAPEX [million EUR]	OPEX (Over 5 years) [million EUR]	Estimated carbon emission reduction (Annual tCO_2e)	Estimated jobs created
	B 2	Addressing seismic and climate-change risks	Investment	Directly targeted	44.1	3	included in B 1	15
	B 3	Upgrades of HVAC systems	Investment	Directly targeted	77.65	5	39,150	18
Water	W 1	Modernisation of the drinking water network	Investment	Some elements	193	1.675	included in W 3	20
	W 2	Nature-based solutions for stormwater management	Investment	Some elements	2.1	0.175	included in W 3	5
	W 3	Technology upgrade for industrial wastewater management	Investment	Some elements	0.6	0.115	57,200	2
	W 4	Reuse of treated wastewater	Policy/Investment	Some elements	3.4	2.45	included in W 3	2
	W 5	Rehabilitation and protection of surface water resources	Investment	Some elements	2.15	0.8	included in W 3	2
Land use and green space	LU 1	Centre for urban planning	Policy and Investment	Directly targeted	0.091	1.19	N.A.	2
	LU 2	Urban regeneration and coherent spatial planning	Policy	Some elements	0.2	N.A.	N.A.	0
	LU 3	Additional green spaces in high-density neighbourhoods	Investment	Some elements	9	0.86	N.A.	12
	LU 4	Parks rehabilitation	Investment	Directly targeted	5.78	0.16	N.A.	10
	LU 5	Urban renewal pilot concepts	Investment	Directly targeted	15	2.4	N.A.	15
Smart City	SC 1	Integrated digital infrastructure/ databases	Policy/Investment	Some elements	15	N.A.	N.A.	15
Air quality	AQ 1	Integrated pollution management and monitoring system	Policy/Investment	Directly targeted	17	N.A.	included in AQ 2	5
	AQ 2	Green belt of Bucharest-Ilfov	Policy/Investment	Directly targeted	48	55.08	3,000	30
Totals					**6,095**	**320.4**	**1,151,670**	**417**

1 Introduction

View of Unirii Bulevard and Constitution Square

1.1 Project Context

This action plan was developed under the umbrella of the **European Bank for Reconstruction and Development (EBRD) Green Cities programme –** a programme which assists cities in building more sustainable living conditions for their citizens. The programme takes a broad approach to identifying and prioritising cities' environmental challenges which are addressed through infrastructure investments, policy measures, regulations and guidelines, leading to this **Green City Action Plan (GCAP)**. The actions of this GCAP serve for reaching Bucharest's environmental strategic goals, resulted from the prioritisation of the challenges, and ultimately fulfil the Green City Vision.

Bucharest has joined the EBRD Green Cities Programme in 2022, next to five other Romanian cities[5] and more than 60 cities in the whole GCAP network. In June 2023, Trinomics, in consortium with Kommunalkredit Public Consulting (KPC), LDK Consultants and local experts, have been selected to assist the Municipality of Bucharest in developing the Bucharest GCAP. Throughout the development process, the Consultant Team has followed the EBRD GCAP Methodology of the EBRD Green Cities programme (hereafter GCAP Methodology[6]), by identifying and prioritizing the environmental challenges, on the base of which the strategic goals were formulated and actions were developed to achieve these goals.

The Bucharest GCAP is a **step-by-step guide** for the General Council and the Councils of the six sectors of the city, for the private sector and for urban practitioners to address the environmental challenges through "hard" actions, such as infrastructure investments and "soft" actions, such as policies, guidelines, campaigns, capacity building, etc. The document takes a **comprehensive and integrated approach** to addressing the environmental challenges stemming from six sectors that form the urban ecosystem, namely **land use, transport, waste management, water and wastewater, energy, and buildings** (henceforth, GCAP sectors)**.** It is supported by digital tools and is accounts for cross-cutting themes that encompass social and economic inclusion, gender and vulnerable population, climate and urban resilience.

The Bucharest GCAP will enable the city to materialise its **Green City Vision** of becoming a green and comfortable city to live in, with clean air and good public transport, alongside non-motorised transport infrastructure, friendly with its inhabitants and visitors, caring for its most vulnerable citizens, with plenty of welcoming and vibrant public spaces, governed by all concerned administrative authorities working together in an integrated manner and in collaboration with the citizens, the private sector and the NGOs, using an expanded digital infrastructure and database system.

[5] These are: Craiova, Iași, Mediaș, Timișoara and Alba-Iulia.
[6] https://www.ebrdgreencities.com/assets/Uploads/PDF/GCAP_2-1_Methodology_January2022.pdf

1.2 Process for Bucharest GCAP Development

The project for the development of **Bucharest GCAP** was launched on September 13, 2023 at the ARCUB Hall in Bucharest, with the participation of EBRD representatives, city officials, including the Mayor, the Consultant Team and numerous stakeholders and citizens, including representatives of the six municipal sectors of Bucharest. The event gathered around 100 participating stakeholders, who were introduced to the GCAP process and the EBRD Green Cities programme.

The launch event was followed by a large stakeholder consultation during which, high-level priorities for the city were collected. The participants were presented with a short interactive survey which steered the discussion on the most pressing urban issues identified.

For the purpose of exchanging the necessary information, as well as for consultations throughout the project, a Technical Committee (TC) was formed at the City level, including representatives from the six municipal sectors/districts. The committee has been coordinated by the Green City Officer along the duration of GCAP development.

The stages for the development of the Bucharest GCAP are the following:

- establishing the baseline environmental performance of the city in the sectors of interests, based on an **analysis of the policy framework** and of the **technical assessment** of the sectors, using the performance indicators
- identifying the **priority environmental challenges** in each sector based on the technical assessment and consultations with the City and the stakeholders
- developing a **Green City Vision and strategic goals** based on the priority challenges
- translating the strategic objectives into short-term actions – **the long list of actions**
- prioritising the actions into the **short list of actions** based on sectoral consultation with the stakeholders at the City level, on consultant experts' opinion and on the survey conducted with the stakeholders in the large sense, including Bucharest's citizens
- developing a **detailed description of the GCAP actions**, including the technical, financial, institutional and cross-cutting aspects, i.e. social, gender, smart maturity
- drafting the **GCAP document.**

Figure 1 is a visual representation of the GCAP development process, including the steps described above.

Figure 1: Development phases of Bucharest GCAP

The development of the GCAP is based on two main reports produced as part of the city environmental baseline:

1. the **Policy and Urban Framework Report**, which analysed the policy framework governing the GCAP sector and
2. the **Technical Assessment Report**, which provides the technical analysis of the environmental topics with regards to their current state and of the GCAP sectors with respect to the pressures they exercise on the environment, as well as the policies responses to alleviate these pressures.

In addition, a **Gender and Social Inclusion Report** has been developed, presenting in detail the socio-economic profile of Bucharest, assessing the relevant gender and economic inclusion aspects for each of the GCAP sectors and providing recommendations on promoting these aspects at the level of each GCAP sector, including through the actions developed in the present document.

The process of the GCAP development had a strong **stakeholder engagement** component. Thus, over 4,000 stakeholders have been consulted at various stages of the GCAP development, through interviews, virtual and in-person meetings, surveys, workshops and written correspondence with the TC at the City level. The process of stakeholder consultations included representatives of the City, both at the municipality level and at the level of the six administrative sectors, representatives of the municipal public utilities, regional and national administration institutions (e.g. the Ministry of Development, Public Works and Administration), academia and research institutions, business associations and private sector actors, civil society organisations, local citizens' associations and individual citizens. A full list of stakeholders is contained in the Stakeholder Engagement Plan (SEP)[7]. Consultations have taken place in each of the four phases of GCAP development presented in Figure 1 and extended from project's inception in September

[7] https://paov.pmb.ro/docs/DLV_1_Bucharest_GCAP_SEP_final_en.pdf

2023 until August 2024 when the final GCAP actions was agreed upon with the City representatives.

The mode of consultation, timeline and the list of stakeholders contacted throughout the process of GCAP production have been established at the beginning of the project and laid out in the SEP, which has been updated as needed during the project. Table 3 summarises the consultation events.

Communication with the core stakeholders at the city level has taken place mainly via emails. Online meetings were scheduled regularly, every two weeks, for updates and discussions of the next steps in the process. The local coordination team has also kept close contact with the Green City Officer and his team at the municipal level, organized and participated in the in-person meetings. The surveys targeting the city's stakeholders in a large sense, including the general population of the city, where disseminated through emails, social medias of the municipality and of the General Mayor, and through the dedicated project website hosted by the municipality (https://paov.pmb.ro/).

Table 3: Summary of stakeholder consultations

Stakeholders' event	Date and place	Purpose	Categories of participating stakeholders	GCAP phase	Participants (% Female)
GCAP Launch and Public Visibility Event	13 Sep 2023 Bucharest: ARCUB Hall	Formal start of the GCAP process and introduction of the GCAP and EBRD Green Cities programme to the City and the stakeholder	City representatives; Representatives of the six districts; EBRD representatives; Consultant team; Stakeholders identified in the SEP	Inception	100 (53%)
Discussion with stakeholders: first stakeholder engagement event	13 Sep 2023 Bucharest: ARCUB Hall	Collect opinion of the stakeholders regarding environmental, infrastructural, including digital challenges of Bucharest and the social issues stemming from them	City representatives; Representatives of the six districts; EBRD representatives; Consultant team; Stakeholders identified in the SEP	Inception	100 (53%)
Survey as part of the first stakeholder consultation	29 Aug -22 Sep 2023 Alchemer online platform	Collect opinion of the stakeholders regarding environmental, infrastructural, including digital challenges of Bucharest and the social issues stemming from them	Representatives of the six districts; EBRD representatives; Stakeholders identified in the SEP	Inception	188 (46%)
Workshop presentation of the technical assessment results	27 Nov 2023 Bucharest City Hall	Present the technical analysis of the sectors to establish the baseline. Presentation held by the project lead accompanied by questions and discussion with the audience	Sectoral experts of the consultant team, the experts in the TC at the City level and selected stakeholders	Green City Baseline and Challenges	approx. 40
Sectoral focus groups	27 Nov 2023 Bucharest City Hall	Discuss the identified challenges for each sector following the technical analysis and collect further inputs from the selected sectoral stakeholders to establish the final prioritisation of environmental challenges	Sectoral experts of the consultant team, the experts in the TC at the City level and selected stakeholders	Green City Baseline and Challenges	approx. 40
Survey prioritisation environmental challenges and Green City Vision	14 Dec 2023 - 5 Jan 2024 Alchemer online platform	Prioritise environmental challenges of the city and collect proposals for the Green City Vision	All stakeholders of the city, including the general population of the city. The survey was disseminated by email and social media.	Green City Baseline and Challenges	753 (41%)
Interviews with the TC sectoral experts	5-13 March 2024 Online and in-person meetings per each GCAP sector	Fill the gaps in information and data relative to the results obtained by the consultant experts through desk research	Sectoral experts of the consultant team and the corresponding experts in the TC at the City level	Green City Baseline and Challenges	N.A.
Consultation with the TC for establishing the Green City Vision	21 May 2024 Online video-call	Agree on the vision statement and the strategic goals	Consultant team, EBRD representatives and the Green City Officer team	Vision and Strategic Goals	N.A.
Sectoral meetings with the City experts: short list of actions and sector prioritisation	29-30 July & 8 Aug 2024 Combination of in-person meetings at the City Hall and video-calls	Presentation of the actions in the long list of actions by the consultant sectoral expert to the City and discussion of actions themselves and the prioritisation proposed by the consultant expert	Experts of the TC at the City level, core consultant team and sectoral consultant expert for each meeting	Production of the GCAP	19 in total, with participants per sector varying between 5 and 9
Survey GCAP actions prioritisation	15-29 July 2024 Alchemer online platform	Prioritisation of actions from the long list of actions	All stakeholders of the city, including the general population of the city. The survey was disseminated by email and social media.	Production of the GCAP	2,971 (43%)

1.3 Structure of Bucharest CGAP

The GCAP document is structured according to the GCAP Methodology steps as follows.

- **Chapter 2** summarizes the **Green City Baseline.** This includes a qualitative and quantitative analysis of city's environmental performance, starting from the institutional and policy framework of Bucharest, with its socio-economic and gender implications, the city's financial performance and a technical assessment of its environmental challenges together with their prioritisations. The details of this analysis are presented in the Policy and Urban Framework Report and the Technical Assessment Report.
- **Chapter 3** presents the long-term **Green City Vision** and the short and medium-term **strategic goals** that guided the development of the GCAP actions.
- **Chapter 4** details the GCAP actions that the city should implement for each sector in order to achieve its medium- and short-term environmental objectives, accounting for the social and gender dimensions. The chapter begins with an overview of the 32 GCAP actions which are subsequently developed in dedicated sectoral sub-chapters.
- **Chapter 5** presents guidance for the implementation, progress and impact monitoring of the actions contained in this GCAP.

2 Bucharest City Baseline

Parliament Building

2.1 City profile

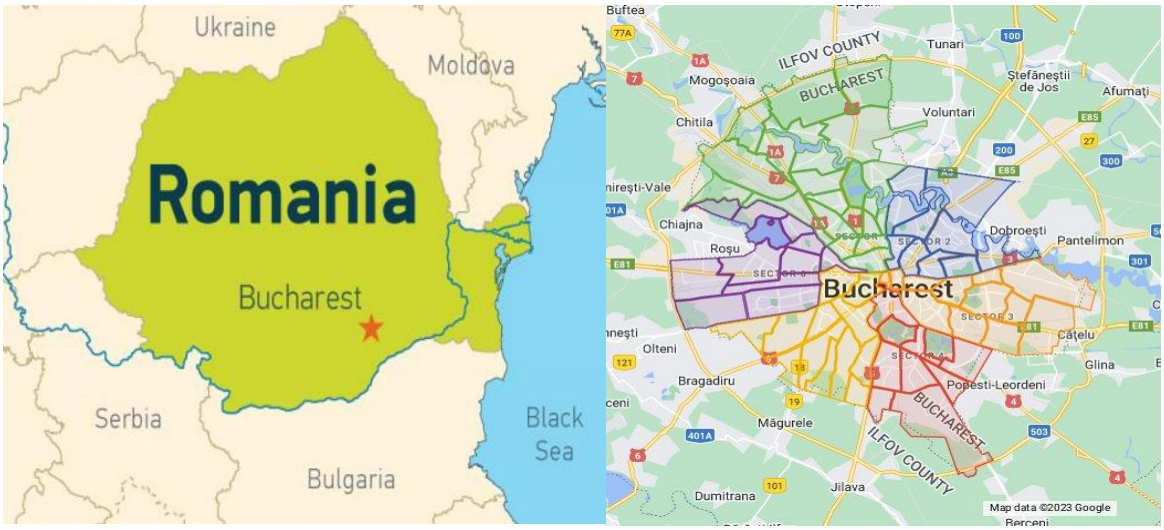
Geographic context

The city of Bucharest hosts around 2 million people[8] and it is divided into **six administrative units, referred to as sectors or districts**. Each sector is managed by a mayor and a local council, having specific local competencies such as ensuring maintenance and investment at local level, relating to secondary streets, parks, schools, and local utilities such as cleaning and waste management services. In addition to the six local administrations, Bucharest is governed by the General Municipality led by the General Mayor and the General Council consisting of 55 councillors. It is responsible for the main streets of the city and projects at municipal level, such as central heating, public transport, hospitals, as well as other big infrastructure projects. The sector mayors and the General Mayor, as well as the local and general councils are every four years elected by the citizens with official residence in Bucharest.

Bucharest is located in the **south-east of Romania**, in the Vlăsiei Plain, which is part of the Romanian Plain. To the East lies the Bărăgan Plain, to the West the Găvanu-Burdea Plain, and to the South, the city is bordered by the Burnaz Plain. The seven hills of Bucharest on which the city is built are the result of the fluvial erosion of the two main water courses that cross it, i.e., Dâmbovița River and Colentina River.

Bucharest is surrounded by 9 areas designated as forests and there are initiatives to maintain and / or extend them in order to establish the "Green Belt" of Bucharest. Figure 2 shows the map of Bucharest with its 6 sectors and the surrounding Ilfov county, together with its position within the country.

Figure 2: Geographical location of Bucharest



Source: Google Maps and https://maps-bucharest.com/bucharest-on-map

The surface area of Bucharest is 240 km^2, with a **built-up area of over 70%**. It is surrounded by Ilfov County, with which it forms one of the 8 Development Regions, the so-called **Bucharest-Ilfov Region (BIR)**. This is an area of 1,804 km^2 and it has approximately 2,300,000 inhabitants, with a daily transit estimated at 3,000,000 inhabitants. The Municipality of Bucharest is designated as an urban agglomeration, the metropolitan area having an additional 480,000 inhabitants, with numerous

[8] National census of Population and Households of 2021: https://bucuresti.insse.ro/populatia/

socio-economic and environmental connections and interdependencies with its neighbouring localities. The regions around Bucharest have transformed from predominantly rural to predominantly suburban since the 2000s, and this trend is continuing today.

Social and economic context

Bucharest is characterized by a **heterogenous population** which is largely reflected in its administrative division in the six sectors, with some sectors being richer (e.g. sectors 1 and 2) than others (e.g. sector 5). The city concentrates almost one tenth (9.8%) of the population with official residence in Romania. Its population density is of 9,004 inhabitants/km^2, which is nearly a hundred times greater than the density calculated at national level. The distribution of the population by age has a slight tail at age group 80+, with the highest proportions being of the ages 30-55. In fact, Bucharest has the highest life expectancy in Romania, being 2.4 years above the national average which is at 75.4 years of age[9].

In the last decade, a **shift of the population towards the satellite towns in the neighbouring county of Ilfov**, formerly a rural area[10], has been observed[11]. In fact, the border between the municipal area of Bucharest and the county of Ilfov is becoming increasingly blurry. Hence, a yet unknown number of people commute daily from Ilfov to the city for work. Therefore, though administratively independent, the developments in Bucharest and Ilfov are interconnected. This has triggered the development of some common strategy documents such as the Strategy for the Development of the Bucharest-Ilfov region 2014-2020 or the Regional Program Bucharest-Ilfov 2021-2027.

As the capital city of Romania, a European Union member since 2007, Bucharest is also the economic, financial, political, administrative and cultural centre of the country. In terms of economy, the capital city is the centre of the Romanian economy, accounting for around **25%** (or 28% together with the Ilfov country[12]) **of the country's GDP** and about one-quarter of its industrial production. In fact, BIR is the most developed region of Romania with a per-capita GDP of around EUR 49,200 in 2021 and a living standard representing 166% of the EU27 average[13].

Bucharest-Ilfov is the top region in terms of average disposable income, which is almost double that of the last-classified region of the country in terms of disposable income. BIR generates over 27% of Romania's GDP according to January 2022 statistics. In terms of employment, 1.4 million persons were in civilian employment, representing 88.5% of the region's labour resources. The unemployment rate as of 31 March 2023 was 0.9%, the lowest at national level, with only 13,300 unemployed persons.

Despite the leading position in economic terms within the country, the strategies and plans designed for Bucharest often overlook social inclusion due to the fact that the **relative wealth of the city skews the perception away from the socially excluded.** As such, many of the existing strategies and plans designed for Bucharest take social inclusion into account to a satisfactory degree, but the depth and breadth of this inclusion can be improved in future documents or revisions of the existing ones. This is so much more important as **Bucharest exhibits sizeable**

[9] Based on data from the 2021 national census of population and households: https://www.recensamantromania.ro/rezultate-rpl-2021/rezultate-definitive-caracteristici-demografice/
[10] The county of Ilfov was an agrarian and rural area during the communist time.
[11] See https://academic-accelerator.com/encyclopedia/ilfov-county and https://www.economica.net/recensamant-2022-populatia-rezidenta-a-bucurestiului-a-scazut-la-171-milioane-de-locuitori_637598.htm.l
[12] Based on Eurostat 2020 data: Gross domestic product (GDP) at current market prices by NUTS 3 regions [nama_10r_3gdp]
[13] Eurostat data Regional gross domestic product (PPS per inhabitant in % of the EU27 (from 2020) average) by NUTS 2 regions [TGS00006].

inequalities and social exclusion. For instance, various minority categories, such as the Roma population, are economically, socially and even culturally vulnerable, with problematic access to public infrastructure such as transportation, nurseries, kindergartens, schools, health system etc.

The unequal development of Bucharest is best described by the concept of Marginalized Urban Areas. Although BIR has recorded the lowest proportion of people exposed to the risk of poverty or social exclusion, being far below the national average, there are still considerable discrepancies among the six administrative sectors of Bucharest in terms of poverty. In 2023, 12.3% of the population of the BIR were at **risk of poverty**[14], which was the lowest among Romanian regions. However, this data is not disaggregated by gender, highlighting the need for collected disaggregated data at all levels to understand the needs of the city's population.

At the country level, there is a sizeable **gender gap within the Roma population** with 83% of Roma girls living at risk of poverty in comparison with 75% of Roma boys[15]. Moreover, the proportion of Roma living without tap water is also high in Romania (40%), but this a problem for a substantial part of the general Romanian population (21%)[16]. Moreover, 42% of Roma compared to 12% of people of other ethnicity have no access to electricity, running water or sanitation and only 24% of the Roma have a paved or a dirt road near their home.[17]

The **unemployment** rate in Bucharest, in 2023, was 2.8% overall and **2.5% for women**[18], the lowest at national level, with only 13,300 unemployed persons. Long-term unemployment was 18.5% overall and 7.7% for women. For young people, 15-29 years of age, the unemployment rate in 2021 was 15.7%. At national level, the share of young people (15-29 years of age) neither in employment, nor in education or training in 2023 was 19.3%, down one percentage point since 2021;[19] there is no available data at NUTS 2 level.

Smart and sustainable infrastructure development becomes a key issue for citizens' well-being and economic growth. A well-developed social infrastructure can have an important role in fighting poverty, improving citizens opportunities in having flexibility, mobility, in achieving equality and justice, in accessing public goods, and overall, in citizens' wellbeing. At the same time, if not considering the reality of social inequalities with respect to gender, class, ethnicity, disability status, sexual orientation and gender identity etc. in the development of the city, in designing public policies and infrastructure projects, different gaps can be perpetuated or even deepened. These include the gender pay gap, the regional disparities, the gaps in accessing different public goods and services (e.g. health and education), poor access to the decision-making process by people with disabilities, by Roma people, by the LGBTQIA+ community, by women etc.

The issues related to **inequality and economic inclusion** of the vulnerable categories of the city of Bucharest are tightly related to the infrastructure of the city, i.e. the GCAP sectors. Therefore, the current GCAP document takes a perspective that substantially integrates aspects of equity, diversity and inclusion, aiming to put people at the centre and ensure ownership of this action plan by city's inhabitants, in addition to the implementing authorities. Thus, the GCAP actions presented in this document have been developed with the view of improving the life of vulnerable groups (e.g. elderly, persons with disabilities, immigrants, minorities, women etc.) in Bucharest, by alleviating the risk of poverty and energy poverty, of street and public transport harassment, by improving their

[14] Eurostat Persons at risk of poverty or social exclusion by NUTS regions
[15] European Union Agency for Fundamental Rights, Roma Survey 2021 – Main results, 2023, p. 26
[16] European Union Agency for Fundamental Rights, Roma Survey 2021 – Main results, 2023, p. 56
[17] European Union Agency for Fundamental Rights' (FRA) Fundamental Rights Report 2018, The National Recovery and Resilience Plan, p. 86;
[18] https://www.statista.com/statistics/1177858/romania-unemployment-rate-by-region/
[19] Eurostat [edat_lfse_18]

labour market opportunities, by combating discrimination etc. These aspects are highlighted in a dedicated section in the description of each action in Section 4.

2.2 Institutional and policy framework

City Governance

According to the Administrative Code of Romania[20], the deliberative authorities for the local public administration (LPA) in Bucharest consist of the General Council of the Bucharest Municipality (GCBM) and the Local Councils (LCs) of the six Districts/Sectors. The General Mayor (GM) of Bucharest and the Local Mayors are the executive authorities for the LPA in Bucharest.

The GCBM approves the strategies for the economic, social and environmental development of the administrative unit – the Bucharest Municipality, as per art. 129 (3)(e) of the Administrative Code. The LCs are entitled to endorse strategies and "studies, forecasts and programmes for social-economic development, territorial organisation and urban management, including the participation to the local and regional development programmes, in accordance with legal requirements, which are to be approved by GCBM", as per art. 166(2)(c) of the Administrative Code.

It can be ascertained that the local councils of the districts exercise, partially, the same responsibilities as those of the GCBM, albeit limited within their administrative competencies. However, there are both overlaps and gaps between the specific competencies of the local councils of the districts and those of the GCBM. For example, the GCBM is responsible for the construction and maintenance of the main roads in the city, while the LCs are in charge of the secondary streets within their administrative borders. In other areas, such as health, education, culture, sport, social services for vulnerable persons, urban development, etc., their competencies overlap. Therefore, cooperation in promoting development strategies at Bucharest Municipality level is necessary.

Additionally, the Administrative Code regulates the relationship between the public administration authorities in Bucharest, as follows. First, the decisions of the GCBM and the regulations adopted by the GM are mandatory to the LPA authorities organised as districts/sectors of the Municipality of Bucharest. Second, the GM and the district mayors shall meet at least once per month, upon the request of the GM or at the proposal of at least 3 district mayors. The agenda of such a meeting can include discussions on how the decisions and the legislative provisions of the GCBM and of the GM are being implemented at the district level, reciprocal information on the activities at the district level, aiming to ensure their coordination for the well-functioning of the Bucharest Municipality as a whole. The Prefect of Bucharest, who is the representative of the Government in the local administrative structure, may also be invited to these meetings. Third, the district mayors are entitled to attend the meetings of the GCBM and may have interventions during the debates.

Table 4 describes the **decision-making power of the municipality** in each of the GCAP sectors, based on existing legislative and policy framework, in terms of ownership and operations, setting and enforcing policies, budget and revenues, and vision setting respectively. The decision-making power is assessed using traffic-light coding: **green colour** represents "strong" power; **orange colour** represents "partial" power; **red colour** represents "limited" power in the respective areas.

[20] Government Emergency Ordinance (GEO) no. 57/2019: https://legislatie.just.ro/Public/DetaliiDocumentAfis/215925

Table 4: City's powers by GCAP sector

Sector	Own and operate	Set and enforce policies	Budget and revenue	Vision setting	City's decision-making power and influence on investment
Transport					The City is responsible for organizing public transportation
Buildings					Approves the general urbanistic plan; approves zonal urbanistic plans; issues construction permits and follows up on the implementation of requirements[21]
Energy					Heat supply through District Heating Systems; natural gas supply; public lighting
Water					Water supply; wastewater collection, treatment and discharge; rainwater collection and evacuation
Solid Waste					Waste management
Land use					Endorses or approves, in accordance with the law, the territorial planning and town planning documentation of localities

Performance of the policy framework

The results of an analysis of the **environmental performance** of the existing **policy framework** governing the environmental areas affected by the GCAP sectors are summarised in Table 5 below. The performance is accessed using a traffic-light coding: **green colour** implies that policy framework exists, and it is well implemented, with no significant need for further expansion; **orange colour** means that a policy framework exists, but implementation challenges have been observed and/or existing policies where not sufficient to solve the issue at stake; **red colour** codes the situation in which a policy framework is non-existent.

Relevant for the policy framework of the city of Bucharest and for its GGAP is that District 2 of the city has been selected in April 2022 as one of the 112 cities that are part of the **EU Mission for 100 climate-neutral and smart cities by 2030**.[22] As part of this mission, the District receives dedicated technical assistance and support from the Mission Platform to reach climate neutrality by 2030. The technical assistance has included consultations with sectoral stakeholders in September 2023.[23] The sectors concerned by the consultation were urban transport, waste management, green urban planning, industry and constructions. In October 2024 Bucharest, including all of its six districts, has been selected as one of the 10 Romanian cities to be part of a **national Mission 100 platform** that mirrors the EU Mission Climate-Neutral and Smart Cities.[24]

As part of the EU Mission 100, District 2 has committed to climate neutrality by 2030, through its Climate City Contract. For this, the District has elaborated an Action Plan for Climate Neutrality by 2030,[25] with actions for the energy sector, transport, waste and circular economy, green infrastructure and nature-based solutions, built environment and cross-cutting actions. The action plan contains 26 actions in total.

[21] According to art. 129 and 166 of the Administrative Code (Emergency Government Ordinance no. 57/2019)
[22] https://netzerocities.eu/mission-cities/
[23] https://www.ps2.ro/index.php/primaria-sectorului-2/presa/stiri/965-sectorul-2-este-parte-a-proiectului-100-de-orase-verzi-si-sustenabile-derulat-de-comisia-europeana-invitam-expertii-la-masa-dialogului
[24] https://m100.ro/selected-cities
[25] https://public.ps2.ro/Administratie%20Publica%20Locala/HCLS2/2024/H309-2024.pdf

Table 5: Environmental performance of the policy framework of the city

Environmental sector	Arguments for the qualification of the performance
AIR QUALITY	There is no valid Integrated Plan for Air Quality for Bucharest Municipality and a Plan for Maintaining of Air Quality for Bucharest Municipality. Following the adoption of the MO no. 685/2023, MEWF has informed the Bucharest Municipality that the air quality plans shall be initiated as follows: (1) an *Integrated Plan for Air Quality for the indicators: NO_2 and NO_x, PM_{10} and $PM_{2,5}$; (2) a Plan for Maintaining the Air Quality for the indicators:* SO_2, CO, C_6H_6, Pb, As, Cd and Ni. According to the annual reports on the implementation of the 2 Plans previously in force (*I.e.,* the Integrated Plan for Air Quality for Bucharest Municipality 2018-2022 and the Plan for Maintaining of Air Quality for Bucharest Municipality 2018-2022), Bucharest Municipality failed to fully implement the plans. Additionally, EU referred Romania to the European Court of Justice for failing to implement Air Quality Directive 2008/50/CE, Articles 13 (1) & Annex XI and 23(1) & Annex XV – PM_{10}, for Bucharest Municipality. Romania has been condemned by the Court in Case C-638/18 for systematically and constant exceedance of the limit values for micro particles (PM_{10}) in Zone RO32101 (Bucharest, Romania) at least for 2007 – 2016.
WATER BODIES, DRINKING WATER	Although there is no specific requirement for Bucharest Municipality of having a specific Plan for water management at local (municipality) or regional (Ilfov County) level, all the legal requirements concerning the water bodies and drinking water are currently met. However, given the particularities – 2 rivers crossing the Capital (Dâmbovița and Colentina), several lakes, the legislator (either at national or regional / local level) could take into consideration developing such plans.
SOIL	Bucharest does not have a strategy for soil protection as such, even if measures are being provided in different pieces of regulation, strategies and or action plans, such as the "Bucharest Integrated Urban Development Strategy 2021-2030", which mentions "REDUCTION OF POLLUTION AND IMPROVEMENT OF AIR, WATER AND SOIL QUALITY" as sectoral program under the strategic Objective 3. Sustainable City; however, there is no measure or action dedicated to soil pollution prevention, soil protection or regeneration, as such. Research performed sporadically during the most recent decade, with respect to soil pollution with chemical substances[26] or with biological pathogens[27] highlight the status of pollution of soils in Bucharest and map changes produced between 2015 and 2020, raising concerns about the increase of polluted areas. pH of soil, Fe, Cu, Pb, Zn, Cr, Cd, Chlorides content in soil are increasing. At regional level, there is no special vision with respect to soil, especially if urbanization on agricultural land and development on horizontal is considered; however national legislation (Order no. 756/1997 for the approval of the Regulation on the assessment of environmental pollution, Law no. 74/2019 regarding the management of potentially contaminated sites and contaminated sites) offer the legal framework with respect to soil pollution. Also, the National sustainable Development Strategy and Action Plan includes objectives with respect to soil, including prevention of soil degradation and erosion and soil restoration.

[26] The current state of the quality of urban soils in Bucharest, https://doi.org/10.21698/rjeec.2020.225
[27] Soil Contamination with Canine Intestinal Parasites Eggs in the Parks and Shelter Dogs from Bucharest Area https://doi.org/10.1016/j.aaspro.2015.08.103

WATER USE	Bucharest does not have a strategy for water supply and use as such, but "Bucharest Integrated Urban Development Strategy 2021-2030", includes "Reduction of pollution and improvement of air, water and soil quality" as a sectoral program under the strategic Objective 3. Sustainable City Development actions with respect to water supply. Also, the city needs to have a Water safety plan, as requested by the Law no. 458/2002. Responsible for the preparation of such a plan is the water producer, as per the provisions of the Order no. 2.721/2.551/2.727/2022 regarding the approval of the General Framework for water safety plans, as well as for establishing the responsibilities of the competent authorities and water producers and/or distributors regarding the preparation, evaluation and approval of water safety plans. At regional level, there is no special vision with respect to water use in cities.
OPEN / GREEN SPACE	Although the law requires it and over the years the municipality has been fined for this, Bucharest City Hall still does not have a Register of Green Spaces today. Currently, there is a Registry that was created in 2011 through a service contract, not updated and not approved by the General Council of the Municipality of Bucharest. In 2020, the Environmental Guard of the Municipality of Bucharest fined the General City Hall with 100,000 lei for the lack of the Register of Green Spaces and, in 2021, the Court decided that the Municipality must create/approve the Register. Also, in 2021, the institution of the Public Lawyer recommended the Municipality to make the necessary diligences and ensure the minimum of 26 sqm of green space per inhabitant. The problem of preparing the Registry and implementing the necessary actions is even more difficult to solve as the municipality lacks an updated General Urbanistic Plan (GUP) and or an up-to-date cadastre registry. With respect to GUP, the preparation is currently under development, and the expected completion is year 2026. At Region level, there is no special requirement with respect to green space/green infrastructure and the national level requirements apply: Law no. 24/2007 covering the regulation and administration of the green space from the interior of the localities, republished, with subsequent changes and additions. Even though at national level, there is, basically, no city that satisfies the requirement of 26 sqm/capita, this should rather be of concern than give any comfort and taking no action.
BIODIVERSITY	Bucharest Municipality does not have a policy or specific legislation covering the elements related to biodiversity, management of natural protected areas, conservation of natural habitats, flora and fauna. However, in 2016, by Governmental Decision – GD no. 349/2016, it has been established *the first natural urban park in Romania, Văcărești Natural Park*, which is located 5 km from the Bucharest city centre, being the biggest and compact green area in Bucharest, covering more than 183 ha. The draft for amending the Emergency Government Ordinance no. 57/2007 (currently the framework law for biodiversity and natural protected areas in Romania), approved with amendments and additions by Law 49/2011, introduces, *inter alia*, a new concept – natural **urban** protected areas and other NPAs established within the administrative territorial units (ATUs). Local Councils, e.g., are entitled to establish natural urban protected areas and NPAs of local interest. For the NPAs of national interest, the endorsement from the Local Councils is part of the documentation for the establishment of such NPA, but it has a consultative attribute. NPAs of local interest can be established only on the public or private property of the ATUs. This is however a draft EGO. National Strategy on Forestry (2030), approved by Governmental Decision no. 1227/2022, is promoting some objectives and measures relevant to the urban environment, such as: Objective 7.6. Increasing of the urban and peri-urban forests so as to ensure the connectivity of the landscape, by the end of 2026. One of the envisaged measures is referring to installing of urban / peri-urban forests and establishing green corridors. This concept has been further developed within the draft for the New Forest Code, which is currently under public consultation. Other projects included in IUDS are also noteworthy, such as the creation of a network of protected urban natural areas (e.g. Petricani Meadow and Saulei Valley) or the support for the protection, conservation and promotion activities of the Văcărești Natural Park of district 4.

CLIMATE CHANGE MITIGATION	Cities in Romania do not have mandatory legal targets for the decrease of their GHG emissions, however they are affected by the policies regulation the different sectors of activity (i.e., The Long-Term Strategy, the National Energy and Climate Plan, the Energy Efficiency in Buildings Directive, etc). Cities can join different EU/International initiatives and assume voluntary targets. Five of the six sectors of Bucharest and the municipality have signed the Covenant of mayors[28], assuming the minimum required targets (i.e., 40% by 2030): Sector 1 (January 29, 2009), Sector 2 (February 20, 2018), Sector 3 (August 25, 2017), Sector 4 (January 22, 2018), Sector 6 (January 30, 2018) and the Municipality of Bucharest (May 16, 2011). However, most of them are outdated, and there is no public information on the intention of updating such plans. Moreover, there is no public information on the results of the monitoring of the implementation of the plans. Recently, Bucharest Municipality has been selected to join the M100 mission (https://m100.ro/home) and will be supported to develop the Climate Change Contract (CCC), that will accommodate the commitments, necessary investments and action plans to achieve climate neutrality by 2035. The CCC will also include the CCC already developed by Bucharest – Sector 2.
CLIMATE CHANGE ADAPTATION	There is no valid climate change adaptation plan, neither at Bucharest Municipality level, nor at district level, containing adaptation measures, although, for example, the extreme weather events increased in frequency and intensity, as well as in recovery costs. There is no preventive and visionary approach towards adapting to climate change and increasing the resilience of Bucharest Municipality in the context of climate change.

[28] https://eu-mayors.ec.europa.eu/en/signatories

2.3 Municipal Finance

The municipal budget of the City of Bucharest is approved annually by the General Council. Similarly, the six municipal sectors or districts set their yearly budgets through a decision of their respective local councils.

An analysis of the most recent available financial data retrieved from official municipal sources[29] shows that the revenues (left picture in Figure 3) of the Municipality of Bucharest **have increased steadily since 2018.** This suggests that the city's financial health improved over time. In 2018, total revenues amounted to 7.2 billion RON (about 1.5 billion EUR) and reached almost 12 billion RON (about 2.4 billion EUR) in 2023. At the same time, the expenditures (right picture in Figure 3) of the Municipality of Bucharest **have consistently increased over the past five years,** reflecting the Municipality's expanding financial commitments.

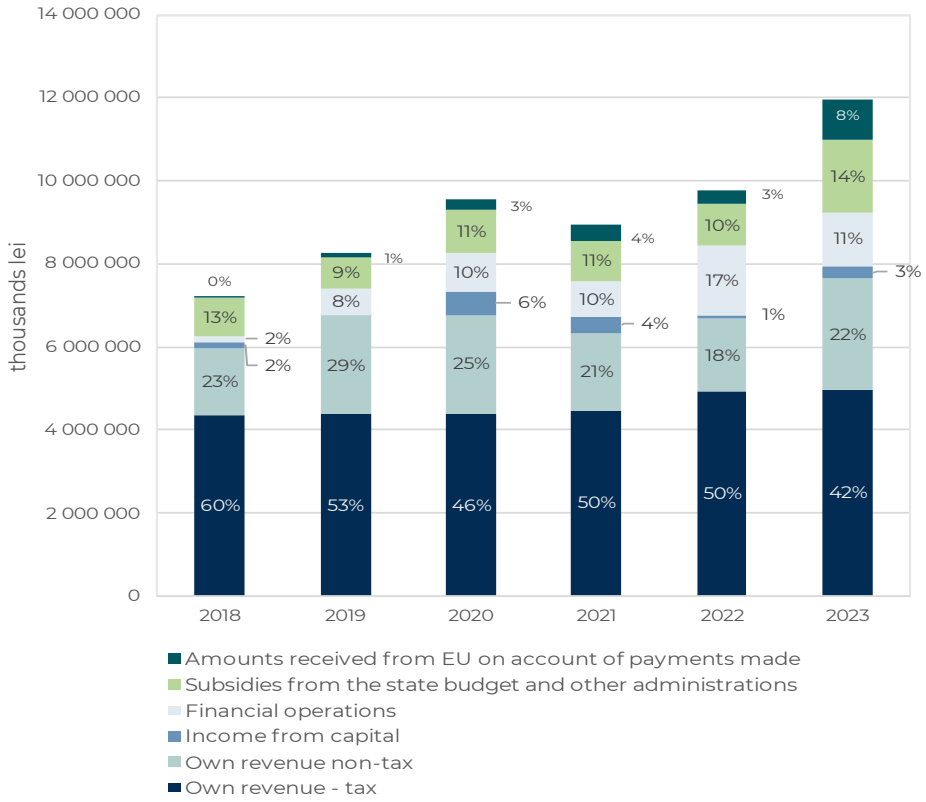
While increasing in absolute amount since 2018, the share of own revenue from taxes has had a decreasing tendency, but it remains the main source of revenue for the municipality. Regarding revenues from taxes, it is important to consider that a proportion of income is not under the control of the local authority but is collected centrally and redistributed. Furthermore, it is worth noting that local taxes and duties, such as property tax, are collected separately by the six administrative sectors and serve as revenue sources in their budget. Additionally, the absence of a special-purpose tax in Bucharest is important, which could potentially serve as a funding source for specific environmental initiatives.

Several other sources contribute to the revenue of Bucharest's municipality as seen in Figure 3, but the amount received from EU funds has steadily increased over the 5 years considered, both in absolute and relative value, with a record share of 8% in 2023. Furthermore, independent credit rating[30] analysis indicates that the Municipality has a reasonably stable financial situation with an ability to manage its debt obligations over the long term.

[29] https://pmb.ro/buget/arhive/get-anual-buget-list/2022
[30] See Fitch Affirms Romanian City of Bucharest at 'BBB-'; Outlook Stable.

Figure 3: Evolution of the budget of Bucharest Municipality, 2018-2023

Revenues



Expenditures

Current expenditure, which covers day-to-day operational costs and routine expenses, has consistently represented the largest portion of total expenditures, ranging between 77% and 88% in the 5 years analysed. Starting in 2018, the share of these expenses has gradually increased to 88% in 2021 before settling at 78% in 2023. The most significant shares of the total current expenditure are allocated to goods and services (19% of total expenses), grants (19%) and staff-related costs (18%).

Several conclusions related to the financial independence and capability of the Municipality of Bucharest, that should be considered in the implementation of the GCAP actions, notably regarding the potential mechanisms and sources of funding for the priority actions are:

- The Municipality's achievement of a balanced budget in 2022 and 2023 reflects cautious financial management during these two years. It indicates responsible budgeting, reducing reliance on external resources for covering expenditures. The stable outlook suggested by credit rating analysis shows the city's financial situation will remain relatively steady in the near future[31].
- The Municipality's reliance on income tax and specific transfers from the state budget make the municipal revenues uncertain, as they are subject to annual changes in the tax code. Considering Fitch's assessment of limited flexibility in local taxes, exploring new revenue avenues like foreign capital investments is crucial.
- The city has some flexibility to adjust spending, being able to free up resources for other expenses. However, it is noteworthy that this flexibility is subject to a discrepancy between sectors' revenues and their obligations in delivering services. Specifically, the absence of sectoral contributions to subsidies, such as for district heating, public transport or hospitals, underscores the limited capacity of the City of Bucharest for investment expenses relative to the sectors.
- There is potential for additional financial operations: The analysed data showed a significant growth in financial operations, such as loans and external payments. Leveraging additional financial instruments effectively can provide additional resources for investment in priority areas.
- There is potential for more EU Funding: The Municipality's access to EU funding sources has increased in the past years. To enhance financial capability, the municipality can continue seeking EU grants and aligning the GCAP measures with EU priorities.

2.4 Findings from the technical analysis of GCAP sectors

This section provides a short summary of the sectoral technical analysis detailed in the *Technical, Risk and Vulnerability and Smart Maturity Assessment* report. For each GCAP sector, the section presents the performance of its governing policy framework and the technical overview of the sector, including risk and vulnerabilities pertaining to city's resilience, as well as smarty maturity, where applicable. This information is based on the results of the analysis of the state, pressure and response data collected as part of the technical assessment of the environmental baseline. The section concludes with summarising the priority environmental challenges and key sectoral challenges identified by the sectoral analysis.

[31] See Fitch Affirms Romanian City of Bucharest at 'BBB-'; Outlook Stable.

Urban transport

Governing policy framework

Bucharest public transport is split among three surface transport modes – tram, bus and trolleybus – and an underground metro network. Surface transport is covered by four operators – Societatea de Transport Bucuresti (STB) SA, STV SA, Ecotrans STCM SRL and Regio Serv Transport SRL. STB SA is the main transport operator at the urban level, while the other three operate bus fleets at regional level. STB SA has one of the most extensive transport networks in Europe, operating on routes with a length of 1,651 kilometres and a fleet of over 2,250 vehicles, namely 1,534 buses, 500 trams and 265 trolleybuses. STB is a public company, and its two shareholders are the Bucharest General Municipal Council and the Ilfov County Council.

The only other urban operator is the metro operator Metrorex SA, a state-owned company, operating 5 underground rail routes on 77 kilometres with 80 trains. The Ministry of Transport, as a majority shareholder in Metrorex SA is also the regulator of the metro company.

Most of the current and future projects seeking to develop and extend the surface public transport and non-motorised transport system in Bucharest and the region are implemented by the **Bucharest City Hall**. Bucharest City Hall is developing, among other things, projects aiming at informing passengers in public transport stations, modernizing and extending the intelligent signalling system in intersections, supplementing the vehicle park for urban and metropolitan lines and upgrading tram lines.

Currently, the municipality of Bucharest **does not regulate the access of highly polluting vehicles** on its roads. To date there has only been one initiative to introduce a low emissions zone, but the municipality abandoned it in 2020, ahead of local elections, due to public opposition.[32] However, a **new sustainable urban mobility framework** (Law no. 155/2023) has come into force at national level and Bucharest is among the cities obliged to introduce a low-emission zone. It will be up to the municipality to design it in a way that brings down emissions from private transport, therefore regulating the access of highly polluting vehicles in the city.

While Bucharest itself has **no fiscal incentives** in place **for the acquisition of energy efficient vehicles**, the inhabitants of Bucharest have access to **national programs for the acquisition of energy efficient, hybrid electric or electric vehicles** through two programs aiming at the renewal of the car park, Rabla Clasic[33] and Rabla Plus[34]. Another instrument is offered to those willing to scrap two cars in exchange for the purchase of an electric vehicle (EV) or a plug-in hybrid EV (PHEV). In 2023, a new program was put in place at national level[35], aiming at scrapping 30,000 old polluting vehicles. In Bucharest, only Sector 6 participated in the program, scrapping 5,000 old cars.

At the end of September 2023, the Municipality of Bucharest announced **an investment of RON 17.9 million for installing 50 public charging stations** with 2 connections each, of 50 kW direct

[32] https://www.hotnews.ro/stiri-administratie_locala-23683139-primarul-gabriela-firea-renunta-vinieta-oxigen-decizia-trebuie-validata-consiliul-general.htm
[33] https://www.afm.ro/rabla_autovehicule.php
[34] https://www.afm.ro/vehicule_electrice.php
[35] https://www.afm.ro/casare_auto_uzate.php

current and of 22 kW alternative current, respectively, and with simultaneous charging possible at capacity, across 11 parking sites. The completion period is 15 months, of which two months for design and 13 months for execution. Additionally, in July 2023, the municipality of district 6 has announced an investment of RON 8.3 million for the installation of 40 public charging stations in 28 locations across the sector. Sector 4 has also announced that it will install 44 charging stations for an investment of RON 8.5 million. Bucharest Municipality has also **simplified the process for installing public and private charging stations** in the city with a regulation that was voted at end of May 2023, whereby the works for the location and connection to the electricity supply network can be carried out without a construction permit, as long as it does not endanger traffic.

Investments in much needed **alternative transport infrastructure** such as bike lanes are late to materialize, leaving the city with only a few kilometres of poorly connected bike tracks[36]. However, the municipality has drawn up a **plan to update and invest in well-connected bike lanes across the city**.

The city is also investing in new acquisitions and refurbishments to supplement and renew the public transport fleet by acquiring 100 new trams and aiming to recondition 120 older ones, buying 100 new electric buses and 100 new trolleybuses already delivered, plus 22 new trolleybuses to be acquired. The city is also renewing trams tracks on some routes. **EU funding and national funding** has also been awarded for the **extension of the underground rail system** with a new line that will link Bucharest with Otopeni International Airport. Regarding the promotion of public and alternative transport thus far the campaigns of the Bucharest Municipality were either ineffective or backfired. For instance, promotional campaigns ran only on video screens inside the buses of the municipal transport company STB for people already using public transport.

The **ticketing** for the surface public transport system was **renewed in 2021**, when a new 90-minute temporal fare was introduced on all urban, regional and express lines. The public transport operator STB and the metro operator Metrorex also introduced **integrated tickets**, and an e-ticketing system was developed.

The municipality is also planning to implement a **new intelligent traffic management system** that will give priority to public transport. The project is financed through the National Recovery and Resilience Program with 25 million euros. Bucharest currently has an intelligent traffic management system that was developed between 2007 and 2008, but it only covers half of the intersections in Bucharest, it was never fully operational, and it was constantly underfunded, despite a high initial investment.

Technical overview

Based on the total number of passenger trips in 2022, operated by STB SA and the underground operated by Metrorex SA, the **modal split** for public transport trips shows that 52.5% of trips were completed with the bus, followed by tram with 28.7%, metro with 12.7% and trolleybus with 6.1%.

The **average age of the car fleet** for Bucharest was 12.4 years in 2020[37], according to calculations based on car park data from the General Direction for Driving Licences and Car Registration (DRPCIV). For comparison, at the end of 2023, the age of the car park was 13.3 years. This is part of a steadily increasing trend since 2012, when the average age of the car park was 10 years.

[36] https://www.zf.ro/economia-verde/analiza-zf-pagina-verde-piste-biciclete-lungime-32-kilometri-21764603
[37] The average age of the car fleet was calculated as a weighted average from the weighted sum of the different age categories over the total number of cars for every year.

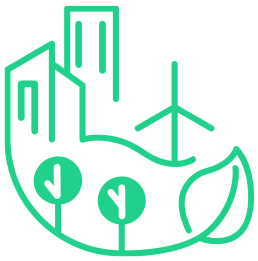
Furthermore, the **percentage of diesel cars** registered in Bucharest has also increased from 36.9% in 2012 to 43.5% in 2020 and has decreased to 39% at the end of 2023. The share of EVs or hybrid EVs as a percentage of the car fleet was around 2% in 2020 and 8% at the end of 2023, showing a moderate level of adoption for cars running on alternative energy.[38] A further disaggregation shows that the adoption rate of EVs in 2023 stands at 1.2% and that of hybrid EVs at 6.8%. This is a significant discrepancy, because the uptake of non-polluting zero emission vehicles is actually low. Concerning the choice of **transport mode** of the commuters, data from a 2019 survey[39] shows that 38% of commuting trips take place with a private car. The latest available data for the percentage of total **trips taken with a private means of transportation** was at 43% in 2023, according to the latest iteration of the Sustainable Urban Mobility Plan, which is a considerably high share. The modal share does not reflect commuting trips by private transport that originate outside of Bucharest, which is safe to assume has a significant impact on the modal share of private trips. In fact, in Bucharest there is a growing number of cars per capita as well as per household. The **number of vehicles per household** has also increased from 1.07 in 2012 to 1.38 in 2020[40], while the **number of vehicles per capita** was already high in 2012 with a value of 0.42 growing to reach 0.59 in 2020[41]. Both the number vehicles per capita and per household remain steady through 2023. The ownership rate for the region Bucharest-Ilfov is even higher with 0.65 vehicles per capita and 1.5 vehicles per household. Given the share of private trips, we can deduct that private transport is worryingly becoming the norm for Bucharest, leading to congestion and added pressure on the environment and overall, on the quality of life for its citizens. As mentioned above, STB has a very good coverage of the city. This is reflected in the high percentage of the city's population with **access to public transport** within a 500-meter distance. According to a 2020 study by the European Commission, this percentage is approximately 90%, well above the international standard of 80%. Nevertheless, road congestion remains a major issue in Bucharest and is partly responsible for an increased use of private transport trips. Data available for 2019 shows that the **average speed**[42] at rush hour was 14 km/h[43] and the daily average for busses was around 13 km/h, which are significantly below the international standards of 30 km/h and 25 km/h, respectively. Therefore, we can safely assume that even though public transport has visibly improved in terms of availability during the past years, this has not prevented the increase of private trips. The low performance of public transport in comparison to private car usage can be explained mainly through the poor accessibility of public transport with issues around travel times and predictability, low frequency, low efficiency of routes, and poor access to public transport stops and connectivity.

Although, as shown above, the municipality is investing in the renewal and modernisation of its public transport service, the team of consultants could not identify any planning, nor any indication of measures envisioned for ensuring the resilience of the bus and rail transit in Bucharest in case of disasters. As such, it can be concluded, that **emergency public transport systems in case of natural disasters are not in place** in Bucharest.

[38] For the share of total passenger car fleet run by alternative energy only hybrid electric and full electric vehicles were taken into account – no fossil alternatives, such as LPG.
[39] Working Habits and commuting patterns 2019, Cushman & Wakefield | Echinox | https://cwechinox.com/insights/working-habits-and-commuting-patterns-2019/
[40] The red benchmark is at 1, while the green benchmark is at 0.5.
[41] For orientation, the red benchmark indicator starts at 0.4, with a green benchmark at 0.3 and below
[42] Working Habits and commuting patterns 2019, Cushman & Wakefield | Echinox | https://cwechinox.com/insights/working-habits-and-commuting-patterns-2019/
[43] Strategia STB SA – 2020-2030, page 25, Fig. 17 | https://www.stbsa.ro/docpdf/STRATEGIA%20STB%20SA%20-%202020-2030.pdf

Energy

Governing policy framework



According to its **Municipal Energy Strategy** from 2008, by 2020 Bucharest was planning to have a carbon neutral supply of heating and hot water and reduce its transport emissions by 50%, through energy savings (45% savings on existing demand), and production based on renewables[44]. These objectives have not been achieved. Meanwhile, the strategy has become outdated, lacking a monitoring and implementation framework. To date, none of the measures to diversify the sources of heating supply from gas to low-carbon forms of energy has been implemented, with combined heat and power (CHP) plants providing most of the heating. Some of these CHP plants are located close to the heat demand areas[45], which allows them to be used effectively and increases the interest to convert them into non-fossil fuels-based generation units. However, the major residential and commercial developments in the North part of the city lack adequate local CHP supply.

At national level **there are some fiscal incentives for investments in renewable energy facilities in private buildings**, including a lower VAT rate for individuals who install solar PV in their houses compared to the VAT rate for companies and a subsidy scheme for individual households ("Casa Verde" programme), albeit with significant implementation delays. However, no such measures exist at municipal level, unlike other municipalities in Romania where local property tax deductions are possible if the building owner invests in green energy. At the level of the General Municipality of Bucharest, compared to other municipalities, **investments in renewables remain quite low** (e.g. limited investments in municipal buildings). There was previously a green certificate scheme, at national level, to incentivise investments in renewables. This scheme has been stopped a few years ago and it is expected to be soon replaced by a Contract for Difference scheme.

According to a 2022 report of the Romanian Energy Regulatory Authority[46],[47] is realising its planned investment in the electricity distribution network and by limiting the number of interruptions compared to other DSOs. The same is not true for the heat DSO which realise only 20% of the planned investments.

Romania has an **electricity supply emergency plan**. However, desk research and discussions with the stakeholders at the level of the municipality suggest that a similar plan **does not exist at municipal level**. In particular, there is no mention of investments for disaster resilience in the DSO network development plan, and the TSO plan only has minor mentions of such investments.

Technical overview

About 12% of the electricity consumption at national level is consumed in Bucharest, which is slightly higher than the national average. Moreover, the energy demand at city level is steadily

[44] Solar heating systems, waste-to-energy facilities, decentralized CHP based on bio-oil, peak-load boilers based on bio-oil and heat pumps.
[45] Heat Roadmap, Aalborg University, 2018.
[46] Raportul privind realizarea indicatorilor de performanţă pentru serviciile de transport, de sistem şi de distribuţie a energiei electrice şi starea tehnică a reţelelor electrice de transport şi de distribuţie pe anul 2022 (page 69).
[47] This is Rețele Electrice Muntenia, part of PPC Group.

increasing, while all injection lines that enter the city are working at full capacity. Despite this, the **electricity grid is well adapted** to supply electricity to end-use consumers, as interruptions are limited, and have decreased over the last decade, despite the **advanced age of the grid**. It is estimated that more than 90% of households in Bucharest have an authorised connection to the grid, as a still unknown number of households with no electricity connection or with an informal electricity connection remains unknown[48].

Data provided by the National Energy Regulator Report for 2022[49] shows that the **electricity network is vulnerable to extreme weather events**. An important reason for this is that over 36% of the electricity distribution network at city level consists of aerial lines, which are highly vulnerable to natural hazards, all the more since less than 29% of low voltage lines are newer than 20 years.

Bucharest hosts **very limited renewable energy production assets for electricity and none for heat**. According to the Integrated Urban Development Strategy 2021-2030 (IUDS), of the total installed power of 654 MW only 12 MW is renewable, i.e. solar, though this is likely to have increased in the past few years due to the massive increase in the number of prosumers. Several network development projects in and around Bucharest have been identified by the Transmission System Operator (TSO) Transelectria, as well as ideas related to electricity storage as future development solutions.

Regarding the **level of digitalisation** of the sector, a few things need to be considered. First, the share of installed smart meters is increasing. According to IUDS, 4% of industrial consumers are equipped with a smart meter. Second, the level of automation of the electricity system, necessary for the penetration of electricity from renewable sources, can be expected to be hight in the transformation posts, provided that 79% of them have been installed after 2000 in Romania. However, the opposite can be stated about the low- and medium-voltage distribution power lines, as most of them have been installed during the 1960s to 1980s.

The **quality of District Heating System (DHS) in Bucharest is weak** (77% of the heating distribution network is older than 30 years, with losses amounting to 36.7% and 1,813 failures in the primary heating network in 2021), leading more and more end-use consumers to disconnect. Less than 50% of the households in Bucharest are still connected to the DHS, according to IUDS, but this percentage is still higher than the country average. In 2021, the district heating operator registered 2,568 disconnections, 3,580 in 2022 and in 3,822 disconnections in 2023, according to data provided by the City. The DHS consists of centralized sources and accompanying pipes, and of 46 neighbourhood-level sources, with their accompanying distribution system. The system provides 72% of the necessary heat at municipal level[50], with the remaining need being covered primarily through individual natural gas boilers. In turn, the number of new connections to the DHS remains insignificant, diminishing every year: 50 new connections in 2021, 33 in 2022 and 26 in 2023, according to data provided by the City. This could change in the near future as modernisation works of the heating network are underway. The most recent investment project

[48] The number of households with no electricity connection or with an informal connection, at national level, ranges from 55,000 to 110,000.
[49] Raportul privind realizarea indicatorilor de performanţă pentru serviciile de transport, de sistem şi de distribuţie a energiei electrice şi starea tehnică a reţelelor electrice de transport şi de distribuţie pe anul 2022
[50] Source: 2023 Strategy for Supplying District Heating to Consumers in the Municipality of Bucharest

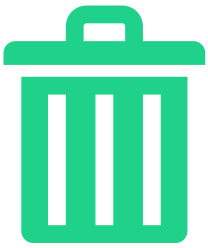
(RON 1.1 billion[51]) is expected to lead to 22% loss reduction, through the rehabilitation of 212 km of heating transport pipes[52].

At the same time, **the share of renewable energy sources** in the DHS **remains zero**, the supply currently consisting entirely of natural gas. Investments in renewables for the district heating sector in Bucharest are nearly non-existent in contrast to some Western EU countries, though the municipality has been assessing the potential for geothermal energy. According to the 2023 Strategy for Supplying District Heating to Consumers in the Municipality of Bucharest, the solar potential of Bucharest is also relatively high, and could be used both for electricity production and hot water preparation. The same document also foresees municipal waste as a potential source for CHP production at municipal level, while also looking into the potential of large-scale heat pumps. The strategy pleads for the need to do pre-feasibility studies for each of these options.

Over two thirds of the heating cost is subsidized by the municipal central budget[53], and the residents of Bucharest pay one of the lowest heating tariffs in Romania. The analysis comprised in the aforementioned strategy indicates that, should households pay a non-subsidized tariff (of 800 RON/Gcal plus VAT) affordability would fall below the 20% threshold even for households with incomes above 6,200 RON/month. This means that the intention expressed in the 2008 in the Municipal Energy Strategy to align costs and prices and eliminate blanket subsidies has not been achieved. The **dire financial situation of the municipal district heating company** is due to this imbalance between costs and tariffs, but also to other elements related to the methodology for setting end-user tariffs.

Solid Waste

Governing policy framework



The waste management policy of Bucharest is made by the GCBM and the LCs of the six administrative districts. The **districts have the responsibility to organize the collection of waste** in their respective jurisdictions. This is accomplished through delegated operators that collect, transport, sort and recycle the waste. The delegated operators can be sanitation operators, which are private companies designated by the district through contracts, or other operators authorised from the point of view of environmental protection but who do not have a licenced sanitation activity[54]. Not all contracts with the sanitation operators contain provisions on the application of the economic instrument "pay as you throw."

All districts are covered by sanitation services, and it is the **responsibility of the district to ensure that the targets for recycling and reuse are met**, at least for paper, metal, plastic and glass. The General Municipality of Bucharest has the role of coordination, monitoring and control all waste management systems developed at the level of the districts.

[51] Source: https://www.economica.net/primaria-bucuresti-organizeaza-o-licitatie-pentru-reabilitarea-a-aproape-212-km-de-conducte-ale-sistemului-de-termoficare_556164.html
[52] In 2008, the total length of the primary network was around 1 100 km, and the length of the secondary network was around 3 300 km, but these have evolved since then.
[53] While the heating cost is approx. RON 1150 per Gcal, the end-user had been charged for many years only RON 350 per Gcal, with a steep increase in end-user prices since 2022 only.
[54] Based on data provided by the Environmental Protection Agency in 2021, there are 41 environmentally authorised operators in Bucharest. They collect waste directly from the generators.

In 2022, the six sectors and the general municipality, have established the Intercommunity Development Association for Integrated Municipal Waste Management in Bucharest (ADIGIDMB), a structure aimed at giving operational consistency throughout the city. ADIGIDMB has taken over the landfilling contracting for the whole 2023 and onwards, and it has concluded the process of tendering for the mechanical-biological treatment for all municipal solid waste, and all contracts have been signed.

Through LCs decisions, ADIGIDMB has received the following responsibilities, which, until 2022, were under the decision power of the GCBM:

- organisation of the processing, neutralisation and material and energy recovery of waste;
- organisation of the mechanical-biological treatment of municipal waste and similar waste;
- management of landfills and/or disposal facilities for municipal and similar waste;
- the Service's Coordination, Monitoring and Control Board, setting and approving the Service's performance indicators, after public debate;
- for the development and approval of the Service's strategy.

Although national environmental legislation foresees penalties for littering and regulations and norms for sanitation exist at municipal level (see Municipal Council Decisions 120/2010 and 345/2020), **no measures to discourage littering** are foreseen for Bucharest, neither in the **Waste Management Plan for the Municipality of Bucharest (2020-2025)** nor in other documents or plans of the municipality. Anti-littering educational campaigns are also missing or failing to provide behavioural changes with visible results.

Overcapacity issues of landfilling in Bucharest mainly **are tackled** in two policy documents, namely IUDS 2021-2023 and the Waste Management Plan of Bucharest (2020-2025). These documents also include measures meant to reduce waste generation through awareness campaigns, to improve the waste collection systems through investments and to promote sorting and recycling. However, implementation challenges have been observed or could not be confirmed due to unavailability of operational data.

Technical overview

In terms of technical data, virtually **all inhabitants of Bucharest benefit from weekly municipal solid waste (MSW) collection**, according to date provided by the Waste Management Plan for the Municipality of Bucharest (2020 - 2025). The same plan mentions that all landfilled MSW is disposed of in EU-compliant sanitary landfills whose remaining lifetime is estimated to be 9 years. Specifically, according to ADIGIDMB, the remaining **lifespan of Vidra Landfill[55] is estimated to be between 9 and 17 years**. This estimation is made under the assumption that the annual rate of reduction of the quantities stored ranges between 4% and 7% of the quantities disposed of in 2023. It should be noted, however, that until 2018, mixed MSW and residual waste from waste management facilities was transported and disposed of in two compliant sanitary landfills rather than in dumpsites. At that time, it was estimated that the remaining lifespan of the landfills was low, of approximately 3 years. The landfills in the proximity of Bucharest, namely Teleorman, Ilfov, Dâmbovița, Călărași, Ialomița, Prahova, Argeș and Giurgiu can be used to dissipate the pressure related to waste management in the city.

[55] EU-compliant sanitary landfill Vidra, owned and operated by Eco Sud S.A., is located in Ilfov county, 10 kilometers outside of Bucharest The facility holds the Integrated Environmental Permit (IEA) No 25 issued on 11.12.2018, which was subsequently updated on 27.08.2020.

The total **MSW generation per capita** showed a sharp upwards trend since 2014, reaching **497 kg/year/capita in 2019**, which is about 200 kg more than the international standards. This sharp increase could also be partially attributed to an improved reporting accuracy by the collection operators. At the same time, the proportion of dry **recyclables separated at the source or from mixed MSW stream was 21%**, while the proportion of **organic waste separated at the source or from mixed MSW stream was 7%.** Both values are below the international standards of 35% and 20% respectively.

This low performance of separated collection and treatment is also due to collectors' practice of mixing the already separated fractions into a single waste collection vehicle or just in dual (wet/dry) pick-up. This discourages waste generators from using the separate collection infrastructure which is nonetheless poorly developed. However, proportion of recyclables collected separately is increasing due to the fact that there are a number of environmentally authorised operators that also collect recyclable waste, mainly packaging waste, from the population and other collectors of specific waste streams.

Finally, the proportion of **MSW treated in sorting, processing and treatment plants was only 35%,** well below the international standard of 75%. The main technologies for treating municipal waste during 2019 were: (i) sorting, for which input is mostly waste collected in a mixture and recyclable waste collected separately, (ii) composting for which input is the biodegradable fraction resulting from the sorting process and separately collected biowaste, and (iii) green waste treatment through shredding. While the recyclables are definitely directed to recycling facilities, due to the direct specific economic interests of the operators, there is no market for treated biodegradables. This makes their destination uncertain and under-monitored. Notably, there were **no mechanical-biological treatment or thermal treatment facilities** for the remaining mixed unsorted waste during the aforementioned year.

The **newly launched Deposit-Return System** will deviate most of the packaging recyclables (i.e. beverage PET-, metal- and glass containers) from the door-to-door and kerbside pickup towards the retail stores. On one hand this will increase the volumes of clean collected recyclables, also directly contributing to the reported city's landfill diversion targets. On the other hand, it will lower even further the performance of selective collection of recyclables from households and organisations via the sanitation companies. This will most likely drive re-alignment of the service cost to accommodate the recyclables revenue depletion.

It is worth mentioning that households have no incentives for better separation of waste at source since there are virtually no differentiated tariffs and **no "pay-as-you-throw" mechanisms in place** for mixed vs. segregated waste. While some isolated initiatives towards differentiated tariffs exist[56], most of them are not communicated nor publicly analysed to allow drawing conclusions. In fact, districts 1 and 3 do not even disclose the costs of waste management to their citizens, who are consistently targeted with "zero cost for waste" messages by the respective authorities.

Finally, **illegal dumping and burning of waste happens extensively** in the outskirts of the city, posing significant challenges and serious risks for human health and the environment, even though official data to confirm this do not exist. This underscores environmental authorities' inability to control inadequate waste management practices, due to a lack of monitoring and of ineffectiveness of fines.

[56] See the initiative at the level of district 2: https://salubrizare.ps2.ro/utilizatori-casnici-administratii/

Buildings

Governing policy framework

Standards regarding the Green **building promotion exist at national level**[57]. However, they are **poorly implemented and fairly lax**. Some municipalities in Romania, such as Cluj or Timisoara, have implemented reductions in different types of taxes based on the energy performance of buildings. The same is not true for Bucharest.

Public investments for energy efficiency in buildings exist at city level, but their percentage in absolute financial terms or in numbers of buildings renovated out of total building stock is not publicly available.[58] According to the Energy Efficiency Law, 3% of public buildings owned by the central government must be renovated each year,[59] but the government did not expand this obligation to the buildings owned by local public administration.

The role of the **digitalisation of the demand side through smart meters** is considered central to securing the optimal control and operation of heating systems. According to the EU Energy Efficiency Directive 2018/2002, all new energy meters and heat cost allocators (HCAs) installed after October 25, 2020 must be remotely readable devices. Moreover, all existing meters must be remotely readable by January 1, 2027. In addition, the national electricity and gas law (Law No 123/2012) requires the existence of a meter in each power consumption point. Meters are owned by distribution operators, which are responsible for the operation and maintenance thereof, even if sometimes these activities are outsourced. In Bucharest the meters are read at least once a year, as required by the regulatory authority. Customers have the possibility to read meters themselves, in which case the billed amount is the consumption reported by the customer. All individual users benefit from individual meters, but not all have smart meters. At DSO level[60], the penetration of smart meters is 38%, and this is planned to increase until 2028.

In many cases, apartments do not have **individual heat meters**[61], causing a lack of transparency regarding[62] and for fear of paying more for energy, citizens are not installing them[63].

In terms of support schemes for building renovation, the **Strategy for Mobilising Investments in the Renovation of Residential and Commercial Buildings, both Public and Private existing at national level**[64], and issued by the Ministry of Regional Development, Public Works and European Funds (MRDPWEF) in 2017, has developed the following steps: (1) identification of

[57] Romania Green Building Council, The National legislation regarding the Energy Performance of buildings, http://www.rogbc.org/en/legislation/green-building-legislation/national-legislation
[58] Most districts in Bucharest only maintain a database with energy efficiency interventions for multistorey residential buildings.
Some examples: https://www.ps2.ro/index.php/reabilitare
[59] Article 6 of Law 121/2014 (https://legislatie.just.ro/Public/DetaliiDocument/160331)
[60] https://www.reteleelectrice.ro/ro/contorul-inteligent
[61] EU Energy Efficiency Directive 2018/2002
[62] An apartment would have to pay approx. RON 500 (the equivalent of EUR 100) to install them.
[63] Demand side digitalisation: A methodology using heat cost allocators and energy meters to secure low-temperature operations in existing buildings connected to district heating networks. https://doi.org/10.1016/j.energy.2022.126272
[64] https://energy.ec.europa.eu/system/files/2018-07/ltrsenromania_0.pdf

stakeholders and information, (2) technical and economic assessment, (3) policy evaluation, (4) development and consultation, (5) publication and implementation, with the purpose of:

- Stimulating a debate among key stakeholders to reach a consensus on policies and initiatives aiming to improve energy performance in buildings.
- Encouraging all stakeholders to adopt ambitious and appropriate attitudes, intended to improve the quality of residential and commercial buildings, in order to provide immediate and long-term benefits to building owners and support the economy.

The expected benefits include job creation; improvement of living conditions in buildings and workspaces; reduced dependency on external energy suppliers; natural resources and well-trained human capital can be used optimally, and in this context, modern and energy efficient buildings, adapted to the 21st century and the years to come, can be provided.

In addition to the above, seismic risk has important implications on the energy efficiency improvement policies currently being rolled out. Presently, there are **two parallel seismic risk reduction programs** in Bucharest, both of them carried out through the Municipal Administration for the Retrofitting of Seismically Risky Buildings – MARSRB (or AMCCRS, in Romanian). Firstly, there is the **National Retrofitting Programme for Seismically Risky Buildings**, financed from the state budget, through the Ministry of Development, Public Works and Administration (MDPWA). Under this programme, MARSRB is currently tackling 24 sites in Bucharest, in various stages of procurement[65]. All 24 projects also include energy efficiency upgrades. The second programme for seismic risk reduction is financed through the **National Plan for Recovery and Resilience**. Consequently, in Bucharest, 17 buildings are lined up for integrated interventions, i.e. energy efficiency and seismic risk reduction, for a total value of RON 283.5 million[66].

Moreover, starting with the year 2022, a new tool has been developed to facilitate the structural assessment of buildings, namely the **Rapid Visual Assessment**[67]. This procedure aims to prioritize interventions for seismic retrofitting in a city where the need for retrofitting is very high, but the resources and the available time are limited. Bucharest city has just started rolling out the Rapid Visual Assessment in select areas in Bucharest and it is expected that the municipalities of the six districts will also support this endeavour, such that, during the year 2025, Bucharest will obtain the results of the first city-wide preliminary screening. Thus, the degree of the seismic vulnerability of the city will be more precisely estimated and a prioritization process for the intervention may start. By articulating the priorities in seismic risk reduction with the priorities in energy refurbishment, Bucharest city will be in a position to effectively prioritize investments and ensure that seismic retrofitting, where needed, is executed before the energy upgrades.

Finally, Romania and, implicitly Bucharest, has in place a **solid system for certifying building inspectors** through the Procedure regarding the technical-professional licensing of project verifiers and technical experts, approved by MDPWA Order no. 817/2021, with subsequent amendments and additions.

[65] https://amccrs-pmb.ro/2023/02/programul-national-de-consolidare-a-cladirilor-cu-risc-seismic-pnccrs/
[66] https://amccrs-pmb.ro/2023/02/planul-national-de-redresare-si-rezilienta-pnrr/
[67] Available in Romanian at: https://legislatie.just.ro/Public/DetaliiDocument/263386

Technical overview

The vast majority of Bucharest's building stock has been constructed before 1963, in a period in which no effective seismic design code was in force[68]. Specifically, 84,939 buildings have been built before 1963. In addition to this, another 16,107 buildings have been constructed between 1963 and 1978. Accounting for the fact that seismic design codes in Romania can be considered satisfactory only after 1978, we can conclude that, by design, **more than 100,000 buildings in Bucharest are insufficiently prepared for a large seismic event**[69]. The Risk Analysis and Coverage Plan for the Municipality of Bucharest mentions that approximately 23,000 buildings in Bucharest may experience significant damage, with 1,000 of these potentially collapsing. Of these, approximately 100 buildings are high-rise buildings. Moreover, during this period, the vast majority of residential buildings in Romania were built without any specific thermal requirements for the building elements that form the building envelope.

The high level of seismic risk that Bucharest exhibits, is relevant both from a state and pressure perspective, as well as from a policy/response perspective. It is widely accepted that, when analysing the predicted carbon-footprint of a building in a seismically active area, an energy refurbishment cannot be considered to flatten the curve for embodied carbon if it does not also include structural retrofitting of the building. This is because, while mitigating normal operating carbon emissions in the lifetime of the building, a purely energy retrofit does not safeguard against the additional carbon equivalent related to repairs or reconstruction after possible earthquakes[70].

In Bucharest, 72% of the dwellings (apartments) are located in multi-family buildings, with an average of 40 apartments per block of flats. Regarding non-residential buildings, it is estimated that one third are public while two thirds are commercial buildings. Apartments in multi-family buildings have an average heated area of 48 square meters compared to 73 square meters for single-family dwellings. The analysis of residential buildings indicated that heating energy represents approximately 55% of the total energy consumed, while electricity consumption represents 45% of the total energy consumption of flats. A single-family dwelling consumes on average 24% more energy per square meter compared to an apartment in a block of flats. In Bucharest, virtually all heating supplied is fossil-fuel based and, therefore, the average annual **fossil fuel consumption for heating and cooling of buildings is higher than the international standards, amounting to 144 kWh/m²**, with residential buildings having the highest average consumption reaching over 150 kWh/m^2.

Electricity consumption in both residential and non-residential buildings is well above the international standards, according to 2017 data[71]: residential buildings consume 123.75 kWh/m^2/year, commercial buildings consume 150 kWh/m^2/year and public buildings consume 212.4 kWh/m^2/year.

Finally, there is an **acute need for building energy data** of the different types of buildings, which could be alleviated through the issuing of Energy Performance Certifications (EPCs) or green certifications. The Legal responsibility of the central EPC database falls under the responsibility

[68] Văcăreanu, R., Pavel, F. și Aldea, A. (2015) Elemente de analiză a hazardului seismic. Conspress. Available at:: https://books.google.ro/books?id=CF91swEACAAJ, cited from: https://iopscience.iop.org/article/10.1088/1755-1315/1185/1/012032/pdf
[69] https://isubif.ro/local/wp-content/uploads/2015/06/2.PAAR-Bucuresti.pdf
[70] Belleri et al. (2017), The impact of earthquakes on the life cycle carbon footprint of existing buildings. 16th World Conference on Earthquake, Chile
[71] https://energy.ec.europa.eu/system/files/2018-07/ltrsenromania_0.pdf

of the MDPWA, while the EPCs in electronic format are received and stored both by MDPWA and by NIRD URBAN-INCERC[72]. The electronic format of the EPCs is not well defined, so the stored information cannot be used in a structured way, i.e. the database is virtually not operational. Currently, there is no information publicly available regarding the content of issued EPCs. However, a number of 45,000 EPCs or 1.5%, mostly apartments in collective buildings, have been introduced in a structured database developed by NIRD URBAN-INCERC based on the criteria defined by MRDPAEF in 2010[73].

Water

Governing policy framework

The utilities company S.C. Apa Nova Bucharest S.A. (henceforth **Apa Nova Bucharest)** manages drinking water and wastewater treatment. The company has elaborated a **Master Plan for Water Supply and Wastewater for Bucharest** in 2019[74], which proposes an investment plan until 2049 to improve the quality of water supplied and to improve and extend the water supply and the wastewater collection networks. According to this planning document, Bucharest is 100% compliant with water quality standards. Moreover, measures are reported to have been taken by Apa Nova for the improvement of the operation of its treatment plants.

The main components of the water supply system of Bucharest are: (i) raw water intakes; (ii) drinking water treatment plants; (iii) transmission pipes, water reservoirs and major pumping stations and (iv) the distribution network. The raw water is provided by the National Administration of Romanian Waters (NARW), **through a monthly program negotiated between NARW and Apa Nova București S.A.**. The main water sources are the Arges river basin through the Crivina intake and the Dâmbovița river basin, through the Brezoaele intake.

Currently there are no regulations or fiscal incentives in place to promote the treatment, reuse and recycling of both industrial and household wastewater. Instead, this is discharged in the sewage network. These discharges are regulated by Apa Nova Bucharest and quality monitoring is required. Moreover, the city does not (sufficiently) promote water saving and water reuse through awareness campaigns.

Measures are implemented in order that the connection rate reach the 100% level by 2025. Parts of the water supply network have been rehabilitated. Still, parts of the network are old (42% of the network is older than 40 years), pipes are from iron and steel, and numerous incidents of failures occur. Access to wastewater collection has been improved significantly, but further plans and investments are needed to cover the whole population of Bucharest-Ilfov region. Finally, the treatment of stormwater has to be improved, to be able to treat larger amounts of stormwater and to contribute to the improvement of the surface water quality downstream the city of Bucharest.

[72] https://uac.incd.ro/EN/index.htm
[73] Energy Performance Certificate databases and open data sources, ENERFUND, Horizon 2020, https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5c8e4cb73&appId=PPGMS
[74] Master plan for water supply and wastewater 2019-2049 (APA NOVA BUCURESTI, Rambol, 2019)

Technical overview

In Bucharest, domestic water consumption per capita is well within the international standards and close to that in the majority of the European capitals, at 143 l per inhabitant per day. According to 2020 data[75], the percentage of non-revenue water was at 22%, which is also within the international standards. Furthermore, water storage of potable water and water consumption per unit of city GDP show a high level of potable water management in the city. Bucharest also performs very well in terms of wastewater treatment, with the percentage of residential and commercial wastewater that is treated according to applicable national standards ranging around 90% from 2012 to 2016 when the most recent data was available. Finally, the treatment of sludge is also within international standards, mainly due to the fact that the wastewater treatment plant of Glina has a fully operational sludge treatment facility. All these show an **overall good performance of the water utilities management of the city of Bucharest**.

Nevertheless, the integrity of the sewer network is problematic. The incidents of pipe breakdown have decreased significantly in the last 10-15 years, from 5.46 break/km/year in 2010 to 3.43 break/km/year in 2020. Yet, progress needs to be made for further modernising and ensuring higher integrity of the network.

Finally, it is worth nothing that there are no significant episodes of drought in the area of Bucharest and the respective risk remains low, according to available data until 2020[76,77]. However, climate change might affect risk in the future. As a consequence, water levels of surface waters will be reduced, significantly affecting the supply of water in the city (see above the main water sources for Bucharest). It is estimated that the frequency and severity of low flows are projected to increase, making streamflow drought and water scarcity more severe and persistent in South-East Europe[78]. Historically, floods are a higher hazard for Romania than drought, with average annual occurrence between 1980 and 2020 of 53% for floods and 2% for droughts.

Therefore, reserves of fresh water must be well forecasted and managed. Also, as a consequence of increased demand, pressure on the infrastructure must be overcome. If consumption restrictions are not established, larger volumes of water are expected to flow through the same infrastructure components, increasing the risk of failure. Earthquake, with a yearly hazard occurrence of 3% in Romania, could be a disruptive element for the water infrastructure, especially, if combined with the impact of other hazards like flood, drought, storms and fire.

Land use and green space

Governing policy framework

Although generally in place, **policies and strategies related to land-use and urban planning are very weak and ineffective** in enabling adequate control of urban development, due to legal uncertainties rooted in political decision-making and lack of coordination between the city and the districts[79]. Due to a high housing demand, real estates developed at a fast

[75] Master plan for water supply and wastewater 2019-2049 (APA NOVA BUCURESTI, Rambol, 2019)
[76] Initiative on "Capacity Development to support National Drought Management Policy"(WMO, UNCCD, FAO and UNW-DPC) Country Report "Drought conditions and management strategies in Romania"
[77] World Bank, Climate Change Knowledge Portal
[78] https://report.ipcc.ch/ar6wg2/pdf/IPCC_AR6_WGII_FinalDraft_Chapter13.pdf
[79] Stavaru, Cosmin; Toma, Alin (2022): The odyssey of urban planning in Bucharest. https://rlw.juridice.ro/21524/the-odyssey-of-urban-planning-in-bucharest.html (download, 17.5.2024)

pace, with profit-driven investment and minimal application of urban planning regulations[80]. In fact, Bucharest has an outdated General Urban Plan (GUP)[81] and under the pressure of strong private interests. In turn, the Zonal Urban Plans (ZUP), valid at district level, have been developed to adapt the city to the changing needs, having the purpose of further specifying the GUP. Although both the GUP and the ZUPs have been challenged in Court, their validity has been confirmed by the recourse instance. As of March 2024[82], for district 1, 3 (approved through Municipal Council Decision nr. 49/31.01.2019), district 5 (approved through Municipal Council Decision nr. 242/18.06.2020) and district 6 (approved through Municipal Council Decisions[83] 278/31.10.2013 and nr. 68/14.02.2020) respectively are annulled, while the ZUPs for district 2 (approved through Municipal Council Decision nr. 339/13.08.2020, modified by Municipal Council Decision nr. 717/18.12.2019) and for district 4 (approved through nr. 443/26.07.2018) are suspended by Court decisions.[84] A new GUP is under development, and it is estimated that it will be in force by the end of 2026. A new GUP will invalidate the need for ZUPs and will offer coherent and sustainable urban planning regulations.

Furthermore, the **protection of existing green space is difficult** due to the lack of planning governance and strict regulations. The background for the dissolution or suspension of the districts' ZUPs has often been related to the lacking declaration of green areas in urban planning documents, allowing construction in green areas, despite being listed as green areas, and the declaration of green areas as construction land. In addition, the weak regulations and planning have led to private ownership creating challenges in terms of protecting urban green space against the high incentive to sell areas to real estate investors. The Alexandru Ioan Cuza Park (Park IOR) in sector 3 is one prominent example[85].

Finally, the responsibility for **park management and maintenance** is split between the general administration of the city, through Administration of Lakes, Parks and Recreation in Bucharest, and that at the sector level, through Administration of Public Domain, which in practice act uncoordinated.

A very important strategic document for Bucharest, which is under development, is the **2021-2030 Integrated Urban Development Strategy for Bucharest (IUDS)**[86]. IUDS contains measures and recommendations to sustainably develop the city, provide green areas, provide public services and neighbourhood amenities, and to align urban development with public transport networks, i.e. transit-oriented development according to the Sustainable Urban Mobility Plan 2016-2030 for the Bucharest-Ilfov region and aligned with the strategy for the development of

[80] World Bank (2021): ROMANIA, Reimbursable Advisory Services Agreement on the Bucharest Urban Development Program (P169577), COMPONENT 1. Elaboration of Bucharest's IUDS, Capital Investment Planning and Management, Output 3. Urban context and identification of key local issues and needs, and visions and objectives of IUDS and Identification of a long list of projects. Chapter 3. Spatial and Functional Profile (p.20f) A. Rapid assessment of the current situation, Section 10. Territorial diagnosis (p.34).
[81] Nae, Mariana; Dumitrache, Liliana; Suditu, Bogdan; Matei, Elena (2019): Housing Activism Initiatives and Land-Use Conflicts: Pathways for Participatory Planning and Urban Sustainable Development in Bucharest City, Romania, Sustainability 2019, 11, 6211
[82] ZUP for district 1 was never approved by the Municipal Council.
[83] District 6 had two ZUPs, one from 2020 and one from 2013. Only the former has been annulled, while the latter is still in force.
[84] https://www.wall-street.ro/articol/Politic/306627/nicusor-dan-a-anuntat-ca-toate-puz-urile-din-bucuresti-sunt-fie-anulate-fie-suspendate.html
[85] https://www.europarl.europa.eu/doceo/document/E-9-2023-001512_EN.html, https://www.rri.ro/en_gb/civic_groups_and_green_spaces_in_the_capital-2696654 (download: 1.3.2024)
[86] World Bank (2021): ROMANIA, Reimbursable Advisory Services Agreement on the Bucharest Urban Development Program (P169577), COMPONENT 1. Elaboration of Bucharest's IUDS, Capital Investment Planning and Management, Output 3. Urban context and identification of key local issues and needs, and visions and objectives of IUDS and Identification of a long list of projects. B. Strategy Development

the subway transport infrastructure in Bucharest. Importantly, it contains ideas on how to combine urban regeneration and sectoral programmes to an integrated, spatially distinct urban regeneration policy. Specifically, IUDS presents a **proposal for green infrastructure development** in Bucharest, as a strategic plan for the development of the green and blue infrastructure. In this context, the **Green Belt for Bucharest** (or Action plan at metropolitan level in order to create forest buffers to protect localities) is seen as a strategic objective for the local administration, being essential for improving the urban climate and fighting climate change[87]. For this, the recently adopted Law no. 331/2024 approving[88] Romania's Forest Code is an important starting point by putting the urban and peri-urban forests under protection. However, secondary legislation still needs to be developed. In addition, agreements to introduce afforestation programmes of relevant areas are foreseen between the municipality of Bucharest and the authorities of the Ilfov county[89].

Technical overview

In terms of settlement structures, Bucharest has by far the highest **population density** of all cities in Romania, i.e. 89 persons/ha, calculated as the number of inhabitants related to the built-up area within the administrative unit. Compared to other large Romanian cities, e.g. Timisoara and Cluj-Napoca, Bucharest shows a **higher share of vacancy within the dwelling stock**. Compared to other cities in Romania, Bucharest has rather limited **green open areas** for recreation. Only about 11% of the cities' surface counts as green areas within the city limits. This gives Bucharest rank 14 among Romanian cities beyond 120,000 inhabitants[90]. If residential compound gardens, street alignments, squares, etc. are included, the share of green space within urban limits rises to 19%[91]. This is still a low share of green space compared to, for example, the average of 30% urban green area of 38 European Environment Agency member and cooperating countries[92].
The most important green areas and parks are[93]:

- Băneasa Forest has 1,221 ha, 582 ha located in the municipality of Bucharest
- Văcărești Natural Park covers 183 ha, being declared a natural park in 2016. It hosts a rich biodiversity and wetlands.
- Metropolitan and local parks: Herăstrău (Regele Mihai I), Tineretului, Cișmigiu, Titan, Plumbuita, Circului, Carol, Herăstrăul Nou, Drumul Taberei and National.

A considerable share of the city's population has **poor accessibility of parks**[94]: about 41% of collective residential areas and 45% of individual residential areas are located at a distance of

[87] World Bank (2019): ROMANIA, Reimbursable Advisory Services Agreement on the Bucharest Urban Development Program (P169577), COMPONENT 1. Elaboration of Bucharest's IUDS, Capital Investment Planning and Management, Output 2. Identification and analysis of existent and relevant strategic and programmatic documents (p163)
[88] https://legislatie.just.ro/Public/DetaliiDocumentAfis/293218
[89] World Bank (2019): ROMANIA, Reimbursable Advisory Services Agreement on the Bucharest Urban Development Program (P169577), COMPONENT 1. Elaboration of Bucharest's IUDS, Capital Investment Planning and Management, Output 2. Identification and analysis of existent and relevant strategic and programmatic documents (p163)
[90] World Bank (2020): ROMANIA, Reimbursable Advisory Services Agreement on the Romania Urban Policy (P171176). Output 2. Companion Paper 5. An analysis of public infrastructure shortage in suburban and peri-urban areas, with focus on a number of key indicators (p. 38)
[91] World Bank (2021): ROMANIA, Reimbursable Advisory Services Agreement on the Bucharest Urban Development Program (P169577), COMPONENT 1. Elaboration of Bucharest's IUDS, Capital Investment Planning and Management, Output 3. Urban context and identification of key local issues and needs, and visions and objectives of IUDS and Identification of a long list of projects. Chapter 10. Territorial Diagnosis (p.105)
[92] https://www.eea.europa.eu/highlights/how-green-are-european-cities
[93] Environmental Platform for Bucharest, 2022: State of the Environment in Bucuresti, Urban Nature, Research Report 2022, Author: Cristian Iojă (p11f)
[94] World Bank (2021): ROMANIA, Reimbursable Advisory Services Agreement on the Bucharest Urban Development Program (P169577), COMPONENT 1. Elaboration of Bucharest's IUDS, Capital Investment Planning and Management, Output 3. Urban context and identification of key local issues and needs, and visions and objectives of IUDS and Identification of a long list of projects. Chapter 7 Environment and Biodiversity (p22)

more than 1,000 m from a park. For newer residential areas, the situation is even worse. Districts 2 and 5 are in the worst situation in terms of green area per capita with slightly above 12 m^2/inhabitant.

Finally, Bucharest is facing a **degradation tendency** of its already insufficient **green infrastructure**[95]. This refers to the quality of tree, shrub and herbaceous vegetation and to the quality of water bodies in parks, which often reduces rather than increases environmental value of parks. Sector 4 shows the highest share (35%) of degraded green spaces of its total green urban area of 225 ha[96].

Priority environmental challenges

Data collected for state indicators have contributed to establishing an overall picture of the environmental status of Bucharest with respect to air quality, water quality and land use/soil presented in Table 6.

Table 6: Summary of Bucharest priority environmental challenges

Environmental asset	Challenges from state indicators	Sectors contributing to the challenges
Air quality	• **Air pollution is one of the most mentioned issues** by the citizens of Bucharest and it goes hand-in-hand with the **congested traffic** and with the sporadic occurrences of **illegal waste incineration** on the outskirts of the city. • Average annual **concentrations of $PM_{2.5}$ and PM_{10}** were found **elevated,** less for PM_{10}, though. • The level of **NO_x was also found slightly elevated** at 53 µg/m^3, though the latest available data is relatively old from 2017.	
Water quality and availability	• Bucharest has **good quality of potable water**, which complies with the national standards • There is **evidence of pollution in surface water bodies**, as indicated by the values of Biochemical Oxygen Demand (BOD) and Ammonium (NH_4) concentrations, measured in three monitoring sites in 2019. • According to the most recent available data from 2019, the value of the water exploitation index calculated at 31% shows that **water consumption in Bucharest is close to becoming unsustainable**, showing an increasing trend from its 2015 value of 25%.	

[95] World Bank (2021): ROMANIA, Reimbursable Advisory Services Agreement on the Bucharest Urban Development Program (P169577), COMPONENT 1. Elaboration of Bucharest's IUDS, Capital Investment Planning and Management, Output 3. Urban context and identification of key local issues and needs, and visions and objectives of IUDS and Identification of a long list of projects. A. Rapid assessment of the current situation, Section 10. Territorial diagnosis (p.38)
[96] Environmental Platform for Bucharest, 2022: State of the Environment in Bucuresti, Urban Nature, Research Report 2022, Author: Cristian Iojă (p16)

Green space

- The share of **green space area within urban limits** is way below the international standards of 50%. In Bucharest, this is only 19%, which is still lower that the average of 30% urban green area of 38 European Environment Agency member and cooperating countries.
- Only about **23% of collective residential areas and 17% of individual residential areas** are located in the **vicinity of green areas**, defined as a distance below 250 m.
- **41% of collective residential areas and 45% of individual residential areas**, accessibility to the next urban park is very low, at a **distance of more than 1,000 m.**

GHG emissions

- The annual **GHG emissions per capita was 5.5 $tCO_2eq/capita$**, at the level of 2014, just above the 5 tCO_2eq/capita benchmark for international standard.
- The municipality has **poor air monitoring quality** and, thus unreliable data. Between 2011-2016 the monitoring equipment did not work correctly and continuously, either due to technical problems or due to a lack of calibration sources, which resulted in invalid results for long periods of time.
- Private monitoring platforms exist, for example installed by environmental NGOs, but **they are not coordinate and integrated** with that of the municipality; meanwhile there are multiple entities that are now submitting data, which should, however, be integrated.
- Information on **the source of emissions** in a traceable and uniform format is also missing

Key sectoral challenges

The findings of the technical analysis have led to a list of key environmental challenges that are detailed in the Technical Assessment Report. These challenges were presented to the TC in a workshop and discussed with selected stakeholder in parallel sectoral focus groups. Bot the workshop and the focus groups were held in person on November 27 in Bucharest (see Table 3). During the workshop, the participants were asked to rank the identified challenges for each sector. Further, the sectoral focus groups had the purpose of validating the findings of the technical analysis as to data accuracy and completion. Project team members took notes of the participants' inputs which were later integrated into a revised version of TAR.

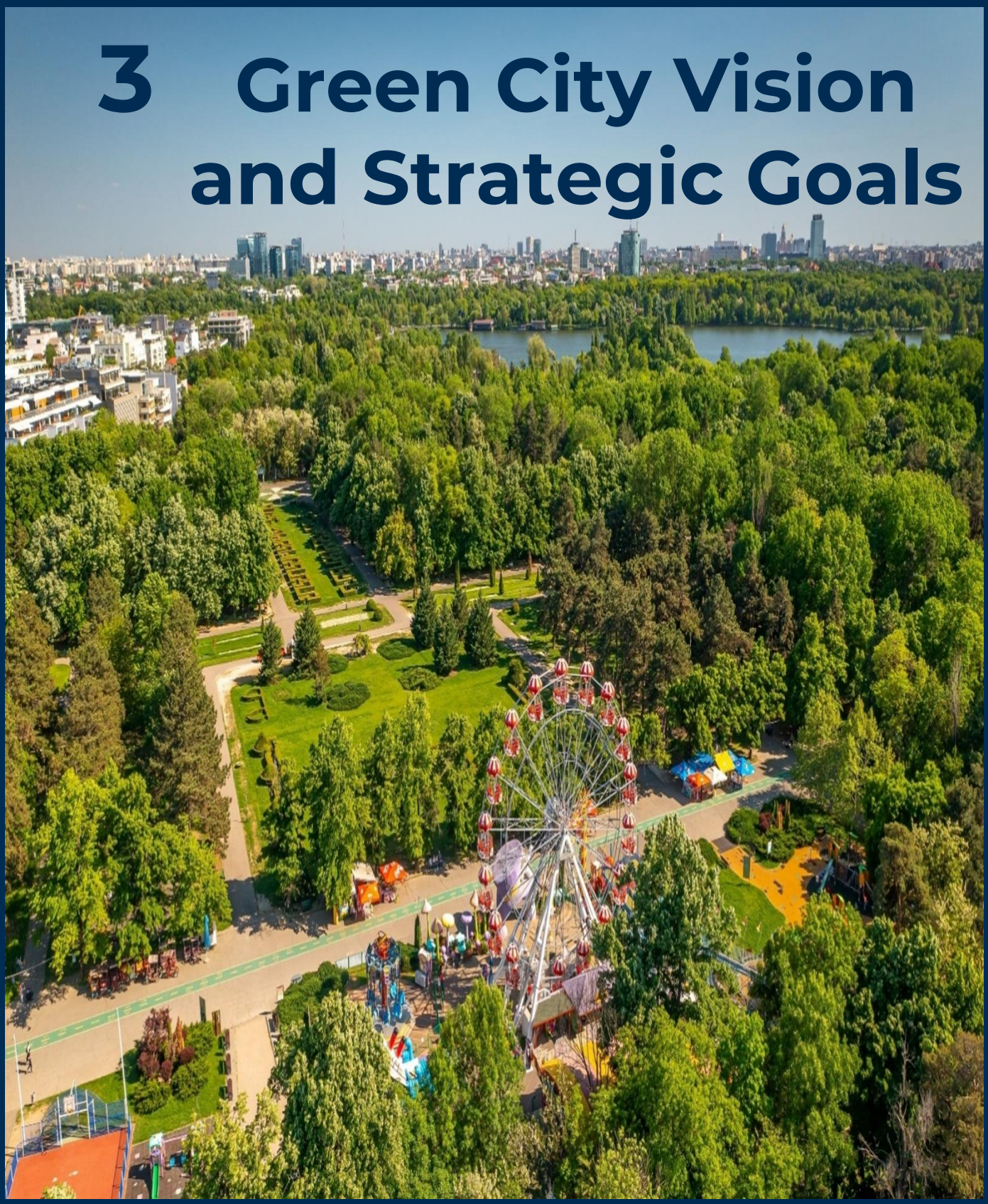
This process has led to a refined list of key sectoral challenges as summarized in Table 7. In the table, for each challenge, the "✓" marking indicates whether it has a component related to gender, to digitalisation or it is related to city's resilient, i.e. risk and vulnerability. These, together with the strategic goals (see Section 1.1) served for the formulation of the long list of Bucharest GCAP actions.

Table 7: Summary of key sectoral challenges

Sector	Key challenges	Challenge has a component of		
		Gender and economic inclusion	Smart maturity	Risk and vulnerability
Land use and open space	Poor planning governance, land inventory not integrated, planning documents are outdated, additional legal implementation issues			
	Low share of green urban areas, poor accessibility of green areas for recreation of inhabitants for many parts in the city	✓		✓
	Degradation tendency of green areas, challenge of different property owners of green areas, poor cooperation and professional knowledge for maintenance	✓		✓
Buildings	Lack of data on energy efficiency and on the used materials in the build environment			
	Increased energy use for heating and cooling	✓		✓
	Potential damage to buildings, due to floods, fire, storms, earthquake	✓		✓
Urban Transport	Traffic congestion aggravated by poor urban planning (lack of public amenities) and consequently by an increase in the number of owned cars per capita	✓		
	Weak public parking policy (to discourage use of automobile at destination), obsolete private parking regulation that requires each new building to provide a minimum no. of parking places (HGCMB 66/2006), lack of park-and-ride network		✓	✓
	Poor performance of the public transport	✓	✓	
	Lack of intermodal facilities	✓	✓	
	Lack of infrastructure for alternative (non-motorised) modes on transport	✓		
	Lack of a coherent vision and a timebound action plan to improve low-emission mobility			✓
Energy	The fragmentation of resources and political power that leads to uncoordinated planning and chaotic implementation of energy projects - e.g. grid development to adapt to increasing number of new residential developments and penetration of decentralization energy sources.		✓	✓
	Lack of political will to implement legal provisions around energy management and decarbonization in heating to improve the quality of service and energy performance of DH.		✓	✓
	Low effective penetration of renewable energy sources in both electricity and heating.		✓	✓
	Missing Nature Based Solution in the built environment in order to retain as much as possible the stormwater flow and to lower the pressure on the sewer network and consequently to minimize the urban flooding risk			✓
	Old and obsolete sectors of the distribution network and sewer network.		✓	
	Leakages and high quantity of non-revenue water		✓	

Sector	Key challenges	Challenge has a component of		
		Gender and economic inclusion	Smart maturity	Risk and vulnerability
Water and wastewater	The utility networks (drinking water and wastewater) are not covering all the city areas	✓	✓	
	Surface water bodies not rehabilitated and not protected			
	Poor management of water resources and implementation of circular economy practices		✓	
	Sludge resulted from wastewater treatment is incinerated instead of being used in agriculture			
Solid Waste	Lack of selective collection incentives and enforcement, poor infrastructure, non-existent data monitoring and interventions.		✓	
	Low profile communication to waste generators, diffused messages and lack of any feedback.		✓	
	No common governance between sectors and municipality in terms of performance ambitions, collaborative approach or other stakeholders' activation, including different tariffs policies which leads to discontent amongst the service beneficiaries from different districts. It is worth mentioning that some districts are even providing free service to all citizens, no matter their involvement and efforts towards separate pre-collection.			
Climate change and urban resilience	Low resilience/lack of adaptation measures to extreme weather events (including heavy precipitations, storm, heat wave-heat stress and heat island)	✓		✓
	Low quality urban planning and integration of Nature based solutions in infrastructure development	✓	✓	✓
	Low resilience/lack of adaptation measures to (flash) floods		✓	✓
	Insufficient understanding of drought impact on buildings and other types of infrastructure		✓	✓
	Poor policy implementation with respect to earthquakes	✓	✓	✓
	Poor consideration of biodiversity and ecosystem services in the general urban planning		✓	✓
	Insufficient policy implementation with respect to rainwater collection and management			✓
	Insufficient policy instruments with respect to electricity consumption for cooling in a changing climate	✓	✓	✓
	Poor implementation of policies related to public transport in case of emergency situations/disasters	✓	✓	✓

3 Green City Vision and Strategic Goals



Herăstrău (Regele Mihai I) Park

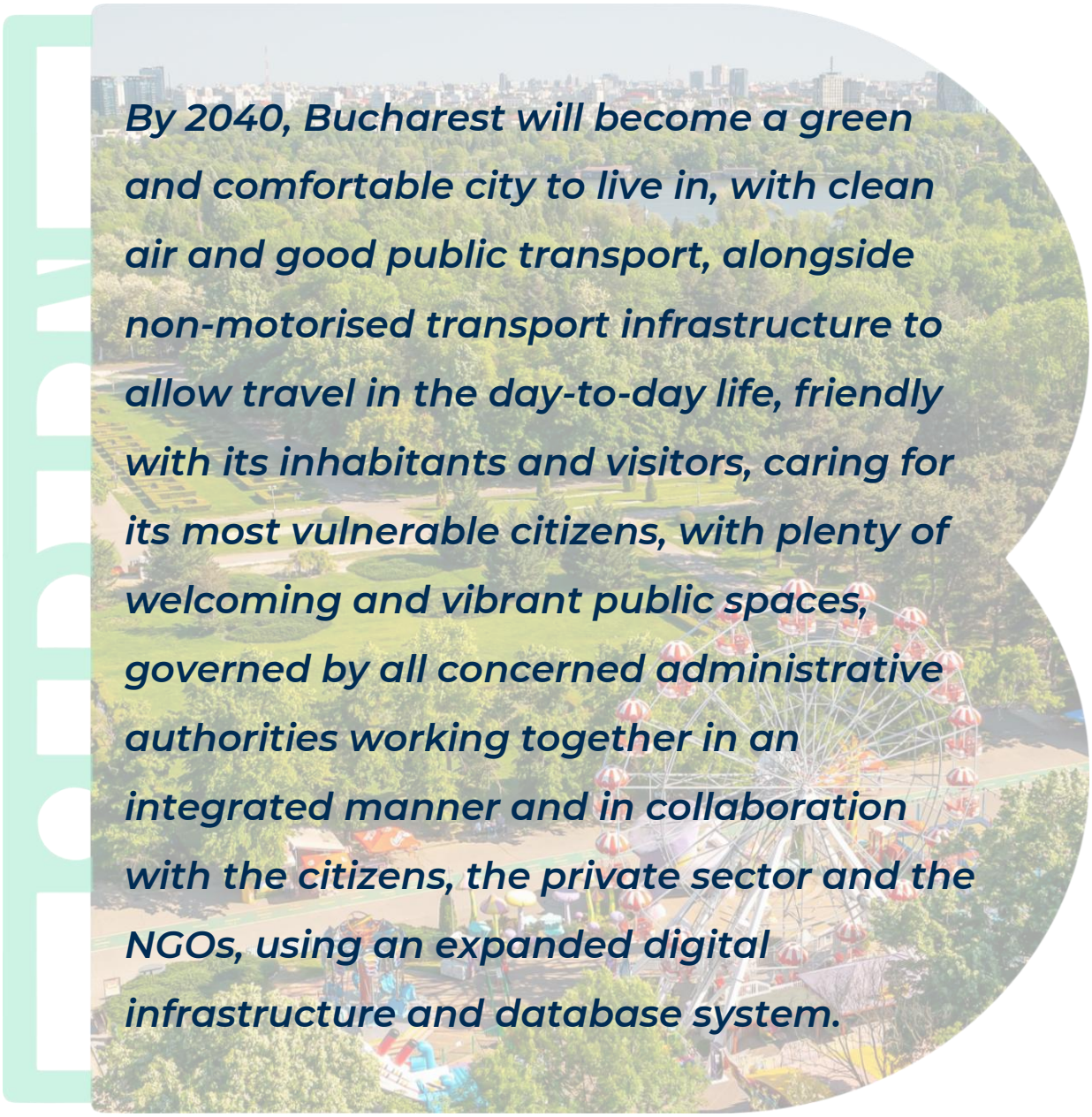
3.1 Vision Statement

The Green City vision is an overarching statement that encompasses the strategic goals of the city and provides a framework within which the GCAP is developed. The vision will guide the development of the city for the next 15 years by addressing its priority environmental challenges.

The vision statement was developed starting from the challenges identified in the technical assessment of the environmental baseline of the city of Bucharest and considering the suggestions provided by the stakeholders during the survey conducted in December 2023 (see Table 3 in Section 1 above). Thus, the statement aimed to encompass the challenges identified and the concerns raised by the stakeholders.

The Green City Vision Statement for Bucharest is presented in Figure 4.

Figure 4: Bucharest Green City Vision



3.2 Strategic goals

To accomplish the Green City Vision, a set of strategic goals and targets have been developed. In accordance with the EBRD GCAP Methodology, the strategic goals have been formulated around the indicators that scored red or yellow in the pressure-state-response framework. These goals will guide the development of GCAP. The strategic goals are detailed in Table 8.

Table 8: Bucharest GCAP Strategic goals and targets

Sector	Strategic goal	Indicator name	Current status	Target	Time horizon
Governance and strategic planning	Elaborate and implement governance models, strategies and plans to address the needs for investments and soft measures that make the urban environment more resilient to climate and other natural shocks	Public and non-motorised transport is promoted through information and awareness campaigns			3 years
		Traffic demand is managed through congestion charges and smart technologies			5 years
		Public transport emergency management (in publicly and/or privately run networks) is planned and tested			4 years
		Energy efficient industrial technologies (electricity, heat, industrial processes) is supported through private investment			4 years
		The resilience of electricity networks in case of disaster is tested and enhanced through investment			4 years
		Littering and non-compliance to sorting systems is dis-incentivised through fines and penalties			3 years
		Green building is promoted through standards and fiscal incentives			4 years
		Drainage facilities are developed through plans and investment			5 years
		Water saving and reuse is encouraged through awareness campaigns			4 years
		Transit-oriented development is promoted			7 years
		Mixed-use development is promoted through zoning regulations or incentives			5 years
		Database system (integrated, shared by all local administrative bodies – general council, districts, subordinated bodies) and digital infrastructure		Database system and digital infrastructure established	7 years
		Collaboration of city's administrative authorities and integrated participatory planning & governance		Collaboration and integrated participatory planning & governance enhanced	4 years

Sector	Strategic goal	Indicator name	Current status	Target	Time horizon
Urban transport	Increase the quality, extent, reliability, safety and inclusiveness of the network of public transport service, while encouraging, through appropriate infrastructure, the non-motorised modes of urban transportation	Average age of car fleet in years	12.4 years	7-8 years	7 years
		The number of commuters working in the subject city who use private transport (cars)	43%	20%	4 years
		Average daily speed of bus service	13 km/h	>25 km/h	4 years
		Kilometres dedicated exclusively to public transit pe 100,000 inhabitants	2.4 km	>25 km	4 years
		Kilometres of bicycle path per 100,000 inhabitants	0.9 km	>15 km	5 years

Sector	Strategic goal	Indicator name	Current status	Target	Time horizon
Energy	Consolidate the power grid to cope with the increasing demand and enhance the share of renewable energy consumed in the city, for electricity, heating and cooling of the buildings	Share of district heating from carbon intensive sources	100%	<50%	12 years
		Percentage of network line losses	9%	<5%	4 years
		Share of renewable in total energy consumption	0%	>10%	5 years
		Power outage by climate extremes such as heatwaves, wind, storms, snow	15%	<10%	4 years
		Share of population with access to quality heating / cooling, i.e. meeting the required demand to achieve norm temperatures in the building.	80%	100%	4 years

Sector	Strategic goal	Indicator name	Current status	Target	Time horizon
Solid Waste	Reform the waste management system in terms of governance and infrastructure to ensure that the city follows closely the EU targets on municipal waste at national level	Total municipal solid waste generation per capita	497 kg/capita/year	390 kg/capita/year	3 years
		Proportion of dry recyclables that are separated at the source or from the mixed municipal solid waste stream	21%	55%	6 years
		Proportion of organic waste that is separated at the source or from mixed municipal solid waste stream.	7%	>30%	6 years
		Municipal solid waste treated in sorting, processing and treatment plants	35%	>90%	6 years

Sector	Strategic goal	Indicator name	Current status	Target	Time horizon
Buildings	Increase the energy efficiency of buildings and decrease the share of fossil fuels in district heating production, along with improving the related information to offer transparency about the energy performance of the building stock	Share of buildings with energy performance certificates	2%	> 30%	7 years
		Electricity consumption in residential building over the year	124 kWh/m^2	<26 kWh/m^2	7 years
		Electricity consumption in public buildings	212 kWh/m^2	<100 kWh/m^2	7 years
		Average fossil fuel consumption for heating and cooling in all types of buildings per square meter measured over the year.	144 kWh/m^2	<100 kWh/m^2	7 years

Sector	Strategic goal	Indicator name	Current status	Target	Time horizon
 Water	Ensure full coverage of the city with drinking water supply networks, while modernising and improving the performance of the existing networks (drinking water and wastewater) to protect the surface water bodies and promote a sustainable water resources management. Development and implementation of Nature Based Solutions, especially Sustainable Urban Drainage Systems in order to decrease the urban flooding risk.	Industrial water consumption in total urban water consumption	38%	<17%	5 years
		Average length of sewer pipes breakages/malfunctioning recorded each year.	3.43 breaks/km/year	0 breaks/km/year	5 years

Sector	Strategic goal	Indicator name	Current status	Target	Time horizon
 Land use and open space	Improve the use of urban land to address the high population density by ensuring access to high-quality green public spaces in all residential areas and to all categories of population	Share of population living within 300 m of open green space of at least 0.5 ha	<30%	40%	15 years
		Population density on urban land	8,900 inh/km^2	<7,000 inh/km^2	15 years
		Vacancy rates of residential buildings	6.6%	5%	12 years
		Index related to minimize mineralization of soil (and/or compensatory measures) / biotope index		Biotope index established in urban regulation and applied in building permits	4 years

Sector	Strategic goal	Indicator name	Current status	Target	Time horizon
 **Air quality**	Collect and use reliable data to understand the sources of pollution particles as a strategy for curbing pollution where it originates	Average annual concentration of $PM_{2,5}$[97]	15.7 µg/m³	<10 µg/m³	4 years
		Average annual concentration of PM_{10}	29.66 µg/m³	<20 µg/m³	4 years
		Average daily concentration of NO_x	52.76 µg/m³	<20 µg/m³	4 years

[97] Based on the average of the values for 2021, 2022 and 2023. Source: https://apmbuc.anpm.ro/raportare-anuala.

4 Bucharest Green City Actions

Herăstrău Lake and the House of the Free Press

4.1. Actions overview

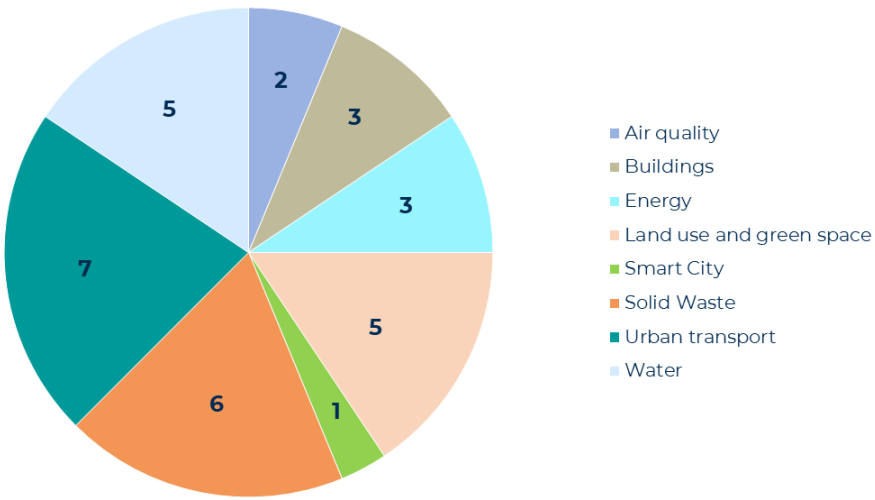
Actions composition

Bucharest GCAP consists of **32 prioritised actions**. Of these, **19 are "hard" investment actions**, **10 actions are a combination of investment and policy**, whereby the investments require legal frameworks, and **3 are "soft" policy actions**. The GCAP actions are explained in detail in sections 4.2 to 4.9, whereby an individual fiche is dedicated to each action. Each action is accompanied by a code reflecting the sector and the number within the respective sector. Table 9 and Figure 5 provide an overview of the composition of the actions per sector.

Table 9: Overview of actions split per sector

Sector	Number of actions	Number of "hard" investment actions	Number of investments and policy actions	Number of "soft" policy actions
Urban transport	7	5	2	0
Energy	3	0	2	1
Solid Waste	6	5	0	1
Buildings	3	2	1	0
Water	5	4	1	0
Land use and green space	5	3	1	1
Smart city	1	0	1	0
Air quality	2	0	2	0
Total	**32**	**19**	**10**	**3**

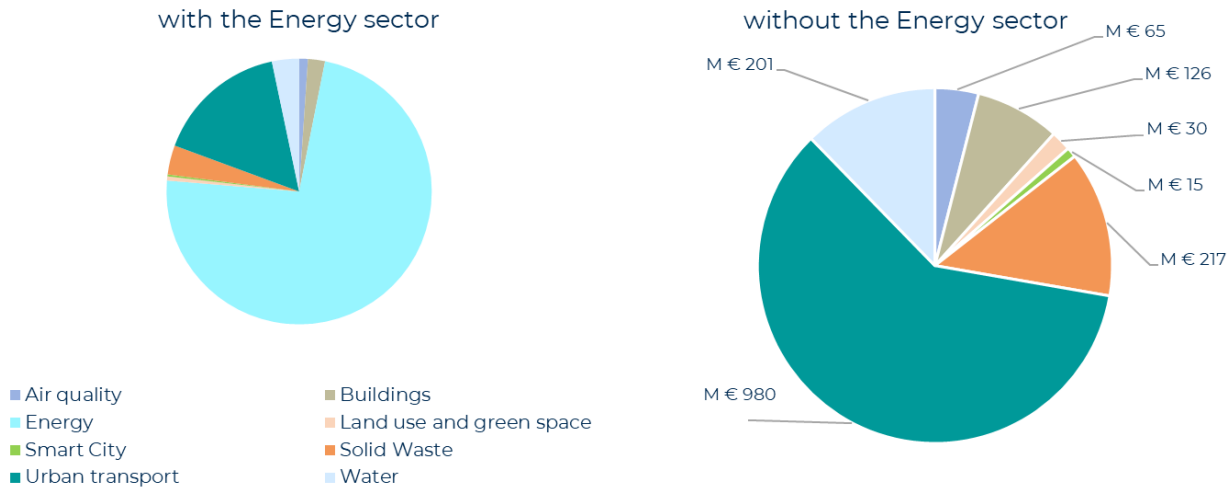
Figure 5: Sectoral Distribution of the GCAP actions



Estimated investment needs for GCAP Actions

Each GCAP action fiche provides estimates for **capital investments (CAPEX) and yearly operational investments (OPEX)**, along with potential sources of funding and possible funding instruments. It is estimated that around **EUR 1.3 billion** is needed for implementing the "hard" investment actions, approximately **EUR 4.8 billion** for the investment actions that also include the development of the policy framework for their implementation, and **EUR 19 million** for the "soft" policy actions. This adds up to a total GCAP CAPEX budget of approximately **EUR 6.1 billion**, distributed per sector as shown in Figure 6. The **energy sector** actions take about 73% of the whole GCAP budget, amounting to approximately **EUR 4.46 billion**, due to the high capital needs for converting the district heating to renewable energy sources. For this reason, the pie chart in Figure 6 shows the distribution of the capital expenditures with the energy sector (left picture) and without the energy sector (right picture) to better highlight the CAPEX for the rest of the GCAP sectors. Thus, the right picture reveals that transport sector is the next most capital-intensive sector with around 15% of the total CAPEX of Bucharest GCAP. The total OPEX of Bucharest GCAP are estimated at approximately **EUR 320 million** for a 5-year period.

Figure 6: CAPEX distribution per GCAP sector in EUR



The largest amount, i.e. almost 90% of the finances needed for implementing the GCAP actions, proposed to be sourced by EU funds and programmes, such as the **Recovery and Resilience Plan, InvestEU, the Cohesion Funds, Horizon Europe, LIFE Programme**, but also from **International Financial Institutions** such as the EBRD,, as well as **Private-Public Partnerships** (PPPs). The financial instruments through which the money can be channelled include **grants, loans, green municipal bonds, sustainability-linked bonds, but also Technical Assistance (TA) instruments**. Only a small amount, i.e. approximately 10% will be sourced from the municipal budget, while the operating cost will be almost exclusively based on the municipal budget and on the budgets of the utility companies.

Estimated carbon emissions reductions

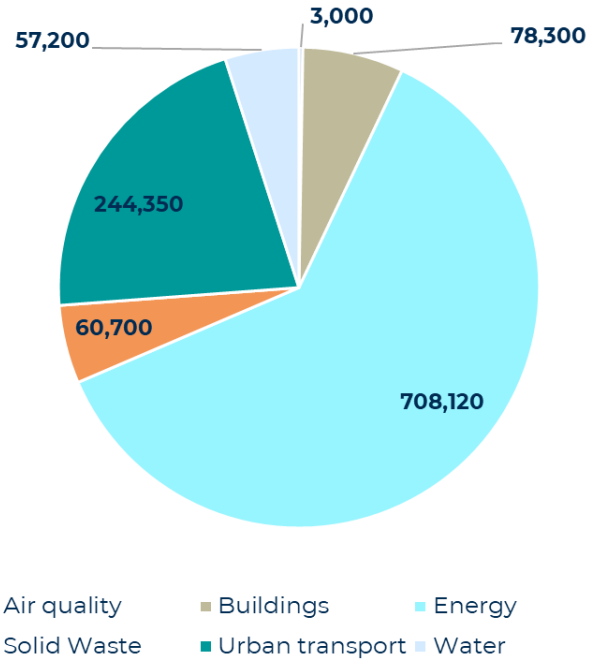
Taken together, the GCAP actions have the potential to **reduce GHG emission** by an estimated **1,151 ktCO_2e per year**, which represents around 9-10% of the Bucharest current emissions.[98] Figure 7 provides and overview of the estimated GHG emission reduction for each GCAP sector for which these could be estimated. The highest potential resides with the energy sector which is responsible for 61% of the total estimated GHG emission reduction of the GCAP sectors, mainly

[98] This is based on the estimates for business-as-usual emissions of the city from the Policy and Urban Framework report.

due to the decarbonisation of the district heating sector of the city (action **E 1**). The second contribution is that of the urban transport sector with 21% of the total estimated GHG emission reduction of the GCAP sectors, resulting primarily from the switch to a net-zero public transport fleet.

As some actions are complementary rather than substitutes in achieving GHG emission reduction, to avoid double counting, in the action fiche, the resulting emissions reduction has been recorded only once. For the complementary actions, the respective fiche mentions the action to which the total emission reduction has been recorded. This is the case for some actions in the energy, solid waste, buildings, water and air quality sectors.

Figure 7: Estimated annual GHG emission reduction per GCAP sector in tCO_2e

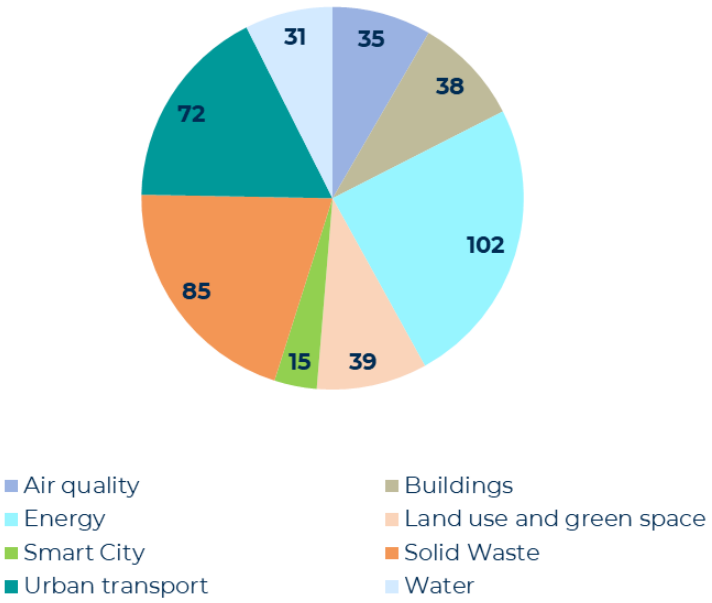


Estimated job creation

Along with GHG emissions reduction benefits and cross-cutting benefits in terms of gender and economic inclusion, urban resilience and the acceleration of city's digitalisation to reach smart maturity, the GCAP actions also have the potential for job creation. It is estimated that most actions have the potential to create new jobs, both in the investment phase (e.g. construction, rehabilitation, installation, landscaping works etc.) and on a longer-term basis in the operation and maintenance phase of the specific investments. In total, **417 new jobs** could be supplied through the implementation of Bucharest GCAP. Most jobs will be created in the energy sector followed by solid waste and transport sector. Figure 8 shows the number of estimated new jobs per GCAP sector.

Despite high capital investments in some sectors, in particular the transportation sector, these investments are directed to upgrading or renewing assets and equipment (see actions UT 1, UT 5, AQ 1, AQ 2 etc. below). Hence, they will not create a significant number of jobs. However, other high-investment actions do create a sizable number of new jobs, and they are often in the category of green jobs, e.g. recycling, green space and implementation of nature-based solutions, decarbonisation of district heating, installation of EV charging stations etc.

Figure 8: Distribution of job creation per GCAP sector



Gender and economic inclusion

The GCAP actions will contribute to reducing gender-based discrimination and harassment and improve economic inclusion of vulnerable groups. This will be accomplished through accessible design and service expansion of public transport fleet, design of the transport stops that is friendly with persons with disabilities, gender-mainstreamed green spaces, reduction of energy poverty for vulnerable groups, equitable access to clean transport alternatives, good quality renovated housing, cleaner air that improves overall health of city's inhabitants, as well as gender-desegregated data collection to inform further city policies.

However, some of the GCAP actions may disrupt current employment, for instance for those employed in traditional vehicle maintenance, requiring reskilling initiatives to ensure equitable workforce inclusion in the green economy. Therefore, these transformations need to be operated considering the vulnerable categories and the women who are generally most prone to difficulties in achieving re-skilling and re-training.

Overview of Bucharest Green City Actions

Table 10 provides an overview of the individual actions, along with the most important elements, namely the action type, whether the action provides cross-cutting benefits, the estimated CAPEX and OPEX, as well as the estimated GHG emissions reduction and estimated jobs that can be created through their implementation.

Table 10: Overview of Bucharest Green City Actions

Sector	Action ID	Action title	Action type	GCAP Action Classification	Co-benefits			Estimated costs (EUR)		Estimated carbon emission reduction (Annual tCO_2e)	Estimated jobs created
					Climate action/risk and vulnerability	Gender and economic inclusion	Smart maturity	CAPEX [million EUR]	OPEX (Over 5 years) [million EUR]		
Urban transport	UT 1	A net-zero emissions public transport fleet and associated infrastructure	Investment	Capital investment	Directly targeted	Directly targeted	Directly targeted	450	N.A.	134,200	5
	UT 2	LEZ with air quality monitoring systems	Policy/ Investment	Capital Investment	Directly targeted	Directly targeted	Directly targeted	15	N.A.	65,700	15
	UT 3	Implementation of the Velo Master Plan	Investment	Capital Investment	Directly targeted	Directly targeted	Directly targeted	150	N.A.	3,000	10
	UT 4	Modern and accessible public and intermodal transport and public transport stops	Investment	Capital Investment	Directly targeted	Directly targeted	Directly targeted	70	N.A.	18,000	10
	UT 5	Optimization and prioritization of public transport through the development of Intelligent Transport Systems	Investment	Capital Investment	Directly targeted	Directly targeted	Directly targeted	70	N.A.	4,200	0
	UT 6	EV public charging network	Investment	Capital Investment	Directly targeted	Directly targeted	Directly targeted	25	N.A.	16,250	18
	UT 7	Intermodal mobility Hubs and Park & Ride Facilities	Policy/ Investment	Capital Investment	Directly targeted	Some elements	Directly targeted	200	N.A	3,000	14
Energy	E 1	Decarbonisation of district heating (planning, investments and programmes)	Policy/ Investment	Strategies, plans, and programmes	Directly targeted	Directly targeted	Directly targeted	3,484	7	708,120	95

Sector	Action ID	Action title	Action type	GCAP Action Classification	Co-benefits			Estimated costs (EUR)		Estimated carbon emission reduction (Annual tCO_2e)	Estimated jobs created
					Climate action/risk and vulnerability	Gender and economic inclusion	Smart maturity	CAPEX [million EUR]	OPEX (Over 5 years) [million EUR]		
	E 2	Energy Manager at municipal level	Human resources / Policy	Strategies, plans, and programmes; Capital investment; Awareness raising, demonstration, training, and capacity building	N.A.	Some elements	N.A.	976	0.455	included in E 1	5
	E 3	Map of electricity grid risks	Policy	Strategies, plans, and programmes	Directly targeted	Some elements	Directly targeted	0.78	N.A.	included in E 1	2
Solid Waste	SW 1	Mechanical-biological treatment facility for mixed municipal waste	Investment	Capital Investment	Directly targeted	Some elements	N.A.	150	175	40,700	25
	SW 2	Infrastructure for separate collection of municipal waste	Investment	Capital Investment	Directly targeted	Directly targeted	Directly targeted	14	7.65	included in SW 1	25
	SW 3	CDW recycling facility	Investment	Capital Investment	Directly targeted	Some elements	N.A.	5	3.75	included in SW 1	15
	SW 4	Biological treatment facility for biowaste	Investment	Capital Investment	Directly targeted	Some elements	N.A.	15	15	20,000	12
	SW 5	Compliant landfill	Investment	Capital Investment	Some elements	Some elements	N.A.	15	30	included in SW 4	0
	SW 6	"Pay-as-you throw" schemes for the six districts	Policy	Strategies, plans, and programmes	Some elements	Some elements	Directly targeted	18	3.475	included in SW 4	8
Buildings	B 1	Energy audits and proactive measures for existing buildings	Policy/ Investment	Standards, guidelines, and regulations Capital Investment	Directly targeted	Directly targeted	Directly targeted	4.45	5.15	39,150	5
	B 2	Addressing seismic and climate-change risks	Investment	Capital Investment	Directly targeted	Directly targeted	Directly targeted	44.1	3	included in B 1	15
	B 3	Upgrades of HVAC systems	Investment	Capital Investment	Directly targeted	Directly targeted	Directly targeted	77.65	5	39,150	18

Sector	Action ID	Action title	Action type	GCAP Action Classification	Co-benefits			Estimated costs (EUR)		Estimated carbon emission reduction (Annual tCO_2e)	Estimated jobs created
					Climate action/risk and vulnerability	Gender and economic inclusion	Smart maturity	CAPEX [million EUR]	OPEX (Over 5 years) [million EUR]		
Water	W 1	Modernisation of the drinking water network	Investment	Capital Investment	Some elements	Some elements	Directly targeted	193	1.675	included in W 3	20
	W 2	Nature-based solutions for stormwater management	Investment	Capital Investment/ Standards, guidelines and regulations	Some elements	Some elements	Directly targeted	2.1	0.175	included in W 3	5
	W 3	Technology upgrade for industrial wastewater management	Investment	Capital Investment	Some elements	N.A.	Directly targeted	0.6	0.115	57,200	2
	W 4	Reuse of treated wastewater	Policy/Investment	Standards, guidelines and regulations Capital Investment	Some elements	Some elements	Some elements	3.4	2.45	included in W 3	2
	W 5	Rehabilitation and protection of surface water resources	Investment	Capital Investment	Some elements	Some elements	Directly targeted	2.15	0.8	included in W 3	2
Land use and green space	LU 1	Centre for urban planning	Policy and Investment	Strategies, plans, and programme Standards, guidelines, and regulations	Directly targeted	Directly targeted	Directly targeted	0.091	1.19	N.A.	2
	LU 2	Urban regeneration and coherent spatial planning	Policy	Strategies, plans, and programmes	Some elements	Some elements	Directly targeted	0.2	N.A.	N.A.	0
	LU 3	Additional green spaces in high-density neighbourhoods	Investment	Capital Investment	Some elements	Directly targeted	N.A.	9	0.86	N.A.	12
	LU 4	Parks rehabilitation	Investment	Capital Investment	Directly targeted	Directly targeted	N.A.	5.78	0.16	N.A.	10
	LU 5	Urban renewal pilot concepts	Investment	Capital Investment	Directly targeted	Some elements	N.A.	15	2.4	N.A.	15
Smart City	SC 1	Integrated digital infrastructure/ databases	Policy/Investment	Capital Investment	Some elements	Some elements	Directly targeted	15	N.A.	N.A.	15
Air quality	AQ 1	Integrated pollution management and monitoring system	Policy/Investment	Strategies, plans, and programmes	Directly targeted	Some elements	Directly targeted	17	N.A.	included in AQ 2	5

Sector	Action ID	Action title	Action type	GCAP Action Classification	Co-benefits			Estimated costs (EUR)		Estimated carbon emission reduction (Annual tCO_2e)	Estimated jobs created
					Climate action/risk and vulnerability	Gender and economic inclusion	Smart maturity	CAPEX [million EUR]	OPEX (Over 5 years) [million EUR]		
	AQ 2	Green belt of Bucharest-Ilfov	Policy/Investment	Strategies, plans, and programmes	Directly targeted	Some elements	N.A.	48	55.08	3,000	30
TOTAL								**6,095**	**320.4**	**1,151,670**	**417**

4.2. GCAP Urban transport actions

The technical analysis and stakeholder consultations have deemed the urban transport sector as the most important GCAP sector of Bucharest. This is reflected in the large number of actions that have been shortlisted. In fact, with its **seven actions**, this is the sector with the largest number of actions in the GCAP. They are set to tackle the pollution problem in the city by increasing the attractiveness of public transport and discouraging the use of private cars in the city centre. Hence, the actions proposed for the urban transport sector have the potential to reduce GHG emissions with 244,350 tCO_2e per year. They also represent the sector with the second-largest investments. The actions in the transport sector are coded **UT 1 to UT 7.**

UT 1	**A net-zero emissions public transport fleet and associated infrastructure** Invest in the renewal of the tram lanes, depots and public transport vehicles, and in the expansion of the net zero-emission public transport fleet
Sector	Urban transport
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Poor performance of the public transport Lack of a coherent vision and a timebound action plan to improve low-emission mobility Traffic congestion aggravated by poor urban planning (lack of public amenities) and consequently by an increase in the number of owned cars per capita
Strategic objective supported	Increase the quality, extent, reliability, safety and inclusiveness of the network of public transport service
Linkage to existing policies /plans	Sustainable Urban Mobility Plan (SUMP) Integrated Urban Development Strategy (IUDS) Integrated Urban Development Plan for Bucharest's Central Zone Ilfov County Development Strategy STB SA Development Strategy 2020-2030 Noise Reduction Action Plan Integrated Air Quality Plan for Bucharest Sector 1 Sustainable Development Strategy 2020-2030 Economic and Social Development Program – Sector 2 Local Development Strategy for Marginalized Urban Areas in Sector 2 Integrated Urban Development Program for Sector 6 (2021-2030) Law no. 155/2023 on sustainable urban mobility National Strategy & Action Plan for Adaptation to Climate Change (2024-2030)
Description	
This action seeks to fully transform Bucharest's public transport system by transitioning to a **net-zero emissions fleet**. The initiative will focus on three interconnected components as detailed below. **Component 1: Modernization of depots and charging infrastructure.** Depots will be overhauled to accommodate electric vehicle (EV) technologies and optimized for renewable energy use. This includes: • **Solar panels and energy storage systems**: Depots will generate their own electricity through renewable sources, reducing reliance on grid power and supporting the overall sustainability of the fleet.	

- **Advanced charging infrastructure**: Fast-charging stations will be installed at depots to ensure rapid turnaround for electric buses and trams.
- **Energy-efficient maintenance facilities**: Modern maintenance centres will be equipped to service electric vehicles efficiently, with energy-saving technologies and eco-friendly materials.

Research suggests that incorporating solar panels and energy storage systems can significantly reduce the carbon footprint of depot operations[99,100].

Implementation steps of Component 1:

1. Conduct a feasibility study focused on prioritizing depot modernization, assessing the potential for renewable energy generation and the capacity needed for electric vehicle maintenance and charging.
2. Develop a detailed design for the modernization of depots, including the installation of solar panels, energy storage systems, and fast-charging infrastructure. Ensure alignment with energy efficiency and sustainability standards.
3. Launch a tender for contractors to implement the depot modernization, including energy system installation and construction of maintenance facilities.
4. Begin the physical upgrades of depots, including installing renewable energy sources (solar panels), energy storage systems, and charging stations for electric vehicles. Coordinate construction with the planned expansion of the electric fleet.
5. Continuously monitor the energy usage, operational efficiency, and capacity of the modernized depots. Make necessary adjustments to optimize performance.

Component 2: Renewal of tram lanes. The existing tram infrastructure will be upgraded to improve efficiency and durability, aligning it with the requirements of modern electric trams. Key modernization strategies include upgrading tracks, improving signalling systems, and integrating smart technologies for real-time passenger information. Tram routes will also be redesigned to improve connectivity with other public transport modes such as buses and metro stations, facilitating easier transfers for passengers. These upgrades will help reduce travel times and energy consumption while boosting the reliability of the tram network.

Implementation steps of Component 2:

1. Map and prioritise renewal of tram lines.
2. Develop detailed engineering designs for tram line upgrades, including track replacements, signalling system improvements, and intersection modifications. These designs should ensure seamless integration with other public transport modes and optimize routes for higher efficiency.
3. Launch a public procurement process to select contractors for the renewal of tram tracks and the upgrading of signalling systems. The procurement should include sustainability criteria and require that contractors minimize disruption to daily tram services during construction.
4. Begin the physical renewal of tram lines, focusing on high-priority sections identified in the feasibility study. Upgrade signalling systems to ensure smoother operations and enhance passenger safety. Special consideration should be given to intersections, integrating tram signals with Bucharest's improved transport management system (BTMS).
5. Continuously monitor the performance of the renewed tram lines, gather data on travel times and service reliability. Use real-time data from the smart transport system to further optimize tram operations.

Component 3: Transition to a Fully Electric and Efficient Fleet. Priority will be given to replacing aging diesel buses with more ecological alternatives, while trams will be upgraded to the latest electric models. The new fleet will feature:

- **Low-floor, fully accessible designs**: This ensures ease of access for passengers with disabilities, parents with strollers, and elderly individuals.
- **Real-time data integration**: Vehicles will be equipped with IoT devices to communicate with the city's smart transport system, providing real-time data on location, energy use, and maintenance needs. This transition will not only cut emissions but also improve the overall public transport experience by offering quieter, smoother, and more reliable services.

Implementation steps of Component 3:

1. Assess needs, plan routes and service improvements based on anticipated new vehicle capacity.
2. Develop technical specifications for electric buses and trams, ensuring they meet environmental and accessibility standards. Launch a public procurement process to acquire new electric vehicles.

[99] Eskander, M., Plenz, M., Avdevicius, E., & Schulz, D. (2023). Optimal design of modular electrical infrastructure for large-scale electric bus depots. IEEE Access, 11, 13754-13772.
[100] Binduhewa, P. (2021). Sizing algorithm for a photovoltaic system along an urban railway network towards net zero emission. International Journal of Photoenergy, 2021, 1-17.

<table>
<tr><td colspan="4">3. Start deploying the newly acquired electric vehicles on high-demand routes. Coordinate vehicle introduction with depot upgrades to ensure charging infrastructure is in place.
4. Provide training programs for drivers and maintenance staff to operate and maintain the new electric fleet effectively. These programs will cover energy-efficient driving techniques, use of real-time data systems, and maintenance of electric vehicles.
5. Track the energy use, performance, and environmental impact of the new electric fleet through the smart transport system. Adjust routes and service levels based on real-time data and ensure that the fleet's integration with depots is seamless.</td></tr>
<tr><td>Linkage to other GCAP actions</td><td colspan="3">UT4: Modern and accessible public transport
UT5:

E3: Map of electricity grid risks
AQ1: Integrated pollution management and monitoring system
SC1: Integrated digital infrastructure/ databases</td></tr>
<tr><td rowspan="2">Cross-cutting themes/co-benefits</td><td>Climate action</td><td>Gender and economic inclusion</td><td>Smart maturity</td></tr>
<tr><td>Directly targeted
<u>Reason:</u>
The switch to a fully electric fleet, coupled with renewable energy use and energy efficiency at depots, will significantly lower Bucharest's transport-related carbon footprint. By eliminating diesel vehicles, Bucharest can reduce air pollution, cut emissions of NO_x and $PM_{2.5}$, and improve public health. This will also make the transport system more resilient to energy price fluctuations and external disruptions.</td><td>Directly targeted
<u>Reason:</u>
By integrating accessible design in the specifications during the public procurement procedure, the new fleet will feature vehicles that are easy to board for everyone, including women with children, elderly individuals, and people with disabilities. Also, by integrating service expansion, the new public transport fleet will be providing more frequent, reliable, safe, better connected and cleaner transport options in underserved areas. This is an action that supports inclusive mobility, connecting marginalized communities with economic and social hubs.</td><td>Directly targeted
<u>Reason:</u>
Real-time data collected from vehicles and charging stations will be used for route optimization, reducing idle time, and ensuring that energy use is as efficient as possible. The depots will also be connected to the smart grid, enabling dynamic energy management, especially during peak hours. Internet of Things integration across the fleet and depots will allow for predictive maintenance. This reduces vehicle downtime, improves operational efficiency, and ensures that public transport remains reliable. The city plans to enhance its ITS/ATMS, which will enable the prioritization of buses and trams at intersections. Through smart ticketing, which is already in place, digital platforms will allow passengers to track vehicle locations in real-time, access eco-friendly journey options, and purchase contactless tickets, improving the user experience.</td></tr>
<tr><td>Implementation steps and timeline</td><td>Step</td><td>Duration (months)</td><td>Step owner/ support required</td></tr>
</table>

	Component 1: Depots modernization		
	Feasibility study and planning	6 months	TPBI, STB, City Hall
	Detailed design of depot upgrades	6-8 months	City Hall, STB, consultant
	Public procurement for depot upgrades	4 months	City Hall
	Depot modernization and energy system installation	18-24 months	Contractors
	Monitoring and Optimization	Ongoing	STB, TPBI, City Hall
	Component 2: Renewal of tram lanes		
	Feasibility study and route optimization	6 months	TPBI, STB, City Hall
	Detailed design for tram line upgrades	8 months	City Hall, consultant
	Public procurement for tram infrastructure upgrades	6 months	City Hall
	Renewal of tram lines and signalling systems	18-24 months	Contractors
	Monitoring and adjustment	Ongoing	City Hall, STB, TPBI
	Component 3: Transition to a fully electric fleet		
	Assessment of fleet needs and planning for transition to fully electric fleet by 2035	6 months	TPBI, City Hall, Transport Operators
	Public procurement for electric fleet expansion	6 months	Transport Operators, TPBI, City Hall
	Deployment of electric fleet	12-18 months	Transport Operators
	Training for drivers and maintenance staff	Ongoing, 12-18 months	Transport Operators, contractors
	Monitoring and system integration	Ongoing	Transport Operators, TPBI, City Hall
Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**	
	City Hall	Involve	
	Transport Operators, Contractors	Involve, Collaborate	
	TPBI	Involve	
	Ilfov County Council	Consult	
Indicative costs [EUR]	**CAPEX**	**OPEX**	
	450,000,000		
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant or loan	Recovery and Resilience Plan	50%
	Guarantee	InvestEU	50%
Revenue opportunities	Yes	Revenue opportunities exist in advertising on modernized electric trams and buses. Additionally, savings on maintenance and fuel from electric fleet	

		transition can create long-term operational cost reductions, indirectly enhancing revenue. Issuing green bonds or sustainability-linked financing to fund the fleet could also attract environmentally conscious investors and generate a return tied to emissions reductions.
Impact of the action: Quantitative and Qualitative	State indicators	• Average annual concentration of $PM_{2,5}$ • Average annual concentration of PM_{10} • Average annual concentration of NO_x • Annual CO_2 equivalent per capita • Annual CO_2 emissions per unit of GDP
	Pressure indicators	• Transport modal share in commuting (cars, motorcycles, taxis, buses, metro, tram, bicycles, pedestrians) • Transport modal share in total trips • Motorization rate • Average number of vehicles (cars and motorbikes) per household • Kilometres of road dedicated exclusively to public transit per 100,000 population
	Estimated Carbon Emissions Reduction	Replacing Bucharest's 1,534 diesel buses with electric models reduces emissions by around **129,000 tCO_2e per year**, calculated using an average annual distance travelled of 73,000 km per bus and emissions of 1.15 kg CO_2/km. Upgrading 246 km of tram routes for approximately 76,000 km travelled per tram for a fleet of 300 trams in operation adds an estimated **2,000 tCO_2e per year** savings assuming a 15% reduction in energy usage from improved efficiency. Modernizing 19 depots to increase energy efficiency by 25% further contributes **3,200 tCO_2e per year**. Total reduction estimated: **134,200 tCO_2e per year**. These emissions reduction estimates are calculated based on best available data for Bucharest and averages used at EU level, therefore it should be considered with caution. Further refinement is recommended once actions are implemented.
	Physical annual savings	If all the diesel bus fleet were replaced, fuel cost savings from bus electrification would total **€62.7 million/year** (using €1.4/litre diesel cost and 2.5 km/litre consumption). Tram lane efficiency upgrades save **€2.14 million/year** in energy costs, assuming 8,550,000 kWh/year saved at €0.25 per kWh and 2.5 kWh per km consumption. Depot upgrades add **€250,000/year** in energy savings. Total savings: **€65 million/year**.
	Climate resilience benefits	**Lower emissions:** Fewer cars, cleaner air. **Better health:** Reduced pollution improves public health. **Reliable transport:** Access to essential services, even in extreme weather. **Less congestion:** Smoother traffic flow, less fuel used. **More green space:** Potential to repurpose land for green infrastructure.
	Reductions in operating expenditures	N.A.
	Social and economic benefits/Gender considerations	Benefits: Improved air quality, which would reduce health issues like asthma and cardiovascular diseases, particularly among vulnerable groups. Economically, a greener fleet could lower fuel and maintenance costs,

		attract EU funding, and support green jobs in vehicle maintenance and infrastructure. Less than 5 new jobs expected to be created in technical fields connected to EV and fuel cell technology, as well as administrative skills in fleet logistics and operations management.
Potential risk of the action	**Area**	**Risk**
	Social	Potential fare increases to fund the transition, could disproportionately affect low-income users. Also, the shift may disrupt current employment for those reliant on traditional vehicle maintenance, requiring reskilling initiatives to ensure equitable workforce inclusion in the green economy.
	Environmental	**Waste:** Need to recycle old vehicles and construction materials properly. **Construction disruption:** Temporary ecosystem disruption and waste. **Noise:** Trams can generate noise, especially in dense areas.
	Economic	Potential fare increases would have economic impacts as users of public transport will have marginally less disposable income.

UT 2	**LEZ with air quality monitoring systems** Establish Low Emissions Zone(s) (LEZ) at metropolitan level, endowed with air quality monitoring systems
Sector	Urban transport
Action Type	Policy/Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Poor performance of the public transport Traffic congestion aggravated by poor urban planning (lack of public amenities) and consequently by an increase in the number of owned cars per capita Lack of a coherent vision and a timebound action plan to improve low-emission mobility
Strategic objective supported	Increase the quality, extent, reliability, safety and inclusiveness of the network of public transport service
Linkage to existing policies /plans	Law no. 155/2023 on sustainable urban mobility Law no. 104/2011 on air quality, as amended Sustainable Urban Mobility Plan (SUMP) Integrated Air Quality Plan for Bucharest Integrated Urban Development Plan for Bucharest's Central Zone Integrated Urban Development Strategy (IUDS) Ilfov County Development Strategy STB SA Development Strategy 2020-2030 Parking Strategy in Bucharest Sector 1 Sustainable Development Strategy 2020-2030 Economic and Social Development Program – Sector 2 Local Development Strategy for Marginalized Urban Areas in Sector 2 Sector 3 Sustainable Development Strategy 2021-2027 Sector 4 Development Strategy 2020-2024 Sector 5 Local Development Strategy Integrated Urban Development Program for Sector 6 (2021-2030) National Strategy & Action Plan for Adaptation to Climate Change (2024-2030)

Description

This action focuses on designing, promoting, and implementing a **Low Emission Zone (LEZ)** across the metropolitan area of Bucharest. The LEZ will gradually restrict the most polluting vehicles from accessing the city, with a clear phase-out calendar that differentiates between fuel types (e.g., diesel, gasoline) and vehicle age. Diesel and older vehicles will face stricter, accelerated restrictions compared to other cars.

The success of the LEZ will be closely tied to a robust air quality monitoring system, with an increased number of measuring stations, and time-bound campaigns to identify and address air pollution hotspots. Public transparency on air quality data is key for ensuring public acceptance. Enforcement will be supported by camera monitoring, street signs, and a communication campaign to raise awareness of the benefits. Fines will be imposed on non-compliant vehicles, and these funds will be redirected to a Clean Mobility Fund, which will help alleviate transport poverty and support sustainable mobility.

Public acceptability is a critical factor for the success of LEZs. Engaging with the community through surveys and public forums can help gauge public opinion and address concerns[101], as public support is often linked to the perceived effectiveness of air quality policies. Therefore, it is essential to communicate the health benefits associated with reduced pollution levels, as demonstrated in studies by Pestel and Wozny[102], Additionally, providing transparent information about the LEZ objectives and expected outcomes can foster greater acceptance.

The effectiveness of LEZs can be significantly enhanced by implementing complementary measures. This includes improving public transport services, creating pedestrian zones, and developing cycling

[101] Oltra, C., Sala, R., López-Asensio, S., & Germán, S. (2023). Public acceptability of policies to reduce urban air pollution: a population-based survey experiment. Revista Española De Sociología, 32(4), a195.

[102] Pestel, N. and Wozny, F. (2021). Health effects of low emission zones: evidence from German hospitals. Journal of Environmental Economics and Management, 109, 102512.

infrastructure[103]. The experience from Lisbon indicates that without complementary measures, the impact of LEZs on traffic reduction may be limited[104]. Therefore, a holistic approach that integrates various transport modes will encourage a shift away from private vehicle use.

Implementation steps:

1. Define the boundaries of the LEZ and determine the classification of vehicles based on emissions standards (e.g., Euro standards). A phased approach will be developed to gradually increase restrictions on high-emission vehicles.
2. Upgrade network of air quality monitoring stations across the city to reflect pollution from vehicles and conduct time-bound campaigns with passive NO_2 samplers to determine if further action is needed in specific areas. Furthermore, use mobile air quality monitoring labs to target high-traffic areas and pollution hotspots and establish an air quality baseline for the city and monitor the impact of the LEZ. Publicly share the data through real-time dashboards.
3. Develop, procure and implement Automatic Number Plate Recognition cameras at entry points to the LEZ, enabling automatic identification of non-compliant vehicles. Establish a system for issuing fines, with funds directed to the Clean Mobility Fund.
4. Launch a communication campaign to inform the public about the LEZ, how to comply, and the benefits to air quality and public health. Highlight the reinvestment of fines into mobility solutions for vulnerable communities.
5. Continuously monitor air quality and traffic data to assess the impact of the LEZ. Adjust the zone's size and restrictions based on data. Publish annual reports to ensure transparency and maintain public support.

Linkage to other GCAP actions	AQ1: Integrated pollution management and monitoring system SC1: Integrated digital infrastructure/ databases LU1: Centre for urban planning UT7: Mobility Hubs and Park & Ride facilities UT6: EV public charging network		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* The LEZ will significantly reduce CO_2 emissions and air pollutants like NO_x and $PM_{2,5}$, particularly in dense urban areas. By gradually phasing out high-polluting vehicles, this action will support Bucharest's climate goals and contribute to cleaner air and a healthier urban environment. LEZs in cities like Berlin, London, and Madrid have demonstrated effectiveness in lowering NO_2 levels by up to 20-30%.	**Directly targeted** *Reason:* The Clean Mobility Fund will target resources toward low-income groups, women, and socially vulnerable populations, ensuring they are not disproportionately affected by transport poverty due to the LEZ. Affordable, sustainable mobility solutions (e.g., public transport subsidies, bike-sharing) will be developed, providing equitable access to clean transport alternatives.	**Directly targeted** *Reason:* The LEZ will integrate with Bucharest's smart city infrastructure, using real-time air quality monitoring systems and camera-based enforcement to dynamically monitor vehicle emissions and enforce regulations. The deployment of the ANPR system will provide opportunities for enhanced traffic monitoring, such as identifying vehicles entering the LEZ. The data collected from air quality sensors will feed into the city's broader smart mobility platform, allowing for data-driven decision-making and optimization of the LEZ boundaries and policies over time.
Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	Design of Low Emission Zone Boundaries and Standards	6-9 months	City Hall, Municipal Council, S1-S6 City Halls, Ministry of Development, National

[103] Börjesson, M., Bastian, A., & Eliasson, J. (2021). The economics of low emission zones. Transportation Research Part A: Policy and Practice, 153, 99-114.
[104] Silva, F. N. d., Lajas, R., & Martins, H. (2014). Low emission zone: Lisbon's experience. Journal of Traffic and Logistics Engineering, 2(2), 133-139.

			Police, Romanian Auto Registry, Ministry of Environment, Waters and Forests and its ancillaries, such as the National Agency for Environment Protection / Air Quality National Reference Laboratories
	Installation of Air Quality Monitoring Systems	6 months, concurrent	City Hall, Ministry of Environment, Waters and Forests and its ancillaries, such as the National Agency for Environment Protection / Air Quality National Reference Laboratories, contractors, NGOs
	Enforcement Systems: ANPR Camera Installation	12-18 months	National Agency for Environment Protection / Air Quality National Reference Laboratories, Contractors
	Communication and Awareness Campaign	Ongoing	City Hall, S1-S6 City Halls, Municipal Council
	Monitoring, Evaluation, and Reporting	Ongoing	City Hall, S1-S6 City Halls, Municipal Companies

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	City Hall, Municipal Council, S1 – S6 City Halls, Municipal Companies	Involve, Empower
	Line ministries and subordinated bodies	Consult & Collaborate
	Contractors	Collaborate
	NGOs	Inform & Consult

Indicative costs [EUR]	**CAPEX**	**OPEX**
	15,000,000	

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant or loan	Recovery and Resilience Plan	50%
	Loan	InvestEU	50%

Revenue opportunities	Yes	Establishing Low Emissions Zones (LEZ) offers revenue opportunities through fines on non-compliant vehicles, which could be reinvested into city mobility improvements. Premium zone-specific parking surcharges within the LEZ could also serve as a deterrent for high-emission vehicles while generating revenue to support air quality initiatives.
Impact of the action: Quantitative and Qualitative	State indicators	• Average annual concentration of $PM_{2,5}$ • Average annual concentration of PM_{10} • Average annual concentration of NO_x • Annual CO_2 equivalent per capita • Annual CO_2 emissions per unit of GDP
	Pressure indicators	• Average age of car fleet, total and by type • Percentage of diesel cars in total vehicle fleet • Share of total passenger car fleet using alternative energy, total and by type

		• Motorization rate • Average number of vehicles (cars and motorbikes) per household • Average travel speed on primary thoroughfares during peak hours • Travel speed of bus service on major thoroughfares, daily average
	Estimated Carbon Emissions Reduction	The phased implementation of Bucharest's Low Emissions Zone (LEZ) aims to progressively reduce high-emission vehicles in the city, addressing its older fleet with an average age of 12.4 years and a 43.5% share of diesel vehicles. Operating year-round, the LEZ initially targets a 10% reduction in high-emission vehicles, saving **21,900 tCO_2e per year**. Mid-term goals raise this to a 20% reduction, yielding **43,800 tCO_2e per year**, and long-term plans aim for a 30% reduction, achieving **65,700 tCO_2e per year**[105]**.**
	Physical annual savings	Health cost savings from cleaner air in LEZ areas could range between **€1.3 to €3.9 million/year**, with reductions in respiratory and cardiovascular illnesses due to lower pollutant levels and improvement in life quality. This range assumes that the implementation is phased and that health-related savings are approximately €30,000 to €80,000 per tonne of $PM_{2,5}$ reduced and €10,000 to €30,000 per tonne of NO_x reduced and an average of 0.005 tonnes of $PM_{2,5}$ and 0.02 tonnes of NO_x per vehicle/year, average vehicle emission for older diesel cars aligning with EURO 3 and EURO 4 standards.
	Climate resilience benefits	• Improved air quality: Reduced emissions of pollutants like nitrogen dioxide (NO_2) and particulate matter ($PM_{2,5}$), leading to better respiratory health and overall well-being for residents. • Reduced greenhouse gas emissions: Contributes to mitigating climate change by limiting emissions from vehicles within the LEZ. • Encourages sustainable transportation: Incentivizes the use of public transport, cycling, and walking, promoting a healthier and more active lifestyle. • Enhanced urban environment: Cleaner air can lead to a more pleasant urban environment, making the city more attractive for residents, businesses, and tourists. • Data-driven decision-making: Air quality monitoring provides valuable data to assess the effectiveness of the LEZ and inform future policies.

[105] Since there is no clear signal from the city for the preference of the size and type of LEZ, the methodology for calculating the estimated emissions reductions is based on assumptions that are informed by the average age of the car park, a high share of diesel vehicles (fuel type), a conservative average length of car trips and a conservative estimate for vehicles affected in time by the introduction of a LEZ within the city center.

The calculation can be adjusted based on the actual size and conditions for the LEZ (e.g elimination calendar for EURO norms and/or fuel type), average trip lengths data and information on the car park from the Romanian Auto Registry and information on disaggregated emissions on EURO norms, fuel and engine size using COPERT – the industry standard emissions calculator, a tool which the city has access to and capacity to use to calculate avoided emissions inside the LEZ, based on agreed upon assumptions.

Therefore, the formula and assumptions for calculating the emissions used in the current calculation are:
Annual CO2 reductions = no. of vehicles affected daily x average emissions factor x average length of car trip x no. of days in the year the LEZ is active x percent of high emissions vehicles affected.

	Reductions in operating expenditures	N.A.
	Social and economic benefits/Gender considerations	Improved public health due to reduced air pollution, leading to lower healthcare costs and enhanced quality of life for residents. It can also stimulate local economies by promoting green transportation options and attracting businesses focused on sustainability. 10-15 new jobs expected to be created in technical and administrative fields such as air quality measurement, spatial data analysis and GIS as well as community outreach and communication.
Potential risk of the action	**Area**	**Risk**
	Social	Potential marginalization of low-income communities that may rely on older, polluting vehicles unable to afford upgrades or replacements, leading to increased inequality and social tension. Furthermore, there could be resistance from businesses that depend on high vehicle traffic or logistical operations that could be hindered by stricter regulations.
	Environmental	• Economic impact on certain groups: May disproportionately affect low-income residents who rely on older, more polluting vehicles. Mitigation measures (e.g., subsidies for cleaner vehicles) are crucial. • Potential for displacement of pollution: If not implemented carefully, pollution may simply be shifted to areas outside the LEZ. Requires regional coordination. • Implementation challenges: Requires effective enforcement mechanisms and clear communication to ensure compliance. • Initial investment costs: Setting up monitoring systems and enforcement infrastructure requires upfront investment
	Economic	Costs of fleet replacement would have impacts on businesses involved in transport.

UT 3	**Implementation of the Velo Master Plan** Build connected bike lanes according to the Velo Master Plan
Sector	Urban transport
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Lack of infrastructure for alternative (non-motorised) modes on transport Lack of a coherent vision and a timebound action plan to improve low-emission mobility Traffic congestion aggravated by poor urban planning (lack of public amenities) and consequently by an increase in the number of owned cars per capita Lack of intermodal facilities
Strategic objective supported	Increase the quality, reliability, safety of public transport service
Linkage to existing policies /plans	Velo Master Plan Sustainable Urban Mobility Plan (SUMP) Integrated Air Quality Plan for Bucharest Integrated Urban Development Plan for Bucharest's Central Zone Integrated Urban Development Strategy (IUDS) Ilfov County Development Strategy STB SA Development Strategy 2020-2030 Parking Strategy in Bucharest Sector 1 Sustainable Development Strategy 2020-2030 Economic and Social Development Program – Sector 2 Local Development Strategy for Marginalized Urban Areas in Sector 2 Sector 3 Sustainable Development Strategy 2021-2027 Sector 4 Development Strategy 2020-2024 Sector 5 Local Development Strategy Integrated Urban Development Program for Sector 6 (2021-2030) Law no. 155/2023 on sustainable urban mobility National Strategy & Action Plan for Adaptation to Climate Change (2024-2030)

Description

The implementation of Bucharest's **Velo Master Plan** aims to develop an integrated and connected cycling network across the city between 2025 and 2034, with a main network of 150 km and a secondary network comprising 415 km. This plan focuses on constructing a network of bike lanes, enhancing intermodality, and making cycling a safer and more attractive transportation option, while providing a fleet of electric bikes and associated infrastructure. The bike lanes will be bi-directional, physically separated from motorized traffic, and will connect key areas and other central and suburban regions. The network will cover critical intersections with public transport, including metro stations, facilitating the seamless transition between cycling and other transport modes. The new lanes will replace some on-street parking and reduce road width where necessary, prioritizing sustainable mobility over private vehicle use.

Implementation steps:

1. Launch a public tender for contractors to build the network, ensuring that the project aligns with sustainability and safety standards.
2. Begin phased construction of bike lanes along key corridors and secondary network, integrating with public transport stops, bike-sharing stations, and parking areas. This includes lane separation measures and installation of necessary signage. The construction of intermodal parking facilities will occur simultaneously to ensure integrated connectivity with the public transport network.
3. Install 200 bike counters and develop a real-time data monitoring platform to assess bike lane usage, safety, and integration with public transport. Test these systems during the early construction phases to ensure smooth operation upon completion. Collect and analyse data to assess the performance of the infrastructure and adjust routes, safety measures, and integration points based on usage patterns.
4. Roll out the 7,000 electric bikes across 350 charging stations, ensuring even distribution across the city to maximize accessibility. The charging stations will be integrated with public transport hubs and parking hubs. Install informational panels at major bike hubs to display real-time data on bike

availability, charging status, and routing options. This will help users plan their journeys and improve the overall user experience.

5. Launch campaigns to raise awareness about the new cycling infrastructure, highlighting safety and convenience. Work with schools and community organizations to promote cycling as a healthy and sustainable form of transport.

Linkage to other GCAP actions	UT7: Mobility Hubs and Park & Ride facilities LU1: Centre for Urban Planning LU2: Urban regeneration and coherent spatial planning SC1: Integrated digital infrastructure / databases UT2: LEZ(s) with air quality monitoring systems

Cross-cutting themes/co-benefits

Climate action	Gender and economic inclusion	Smart maturity
Directly targeted *Reason:* By increasing the share of trips made by bicycles, the Velo Master Plan will contribute to **lowering CO_2 emissions** from urban transport. It will reduce the dependency on private cars, particularly for short trips. The promotion of cycling as a sustainable mode of transport directly supports the city's goals for reducing its carbon footprint and improving air quality.	**Directly targeted** *Reason:* The plan prioritizes **accessibility** and inclusivity, targeting specific groups such as women, elderly individuals, and children. By providing a safe, family and children-friendly, and reliable cycling infrastructure, it ensures that vulnerable populations have access to a convenient and affordable mode of transport. The expansion of safe, properly lighted bicycle parking at residential areas and intermodal stations also addresses the specific needs of lower-income communities who rely more heavily on public transport and non-motorized modes of travel.	**Directly targeted** *Reason:* The **data collection and monitoring system** will leverage smart technologies to provide real-time data on cycling patterns and increase the safety of parking spaces. The use of dashcams will also enable efficient mapping and monitoring of cycling infrastructure, as well as the identification of potential risks. This data will enable more informed decision-making and the optimization of cycling infrastructure. By integrating real-time data into urban planning, Bucharest can make its cycling network more responsive to the needs of its residents and adjust to changing traffic patterns.

Implementation steps and timeline

Step	Duration (months)	Step owner/ support required
Procurement and contractor selection	6 months	City Hall
Construction and lane implementation	2025-2034	Contractor
Monitoring and data collection	Ongoing	City Hall
Deployment of electric bike fleet and charging stations	2027-2029	City Hall, Municipal Companies
Public awareness and launch campaigns	2026, Ongoing	City Hall

Stakeholders

Stakeholder category	Engagement (Inform, Consults, Involve, Collaborate or Empower)
City Hall	Involve
Municipal Companies	Involve
Contractor	Collaborate

Indicative costs [EUR]

CAPEX	OPEX
150,000,000	

Potential funding

Instrument	Source	Amount [EUR]/ share [%]
Grant or loan	Recovery and Resilience Plan	50%

	Loan	InvestEU	50%
Revenue opportunities	Yes	The Velo Master Plan can generate revenue by introducing bike-sharing services with subscription models, which could offer a steady income stream from regular users. Additionally, sponsorships for annual cycling events or partnerships with cycling clubs to host tours along the city's bike lanes could attract sponsorship funds.	
Impact of the action: Quantitative and Qualitative	State indicators	• Average annual concentration of $PM_{2.5}$ • Average annual concentration of PM_{10} • Average annual concentration of NO_x • Annual CO_2 equivalent per capita • Annual CO_2 emissions per unit of GDP	
	Pressure indicators	• Percentage of diesel cars in total vehicle fleet • Transport modal share in commuting (cars, motorcycles, taxis, buses, metro, tram, bicycles, pedestrians) • Motorization rate • Average number of vehicles (cars and motorbikes) per household • Kilometres of dedicated bicycle path per 100,000 population • Average travel speed on primary thoroughfares during peak hours	
	Estimated Carbon Emissions Reduction	Building connected bike lanes is expected to shift 1% of short car trips to bicycles, equating to 10,000 fewer car trips per day. With average car emissions of 0.2 kg CO_2/km and a 5 km trip length, this shift results in **3,000 tCO_2e per year** in emissions reductions.	
	Physical annual savings	Fuel cost savings from reduced car use amount to **€1.8 million/year**. Health benefits from increased cycling and reduced emissions provide an additional **€3 million/year** in public health savings.	
	Climate resilience benefits	• Sustainable transportation: Encourages cycling as a primary mode of transport, reducing reliance on cars and lowering greenhouse gas emissions. • Improved air quality: Fewer cars on the road translates to less air pollution, improving public health and reducing respiratory illnesses. • Increased physical activity: Promotes a healthier and more active lifestyle, reducing the risk of chronic diseases. • Reduced traffic congestion: Frees up road space and eases traffic flow, making the city more efficient and reducing fuel consumption. • Enhanced the quality of life in the city: Creates a more pedestrian and cyclist-friendly city, improving the quality of life for residents. • Economic benefits: Can boost local businesses, tourism, and property values in areas with good cycling infrastructure.	
	Reductions in operating expenditures	N.A.	
	Social and economic benefits/Gender considerations	Enhancing cycling infrastructure promotes active transportation, reduces traffic congestion, and lowers greenhouse gas emissions, leading to improved public health and quality of life. Additionally, it can stimulate local economies by attracting tourists, increasing foot traffic to businesses, and lowering transportation costs for commuters.	

		5 – 10 new jobs expected to be created in fields requiring skills in urban infrastructure design and monitoring tools for bike traffic.
Potential risk of the action	**Area**	**Risk**
	Social	Potential displacement of existing road users, such as drivers and public transport users, may increase travel times and frustration. There could also be pushback from residents and businesses concerned about changes to parking availability and road access. Inclusive community engagement is essential to address these concerns and foster acceptance of the bike lane network.
	Environmental	• Increased impermeable surfaces: Constructing new bike lanes can increase the area of impermeable surfaces (like concrete), which can worsen urban flooding by reducing rainwater absorption. • Disruption of existing green spaces: Depending on the chosen routes, some bike lanes might require the removal of trees or the alteration of existing green spaces, impacting biodiversity and urban ecosystems. • Construction impacts: The construction process itself can generate noise, dust, and waste, temporarily disrupting local environments. • Material sourcing: The materials used to build the bike lanes (e.g., concrete, asphalt) have their own environmental footprint associated with extraction, manufacturing, and transportation. • "Induced demand": While counterintuitive, sometimes new infrastructure can increase traffic, as more people choose to drive due to perceived improved road conditions. This could offset some of the emissions benefits
	Economic	N.A.

UT 4	**Modern and accessible public and intermodal transport and public transport stops** Modernize and increase the accessibility of public transport stops, while improving transport prediction for passengers
Sector	Urban transport
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Poor performance of the public transport Traffic congestion aggravated by poor urban planning (lack of public amenities) and consequently by an increase in the number of owned cars per capita Lack of a coherent vision and a timebound action plan to improve low-emission mobility
Strategic objective supported	Increase the quality, reliability, safety of public transport service
Linkage to existing policies /plans	Sustainable Urban Mobility Plan (SUMP) Integrated Air Quality Plan for Bucharest Integrated Urban Development Plan for Bucharest's Central Zone Integrated Urban Development Strategy (IUDS) Ilfov County Development Strategy STB SA Development Strategy 2020-2030 Noise Reduction Action Plan Sector 1 Sustainable Development Strategy 2020-2030 Economic and Social Development Program – Sector 2 Local Development Strategy for Marginalized Urban Areas in Sector 2 Sector 3 Sustainable Development Strategy 2021-2027 Integrated Urban Development Program for Sector 6 (2021-2030) Law no. 155/2023 on sustainable urban mobility

Description

This action aims to modernize and increase the accessibility of Bucharest's public transport stops, ensuring they meet modern standards for convenience, safety, and inclusivity. Upgrades will include the installation of waiting benches, weatherproof shelters, real-time display boards showing bus and tram arrival times, and improved lighting for safety. Special attention will be given to enhancing accessibility for disabled persons, individuals with visual impairments, and parents with baby strollers. A key part of the modernization will include tactile pavements, ramps for wheelchair users, audio announcements for visually impaired passengers, and dedicated spaces for strollers.

Implementation steps:

1. Conduct an assessment of all public transport stops to evaluate their current state and prioritize those in greatest need of modernization and accessibility upgrades. This will include high-traffic areas and locations serving socially vulnerable populations.
2. Develop detailed plans for upgrading public transport stops, including the installation of tactile paving, ramps, shelters, benches, and real-time display systems. Ensure access to stops and compliance with accessibility standards for disabled persons and visually impaired passengers.
3. Launch tenders for contractors to carry out the modernization of transport stops. Ensure that tenders specify sustainable materials, smart technology integration, and compliance with accessibility regulations.
4. Upgrade and modernize public transport stops, installing new infrastructure and technology systems at prioritized locations. This includes integrating lighting, benches, shelters, and digital displays with real-time transport information.
5. Install real-time arrival boards and integrate them with Bucharest's smart mobility platform.
6. Engage the public and collect feedback on the newly upgraded transport stops, particularly from disabled persons and other users with specific accessibility needs. Make iterative improvements based on user input.

7. Monitor usage and user satisfaction at upgraded stops through surveys and digital feedback. Track improvements in accessibility and user experience to guide future upgrades.

Linkage to other GCAP actions	UT1: A net-zero emissions public transport fleet UT7: Mobility Hubs and Park & Ride facilities LU2: Urban regeneration and coherent spatial planning SC1: Integrated digital infrastructure/ databases AQ1: Integrated pollution management and monitoring system		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* By making public transport more convenient and accessible, this action will encourage a shift from private cars to buses and trams, leading to reduced traffic congestion and lower greenhouse gas emissions.	**Directly targeted** *Reason:* Enhanced accessibility at transport stops will improve mobility for women, elderly individuals, disabled persons, and parents with small children. The inclusion of tactile surfaces, ramps, and audio announcements specifically addresses the needs of visually impaired and mobility-challenged individuals, ensuring that public transport serves all groups equally. This action helps bridge the gap in public transport access for vulnerable populations.	**Directly targeted** *Reason:* Modern public transport stops will integrate smart technologies, such as real-time tracking of bus and tram arrivals through digital displays and wayfinding tools for the visually impaired, improving the passenger experience.
Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/ support required**
	Site assessment and prioritization	6 months	City Hall, S1-S6 City Halls, TPBI
	Design and infrastructure planning	8 months	City Hall, S1-S6 City Halls, TPBI, consultant
	Tendering and procurement	6 months	City Hall, TPBI
	Construction and installation	16-18 months	Contractors
	Smart system integration	Concurrent with construction	Contractors
	Public engagement and feedback collection	Ongoing	City Hall, S1-S6 City Halls, TPBI, NGOs
	Monitoring and evaluation	Ongoing	City Hall, S1-S6 City Halls, TPBI
Stakeholders	**Stakeholder category**		**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	City Hall, S1-S6 City Halls, TPBI		Involve
	Transport operators, contractors		Involve, Cooperate
	Consultant		Consults & Cooperate
	NGOs		Inform & Consults
Indicative costs [EUR]	**CAPEX**		**OPEX**
	70,000,000		
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant or loan	Recovery and Resilience Plan	50%
	Loan	InvestEU	50%

Revenue opportunities	Yes	Enhanced stops with digital displays offer advertising spaces and could also support retail kiosks or vending machines.
Impact of the action: Quantitative and Qualitative	State indicators	• Average annual concentration of $PM_{2,5}$ • Average annual concentration of PM_{10} • Average annual concentration of NO_x • Annual CO_2 equivalent per capita • Annual CO_2 emissions per unit of GDP
	Pressure indicators	• Transport modal share in commuting (cars, motorcycles, taxis, buses, metro, tram, bicycles, pedestrians) • Transport modal share in total trips • Motorization rate • Average number of vehicles (cars and motorbikes) per household
	Estimated Carbon Emissions Reduction	Improving accessibility is projected to shift 2% of car users to public transport, reducing car trips by 30,000 daily. With each car emitting 0.2 kg CO_2/km over a 10 km average trip, this shift yields **18,000 tCO_2e per year** in emissions reductions.
	Physical annual savings	Fuel cost savings from reduced car use amount to **€1.8 million/year**. Health benefits from increased cycling and reduced emissions provide an additional **€3 million/year** in public health savings.
	Climate resilience benefits	• Reduced reliance on private vehicles: By making public transport more appealing and reliable, people are more likely to choose it over private cars, leading to fewer emissions and less air pollution. This directly contributes to mitigating climate change and its associated risks like heat waves and extreme weather events. • Enhanced accessibility during extreme weather: Modernized stops with real-time information can help people navigate disruptions caused by extreme weather events. Imagine digital displays showing alternative routes or providing updates on service changes due to flooding or storms. This makes the city more resilient to disruptions. • Encourages denser urban development: Efficient and accessible public transport supports denser urban development, reducing urban sprawl and the need for car travel. This limits habitat destruction and preserves green spaces, contributing to a more sustainable and resilient city. • Promotes active transportation: Well-designed stops often integrate with walking and cycling infrastructure, encouraging active transportation as part of the public transport journey. This further reduces emissions and promotes healthier lifestyles, which can be a key factor in adapting to a changing climate. • Data-driven adaptation: Real-time data on passenger flow and transport usage can inform climate adaptation strategies. For example, data can highlight areas vulnerable to extreme heat where increased tree canopy or cooling stations at stops might be needed.
	Reductions in operating expenditures	N.A.
	Social and economic benefits/Gender considerations	Modernizing public transport stops and improving accessibility enhances mobility for all users, including the elderly and disabled, while reducing reliance on private vehicles. This can lead to increased ridership, alleviated traffic congestion, and lower emissions, benefiting public health and stimulating local economies.

		5 – 10 new jobs expected to be created, requiring technical and administrative skills in accessibility standards, digital systems integration, stakeholder engagement.
Potential risk of the action	**Area**	**Risk**
	Social	Disruptions during construction may inconvenience vulnerable populations, and prioritizing certain areas could result in unequal access to transport services. Ensuring inclusive planning and effective communication is essential to address these risks and maximize the benefits of modernization efforts.
	Environmental	• Increased energy consumption: Digital displays, real-time information systems, and enhanced lighting at modernized stops consume more energy than traditional stops. This can increase the city's carbon footprint if the energy is sourced from fossil fuels. • Material use and waste generation: Construction and renovation activities require materials like concrete, steel, and electronics, which have environmental impacts associated with their production and transportation. Additionally, demolition of old stops generates waste that needs to be properly managed. • Light pollution: Brighter lighting at stops can contribute to light pollution, disrupting nocturnal wildlife and affecting the urban ecosystem. • Electronic waste: Digital displays and information systems have a limited lifespan and will eventually become electronic waste, requiring proper recycling and disposal to prevent environmental harm. • Habitat disruption: Construction activities can temporarily disrupt local habitats and displace wildlife, particularly if stops are located near green spaces
	Economic	N.A.

UT 5	**Optimization and prioritization of public transport through the development of Intelligent Transport Systems** Invest in improving the operation of Bucharest public transport through integration of ITS systems
Sector	Urban transport
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Poor performance of the public transport Lack of a coherent vision and a timebound action plan to improve low-emission mobility Traffic congestion aggravated by poor urban planning (lack of public amenities) and consequently by an increase in the number of owned cars per capita
Strategic objective supported	Increase the quality, reliability, safety of public transport service
Linkage to existing policies /plans	Sustainable Urban Mobility Plan (SUMP) Integrated Air Quality Plan for Bucharest Integrated Urban Development Plan for Bucharest's Central Zone Integrated Urban Development Strategy (IUDS) Ilfov County Development Strategy STB SA Development Strategy 2020-2030 Law no. 155/2023 on sustainable urban mobility

Description

This action focuses primarily on integrating the Bucharest Traffic Management System (BTMS) with Automated Vehicle Location to prioritize public transport at intersections and by integrating other ITS components aiming at improving the public transport service. These upgrades aim to improve the efficiency and reliability of public transport by prioritizing buses and trams at signalized intersections as well as optimizing traffic flow and reducing congestion in general.

Currently, STB vehicles are equipped with Automated Vehicle Location devices, but the data is only used for traveller information. This action will expand the use of AVL data to communicate with BTMS, allowing real-time adjustments to traffic signals. If public transport vehicles are behind schedule, traffic signals will prioritize their passage at key intersections. The BTMS will be dynamically adjusted based on real-time data to ensure that delayed buses and trams move through intersections with minimal stoppage, improving service reliability and reducing delays. This upgrade will also contribute to reducing fuel consumption and emissions by minimizing idling at traffic lights.

The action proposed recommends the implementation of other ITS components that could deliver further improvements of public transport services, including, but not limited to:

- Introducing ITS enforced camera systems on bus/tram lanes that detect and ticket unauthorized vehicles in dedicated lanes
- Equipping vehicles with sensors that monitor engine diagnostics, fuel consumption, brake performance and other critical parameters, allowing the operator to schedule maintenance before breakdowns occur
- In-cabin systems that can guide drivers toward more efficient driving styles
- Predictive modelling that combines real-time AVL data, historical demand patterns and external factors to predict where capacity and frequency need adjustment throughout the day
- Integrate real-time in-station displays or digital signage at bus/tram stops
- Introducing automated incident detection on buses/trams that alert operator/BTMS to unusual stops, emergency button presses or abrupt changes in passenger flows like forced doors

Implementation steps:

1. Assess the technical requirements for integrating AVL data with BTMS and prioritizing public transport vehicles at signalized intersections, including but not limited to potentially upgrading AVL devices on public transport vehicles. Identify key intersections where the system would provide the most benefit, focusing on high-traffic areas. Assess further introduction and integration of other ITS components.
2. Upgrade or develop and test the technology necessary to link AVL data from public transport vehicles with BTMS, ensuring that traffic signals can dynamically adjust to prioritize delayed buses and trams. Develop and test integration with other ITS components.

3. Implement and test the integrated BTMS/AVL at selected high-traffic intersections. Test the system in real-time to ensure that public transport vehicles receive signal priority as intended. Monitor the impact on traffic flow, public transport punctuality and/or accuracy of real-time estimations on arrivals. Implement and test other ITS components.
4. Inform the public about the improvements to the transport system, emphasizing the benefits of dedicated bus lanes and the new integrated ITS components. Provide training for public transport drivers to ensure they understand how the systems work.
5. Continuously monitor the performance of the integrated ITS components and of dedicated bus lanes. Use real-time data to make necessary adjustments to optimize traffic flow and public transport efficiency. Collect data on public transport punctuality, passenger satisfaction, and traffic patterns.

Linkage to other GCAP actions	SC1: Integrated digital infrastructure/ databases UT1: A net-zero emissions public transport fleet UT4: Modern and accessible public transport		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* By prioritizing public transport vehicles, this action will encourage a **modal shift** from private cars to buses and trams, reducing traffic congestion and associated greenhouse gas emissions. The decreased travel times and smoother traffic flow will also **reduce the fuel consumption and idling of buses**, lowering overall emissions.	**Directly targeted** *Reason:* The improved reliability and reduced travel times for buses and trams will benefit socially vulnerable groups, including women, elderly individuals, and low-income residents who rely on public transport. Enhanced public transport services provide more **equitable access to economic and social opportunities** across the city, especially for populations that may not have access to private vehicles.	**Directly targeted** *Reason:* **Real-time data** will be leveraged to manage traffic flow and dynamically adjust signals, ensuring that public transport is prioritized at critical intersections. This enhances the efficiency of the overall transport system while using technology to streamline operations. **BTMS – AVL integration** will be monitored in real-time through sensors and data collection systems, providing the city with valuable insights into traffic patterns and helping to optimize the system continuously.

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	System design for ITSBTMS – AVL Integration	6 months	City Hall, TPBI, Transport Operators
	Development/upgrade and integration of technology	12 months	City Hall, TPBI, contractors
	Pilot testing and installation at key intersections	12 months	City Hall, TPBI, Transport Operators, contractors
	Public communication and staff training	Ongoing	City Hall, TPBI, Transport Operators, contractors
	Monitoring and optimization of integrated ITS	Ongoing	City Hall, TPBI

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	City Hall, TPBI, ADIZMB	Involve
	Transport Operators, Contractors	Involve, Collaborate

Indicative costs [EUR]	**CAPEX**	**OPEX**
	70,000,000	

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU: Cohesion Fund, Recovery and Resilience Plan, and/or InvestEU	100%

Revenue opportunities	Yes	Data on public transport patterns can be anonymized and sold to researchers, urban planners, or advertisers looking for insights into commuter behaviour. Enhanced system data may also be monetized through partnerships with traffic management apps or ride-sharing platforms.
Impact of the action: Quantitative and Qualitative	State indicators	• Average annual concentration of $PM_{2.5}$ • Average annual concentration of PM_{10} • Average annual concentration of NO_x • Annual CO_2 equivalent per capita • Annual CO_2 emissions per unit of GDP
	Pressure indicators	• Transport modal share in commuting (cars, motorcycles, taxis, buses, metro, tram, bicycles, pedestrians) • Transport modal share in total trips • Average travel speed on primary thoroughfares during peak hours • Travel speed of bus service on major thoroughfares, daily average • Efficiency of transport emergency systems in case of disaster
	Estimated Carbon Emissions Reduction	Extending BTMS improves traffic flow, reducing idling and stop-and-go traffic for 100,000 vehicles daily. A 5% reduction in idling emissions is estimated to save **4,200 tCO_2e per year** based on average emissions of 0.2 kg CO_2/km over 14 km/day per vehicle.
	Physical annual savings	Fuel savings from reduced idling total **€2.94 million/year** (using an average fuel consumption of 10 litres per 100 km and a fuel cost of €1.4 per litre). Maintenance savings from reduced vehicle wear and tear add **€600,000/year**.
	Climate resilience benefits	• Optimized Traffic Flow & Reduced Congestion: Less idling and stop-and-go traffic: A smart system can optimize traffic light timing and adjust traffic flow in real-time, reducing idling and unnecessary acceleration/deceleration, which are major sources of emissions. This leads to lower fuel consumption and greenhouse gas emissions. • Reduced congestion: By efficiently managing traffic flow and providing real-time information to drivers, the system can help avoid congestion hotspots, further reducing emissions and improving air quality. • Enhanced Public Transport Efficiency: Prioritizing public transport: The system can prioritize public transport vehicles at intersections, reducing travel times and making public transport a more attractive option. This encourages a shift away from private vehicles, leading to lower overall emissions. • Real-time information: Providing passengers with accurate, real-time information on public transport arrival times improves reliability and encourages ridership, further reducing reliance on private vehicles. • Facilitating Multimodal Transport: Integrated information: By providing real-time information on various modes of transport, including public transport, cycling routes, and pedestrian walkways, the system can help people make informed choices and plan multimodal journeys. This can lead to a reduction in car usage and promote more sustainable transport options. • Adapting to Extreme Weather Events through real-time adjustments: During extreme weather events like heavy rain or heat waves, the system can adjust traffic flow, reroute public transport, and provide real-time information to help people navigate the city safely and efficiently. This

		enhances the city's ability to cope with climate-related challenges. • Emergency response: In case of emergencies, the system can assist with evacuations, direct traffic flow for emergency vehicles, and provide critical information to residents, improving the city's overall resilience. • Data-Driven Decision Making: Traffic pattern analysis: The system collects valuable data on traffic patterns and transport usage, which can be used to inform future urban planning and infrastructure development. This data-driven approach can help create a more sustainable and resilient transport network.
	Reductions in operating expenditures	N.A.
	Social and economic benefits/Gender considerations	Extending, improving and integrating Intelligent Transport Systems can enhance overall transport efficiency, leading to reduced travel times and improved reliability for commuters. This investment can also facilitate better traffic management, decrease congestion, and lower emissions, ultimately contributing to a more sustainable urban environment and improved quality of life for residents No new jobs are expected to be created.
Potential risk of the action	**Area**	**Risk**
	Social	Potential disruptions during the implementation phase, may inconvenience commuters and create temporary traffic challenges. Additionally, if the system integration is not accompanied by adequate community outreach and user training, there could be confusion and resistance among residents, potentially undermining the effectiveness of the improvements.
	Environmental	• Increased energy consumption: A more complex and technologically advanced transport management system will likely require more energy to operate, potentially increasing carbon emissions if the energy comes from non-renewable sources. • Manufacturing and e-waste: Upgrading and expanding the system will involve manufacturing new hardware (sensors, cameras, servers, etc.), which has an environmental footprint. Properly managing the e-waste from old equipment is crucial. • Data centres and energy use: Storing and processing large amounts of traffic data requires significant computing power, potentially leading to increased energy consumption in data centres.
	Economic	N.A.

UT 6	EV public charging network Invest in planning and expanding electric vehicles (EVs) public charging infrastructure
Sector	Urban transport
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Poor performance of the public transport Lack of a coherent vision and a timebound action plan to improve low-emission mobility
Strategic objective supported	Increase the quality, reliability, safety of public transport service
Linkage to existing policies /plans	Sustainable Urban Mobility Plan (SUMP) Integrated Air Quality Plan for Bucharest Integrated Urban Development Plan for Bucharest's Central Zone Integrated Urban Development Strategy (IUDS) Ilfov County Development Strategy Parking Strategy in Bucharest Sector 1 Sustainable Development Strategy 2020-2030 Economic and Social Development Program – Sector 2 Local Development Strategy for Marginalized Urban Areas in Sector 2 Sector 3 Sustainable Development Strategy 2021-2027 Sector 4 Development Strategy 2020-2024 Sector 5 Local Development Strategy Integrated Urban Development Program for Sector 6 (2021-2030) Law no. 155/2023 on sustainable urban mobility National Strategy & Action Plan for Adaptation to Climate Change (2024-2030)

Description

This action aims to expand Bucharest's public electric vehicle (EV) charging infrastructure to support the growing number of EVs and accelerate the city's transition to cleaner transportation. The initial target will be a ratio of 1 charger per 10 EVs, following recommendations from the IEA Global EV Outlook and EU Guidelines, while adapting the ratio based on real-time usage and adoption patterns (e.g. McKinsey, BloombergNEF). The placement of chargers will be prioritized for potential users, such as delivery companies, postal service providers, taxi and ride-sharing businesses, transport operators and areas with high traffic density and commuting patterns, such as:

- Highway entrances/exits on A1, A2, and A3.
- Transport hubs, particularly those targeted for Transit-Oriented Development (TOD).
- High-density residential areas (e.g., S1 and S3 sectors).
- Business districts, and shopping & entertainment areas.

The focus will be on residential neighbourhoods, where EV charging availability is a key challenge. Solutions will include:

- Shared charging hubs in neighbourhoods.
- On-street charging stations.
- Partnerships with property developers for retrofitting existing buildings and incentivizing EV charging infrastructure in new developments.

The plan also includes launching pilot projects, establishing PPPs, and integrating smart-charging technologies (e.g., dynamic pricing and load management software) to optimize charging based on demand and grid capacity. Regular monitoring and adaptation of the charging network, as well as public awareness campaigns, will ensure the infrastructure evolves to meet the city's growing EV needs.

Implementation steps:

1. Conduct an EV infrastructure needs assessment and strategic planning to determine the optimal locations for chargers based on traffic data, commute patterns, and existing vehicle density. Prioritize high-traffic areas such as highways, multimodal hubs and high-density residential areas, like S1 and S3. Include an assessment of grid capacity and the availability of medium-voltage lines for fast and ultra-fast charging.

2. Engage stakeholders—including local government, utility companies, private sector partners, and community organizations— a crucial step for successful infrastructure deployment. Stakeholders can provide insights into local needs and preferences, which can inform the planning process[106].
3. Develop partnerships with private companies (e.g., EV charger manufacturers, energy companies) to co-fund and co-develop charging stations in key areas. Incentivize property developers to install charging points in new residential and commercial developments.
4. Launch pilot projects for shared neighbourhood charging hubs and on-street chargers in sectors S1 and S3. These projects will help test solutions for residential EV charging and gather data to guide future deployments. Introduce financial incentives for property owners and managers to retrofit existing buildings with charging infrastructure.
5. Design the charging infrastructure and technology implementation. This includes determining the types of chargers to be installed (e.g., fast chargers vs. standard chargers) and ensuring that the infrastructure is scalable to meet future demand. The integration of renewable energy sources, such as solar panels, can enhance sustainability and reduce operational costs[107]. Furthermore, leveraging smart technology for real-time monitoring and management of charging stations can optimize performance and user experience[108].
6. Run a public awareness campaign to educate residents about the benefits of EVs and the availability of public charging stations. Provide information on subsidies and incentives for purchasing EVs and installing home charging stations.
7. Establish a system for ongoing monitoring. This includes tracking usage patterns, user satisfaction, and the overall impact on EV adoption rates. Adjust infrastructure placement and expansion plans based on real-time data, ensuring the network evolves with demand.

Linkage to other GCAP actions	UT7: Mobility Hubs and Park & Ride facilities L58: Energy Manager at municipal level L64: Map of electricity grid risks LU1: Centre for urban planning LU2: Urban regeneration and coherent spatial planning LU5: Urban renewal pilot concepts SC1: Integrated digital infrastructure/ databases

Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* Expanding Bucharest's EV charging network will significantly reduce emissions from the transport sector by encouraging the adoption of zero-emission vehicles. The presence of a reliable and extensive charging network is key to supporting Bucharest's overall decarbonization.	**Directly targeted:** *Reason:* Given the different travel environments for women and men, especially the fact that women have more stops (by virtue of traditional gender roles, see housework and care work), the consolidation of the EV public charging network, and especially a distribution of stations in areas frequented by women (schools, hospitals, supermarkets,	**Directly targeted** *Reason:* As a future potential development, integrating smart-charging technology into Bucharest's grid will enhance grid resilience by managing peak loads and offering dynamic pricing based on demand. This will enable real-time load balancing and optimize the distribution of electricity. The deployment of smart data will also enable the city to track usage and adjust infrastructure placement based on real-world EV adoption patterns.

[106] Martínez & Sumper, 2023; Wolbertus et al., 2020.
[107] Pearre et al., 2022; Erickson & Jennings, 2017
[108] Pratama, 2024; Sweda & Klabjan, 2015

		parks) will have a direct impact on increasing women's mobility.	
Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	Assessment of EV charging needs and strategic planning	6 months	City Hall, S1-S6 City Halls
	Engage stakeholders and establish supportive policy framework	6 months	City Hall, S1-S6 City Halls, Ministry of Environment, Ministry of Energy, NGOs
	Develop PPPs	6-12 months, concurrent	City Hall, S1-S6 City Halls, Ministry of Environment, Ministry of Finance, private sector
	Launch pilot project for residential charging	6-12 months, concurrent	City Hall, S1-S6 City Halls, private sector
	Design charging infrastructure and implementation	12 months	City Hall, S1-S6 City Halls, consultants
	Run public awareness campaign	10 months	City Hall, S1-S6 City Halls
	Monitoring, evaluation and adaption	12 months, ongoing	City Hall, S1-S6 City Halls
Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**	
	City Hall, S1-S6 City Halls	Involve	
	Ministry of Environment, other line ministries (i.e. Ministry of Energy)	Involve, Collaborate	
	Consultants, Private sector	Consult, Collaborate	
	NGOs	Inform, Consult	
Indicative cots [EUR]	**CAPEX**	**OPEX**	
	25,000,000		
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU: Cohesion Fund, Recovery and Resilience Plan, and/or InvestEU	100%
Revenue opportunities	Yes	EV charging stations directly generate revenue through charging fees for electric vehicle users. Partnerships with energy providers could also offer additional revenue or subsidies. Charging station areas could host digital advertisements or branded station designs sponsored by EV manufacturers or energy companies. With smart charging, the network could participate in grid balancing, potentially earning fees from utilities by reducing or delaying charging during peak hours.	
Impact of the action: Quantitative and Qualitative	State indicators	• Average annual concentration of $PM_{2,5}$ • Average annual concentration of PM_{10} • Average annual concentration of NO_x • Annual CO_2 equivalent per capita • Annual CO_2 emissions per unit of GDP	
	Pressure indicators	• Average age of car fleet, total and by type • Percentage of diesel cars in total vehicle fleet	

		• Share of total passenger car fleet using alternative energy, total and by type
	Estimated Carbon Emissions Reduction	Expanding EV infrastructure supports a shift from ICE to electric vehicles. Assuming 10,000 ICE vehicles switch to electric, each driving an average of 6,500 km annually, the resulting emissions savings are **16,250 tCO_2e per year** (using a 0.25 kg CO_2/km emissions factor, based on the older diesel fleet.
	Physical annual savings	Fuel cost savings from reduced ICE use and revenue from charging fees could total **€6.32 million/year,** assuming an annual distance of 6,500 km per vehicle, a €1.2 average fuel cost and an 8-liter average consumption. Additionally, electric vehicles have lower maintenance costs, providing an estimate of **€10 million/year** in savings, assuming an average maintenance cost of €1,000 per year for an older car.
	Climate resilience benefits	• Reduced emissions: EVs produce zero tailpipe emissions, improving air quality and reducing greenhouse gases that contribute to climate change. This lessens the urban heat island effect and reduces the city's vulnerability to extreme heat events. • Energy diversification: EVs can be charged using renewable energy sources, reducing reliance on fossil fuels and making the city's energy supply more resilient to disruptions. • Emergency preparedness: In a power outage, EVs with bidirectional charging capabilities can act as mobile power sources, providing backup power to homes and critical infrastructure. This enhances the city's ability to respond to extreme weather events and other emergencies. • Reduced reliance on imported fuel: Shifting to EVs decreases dependence on imported fossil fuels, making the city less vulnerable to global energy price fluctuations and supply chain disruptions. • Improved public health: Cleaner air from reduced vehicle emissions leads to better respiratory health and overall well-being, making the population more resilient to health impacts associated with climate change. • Economic opportunities: Investing in EV charging infrastructure can attract businesses and create jobs in the green technology sector, boosting the city's economic resilience. • Enhanced urban life quality: Promoting EVs contributes to a quieter and more pleasant urban environment, making the city more attractive and resilient to the challenges of a changing climate.
	Reductions in operating expenditures	N.A.
	Social and economic benefits/Gender considerations	A comprehensive charging network can create jobs and stimulate local economies, while

		promoting social equity by making EVs a viable option for a broader range of income levels Additionally, improvement of air quality and public health, particularly in urban areas with high traffic pollution is expected. Approximately 18 new jobs are expected to be created in fields requiring skills in planning and feasibility studies, integration of RES systems, PPP modalities and technical knowledge of EV infrastructure needs.

	Area	Risk
Potential risk of the action	Social	Potential unequal access to charging stations, which could disproportionately affect low-income communities and those without off-street parking options. There may also be community resistance to charging station placements, especially if they disrupt residential areas or local businesses.
	Environmental	• Increased Electricity Demand: Fossil fuel reliance: If Bucharest's electricity grid relies heavily on fossil fuels (like coal), increased EV charging could inadvertently increase greenhouse gas emissions. • Grid strain: A sudden surge in electricity demand could strain the existing grid infrastructure, potentially leading to blackouts or the need for costly upgrades. • Battery Production and Disposal: • Resource extraction: EV batteries require metals like lithium, cobalt, and nickel, the extraction of which can have significant environmental impacts (habitat destruction, water pollution). • Manufacturing emissions: Battery production is energy-intensive and can generate greenhouse gas emissions and other pollutants. • End-of-life management: Improper disposal of EV batteries can lead to soil and water contamination due to the release of toxic heavy metals. • Charging Station Placement Land use changes: Building new charging stations can require land clearing and contribute to urban sprawl, potentially impacting ecosystems and biodiversity. • Visual impact: Poorly planned charging stations can detract from the aesthetic appeal of the urban environment. • "Induced demand": More cars, more roads: Just like with bike lanes, more EV infrastructure could encourage more people to drive, potentially leading to increased road construction and its associated environmental impacts.
	Economic	N.A.

UT 7	**Intermodal mobility Hubs and Park & Ride Facilities** Develop Transit Oriented Development Plan and build Mobility Hubs and Park & Ride facilities
Sector	Urban transport
Action Type	Policy/Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Lack of a coherent vision and a timebound action plan to improve low-emission mobility Lack of intermodal facilities Traffic congestion aggravated by poor urban planning (lack of public amenities) and consequently by an increase in the number of owned cars per capita Poor performance of the public transport Weak public parking policy Lack of infrastructure for alternative (non-motorised) modes on transport
Strategic objective supported	Increase the quality, reliability, safety of public transport service
Linkage to existing policies /plans	Law no. 155/2023 on sustainable urban mobility Sustainable Urban Mobility Plan (SUMP) Integrated Air Quality Plan for Bucharest Integrated Urban Development Plan for Bucharest's Central Zone Integrated Urban Development Strategy (IUDS) Ilfov County Development Strategy Parking Strategy in Bucharest Sector 1 Sustainable Development Strategy 2020-2030 Economic and Social Development Program – Sector 2 Local Development Strategy for Marginalized Urban Areas in Sector 2 Sector 3 Sustainable Development Strategy 2021-2027 Sector 4 Development Strategy 2020-2024 Sector 5 Local Development Strategy Integrated Urban Development Program for Sector 6 (2021-2030) National Strategy & Action Plan for Adaptation to Climate Change (2024-2030)

Description

The Transit Oriented Development (TOD) plan seeks to encourage walking, cycling, and public transport by clustering residential, commercial, and recreational developments around major public transport nodes, such as metro and tram stations. By fostering mixed-use developments in high-density areas, these hubs will offer residents easy access to daily needs within a short walking distance.

The TOD framework includes the revitalization of key transport corridors, improving pedestrian and cycling infrastructure, and promoting community engagement to ensure developments meet local needs. Specific focus will be placed on areas such as Gara de Nord, Piața Victoriei, Piața Unirii, and other transit-heavy regions. These areas will be redesigned to offer seamless intermodal connections between buses, trams, metro, cycling, and walking.

Implementation steps:

1. Engage stakeholders, including local authorities, community groups, and transportation agencies, to understand the needs and expectations of the community. This phase should also include surveys and workshops to gather input on transportation needs and urban development goals.
2. Identify priority transit hubs for redevelopment, including Gara de Nord, Piața Victoriei, Piața Unirii, and Aurel Vlaicu. Conduct assessments of current land use, ridership, infrastructure needs and demographic trends.
3. Develop a comprehensive TOD plan that outlines strategies for integrating public transport with residential and commercial development. This plan should focus on creating high-density, mixed-use areas that promote walking and cycling. The plan should also include zoning regulations that support TOD principles.
4. Present the draft plan to the public for feedback. This step is essential for ensuring community buy-in and addressing any concerns. Engaging the public through social media and other platforms can facilitate broader participation.

5. Incorporate feedback and finalize the TOD plan. This step may involve negotiations and adjustments based on stakeholder input, as indicated by the need for consensus in public transport decisions
6. Begin implementing the TOD plan, focusing on infrastructure development and public transport enhancements. Continuous monitoring and evaluation will be necessary to assess the effectiveness of the plan and make adjustments as needed.

Park & Ride facilities will enable commuters to leave their cars at the city's periphery and use public transit to complete their journeys, reducing traffic congestion and emissions within the city centre.
Bucharest has a population of approximately 2.1 million residents, with a high rate of car ownership. For example, cities with similar populations and car ownership rates tend to have 1 P&R facility per 200,000 to 300,000 residents, depending on urban density and public transport usage patterns. This could translate to 7-10 P&R facilities for Bucharest.
Bucharest's high commuter traffic into the city from surrounding areas would suggest that P&R facilities should be strategically placed along major entrance highways (A1, A2, A3) and along metro and tram lines with large passenger capacities.
Bucharest's high commuter traffic into the city from surrounding areas would suggest that P&R facilities should be strategically placed along major entrance highways (A1, A2, A3) and along metro and tram lines with large passenger capacities.
To make sure people riders use them, P&R facilities should be affordable or free for those who combine parking with public transport. The city should also provide real-time updates on public transport schedules and parking space availability via smart apps and digital signage at the P&R facilities. People will use P&R facilities only if they feel confident that their cars are safe. This requires well-lit, secure parking lots with CCTV surveillance and security patrols. The P&R lots should be linked to well-maintained and comfortable transit hubs with shelters, restrooms, and seating to make the switch to public transport seamless and comfortable. Raise public awareness about the benefits of using P&R facilities through marketing campaigns that emphasize the cost savings, reduced stress, and environmental benefits of parking at the city's edge rather than driving into the congested city center. Last, but not least, partner with local employers through PPPs to offer incentives to employees who use P&R facilities, such as subsidized transit passes or rewards programs for regular users.
Implementation steps:

1. Identify potential sites for Park & Ride facilities based on accessibility to public transport and existing traffic patterns. Conduct feasibility studies to evaluate the economic and environmental impacts of proposed sites.
2. Develop designs for the Park & Ride facilities that prioritize user convenience and safety. This phase should consider the integration of facilities with existing public transport networks.
3. Engage the community to gather input on the design and functionality of the Park & Ride facilities. Public participation can enhance the acceptance of the project and ensure that it meets community needs.
4. Prepare the tender documents, including specifications, drawings, and terms of reference for the construction of the Park & Ride facilities. Evaluate bidders, negotiate the terms of the contracts and award the contracts.
5. Prepare for construction by obtaining necessary permits and approvals.
6. Commence construction of the Park & Ride facilities and integrate smart systems. Ensure the system is integrated with Bucharest's Integrated Mobility Center. Regular updates and communication with stakeholders during this phase will help maintain transparency and address any emerging issues.
7. Once construction is complete, test, commission and launch the Park & Ride facilities
8. Promote their use through marketing campaigns. Emphasizing the benefits of using Park & Ride, such as reduced congestion and improved access to public transport, can encourage adoption.

Linkage to other GCAP actions	UT6 EV public charging network E3 Map of electricity grid risks LU1 Centre for Urban Planning LU2 Urban regeneration and coherent spatial planning SC1 Integrated digital infrastructure/ databases AQ1 Integrated pollution management and monitoring system		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* The TOD Plan and P&R facilities will reduce private car dependency,	**Some elements** *Reason:* Improved public transport and cycling options will benefit	**Directly targeted** *Reason:* Key technologies to consider including with new and existing P&R facilities:

	leading to a decrease in greenhouse gas emissions and air pollution.	women, children, the elderly, and persons with disabilities, by providing safer, more reliable, and more inclusive mobility options.	• Parking sensors: detect available spaces and guide drivers through digital displays or mobile apps. • Digital displays: show available parking spaces, transit schedules, and live updates. • Smart lighting: motion-activated LED lights reduce energy consumption while enhancing security. • Surveillance cameras: monitor parking areas for safety. • Automatic Number Plate Recognition (ANPR) that enables automated entry, exit, and payment. • Cashless payments: allow payment through mobile apps or bank cards at terminals • Smart ticketing Integration: combine parking fees with public transport fares using a single payment platform (terminal and/or mobile app). • Mobile apps: provide parking availability, subscription options and other amenities • Smart charging stations for EVs: equipped with integrated payment and real-time status updates. • Shared mobility integration: offer bike-sharing and e-scooter docks connected to the P&R facility.
Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/ support required**
	Transit Oriented Development Plan		
	Stakeholder engagement and needs assessment	3 months	City Hall, S1-S6 City Halls, TPBI, Municipal Companies, Transport Operators, NGOs, private sector
	Data collection and analysis	3 months	City Hall, TBPI, Transport Operators, NGOs
	Drafting the TOD Plan	3 months	City Hall, S1-S6 City Halls, TPBI
	Public review and feedback	3 months	City Hall, TPBI
	Finalization and approval	3 months	City Hall, TPBI
	Implementation and monitoring	10 months	City Hall, TPBI
	Park & Ride facilities		
	Site selection and feasibility study	3 months	City Hall, S1-S6 City Halls
	Design and planning	3 months	City Hall, S1-S6 City Halls, consultants
	Community engagement	3 months	City Hall, S1-S6 City Halls, NGOs
	Tender preparation, bid evaluation and contracting	6 months	City Hall, S1-S6 City Halls
	Construction planning and permitting	6-9 months	City Hall, S1-S6 City Halls, contractors

	Construction and integration of smart systems	6-12 months per facility	City Hall, S1-S6 City Halls, contractors
	Testing, commissioning and launch	2 months	City Hall, S1-S6 City Halls, contractors
	Promotion through marketing campaigns	Ongoing	City Hall, S1-S6 City Halls
	Monitoring and maintenance	Ongoing	City Hall, S1-S6 City Halls
Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**	
	City Hall, S1-S6 City Halls, TPBI	Involve	
	Municipal Companies, Transport Operators	Involve, Collaborate	
	Contractors	Collaborate	
	Consultants	Consult, Collaborate	
	NGOs	Inform, Consult	
Indicative costs [EUR]	**CAPEX**	**OPEX**	
	200,000,000		
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU: Cohesion Fund, Recovery and Resilience Plan, and/or InvestEU	100%
Revenue opportunities	Yes	Revenue can be generated from parking fees at Park & Ride locations and retail leasing opportunities. Additionally, premium or reserved parking spaces at P&R facilities could be offered at a higher rate. Offering short-term workspace rentals within the hubs could attract commuters needing flexible office spaces, especially near key transport links.	
Impact of the action: Quantitative and Qualitative	State indicators	• Average annual concentration of $PM_{2.5}$ • Average annual concentration of PM_{10} • Average annual concentration of NO_x • Annual CO_2 equivalent per capita • Annual CO_2 emissions per unit of GDP	
	Pressure indicators	• Transport modal share in commuting (cars, motorcycles, taxis, buses, metro, tram, bicycles, pedestrians) • Transport modal share in total trips • Average travel speed on primary thoroughfares during peak hours • Travel speed of bus service on major thoroughfares, daily average	
	Estimated Carbon Emissions Reduction	Developing Mobility Hubs and Park & Ride facilities shifts an estimated 5,000 car trips daily to public transit. With each car trip averaging 10 km and emitting 0.2 kg CO_2/km, this action is expected to reduce emissions by **3,000 tCO_2e per year**.	
	Physical annual savings	Reduced car use translates to **€1.8 million/year** in fuel savings. Additional savings of **€500,000/year** stem from reduced congestion and lower road maintenance costs due to fewer vehicles entering the city center.	
	Climate resilience benefits	• Reducing the city's overall carbon footprint: Lowering emissions helps mitigate climate change and its associated risks.	

		• Improving air quality: Cleaner air reduces respiratory illnesses and other health problems exacerbated by climate change. • Creating more sustainable and efficient urban environments: TOD helps create a more compact and connected city, reducing the need for extensive infrastructure and minimizing environmental impacts. • Enhancing accessibility and mobility: A strong public transport system ensures people can access essential services and evacuate safely during extreme weather events.
	Reductions in operating expenditures	N.A.
	Social and economic benefits/Gender considerations	Improved social equity by increasing access to public transportation for diverse populations, including low-income individuals who may rely heavily on transit. These facilities can promote community interaction by creating vibrant public spaces that encourage social engagement and activity. Additionally, they can enhance mobility options for residents, making it easier for them to access employment, education, and essential services. Approximately 14 jobs are expected to be created in fields requiring skills in multi-modal transport planning, urban parking management, smart mobility technologies, user behaviour analysis and demand forecasting.
Potential risk of the action	**Area**	**Risk**
	Social	Social risks include the potential displacement of long-standing residents and businesses as new developments emerge, which may lead to gentrification and loss of community identity. There is also the risk that Mobility Hubs and Park & Ride facilities may not adequately serve marginalized communities if they are not strategically placed, exacerbating existing inequalities in access to transportation.
	Environmental	• Increased Urban Sprawl/ Habitat Loss and Fragmentation: If not carefully planned, TOD can encourage development further away from the city centre, leading to the conversion of natural habitats and agricultural land. This can disrupt ecosystems and reduce biodiversity. • Increased Car Dependency: While TOD aims to reduce car use, poorly designed Park & Ride facilities located far from the city centre might actually encourage people to drive further, increasing overall vehicle miles travelled and emissions. • Construction Impacts: Pollution and Waste: Construction of Mobility Hubs and Park & Ride facilities generates noise, dust, and construction waste, potentially impacting local air and water quality. • Material Sourcing: The materials used for construction (concrete, asphalt, steel) have their own environmental footprint associated with extraction, manufacturing, and transportation. • Impact on Existing Green Spaces: Loss of Green Cover: Depending on their location, Mobility Hubs and Park & Ride facilities might require the removal of trees or the alteration of existing green spaces, affecting urban biodiversity and ecosystem services.

		• Water Management Challenges; Increased Impervious Surfaces: Large parking lots and associated infrastructure increase impermeable surfaces, leading to reduced rainwater infiltration and increased runoff. This can exacerbate urban flooding and pollute waterways.
	Economic	N.A.

4.3. GCAP Energy actions

There are **three actions** prioritised in the energy sector which target the decarbonisation of the district heating, establishing a governance structure for the energy sector at the city level and ensuring a robust energy grid for the foreseen increase demand coming largely from the transportation sector following its decarbonisation. The actions in the energy sector will require the largest investment of all GCAP actions, i.e. approximately 95% of all capital investments of the plan. At the same time, it will create the largest number of jobs, i.e. over 26% of all new jobs created through the Bucharest GCAP. The actions in the energy sector are coded from **E 1 to E 3**.

E 1	**Decarbonisation of district heating (planning, investments and programmes)** Pilot and expand district heating options, considering all sources, carriers and technologies, and exploring alternatives such as resizing, decentralising, decarbonising, refurbishing etc.
Sector	Energy
Action Type	Policy/Investment
GCAP Action Classification	Strategies, plans, and programmes
Priority environmental challenges addressed	• weak quality of district heating (most environmentally and financially efficient heating supply option) in Bucharest • lack of attractiveness of district heating for consumers • high carbon-intensity of district heating and lack of penetration of renewable sources in DHC • lack of financial sustainability of the current DHC setup • low air quality due to individual natural gas boilers being used by over 50% of the population
Strategic objective supported	• Consolidate the power grid to cope with the increasing demand and enhance the share of renewable energy consumed in the city, for electricity, heating and cooling of the buildings • Ensure an appropriate sector coupling, where DHC support the electric grid and facilitate greater penetration of renewable sources for electricity generation as larger scale electrified heat sources are added (mainly heat pumps)
Linkage to existing policies /plans	• Integrated Plan for Air Quality • Plan for Maintaining the Air Quality • National Energy and Climate Action Plan • National Energy Strategy (in adoption) • National Strategy for Energy Performance in Buildings • National Strategy for Heating & Cooling • Integrated Urban Development Strategy • National Strategy & Action Plan on Adaptation to Climate Change (2024-2030)
Description	
As evidenced in the public consultation process implemented during the GCAP elaboration, within the complex milieu of energy challenges the city is facing, heating is the biggest pain point for the citizens. The current state of district heating in Bucharest is unsustainable financially and environmentally. While district heating remains the option of choice in terms of efficiency when it comes to municipal heating and cooling, the current actions to improve the quality of district heating in Bucharest must by redesigned. The starting point for this strategic reshape is a new local heating and cooling plan, as prescribed by Article 25 of the Energy	

Efficiency Directive. The article foresees that all "Member States shall ensure that regional and local authorities prepare local heating and cooling plans at least in municipalities having a total population higher than 45,000". Bucharest will be obliged to prepare such a local heating and cooling plan.
As part of the preparation process, the municipality must undertake the following steps:

- establish the governance structure for the plan (engaging all stakeholders, particularly districts and communities)
- develop a long-term vision to fully decarbonise H&C, while chartering the feasibility of continuing to utilize natural gas in existing or new CHP plants, given the long-term decarbonization targets.
- prepare the plan by assessing all potentials (resources, but also savings), considering all H&C sources, carriers and technologies (including DHC, but also decentralized solutions where more feasible) , and also options for DHC to participate in sector integration (e.g. combining the use of heat storage or heat inertia to pilot the heat generated of large scale heat pumps, as suggested by RED3[109]). The plan should include place-based feasibility studies for increasing the penetration of renewable energy sources (RES) in heat production (e.g. geothermal, HP etc.) to be able to comply with RED2 directive on increasing renewables in heating & cooling. These studies should run in partnership with surrounding Ilfov-based municipalities and should cover the North part of the municipality, where expansion is the highest and in which first indications show the highest geothermal potential. These studies should investigate mapping and utilising sources of urban waste heat for decarbonising the heating in the city. Sources like data centres, wastewater treatment plants and metro systems/stations (ventilation shafts) are potential sources of low-carbon energy for heating, yet now there is no mapping of their potential at municipal level. The plan should also include a permanent climate risk/ resilience assessment instrument. Data management infrastructure (by putting together data collected by difference entities, private and public, including territorial databases on energy efficiency in buildings) should be a core mandate of the governance structure. The specificities of Bucharest require the development of these complex multi-level multi-stakeholder arrangement.

A particular angle of the plan must be energy poverty, the current scarce, albeit credible data showing that several thousand low-income and/ or informal dwellings in Bucharest use wood, municipal waste, paper and cardboard, tires, etc. for heating. One solution can be a Heat Scrap programme, providing financial incentives for citizens to switch to more efficient sources.
Once adopted, the implementation of the plan will comprise investment actions that support the improvement and decarbonization of heating and cooling supply at the city level: continuation and resizing of investments in the heating grid (aiming to also resize the current 3,000+ km of heating grid), investments that tackle the increase of the energy performance of the DH (smart measurement devices, SCADA, etc.), the switch to RE supply, the switch to smaller scale/ building- or neighbourhood-scale solutions, such as heat pumps, heat boilers, etc. The plan will have to mainstream the definition of Efficient DHC as per art 26 of Energy Efficiency Directive (EED) into the policy and financial framework, e.g. by facilitating the access to finance for EDHC, by mandating centralized solutions for all new buildings, etc.
Several specific programmes require to be developed and implemented urgently (cf. link with Energy Action E 2 on Energy Manager at Municipal Level), such as

- Continuing to invest in the electricity grid refurbishment and reinforcement;
- Deployment of geothermal plant to supply district network in the north part of the city; [110]

These programmes are closely linked to those covered under Energy Action E 2 Energy Manager at Municipal Level:

- Replacement of old wood heaters by more efficient heating appliances (fed by renewable sources)
- Deployment of heat pumps, where district heating is not supplying heat to end-consumers (where stand-alone solutions are needed)

These programmes are part of the implementation of the Long-Term decarbonization vision, but given they are already identified to be strategic, they could possibly be implemented ahead of the H&C Plan (to avoid postponing by several years).

Linkage to other GCAP actions	E 2: Energy Manager at municipal level E 3: Map of electricity grid risks B 1: Energy audits and proactive measures for new buildings B 3: Upgrade of HVAC systems SC 1: Integrated digital infrastructure/ databases

[109] Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652
[110] Using the "Business Models Geothermal on DH system paper; The economic Case for Geothermal District Heating for Residential and Industrial Applications in Europe – An LCOH analysis;

	AQ 1: Integrated air pollution management and monitoring system		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* Reducing emissions in the heating and cooling system as well as improving the efficiency of heating systems at municipal level is a significant climate action measure.	**Directly targeted** *Reason:* Making heating systems more efficient has a major impact on the budget of households and can alleviate the pressure related to good household waste management which is considered to be mainly women's responsibility. The special attention given to vulnerable groups (energy poverty) will contribute substantially to improving the quality of life of women who are responsible for housework and care, including heating and providing an energy source for cooking.	**Directly targeted** *Reason:* The use of smart metering (installation of smart measurement devices, SCADA, etc.) will allow to monitor the energy performance of the DH. This initiative will focus on investing in digital solutions like thermal imaging and smart metering systems (e.g., SCADA) to monitor, control, and optimize processes related to heat loss, thereby enhancing energy efficiency and improving resource management. Furthermore, developing a thermo-hydraulic model to gain deeper insights into and optimize heat distribution across the network could complement the refurbishment efforts. The data collected (regarding the energy distribution, the type of sources used, etc.) will be also useful to other actions such as air quality.
Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	Establish governance structure of the plan	2 months	Bucharest municipality with support from line ministries, e.g. Ministry of Energy, Ministry of Development, etc.; Districts' mayoralties; Ilfov mayoralties.
	Long-term vision to fully decarbonize DHC	2 months	Bucharest municipality (political consensus required)
	Prepare plan and specific programmes (reinforce grid, deploy geothermal)	12 months	Bucharest municipality (governance structure members)
	Implement plan and specific programmes	62 months and on ongoing	DHC companies (support needed from municipality, line ministries, etc.)
Stakeholders	**Stakeholder category**		**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	Districts		Collaborate
	Ilfov mayoralties		Involve
	Line ministries		Involve
	Energy companies involved (grid operator, heat suppliers)		Empower
	Owners' associations		Consult
	Energy management & cleantech companies		Inform
Indicative costs [EUR]	**CAPEX**		**OPEX**
	3,483,700,000 This includes: preparation of a long term vision and specific plans, infrastructure costs		1,400,000 This includes the costs of running the new geothermal facility[111]

[111] https://www.georisk-project.eu/wp-content/uploads/2020/10/2020-10-06-Business-plans-for-Geothermal-M-Antics.pdf

	(refurbishment of installation and of 900 km of grid lines, and construction of one geothermal doublet)		
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	TA instruments	European Funds, IFIs	<1%
	Loans	EBRD, EIB, commercial banks	>99%
Revenue opportunities	Yes	Heating & cooling is a paid service.	
Impact of the action: Quantitative and Qualitative	State indicators	• Annual CO_2 equivalent emissions per MWh delivered & MWh produced; • Annual MWh delivered to end consumers per MWh produced	
	Pressure indicators	• Heating and cooling consumption in non-residential buildings from fossil fuels; • Share of population with access to district heating and cooling; • Proportion of total energy derived from RES as a share of total city energy consumption; • Buildings covered by district heating systems	
	Estimated Carbon Emissions Reduction	Considering that DHC is currently supplied by fossil-based energy sources, we can assume that, according to the Municipality Energy Strategy, a reduction of 45% of carbon emissions is realistic, if there is significant increase in performance and penetration of renewable. Thus, it is estimated that this action can reduce **708,120 tCO_2e per year.**	
	Physical annual savings	Savings are expected with regard to reduced energy use (higher efficiency of network, distribution equipment and generation assets)	
	Climate resilience benefits	• Reduced greenhouse gas emissions: Shifting from individual heating systems to a centralized, optimized system allows for the use of more efficient and lower-carbon energy sources, like geothermal, biomass, or waste heat. • Improved air quality: Reduced reliance on individual fossil fuel burning appliances (e.g., gas boilers) leads to lower air pollution levels, improving public health. • Increased energy efficiency: District heating can reduce energy waste through optimized heat generation and distribution, minimizing overall energy consumption. • Enhanced energy security: Diversifying energy sources for district heating reduces reliance on single sources (like natural gas), improving energy security in the face of geopolitical instability or supply disruptions. • Resilience to extreme weather: A well-maintained district heating system can provide reliable heating during extreme cold spells, reducing the risk of disruptions and ensuring thermal comfort for residents. • Reduced fuel poverty: District heating can offer more affordable heating options for low-income households, reducing vulnerability to energy price fluctuations.	
	Reductions in operating expenditures	An efficient DHC is expected to reduce the current operating expenditures of Termoenergetica by over 70%. Furthermore, switching from gas to renewables as energy sources will reduce the operating expenditures on the heating supply side by over 80%.	
	Social and economic benefits/Gender considerations	No more accumulation of public debt due to cross-subsidies, lower cost in citizens' energy bill. Evidence (e.g.: town of Beiuș) shows that switching from gas to geothermal can reduce citizens' heating bill by a factor of 3. Enhancement of social equity by providing affordable and sustainable heating options to a broader range of residents, particularly in low-	

		income areas that may struggle with energy costs. By utilizing diverse sources and technologies, such as renewable energy and waste heat, the initiative can improve energy security and resilience in communities. Additionally, transitioning to decarbonized heating can foster local job creation in green technology sectors, promoting community development and enhancing public health by reducing air pollution and related health issues. Approximately 95 new jobs are expected to be created in fields requiring the following skills: renewable heating systems, planning and operations, energy efficiency optimisation, financial analysis for green energy investments.
Potential risk of the action	**Area**	**Risk**
	Social	Social risks associated with decarbonizing district heating include the potential for disruptions during the transition period, which may inconvenience residents reliant on existing systems. If not managed carefully, there could be increased energy costs during the transition, disproportionately affecting vulnerable populations. Moreover, there is a risk that investments may favour certain neighbourhoods over others, potentially leading to unequal access to improved heating options.
	Environmental	• Source-dependent emissions: If the district heating system relies heavily on fossil fuels (like natural gas or coal), it can still contribute to greenhouse gas emissions and air pollution. • Leakage and heat loss: Aging or poorly maintained pipes can lead to heat loss and potentially leakages, impacting energy efficiency and potentially contaminating soil or groundwater. • Construction impacts: Expanding the district heating network involves excavation and construction, which can disrupt ecosystems, generate noise and dust pollution, and produce construction waste. • Water consumption: Depending on the cooling technology used in centralized heat generation, there could be significant water consumption, putting pressure on local water resources.
	Economic	High capital costs and low payback times.

E 2	**Energy Manager at municipal level** Appoint an Energy Manager and improve administrative capacity in energy management at municipality level
Sector	Energy
Action Type	Human resources/Policy
GCAP Action Classification	• Strategies, plans, and programmes; • Capital Investment; • Awareness raising, demonstration, training, and capacity building.
Priority environmental challenges addressed	• The fragmentation of resources and political power that leads to uncoordinated planning and chaotic implementation of energy projects - e.g. grid development to adapt to increasing number of new residential developments and penetration of decentralization energy sources. • Lack of political will to implement legal provisions around energy management and decarbonization in heating to improve the quality of service and energy performance of DH.
Strategic objective supported	Set up an energy management system at city level to • Coordinate efficiently all parties concerned by energy in the frame of climate mitigation • Support developing a strategic vision for the decarbonisation of the energy sector • Coordinate all required efforts/actions. This will at least encompass setting up a heating and cooling plan, as per EED • Support the reduction of carbon emissions of the energy sector while ensuring security of energy supply
Linkage to existing policies /plans	• National Energy and Climate Plan • Energy Efficiency Directive (Art 25(6)) • National Energy Strategy (in adoption) • National Strategy for Long-Term Renovation • Integrated Urban Development Strategy

Description

To ensure long term decarbonisation of the energy sector, there is need for the City of Bucharest to develop a strong and integrated vision for energy production, infrastructure, supply and demand management which covers production, infrastructure, distribution, supply and demand for:

1. Heating and cooling, production and demand in buildings and industry;
2. Electricity, production (at city level) and demand in all sectors;
3. Energy system integration to manage and optimize the entire energy system by connecting the different energy sectors (inc. transport).

The first task of the Energy Manager will be to prepare an integrated Long-term Energy and Decarbonisation Vision, including among others renewable generation, H&C production and supply, district H&C deployment, climate adaptation of energy infrastructure, increasing energy resilience, etc.

The second task will be to coordinate the preparation of a H&C plan (cf. Article 25(6) of the recast Energy Efficiency Directive EED), ensuring the appropriate consultation and implication of relevant parties, both from public and private. However, the link to electricity and transport should be addressed at the same time, to avoid missing opportunities to strengthen the entire energy system.

To comply with Article 25(6) of the recast EED, the City of Bucharest needs to develop a **local heating and cooling plan** (such plans must be prepared by regional and local authorities in municipalities with populations greater than 45,000).

The local heating and cooling plan should be comprehensive, inclusive, and aligned with energy efficiency and climate goals. Its key elements are:

1. Inform the plan with comprehensive assessments, estimating potential improvements in energy efficiency, renewable energy use, and heat recovery;
2. Prioritize Energy Efficiency First (EEF) principle in decision-making at all levels;
3. Strategic use of resources using efficiently the potential identified in the assessments under (1);
4. Involve relevant local and regional stakeholders, as well as the general public and energy infrastructure operators, must be involved in the plan's preparation;
5. Consideration of existing infrastructure: existing energy infrastructure must be taken into account;

6. Cross-regional coordination: it should consider the needs of local communities and possible synergies with neighboring areas for efficiency and joint investments;
7. Role of energy communities: it should assess the potential role of energy communities and consumer-led initiatives in contributing to local heating and cooling projects;
8. Building stock analysis: there should be an analysis of local building heating and cooling systems, with a focus on improving energy efficiency in poorly performing buildings and addressing the needs of vulnerable households;
9. Financial planning: it must assess financing options for implementing the measures and policies, including mechanisms that help consumers transition to renewable heating and cooling;
10. Goal alignment and monitoring: a trajectory towards climate neutrality should be established, with mechanisms to monitor the progress of the implemented measures;
11. Phasing out fossil fuels in public buildings: it aims to replace old, inefficient heating and cooling systems in public bodies with highly efficient alternatives, ultimately phasing out fossil fuels.
12. Joint investments: opportunities for collaboration with neighboring authorities should be explored to encourage joint investments and cost efficiency.

The third task will be to develop & implement several specific programmes such as:

- Replacement of old wood heaters by more efficient heating appliances (fed by renewable sources)
- Deployment of heat pumps, where district heating is not supplying heat to end-consumers (where standalone solutions are needed)

And coordinate the following (addressed under Energy Action E1 on Decarbonisation of district heating (planning, investments and programmes))

- Continuing to invest in the electricity grid refurbishment and reinforcement;
- Deployment of geothermal plant to supply district network in the north part of the city;

These programmes are part of the implementation of the Long-Term decarbonization vision (task 1), but given they are already identified to be strategic, they could possibly be implemented ahead of the H&C Plan (to avoid postponing by several years). Therefore, this third task could be considered as first task.
Considering the importance of the tasks, it might be required to hire a full team of Energy Manager(s), rather than one single EM.

Linkage to other GCAP actions	UT 6: EV Public Charging Network UT 7: Mobility Hubs and Park & Ride facilities E 1: Expansion and improvement of district heating E 3: Map of electricity grid risks B 1: Energy audits and proactive measures for new buildings B 2: Addressing seismic and climate-change risks B 3: Upgrades of HVAC systems SC 1: Integrated digital infrastructure/ databases

Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	N.A.	**Some elements** *Reason:* The comprehensive assessments will integrate also a gender and intersectional perspective like minimizing the potential improvements in energy efficiency, renewable energy use, and heat recovery for vulnerable groups. Substantive local and regional stakeholder consultation, gender equality NGO's and other formal or informal groups included, will lead to a better representation of the interests of various vulnerable groups on the agenda. Women will be able to get involved in the development and management of energy communities, thus contributing to their economic empowerment and increased quality of life.	N.A.

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	1.1 Decide on precise tasks and responsibilities, to define appropriate profile(s) and prepare job description	3 months	Bucharest General Council / Municipality - Bucharest S1-S6 Councils

	1.2. Hire Energy Manager (and possibly its team)	3 months	Bucharest General Council / Municipality
	1.3. Precise action plan for Energy Manager (and team)	3 months	Bucharest General Council / Municipality
	1.4. Draft the integrated Long-term Energy and Decarbonisation Vision	6 months	Bucharest General Council / Municipality
	1.5. Stakeholder engagement (private & public) with the draft Decarbonisation Vision	12 months	Bucharest General Council / Municipality - Bucharest S1-S6 Councils
	1.6. Finalise the integrated Long-term Energy and Decarbonisation Vision	6 months	Bucharest General Council / Municipality
	2.1. Collect all existing assessments, estimating potential improvements in energy efficiency, renewable energy use, and heat recovery, and assess main gaps	6 months (can overlap with steps 1.3 and 1.4)	Bucharest General Council / Municipality - Bucharest S1-S6 Councils
	2.2. Draft the H&C plan engaging district authorities	12 months (can overlap with steps 1.4 & 1.5)	Bucharest General Council / Municipality - Bucharest S1-S6 Councils
	2.3. Stakeholder engagement (private & public) with the draft H&C Plan	12 months (can overlap with steps 1.5 and 1.6)	Bucharest General Council / Municipality - Bucharest S1-S6 Councils
	2.4. Finalise the H&C plan	6 months (can overlap with step 2.1)	Bucharest General Council / Municipality - Bucharest S1-S6 Councils
	2.5. Coordinate the implementation of the H&C plan	Long term	Bucharest General Council / Municipality - Bucharest S1-S6 Councils
	3.1. Prepare / draft specific programmes (replace wood stoves, deploy heat pumps) and coordinate other programmes (reinforce grid, deploy geothermal)	12 months	Bucharest General Council / Municipality - Bucharest S1-S6 Councils
	3.2. Implement the specific programmes	Long term	Bucharest General Council / Municipality
Stakeholders	**Stakeholder category**		**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	District		Involve for the decarbonisation vision Collaborate for the H&C plan
	Energy companies (infra operators, suppliers, producers, developers)		Consult
	Service companies (e.g. ESCO, auditors)		Consult
	Construction sector companies (inc. architects, urbanists, engineering)		Consult
	Consumers and communities		Consult and empower
Indicative costs [EUR]	**CAPEX**		**OPEX**
	975,700,000		91,000

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Operational costs (mainly staff)	City budget, National support (application of EED art 25)	100%
Revenue opportunities	No	Does not create direct income	
Impact of the action: Quantitative and Qualitative	State indicators	• Annual CO_2 equivalent emissions per capita; • Annual MWh delivered per capita	
	Pressure indicators	• Heating and cooling consumption in non-residential and residential buildings from fossil fuels; • Share of population with access to heating and cooling; • Proportion of total energy derived from RES as a share of total city energy consumption; • Buildings covered by district heating systems	
	Estimated Carbon Emissions Reduction	Considering that DHC is currently supplied by fossil-based energy sources, we can assume that, according to the Municipality Energy Strategy, a reduction of 45% of carbon emissions is realistic, if there is significant increase in performance and penetration of renewable. **Estimated emissions are included in E 1**	
	Physical annual savings	Savings are expected with regard to reduced energy use (higher efficiency of network, distribution equipment and generation assets); Decarbonisation vision has to fix a climate target for the energy system.	
	Climate resilience benefits	Reduced energy consumption: An Energy Manager can identify and implement energy efficiency measures in municipal buildings and operations, leading to significant reductions in energy use and greenhouse gas emissions. Improved energy security: By optimizing energy use and exploring renewable energy sources, the city can reduce its reliance on fossil fuels and enhance its energy security in the face of climate change impacts on energy supply. Cost savings: Reducing energy consumption translates to lower energy bills for the municipality, freeing up resources for other climate resilience initiatives. Enhanced sustainability: A dedicated Energy Manager can promote sustainable practices across municipal departments and operations, contributing to a more environmentally responsible city. Data-driven decision-making: Improved energy management provides valuable data on energy consumption patterns, enabling informed decision-making for future infrastructure projects and policies. Increased public awareness: An Energy Manager can play a key role in educating the public about energy conservation and sustainable practices, fostering a culture of energy responsibility. Better preparedness for extreme weather: Optimizing energy use can reduce the city's vulnerability to power outages and disruptions during extreme weather events.	
	Reductions in operating expenditures	Increased efficiency of current and future assets (e.g. DHC)	
	Social and economic benefits/Gender considerations	No direct benefits are foreseen, however, indirectly an Energy Manager at the municipal level can improve energy efficiency, reducing operational costs and emissions while enhancing public health and fostering a culture of sustainability. This role also supports local job creation in green sectors and can attract funding for sustainable	

		projects. It also represents an opportunity to engage vulnerable communities. Approximately 5 new jobs are expected to be created with skills in energy performance analytics, use of energy forecasting and modelling software.
Potential risk of the action	**Area**	**Risk**
	Social	Initial investments may strain budgets, and without visible short-term results, may face public resistance. Additionally, poorly implemented measures could lead to service disruptions or unintended economic impacts on local jobs. There may also be variations in energy price structures, with possibly an increase for vulnerable households (also linked to ETS2).
	Environmental	• Overemphasis on energy efficiency without considering the source: While energy efficiency is important, it's crucial to ensure that the energy saved comes from renewable sources. Otherwise, there's a risk of perpetuating reliance on fossil fuels. • Neglecting other environmental aspects: Focusing solely on energy management might lead to overlooking other important environmental considerations, such as water conservation, waste reduction, and biodiversity protection. • Unintended consequences of energy-saving measures: Some energy-saving technologies or practices could have unintended environmental consequences. For example, certain insulation materials might release harmful chemicals, or the disposal of old equipment could create electronic waste. • Rebound effect: Increased energy efficiency can sometimes lead to increased consumption, offsetting some of the environmental benefits.
	Economic	Missing the holistic approach that is key for long term economic added value; Stranded assets

E 3	**Map of electricity grid risks** Map the risks of electricity grid congestion
Sector	Energy
Action Type	Policy
GCAP Action Classification	Investment related Feasibility Study; Strategies, plans, and programmes
Priority environmental challenges addressed	• Low effective penetration of renewable energy sources in both electricity and heating.
Strategic objective supported	• Consolidate the power grid to cope with the increasing demand and enhance the share of renewable energy consumed in the city, for electricity, heating and cooling of the buildings • Consider sector coupling as an efficient approach to manage an increasing renewable generation and the increasing electrification of the heating and cooling sector
Linkage to existing policies /plans	• National Strategy & Action Plan on Adaptation to Climate Change (2024-2030) • National Energy and Climate Action Plan • National Energy Strategy (in adoption) • Network development plans of TSO and DSO

Description

Current evidence on grid congestion and/ or lack of resilience risks is limited. While Bucharest accounts for 12% of electricity consumed at national level, local power production is very limited (e.g. approx. 12 MW of installed capacity in renewable power production), meaning the transmission grids are working at full capacity to bring power to the city. While current indicators on power interruptions and power supply quality at DSO levels are satisfactory, foreseen increased in electricity consumption as a response to decarbonization targets (e.g.: in transportation) or as a response to more frequent extreme weather events (e.g.: heatwaves) will pose challenges in terms of the resilience of transmission and distribution grids. The tendency is further accentuated by a lack of energy management systems to modulate demand at consumer level, leading to avoidable consumption spikes. Together with the DSO (PPC) and municipal companies/ public institutions, the municipality must perform a risk-mapping on congestion given planned developments in different areas (e.g.: mobility) and climate risks (e.g.: extreme weather events leading either to spikes in electricity consumption or to electricity supply interruptions) and identify priority areas for network reinforcement. The study needs to consider the public mobility plans of STB, including the plans for building new bus/ tram depots (with charging infrastructure), where arguably grid reinforcement is needed. It also needs to consider commercial and real estate development, as well as the penetration of prosumers, esp. large industrial prosumers that need grid reinforcement. The study needs to be integrated with foreseen grid developments in Ilfov.

The study should also consider the important role of sector coupling and the support that other sectors such as transport and heating can provide to the electricity system (e.g. through shifting demand and even providing frequency response services), to more appropriately balance the load on the grid. This is also going together with an increasing demand as these sectors are expected to progressively electrifying.

Linkage to other GCAP actions	E 2: Energy Manager at municipal level E 1: Expansion and improvement of district heating SC 1: Integrated digital infrastructure/ databases AQ 1: Integrated air pollution management and monitoring system

	Climate action	**Gender and economic inclusion**	**Smart maturity**
Cross-cutting themes/co-benefits	**Directly targeted** *Reason:* Reducing emissions in the heating and cooling system as well as improving the efficiency of heating systems at municipal level is a significant	**Some elements** *Reason:* Reducing the risks of congestion on the electricity grid contributes to better management of housework and care work and reduces the pressure on women in particular when dealing	**Directly targeted** *Reason:* The use of smart metering (installation of smart measurement devices, SCADA, etc.) will allow to monitor the energy performance of the grid and related risks. This initiative aims at investing digital solutions like smart metering systems, telecommunication and data gathering,

	climate action measure.	with power outages or heat bottlenecks. Women are still mainly responsible for domestic and care work and are also the most affected by such bottlenecks caused by poor infrastructure.	and the data management system to monitor, control, to rapidly identify potential damages and grid losses, or manage grid load thanks to flexible operation of both generation and demand assets. It also aims to invest in flexible assets. The data collected (regarding the energy distribution, the type of sources used, etc.) will be also useful to other actions such as air quality.

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	Establish data exchange protocols and a stakeholder engagement system with all involved actors	3 months	Bucharest City Hall (support TSO, DSO, real estate developers, municipal transportation companies, etc.).
	Do space-based risk mapping study	12 months	DSO (with support from TSO, municipal companies, etc.)
	Draft action and investment plan to mitigate risks	4 months	DSO & Bucharest City Hall

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	Districts	Collaborate
	Ilfov Mayoralties	Involve
	Ministry of Energy	Involve
	DSO & TSO	Empower
	Real estate developers' associations	Consult
	Energy management & cleantech companies	Inform

Indicative costs [EUR]	**CAPEX**	**OPEX**
	780,000	0

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	TA instruments	European Funds, IFIs	40%
	DSO & TSO capital	Own funds	60%

Revenue opportunities	No	Once the grid reinforcement plan will be implemented and investments carried out, the expenditure will be reflected in network tariffs. The study on risk mapping itself is not a revenue-generating activity.
Impact of the action: Quantitative and Qualitative	State indicators	• Annual CO_2 equivalent emissions per produced MWhe; • Disconnections, Loss of Load per year; • Annual MWhe delivered per capita
	Pressure indicators	• Electricity supply emergency plan at municipal level; • Investment plan at TSO/DSO level to improve grid capacity/ flexibility and disaster resilience capacity; • Increasing penetration of renewables in electricity generation due to inadequate grid carrying capacity; • Electricity network resilience plan;

		• Level of digitalization of the grids • Level of risk management and control.
	Estimated Carbon Emissions Reduction	Higher share of renewable in the electricity system will contribute to significantly reduce carbon emissions. Savings are expected from more performing distribution and transmission assets. The decarbonisation vision (cf. Energy Action E2 on Energy Manager at Municipal level) has to fix climate adaptation and mitigation targets for the electricity system. **Estimated emissions are included in E 1**
	Physical annual savings	Savings are expected with regard to reduced energy use (higher efficiency of network, distribution equipment and generation assets);
	Climate resilience benefits	• Anticipate and mitigate disruptions: By identifying vulnerabilities in the grid, Bucharest can take proactive steps to strengthen infrastructure and prevent outages caused by extreme weather events (heatwaves, storms) or increased demand from things like air conditioning. • Optimize energy distribution: Understanding congestion risks allows for better planning of renewable energy integration and microgrids, ensuring a more reliable and sustainable energy supply. • Facilitate EV adoption: Mapping grid capacity helps prepare for the increased electricity demand from electric vehicles (EVs), supporting a transition to cleaner transportation. • Improve emergency response: In case of extreme events and power disruptions, having a clear picture of grid vulnerabilities allows for more efficient and targeted emergency response, minimizing downtime and impact on essential services. • Enhance urban planning: Grid congestion maps inform urban development and infrastructure planning, ensuring that new buildings and developments are integrated in a way that supports grid stability and resilience. • Promote energy efficiency: By identifying areas prone to congestion, targeted energy efficiency programs can be implemented to reduce overall demand and strain on the grid.
	Reductions in operating expenditures	Identifying key congestion risk and targeting investments in those areas can results in a reduction of the operating expenditure of the DSO. If flexibility and demand-side measurements will be implemented as a response to the risk mapping, further reductions can be envisaged.
	Social and economic benefits/Gender considerations	Mapping electricity grid congestion risks enables proactive management of energy demand, reducing the likelihood of blackouts and improving grid reliability for residents and businesses. This can attract investment, support economic resilience, and help prioritize

		infrastructure improvements where they are most needed. It would also lead to fewer power cuts and more consumer satisfaction with electricity distribution services and potentially maximize the integration of prosumers into the grid. About 2 new jobs are expected to be created with technical skills in grid analysis and system reliability studies, GIS and risk modelling.
Potential risk of the action	**Area**	**Risk**
	Social	The mapping process may reveal vulnerabilities that require significant investment to address, potentially straining municipal budget. Additionally, public disclosure of grid weaknesses could raise community concerns about energy reliability or security, especially if mitigation plans are not clearly communicated. Furthermore, the grid reinforcement expenditures must be passed through to consumers in a staged process.
	Environmental	None
	Economic	High capital costs and low payback times.

4.4. GCAP Solid Waste actions

The solid waste sector has **six actions** that aim to improve the waste management in the city, through policy, incentives and infrastructure for separate waste, sorting and recycling, including for construction and demolition waste, as well as facilities for waste treatment with energy recovery. The actions in this sector will generate the second-largest number of jobs among all GCAP sector. The solid waste actions are coded from **SW 1 to SW 6**.

SW 1	**Mechanical-biological treatment facility for mixed municipal waste** Build a mechanical-biological treatment facility for mixed/residual municipal waste
Sector	Solid Waste
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Lack of selective collection incentives, poor infrastructure, non-existent data monitoring and interventions Targets to be addressed: Municipal solid waste treated in sorting, processing and treatment plants within 6 years: > 90%
Strategic objective supported	Reform the waste management system in terms of governance and infrastructure to ensure that the city follows closely the EU targets on municipal waste at national level
Linkage to existing policies /plans	• National Strategy & Action Plan for the Circular Economy in Romania • Waste Management Plan for the Municipality of Bucharest 2020 - 2025

Description

The City of Bucharest is set to construct a Mechanical Biological Treatment (MBT) facility for mixed/residual municipal waste (after source-separation of recyclables and biowaste) to meet the growing waste management needs of the city. This facility aims to significantly enhance landfill diversion and recycling rates by focusing on both Material Recovery and Energy Recovery. The design and implementation of the facility will be guided by the findings from a comprehensive feasibility study that evaluates the technical, economic, and environmental viability of the MBT system, ensuring alignment with best practices in waste processing. The feasibility study will determine the number and the capacity of the MBTs required to serve the City.
The facility will utilize state-of-the-art sorting technologies to optimize the recovery of recyclables from MSW. This initiative is in line with Romania's commitment to improving its waste management systems and meeting EU directives regarding recycling and landfill diversion.
Recovered organic waste will be processed through anaerobic digestion, converting it into biogas that can be harnessed for electricity generation or thermal energy. This process supports a circular economy by transforming waste into a valuable resource.
The facility will also produce Refuse-Derived Fuel (RDF), which enhances energy recovery options and reduces reliance on fossil fuels. RDF can be utilized in various industrial applications, including cement production, thus lowering greenhouse gas emissions associated with traditional fuel sources.
The facility will incorporate advanced emission control technologies to ensure compliance with air quality standards while minimizing pollutants released during waste processing.
Collaboration with engineering experts will ensure that the facility employs the latest technologies for efficiency and minimal environmental impact, fostering public trust in waste management initiatives.

To ensure the success of this action, it will be accompanied by an extensive public education and involvement campaign aimed at promoting participation and raising awareness.

Linkage to other GCAP actions	SW 2: Infrastructure for separate collection of municipal waste SW 4: Biological treatment facility for biowaste SW 5: Compliant landfill SW 6: "Pay-as-you throw" schemes for the six districts

Cross-cutting themes/co-benefits

Climate action	Gender and economic inclusion	Smart maturity
Directly targeted *Reason:* Landfill gas capture, waste volume reduction, and material recovery all contribute to lower greenhouse gas emissions; Diverting waste from landfills reduces their environmental impact and vulnerability to climate change. Energy recovery boosts local energy security, while the facility promotes a circular economy by recovering valuable resources and minimizing waste.	**Some elements** *Reason:* Better municipal solid waste management and better work and life balance due to better (easier/ better facilities) recycling rates and better waste management facilities.	**Some elements** *Reason:* Integrating digital and smart technologies, such as sensors and automated processes, into the MBT system can significantly enhance waste sorting efficiency and improve waste management strategies.

Implementation steps and timeline

Step	Duration (months)	Step owner/support required
1. Procure feasibility study (prepare tender documents - tender process management)	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
2. Develop the feasibility study	4 months (can overlap with step 3)	Contractors / Bucharest General Council/Municipality - Bucharest S1-S6 Councils
3. Land allocation	3 months (can overlap with step 2)	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
4. Stakeholder Engagement	2 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
5. Determine financing and procurement strategy	1 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
6. Develop tender documents for design, construction, operation and supervision works	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
7. Manage Tender Process and Award Contracts	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
8. Construction works / Supervision	24 months (can overlap with step 9)	Contractors / Bucharest General Council/Municipality - Bucharest S1-S6 Councils
9. Public Awareness Campaign	2 months (can overlap with step 8)	Bucharest General Council/Municipality - Bucharest S1-S6 Councils

Stakeholders

Stakeholder category	Engagement (Inform, Consults, Involve, Collaborate or Empower)
Bucharest Municipality	Involve, Collaborate
Sanitation companies	Involve, Collaborate
Sectors municipalities	Involve, Collaborate

<table>
<tr><td></td><td colspan="2">Citizens</td><td colspan="2">Inform</td></tr>
<tr><td rowspan="2">Indicative costs [EUR]</td><td colspan="2">CAPEX</td><td colspan="2">OPEX</td></tr>
<tr><td colspan="2">150,000,000</td><td colspan="2">35,000,000</td></tr>
<tr><td rowspan="3">Potential funding</td><td>Instrument</td><td>Source</td><td colspan="2">Amount [EUR]/ share [%]</td></tr>
<tr><td>Grant / loan</td><td>EU: Cohesion Fund</td><td colspan="2">98% of CAPEX</td></tr>
<tr><td>Own source</td><td>Municipal budget</td><td colspan="2">2% of CAPEX; 100% of OPEX</td></tr>
<tr><td>Revenue opportunities</td><td>Yes</td><td colspan="3">Sale of Recyclables: Revenue from selling recovered recyclables.
Energy Generation: Income from biogas converted to electricity or thermal energy, sold back to the grid.
Refuse-Derived Fuel (RDF): Revenue from selling RDF to industrial sectors, such as cement production.
PPPs: Shared revenue models and financing solutions through collaboration with private sector partners.</td></tr>
<tr><td rowspan="5">Impact of the action: Quantitative and Qualitative</td><td>State indicators</td><td colspan="3">N.A.</td></tr>
<tr><td>Pressure indicators</td><td colspan="3">• Municipal solid waste treated in sorting, processing and treatment plants</td></tr>
<tr><td>Estimated Carbon Emissions Reduction</td><td colspan="3">40,700 tCO_2e per year</td></tr>
<tr><td>Physical annual savings</td><td colspan="3">Landfill Volume Savings: Reduces landfill waste by 30-50%, saving space and extending landfill life.
Greenhouse Gas Emission Savings: Minimizes methane emissions, resulting in savings for air quality management and compliance efforts.
Resource Recovery Savings: Increases the recovery of recyclables like metals and plastics, leading to savings in raw material costs.
Soil Quality Improvement Savings: Produces digestate that enhances soil quality, saving costs on fertilizers and soil amendments.
Energy Production Savings: Generates biogas, providing energy savings by reducing reliance on fossil fuels.
Transportation Savings: Lowers fuel consumption and infrastructure wear by processing waste locally, resulting in transportation cost savings.
Refuse-Derived Fuel (RDF) Savings: Converts non-recyclable materials into RDF, saving costs associated with landfill disposal and providing an alternative energy source.</td></tr>
<tr><td>Climate resilience benefits</td><td colspan="3">• Landfill Gas Capture: MBTs decompose the organic share of mixed MSW via aerobic or an anaerobic process step, thus the rejects sent to landfill are producing less leachate and landfill gas.
• Reduced Transportation: By processing waste locally, the need to transport it long distances to landfills is minimized, lowering fuel consumption and emissions.
• Recycling: MBTs processes divert waste from landfills and reduce the overall carbon footprint of waste management.
• Reduced Flood Risk: By reducing the amount of waste sent to landfills, MBT facilities can help minimize the risk of leachate contamination of groundwater and surface water during floods.
• Improved Public Health: Proper waste management reduces the risk of disease outbreaks, which can be exacerbated by extreme weather events.</td></tr>
</table>

	Reductions in operating expenditures	**Lower Landfill Expenditures:** Reduces costs associated with landfill disposal by diverting waste, leading to significant savings in landfill fees. **Reduced Transportation Expenditures:** Minimizes fuel and maintenance costs by processing waste locally, reducing the need for long-distance transport. **Lower Energy Expenditures:** Generates biogas for energy use, lowering costs related to purchasing fossil fuels or electricity. **Refuse-Derived Fuel (RDF) Expenditures Savings:** Provides an alternative energy source, saving costs associated with traditional fuel purchases. **PPPs:** Collaborating with private sector partners can provide innovative financing solutions, reducing the financial burden on the municipality and lowering overall operating cost. **Potential for Grants and Funding Expenditures:** Aligning with EU directives makes the project eligible for various funding opportunities that can offset operational costs.
	Social and economic benefits/Gender considerations	Socially, there could be significant reduction of landfill use, improved recycling rates, and less environmental pollution, enhancing community health and quality of life. Economically, the facility can create local jobs in waste management and recycling, generate revenue from recovered materials, and reduce long-term municipal waste disposal costs, making waste management more sustainable. Approximately 25 new jobs could be created for people with skills in the field of waste processing technology, facility management, environmental impact assessments and in circular economy.
Potential risk of the action	**Area**	**Risk**
	Social	The initial cost of building and maintaining the MBT facility may strain municipal budget, especially if there is limited funding or waste volumes are low. Socially, nearby communities may raise concerns about potential odours, noise, or traffic related to facility operations, and addressing these concerns with transparent communication and effective mitigation strategies is essential for gaining public support.
	Environmental	• Air pollution: MBT facilities can release air pollutants like dust, volatile organic compounds (VOCs), and greenhouse gases (methane, CO_2) during processing. Proper air filtration and treatment systems are essential. • Water pollution: Leachate (contaminated water) can be generated from stored waste and treatment processes. This needs careful management and treatment to prevent soil and groundwater contamination. • Odor: MBT plants can generate unpleasant odours, especially during the biological treatment phase. Odor control measures are crucial to minimize impacts on surrounding communities. • Energy consumption: MBT facilities require energy for operation, which can contribute to greenhouse gas emissions if the energy source is not renewable. • Waste generation: While MBT reduces the volume of waste going to landfills, it still produces residual waste that needs to be disposed of.

		• Land use: MBT facilities require significant land area, potentially impacting natural habitats or agricultural land. • Traffic: Increased truck traffic to and from the facility can contribute to local air pollution and congestion. • Noise: MBT operations can generate noise pollution, affecting nearby residents.
	Economic	N.A.

SW 2	**Infrastructure for separate collection of municipal waste** Invest and set up infrastructure for separate collection of recyclable and biodegradable municipal waste in districts 1-6
Sector	Solid Waste
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Lack of selective collection incentives, poor infrastructure, non-existent data monitoring and interventions Targets to be addressed: Proportion of dry recyclables that are separated at the source or from the mixed municipal solid waste stream within 6 years: 55%; Proportion of organic waste that is separated at the source or from mixed municipal solid waste stream within 6 years: >30%
Strategic objective supported	Reform the waste management system in terms of governance and infrastructure to ensure that the city follows closely the EU targets on municipal waste at national level
Linkage to existing policies /plans	• National Strategy & Action Plan for the Circular Economy in Romania • Waste Management Plan for the Municipality of Bucharest 2020 - 2025

Description

The City of Bucharest is implementing a system for the separate collection of dry recyclable and biodegradable municipal waste in districts 1-6. This initiative aims to improve recycling rates, reduce landfill waste, and align with EU directives on waste management. A feasibility study will evaluate the technical, economic, and environmental viability of various source separation systems to determine the most effective approach. The potential systems under consideration include:

- 2-Bin System: All dry recyclables (paper/cardboard, plastic, metal) in one container and biowaste in another.
- 3-Bin System: Glass collected separately from other recyclables and biowaste.
- 4-Bin System: Separate bins for glass, plastic/metal, paper/cardboard, and biowaste.
- 5-Bin System: Individual bins for glass, plastic, metal, paper/cardboard, textile and biowaste.

In addition to evaluating collection systems, the feasibility study will assess various infrastructure options for implementation. This includes the potential installation of underground bins with a capacity of 1,100 litres in high-density areas, above-ground bins with a capacity of 660 litres in medium-density areas, and the distribution of 240-liter capacity bins for individual housing areas. The study will also evaluate the need for purchasing additional waste collection vehicles to effectively support the new systems.

The feasibility study will also assess various smart opportunities including route optimization and sensor-based collection infrastructure to reduce collection related emissions and operational costs.

Remaining waste will be collected in designated containers for mixed municipal waste. Source-separated dry recyclables will be processed at existing sorting plants, while source-separated biowaste will be processed at a new biological treatment facility (pl. refer to Action SW 4).

To ensure the success of this action, it will be accompanied by an extensive public education and involvement campaign aimed at promoting participation and raising awareness.

Linkage to other GCAP actions	SW 1: Mechanical-biological treatment facility for mixed municipal waste SW 4: Biological treatment facility for biowaste SW 5: Compliant landfill SW 6: "Pay-as-you throw" schemes for the six districts		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* Setting up infrastructure for separate collection of recyclable and biodegradable waste offers climate action co-benefits by reducing greenhouse	**Directly targeted** *Reason:* Women spend on average 2.5 hours more time per day on housework and care work. Recycling and selective collection activities in households are also likely to	**Directly targeted** *Reason:* The integration of smart sensors to monitor waste capacity will offer information for optimizing collection routes, streamlining collection timelines, adjusting schedules, and further reducing

	gas emissions from landfills and manufacturing, conserving natural resources by decreasing the need for new materials and increasing carbon sequestration	fall on the responsibility of women. A proper collection infrastructure can reduce the time spent on this task and help to supplement incomes in vulnerable households, including women's incomes.	operational costs. Additionally, it will provide a comprehensive view of waste levels across various urban areas, enabling better waste management strategies. The data from this action will feed in the database proposed in action SC1.

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	1. Procure the feasibility study (prepare tender documents - tender process management)	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	2. Develop the feasibility study	4 months	Contractors / Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	3. Formulate and approve policy and enforce regulatory and financial measures for enhancing source separation	6 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	4. Develop tender documents for supply equipment (containers and collection fleet)	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	5. Manage Tender Process and Award Contracts	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	6. Supply and set-up the equipment	12 months (can overlap with step 7)	Contractors / Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	7. Public Awareness Campaign	2 months (can overlap with step 6)	Bucharest General Council/Municipality - Bucharest S1-S6 Councils

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	Bucharest Municipality	Involve, Collaborate
	Sanitation companies	Empower, Collaborate
	Sectors municipalities	Empower, Collaborate
	Citizens	Inform, Involve

Indicative costs [EUR]	**CAPEX**	**OPEX**
	14,000,000 This includes: costs for an initial study, vans (other infrastructure costs are covered under SW6, and a public awareness campaign.	1,530,000

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU: Cohesion Fund	98% of CAPEX
	Own source	Municipal budget	2% of CAPEX; 100% of OPEX

Revenue opportunities	Yes	**Increased Recycling Revenue:** Implementing a separate collection system will enhance the volume of recyclables and biowaste collected, allowing for potential revenue from processing fees. **Increased Property Values:** Improved waste management infrastructure can enhance the attractiveness of districts, potentially leading to

		increased property values and higher tax revenues for the municipality over time. **Tax Revenues:** Effective separate collection systems can increase tax revenues by boosting recycling businesses, leading to higher business and employment taxes.
Impact of the action: Quantitative and Qualitative	State indicators	N.A.
	Pressure indicators	• Proportion of dry recyclables • Proportion of organic waste
	Estimated Carbon Emissions Reduction	Estimated emissions are included in SW 1
	Physical annual savings	**Waste Volume Savings:** Reduces the total volume of mixed waste sent to landfills by promoting source separation, leading to significant savings in landfill space. **Recyclable Material Savings:** Increases the quantity of recyclable materials collected, enhancing resource recovery and reducing the need for new raw materials. **Biodegradable Waste Savings:** Diverts organic waste from landfills, resulting in physical savings in methane emissions and improving environmental quality. **Transportation Savings:** Lowers the physical burden on waste collection vehicles by optimizing routes and reducing the distance travelled for mixed waste collection. **Public Awareness Savings:** Enhances community engagement and participation in recycling efforts, leading to a physical increase in the volume of materials diverted from landfills. **Environmental Impact Savings:** Reduces the overall environmental footprint associated with waste management by decreasing emissions and promoting sustainable practices.
	Climate resilience benefits	• Less reliance on landfills: Landfills are a major source of methane, a potent greenhouse gas. By diverting waste from landfills through recycling, Bucharest can significantly reduce its methane emissions. • Lower energy consumption: Recycling often requires less energy than producing new materials from raw sources. This translates to reduced reliance on fossil fuels and lower carbon emissions. • Reduced transportation needs: Proper waste sorting and processing can reduce the need to transport waste long distances, further lowering emissions. • Reduced pollution: Proper waste management minimizes pollution of air, water, and soil, contributing to a healthier urban environment and reducing the vulnerability of ecosystems to climate change impacts. • Improved public health: Reduced pollution and a cleaner environment leads to improved public health, making the population more resilient to the effects of climate change. • Job creation and economic development: Investing in waste management infrastructure can create jobs and stimulate economic development in the recycling sectors. • Reduced waste generation: Promoting waste reduction and recycling helps minimize the overall

		amount of waste generated, reducing the city's vulnerability to disruptions in waste management services caused by extreme weather events. • Organic waste management: Biological Treatment of organic waste helps create nutrient-rich soil amendments, which can improve soil health and water retention, making urban green spaces more resilient to drought and extreme heat.
	Reductions in operating expenditures	**Lower Landfill Expenditures:** Decreases costs associated with landfill disposal by diverting waste, leading to significant savings in landfill fees. **Reduced Transportation Expenditures:** reduced fuel, labour and maintenance costs through optimized collection routes and reduced distances for waste transport, thanks to smart technologies. **Lower Processing Expenditures:** Minimizes costs related to waste processing by increasing the efficiency of recycling operations. **Reduced Collection Frequency Expenditures:** With effective source separation, the volume of mixed municipal waste decreases, allowing for less frequent collection of residual waste, further lowering operational costs. **Potential for Grants and Funding Expenditures:** Aligning with EU directives makes the project eligible for various funding opportunities that can offset operational costs.
	Social and economic benefits/Gender considerations	The action can increase recycling rates and reduce landfill dependency, promoting cleaner neighbourhoods and improving public health. Economically, it can lower waste processing costs over time, generate revenue from recyclable materials, and create jobs in waste collection and processing, fostering a more circular local economy. Approximately 25 jobs are expected to be created for personnel skilled in logistics planning for waste collection, data tracking for waste metrics; solid waste planning and management; as well as for outreach and communication.
Potential risk of the action	**Area**	**Risk**
	Social	Initial investments in bins, vehicles, and public outreach may be high, potentially challenging for available limited budget. Socially, there may be challenges in gaining public participation and compliance, and some residents may view the new system as inconvenient or disruptive without effective education and engagement efforts.
	Environmental	• Contamination and improper sorting: If residents don't properly separate their waste, recyclable materials can become contaminated with food waste or other non-recyclables, rendering them unusable and increasing the volume of waste sent to landfills. • Increased transportation and processing: Separate collection often involves more frequent waste collection and transportation to different processing facilities, potentially leading to increased fuel consumption and emissions.

		• "Wishcycling": People may put items in recycling bins that they hope or believe are recyclable, but actually are not. This contaminates the recycling stream. • Focus shifting from reduction: While recycling is important, it's further down the waste hierarchy than reducing and reusing. People might feel they are doing "enough" by recycling and not focus on reducing consumption in the first place. • Inadequate processing infrastructure: If Bucharest lacks sufficient processing capacity for recyclables and biodegradable waste, the collected materials may end up being landfilled or exported, negating the environmental benefits. • Illegal dumping and burning: If the separate collection system is poorly managed or inconvenient, it could lead to an increase in illegal dumping or burning of waste, creating environmental and health hazards.
	Economic	High initial costs and long payback period.

SW 3	CDW recycling facility Build a construction and demolition waste (CDW) recycling facility
Sector	Solid Waste
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Lack of selective collection incentives, poor infrastructure, non-existent data monitoring and interventions. Specifically, CDW is wrongly disposed of in municipal landfills, hindering recycling efforts. Significant amounts of CDW are illegally dumped instead of being properly managed by local authorities.
Strategic objective supported	Reform the waste management system in terms of governance and infrastructure to ensure that the city follows closely the EU targets on municipal waste at national level
Linkage to existing policies /plans	• National Strategy & Action Plan for the Circular Economy in Romania • Waste Management Plan for the Municipality of Bucharest 2020 - 2025

Description

The City of Bucharest is initiating the establishment of a Construction and Demolition Waste (CDW) recycling facility to improve waste management, promote recycling, reduce illegal disposal, and foster a circular economy by reintegrating recycled materials into construction projects.
This facility aims to tackle the significant challenges associated with CDW management in the city by recycling a variety of materials, including concrete, reinforced concrete, asphalt, building ceramics (such as bricks), broken rock materials, inert mineral waste, and wood. In addition to recycling these materials, the facility will be equipped to safely segregate and manage hazardous materials like asbestos and paints, which is essential for protecting public health and ensuring environmental safety.
Strategically located near Bucharest, the facility will facilitate easy access for construction companies and waste transporters. It will incorporate advanced sorting and recycling technologies, including mechanical sorting systems for efficient material separation, crushing and grinding equipment for concrete and asphalt, and thermal treatment systems for hazardous materials.
The design and implementation of the facility will be guided by findings from a comprehensive feasibility study that encompasses market analysis, environmental assessments, technical and economic viability, regulatory compliance, stakeholder engagement, and risk assessments to ensure the project's sustainability and effectiveness.

To ensure the success of this action, it will be accompanied by an extensive public education and involvement campaign aimed at promoting participation and raising awareness.
To effectively manage CDW and ensure it reaches processing facilities, the City of Bucharest should implement necessary policy changes and enforcement measures for the separate collection of CDW. This includes establishing accessible drop-off points for households and developing incentivization strategies for construction companies. Additionally, it is crucial to enhance enforcement mechanisms to prevent illegal dumping, ensuring that both residential and commercial CDW is directed to designated processing sites.

Linkage to other GCAP actions	N.A.		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* Reducing greenhouse gas emissions from landfills (in case of organic waste), material production, and transportation; conserving natural resources by recovering materials and promoting a circular economy in the construction sector.	**Some elements** *Reason:* Emptying the city of construction waste will make it more walkable and more accessible for children, people with disabilities, the elderly, accidents will be avoided, spaces will be freed up that can become accessible for community and recreational activities.	N.A

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	1. Procure feasibility study (prepare tender documents - tender process management)	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	2. Develop the feasibility study	4 months (can overlap with step 3)	Contractors / Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	3. Land allocation	3 months (can overlap with step 2)	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	4. Stakeholder Engagement	2 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	5. Determine financing and procurement strategy	1 month	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	6. Develop tender documents for design, construction, operation and supervision works	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	7. Manage Tender Process and Award Contracts	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	8. Construction works / Supervision	12 months (can overlap with step 9)	Contractors / Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	9. Public Awareness Campaign	2 months (can overlap with step 8)	Bucharest General Council/Municipality - Bucharest S1-S6 Councils

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	Bucharest Municipality	Involve, Collaborate
	Ministry of Environment	Involve, Collaborate, Empower
	Sanitation companies	Involve, Collaborate, Empower
	Building companies	Involve, Collaborate, Empower

Indicative costs [EUR]	**CAPEX**	**OPEX**
	5,000,000	750,000

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU: Cohesion Fund	98% of CAPEX
	Own source	Municipal budget	2% of CAPEX; 100% of OPEX

Revenue opportunities	Yes	**Sale of Recycled Materials:** Generate revenue by selling recycled material to manufacturers and construction companies. **Tipping Fees:** Charge tipping fees, creating a consistent revenue stream. **Extended Producer Responsibility (EPR):** Implement EPR fees on producers based on waste generated, providing additional revenue for recycling efforts.
Impact of the action: Quantitative and Qualitative	State indicators	N.A.
	Pressure indicators	N.A.
	Estimated Carbon Emissions Reduction	Estimated emissions are included in SW 1

	Physical annual savings	**Waste Volume Savings:** Reduces the total volume of CDW sent to landfills, leading to significant savings in landfill space. **Material Recovery Savings:** Increases the quantity of recyclable materials, enhancing resource recovery and reducing the need for new raw materials. **Hazardous Material Management Savings:** Safely segregates hazardous materials like asbestos, protecting public health and reducing potential environmental remediation costs. **Public Health Savings:** Reduces risks associated with illegal dumping and hazardous waste exposure, contributing to overall community health improvements.
	Climate resilience benefits	• Lower emissions from transportation: By processing CDW locally, the need to transport waste long distances is reduced, lowering fuel consumption and greenhouse gas emissions. This improves local air quality and reduces the city's carbon footprint. • Creates a circular economy: A CDW recycling facility promotes a circular economy by turning waste into a valuable resource. This reduces waste generation, conserves resources, and creates local jobs, strengthening the city's economic resilience. • Disaster debris management: In the event of natural disasters or emergencies, a CDW recycling facility can process debris more efficiently, aiding in faster recovery and rebuilding efforts. This enhances the city's capacity to cope with unexpected events.
	Reductions in operating expenditures	**Lower Landfill Expenditures:** Decreases costs associated with landfill disposal by diverting CDW, leading to significant savings in landfill fees. **Decreased Hazardous Material Management Expenditures:** Minimizes costs associated with the safe handling and disposal of hazardous materials by integrating proper management practices at the facility. **Lower Environmental Compliance Expenditures:** Reduces costs related to meeting environmental regulations by ensuring proper recycling and hazardous material management. **Potential for Grants and Funding Expenditures:** Aligning with EU directives makes the project eligible for various funding opportunities that can offset operational costs.
	Social and economic benefits/Gender considerations	The facility can provide local jobs and workforce training opportunities, benefiting residents and building a stronger green economy. By creating a local source of recycled materials, the facility supports affordable, sustainable building practices that may contribute to more accessible housing and infrastructure projects. Social entrepreneurship in circular economy can also result as an option. Approximately 15 new jobs are expected to be created in fields requiring skills in material recover and recycling processes, knowledge of construction and demolition waste standards, operation of waste sorting and processing equipment.
Potential risk of the action	**Area**	**Risk**
	Social	Initial setup costs could divert funding from other community projects, potentially creating tension if the

		benefits aren't immediately visible. Socially, nearby residents may have concerns about increased traffic, dust, or noise, as well as potential impacts on property values. Engaging the community early, ensuring open lines of communication, and committing to rigorous environmental safeguards can help mitigate these concerns and foster community support.
	Environmental	• Site Contamination / Leachate: Improperly managed CDW can generate leachate, a contaminated liquid that can pollute soil and groundwater if not properly collected and treated. • Dust and Airborne Particles: Processing CDW can release dust and potentially harmful particles (like asbestos if present in older materials), affecting air quality and posing risks to worker and community health. • Noise and Vibration / Operational Noise: Crushing, sorting, and processing CDW can generate significant noise pollution, impacting nearby residents and potentially wildlife. • Heavy Traffic: Increased truck traffic to and from the facility can contribute to noise and air pollution. • Wastewater Management / Water Usage: CDW recycling often requires water for dust suppression and material processing. This can put pressure on local water resources. • Wastewater Treatment: Wastewater from the facility needs to be treated effectively to remove contaminants before being discharged. • Habitat Disruption / Site Selection: Building the facility could potentially disrupt existing habitats, especially if located in a greenfield area. • Transportation Impacts: Emissions: Transporting CDW to and from the facility generates greenhouse gas emissions and contributes to air pollution.
	Economic	N.A.

SW 4	**Biological treatment facility for biowaste** Build a biological treatment facility for separately collected biowaste
Sector	Solid Waste
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Lack of selective collection incentives, poor infrastructure, non-existent data monitoring and interventions Targets to be addressed: Municipal solid waste treated in sorting, processing and treatment plants within 6 years: > 90%
Strategic objective supported	Reform the waste management system in terms of governance and infrastructure to ensure that the city follows closely the EU targets on municipal waste at national level
Linkage to existing policies /plans	• National Strategy & Action Plan for the Circular Economy in Romania • Waste Management Plan for the Municipality of Bucharest 2020 - 2025

Description

The City of Bucharest is set to construct a biological treatment facility, specifically designed for the separately collected biowaste. This initiative aims to significantly increase landfill diversion and recycling rates while generating low-carbon energy through anaerobic digestion and biogas combustion. By converting biowaste into energy, the facility will not only mitigate greenhouse gas emissions but also address local energy needs, thereby promoting sustainability within the community. Additionally, the facility will produce high-quality digestate from the processed biowaste, which will enhance soil quality and support sustainable agricultural practices.

Its strategic location near Districts 1-6 will optimize collection and processing efficiency, ensuring streamlined logistical operations that minimize transportation emissions and costs. The new infrastructure for the separate collection of biowaste (pl. refer to Action SW 2) will be implemented in these districts, which is vital for efficiently collecting and processing biowaste to maximize recycling rates.

To guarantee the project's sustainability and effectiveness, a comprehensive feasibility study will guide the design and implementation of the facility. This study will encompass several critical components, including market analysis, environmental assessments, technical and economic viability evaluations, regulatory compliance checks, stakeholder engagement strategies, and risk assessments. The feasibility study will determine the number, and the capacity of the facilities required to serve the City. Furthermore, it will explore the potential for integrating this facility into the new Mechanical Biological Treatment (MBT) facility (pl. refer to Action SW 1). This integration could enhance operational efficiency and further contribute to Bucharest's waste management objectives.

To ensure the success of this action, it will be accompanied by an extensive public education and involvement campaign aimed at promoting participation and raising awareness.

Linkage to other GCAP actions	SW 1: Mechanical-biological treatment facility for mixed municipal waste SW 2: Infrastructure for separate collection of municipal waste SW 5: Compliant landfill SW 6: "Pay-as-you throw" schemes for the six districts		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* Establishing a biological treatment facility for source-separated biowaste in Bucharest presents compelling climate action co-benefits through: **Mitigation of Greenhouse Gas Emissions**: Anaerobic digestion of biowaste captures methane, a potent greenhouse gas, and can be utilized for renewable energy generation. Furthermore, digestate enriches soil health, promoting carbon sequestration and reducing reliance on synthetic fertilizers with high	**Some elements** *Reason:* Various stakeholders, including women's organizations, will be consulted in capacity building. Public procurement processes will encourage enterprises with	N.A.

	embedded carbon. Localized processing also minimizes transportation distances, further curbing emissions. **Optimization of Resource Management**: The facility transforms organic waste into valuable resources: nutrient-rich digestate to enhance soil fertility and biogas for renewable energy production, contributing to a circular economy model. **Enhancement of Urban Sustainability**: Diverting biowaste from landfills extends their operational lifespan and reduces the demand for new sites. This approach aligns with circular economy principles, fostering sustainable urban development and resource efficiency.	women in management. Awareness and education campaigns will facilitate the redistribution of resources to women.	

Implementation steps and timeline

Step	Duration (months)	Step owner/support required
1. Procure feasibility study (prepare tender documents - tender process management)	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
2. Develop the feasibility study	4 months (can overlap with step 3)	Contractors / Bucharest General Council/Municipality - Bucharest S1-S6 Councils
3. Land allocation	3 months (can overlap with step 2)	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
4. Stakeholder Engagement	2 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
5. Determine financing and procurement strategy	1 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
6. Develop tender documents for design, construction, operation and supervision works	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
7. Manage Tender Process and Award Contracts	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
8. Construction works / Supervision	12 months (can overlap with step 9)	Contractors / Bucharest General Council/Municipality - Bucharest S1-S6 Councils
9. Public Awareness Campaign	2 months (can overlap with step 8)	Bucharest General Council/Municipality - Bucharest S1-S6 Councils

Stakeholders

Stakeholder category	Engagement (Inform, Consults, Involve, Collaborate or Empower)
Bucharest Municipality	Consult, Involve
Sector Municipalities	Involve, Empower, Collaborate
Sanitation companies	Involve, Empower
Biowaste Treatment companies	Involve, Empower

Indicative costs [EUR]	**CAPEX**	**OPEX**	
	15,000,000	3,000,000	
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU: Cohesion Fund	93% of CAPEX
	Own source	Municipal budget	7% of CAPEX; 100% of OPEX
Revenue opportunities	Yes	**Sale of Digestate:** Generate revenue by selling digestate from processed biowaste, creating a consistent revenue stream. **Biogas Production:** Produce biogas through anaerobic digestion and sell it as renewable energy, generating additional revenue. **Tipping Fees:** Charge revenue-generating tipping fees for accepting biowaste from businesses and residents, ensuring a steady flow of revenue. **Public-Private Partnerships:** Engage in public-private partnerships to share operational costs and revenue, maximizing financial benefits.	
Impact of the action: Quantitative and Qualitative	State indicators	N.A.	
	Pressure indicators	• Municipal solid waste treated in sorting, processing and treatment plants	
	Estimated Carbon Emissions Reduction	**20,000 tCO_2e per year**	
	Physical annual savings	**Waste Volume Savings:** Reduces the total volume of biowaste sent to landfills, leading to significant savings in landfill space. **Energy Savings:** Generates low-carbon energy through anaerobic digestion, providing a renewable energy source and reducing reliance on fossil fuels. **Digestate Savings:** Produces high-quality digestate, enhancing soil quality and reducing the need for synthetic fertilizers. **Transportation Savings:** Minimizes transportation emissions and costs by being strategically located near Districts 1-6, facilitating efficient waste collection and processing. **Greenhouse Gas Emission Savings:** Mitigates greenhouse gas emissions by diverting biowaste from landfills, contributing to improved air quality and environmental health.	
	Climate resilience benefits	By processing biowaste locally, Bucharest becomes less reliant on external resources and waste disposal systems, increasing its self-sufficiency and ability to adapt to disruptions.	
	Reductions in operating expenditures	**Lower Landfill Expenditures:** Decreases costs associated with landfill disposal by diverting biowaste from landfills, leading to significant savings in landfill fees. **Lower Energy Expenditures:** Generates energy from biowaste, reducing costs related to purchasing fossil fuels or electricity for facility operations.	

		Decreased Environmental Compliance Expenditures: Reduces costs related to meeting environmental regulations by ensuring proper biowaste management and minimizing emissions. **Potential for Grants and Funding Expenditures:** Aligning with EU directives makes the project eligible for various funding opportunities that can offset operational costs.
	Social and economic benefits/Gender considerations	Socially, the facility supports a greener, more sustainable community, promoting environmental responsibility and potentially reducing waste management costs for residents over time. It also provides job opportunities in green technology and waste management, contributing to local economic development. Approximately 12 new jobs could potentially be created in fields requiring skills in planning and operation of composting and anaerobic digestion systems, facility design and operations management, biowaste composition analysis and environmental impact monitoring.
Potential risk of the action	**Area**	**Risk**
	Social	High initial construction and maintenance costs may strain local budget, especially if subsidies or partnerships are limited. Socially, nearby communities might have concerns about odours, increased traffic, and the environmental impacts of the facility. Proactive community engagement, transparent communication, and strict odour and emissions controls are essential to address these concerns and gain public acceptance.
	Environmental	• Odor emissions: Improperly managed biowaste treatment facilities can release unpleasant odours, impacting air quality and potentially causing nuisance to nearby residents. • Water pollution: Leachate (liquid that percolates through the waste) from the facility can contaminate groundwater or surface water if not properly collected and treated. • Greenhouse gas emissions: Anaerobic digestion, a common process in biowaste treatment, produces methane, a potent greenhouse gas. If not properly captured and utilized, it can contribute to climate change. • Pest attraction: Poorly managed facilities can attract pests like rodents and insects, potentially spreading disease and causing nuisance. • Noise pollution: The operation of the facility, including machinery and transportation of waste, can generate noise that may disturb nearby residents and wildlife.

		• Impact on local ecosystems: Depending on the location and size of the facility, it could potentially impact local ecosystems, especially if it requires clearing of natural habitats. • Digestate quality: The quality of the digestate produced can vary depending on the input materials and the treatment process. If not properly managed, it may contain contaminants or pathogens.
	Economic	High capital costs and long potential payback period.

SW 5	**Compliant landfill** Construction of new compliant landfilling capacity
Sector	Solid Waste
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Waste disposal: The landfill serving the city has a limited remaining life. Targets to be addressed: Municipal solid waste disposed in EU-compliant/equivalent sanitary landfills
Strategic objective supported	Reform the waste management system in terms of governance and infrastructure to ensure that the city follows closely the EU targets on municipal waste at national level
Linkage to existing policies /plans	Waste Management Plan for the Municipality of Bucharest 2020 - 2025

Description

The City of Bucharest is set to construct a new compliant landfill cell, in accordance with EU requirements, to increase its capacity. This action aims to ensure proper waste disposal and accommodate the growing solid waste generation driven by Bucharest's expanding population. However, it is important to note that the prevailing view is that landfilling should not be encouraged, especially considering the EU target of reducing landfill waste to less than 10% by 2035. Given that the existing landfill is nearing its end of life and that waste reduction efforts are progressing slowly, this action will be treated as a reserve. The City will revisit this initiative after engaging in discussions with waste management authorities at the city level to determine its necessity and alignment with broader sustainability goals.

The construction of the new sanitary landfill cell will involve several critical works, such as:

- Excavation of Materials: Removal of existing soil and waste to prepare the site for the new cell.
- Lining Installation: Implementing a robust lining system to prevent leachate from contaminating surrounding soil and groundwater.
- Leachate Collection and Management: Establishing a comprehensive system for collecting and treating leachate generated from the landfill, ensuring environmental compliance.
- Landfill Gas Extraction and Utilization: Installing a network of gas collection wells and infrastructure to capture landfill gas (LFG) for energy production. This includes capping the existing cell to prevent gas escape and facilitate effective gas management.
- Infrastructure for Landfill Gas Capture: Developing systems for processing and utilizing captured LFG, which may include converting it into renewable natural gas (RNG) or using it for electricity generation.
- Capping Existing Cells: Properly sealing existing landfill cells to minimize environmental impact and preparing them for future solar panel installations.

To guarantee the project's sustainability and effectiveness, a comprehensive feasibility study will guide the planning, design and implementation of the facility. This study will encompass several critical components, including market analysis, environmental assessments, technical and economic viability evaluations, regulatory compliance checks, stakeholder engagement strategies, and risk assessments.

Linkage to other GCAP actions	SW 1: Mechanical-biological treatment facility for mixed municipal waste SW 2: Infrastructure for separate collection of municipal waste SW 4: Biological treatment facility for biowaste SW 6: "Pay-as-you throw" schemes for the six districts		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Some elements Reason: A new, compliant landfill in Bucharest can offer some climate action co-benefits:	**Some elements** *Reason:* Various stakeholders, including women's organizations, will	N.A.

	Reduced greenhouse gas emissions: By capturing and utilizing landfill gas (mainly methane) for energy – though already compulsory by law. Improved waste management: Preventing uncontrolled waste disposal and enabling future resource recovery.	be consulted in capacity building. Public procurement processes will encourage enterprises with women in management.	

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	1. Procure feasibility study (prepare tender documents - tender process management)	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	2. Develop the feasibility study	4 months (can overlap with step 3)	Contractors / Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	3. Stakeholder Engagement	2 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	4. Determine financing and procurement strategy	1 month	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	5. Develop tender documents for design, construction, operation and supervision works	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	6. Manage Tender Process and Award Contracts	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	7. Construction works / Supervision	12 months	Contractors / Bucharest General Council/Municipality - Bucharest S1-S6 Councils

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	Bucharest Municipality	Involve, Collaborate, Empower
	Sector Municipalities	Involve, Collaborate
	Sanitation companies	Involve, Collaborate
	Landfill operators	Involve, Collaborate, Empower

Indicative costs [EUR]	**CAPEX**	**OPEX**
	15,000,000	6,000,000

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU: Cohesion Fund	99.8% of CAPEX
	Own source	Municipal budget	0.2% of CAPEX

Revenue opportunities	Yes	**Tipping Fees:** Charge revenue-generating tipping fees for waste disposal, providing a consistent revenue stream. **Leachate Treatment Fees:** Charge fees for treating leachate from other landfills or facilities, creating additional revenue. **Public-Private Partnerships:** Engage in public-private partnerships to share operational costs and revenue, maximizing financial benefits.
	State indicators	N.A.

Impact of the action: Quantitative and Qualitative	Pressure indicators	• Municipal solid waste disposed in EU-compliant/equivalent sanitary landfills. • Remaining life of current landfills.
	Estimated Carbon Emissions Reduction	Estimated emission included in SW 4
	Physical annual savings	**Waste Volume Savings**: Increases capacity for proper waste disposal, reducing the total volume of waste sent to illegal dumpsites and ensuring better management of solid waste. **Leachate Management Savings**: Implements a leachate collection system, preventing contamination of surrounding soil and groundwater, which saves on potential remediation costs. **Landfill Gas Utilization Savings**: Captures landfill gas for energy production, reducing greenhouse gas emissions and providing a renewable energy source, which contributes to energy needs. **Environmental Compliance Savings**: Ensures adherence to EU regulations, minimizing risks associated with non-compliance and avoiding potential fines or remediation costs. **Public Health Savings**: Reduces health risks associated with improper waste disposal and landfill operations, contributing to overall community well-being. **Future Land Use Savings**: future solar panel installations, enhancing land use efficiency and promoting sustainability.
	Climate resilience benefits	• Less methane: Modern landfills capture this potent greenhouse gas • Reliable waste handling: Ensures proper waste management even during crises. • Resource recovery: Can incorporate waste-to-energy and recycling to reduce reliance on new materials. • Ecosystem protection: Prevents pollution from contaminating groundwater and surrounding environments. • Healthier city: Reduces disease risk, especially important during climate-related events.
	Reductions in operating expenditures	**Decreased Environmental Compliance Expenditures**: Reduces costs related to meeting environmental regulations by implementing best practices for waste management and gas capture, preventing illegal dumping, and minimizing remediation costs for contaminated sites. **Potential for Grants and Funding Expenditures:** Aligning with EU directives makes the project eligible for various funding opportunities that can offset operational costs.
	Social and economic benefits/Gender considerations	Constructing a new compliant landfill can ensure safe, regulated waste disposal, reducing illegal dumping and minimizing environmental contamination, which benefits public health. Economically, a compliant landfill can efficiently manage waste management capacity, potentially lowering costs for residents and businesses by providing a local, regulated disposal option that adheres to environmental standards. No new jobs are foreseen.

	Area	Risk
Potential risk of the action	Social	Socially, as in the previous action, nearby residents may express concerns about potential odours, noise, traffic, and impacts on property values.
	Environmental	• Greenhouse gas emissions: Methane generation contributes to climate change. • Water contamination: Leachate can pollute groundwater and surface water. • Habitat loss: Landfills require significant land, impacting biodiversity. • Air pollution: Landfill gas and waste fires release harmful pollutants. • Traffic and noise: Increased truck traffic impacts nearby communities. • Long-term liability: Requires ongoing monitoring and management.
	Economic	The high cost of construction and ongoing compliance monitoring may strain municipal budget or increase waste disposal fees.

SW 6	SW 6: "Pay-as-you throw" schemes for the six districts Introduction/application of the economic instrument "pay-as-you throw" schemes in Districts 1-6
Sector	Solid Waste
Action Type	Policy
GCAP Action Classification	Strategies, plans, and programmes
Priority environmental challenges addressed	Lack of selective collection incentives, poor infrastructure, non-existent data monitoring and interventions Targets to be addressed: Total municipal solid waste generation per capita within 3 years: 390 kg/capita/year
Strategic objective supported	Reform the waste management system in terms of governance and infrastructure to ensure that the city follows closely the EU targets on municipal waste at national level
Linkage to existing policies /plans	• National Strategy & Action Plan for the Circular Economy in Romania Waste Management Plan for the Municipality of Bucharest 2020 - 2025

Description

The City of Bucharest is set to introduce a Pay-As-You-Throw (PAYT) scheme within the contracts of sanitation operators across the six districts. This initiative serves as an effective financial incentive that encourages immediate waste separation for dry recyclables and biowaste, while also promoting source reduction among commercial waste generators and/ or households.

The primary objectives of implementing PAYT schemes in Bucharest's districts are to reduce waste generation by linking fees directly to waste output, thereby motivating users to minimize their waste footprint. Additionally, the program aims to increase recycling rates, as financial incentives will likely lead more users to engage in recycling efforts. Furthermore, the PAYT system is designed to enhance waste management efficiency by promoting better resource allocation within municipal services, aligning costs with actual usage.

Various PAYT models can be implemented, including volume-based pricing, where fees are determined by the size of waste containers; weight-based pricing, which charges based on the actual weight of waste collected; and sack-based pricing, where users purchase specific bags for disposal, with fees corresponding to the number of bags used. These models not only incentivize waste reduction but also promote recycling by making these services either free or less costly compared to general waste disposal.

To ensure successful implementation, a comprehensive feasibility study will evaluate community needs, financial implications, and potential PAYT models. This study will involve stakeholder engagement through surveys and public consultations to gather insights on preferences and concerns.

Based on the findings from this study, each district will conduct a financial analysis and inform the municipality about the results and their implementation. A suitable PAYT model will be finalised for each district, determining a rate structure that reflects actual waste generation while ensuring fairness across different income groups.

The municipality will also ensure compliance with existing waste management regulations and align PAYT implementation with broader environmental goals set forth in national policies. An outreach strategy will be developed to inform users about the benefits and operational details of the PAYT system, fostering acceptance and participation in the program.

Necessary infrastructure (pl. refer to Action SW 2) will be established, including specialized bins or tagging systems for waste identification and digital technologies to facilitate effective implementation and monitoring.

A pilot program will be launched in selected areas to evaluate the effectiveness of the PAYT scheme before full-scale implementation across all districts. Continuous assessment will track program performance, gather feedback, and make adjustments as needed to enhance effectiveness.

Linkage to other GCAP actions	SW 1: Mechanical-biological treatment facility for mixed municipal waste SW 2: Infrastructure for separate collection of municipal waste SW 4: Biological treatment facility for biowaste SW 5: Compliant landfill

Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Some elements *Reason:* PAYT also promotes resource efficiency, encourages sustainable consumption, and raises environmental awareness.	**Some elements** *Reason:* Various stakeholders, including women's organizations, will be consulted so that women's interests are represented.	**Directly targeted** *Reason:* The use of smart metering and the possible development of data visualization dashboards for waste tracking will allow the municipality to monitor progress, manage resources efficiently, and ensure transparency in billing. The data from this action will feed in the database proposed in action SC1.

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	1. Planning and Preparation (form a task force and define goals, ensuring alignment with legal requirements)	1 month	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	2. Procure feasibility study (prepare tender documents - tender process management)	2 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	3. Develop the feasibility study	4 months	Contractors / Bucharest General Council/Municipality - Bucharest S1-S6 Councils
	4. Procure financial analysis of the selected PAYT model (prepare tender documents - tender process management)	1 months	Bucharest S1-S6 Councils
	5. Develop the financial analysis	2 months	Contractors / Bucharest S1-S6 Councils
	6. Program Design (finalize PAYT model, determine a rate structure, update sanitation operator contracts)	2 months	Bucharest S1-S6 Councils
	7. Pilot Testing	6 months	Bucharest S1-S6 Councils and Sanitation Operators

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	Bucharest Municipality	Inform, Collaborate
	Sector Municipalities	Empower, Collaborate
	Sanitation companies	Empower, Collaborate
	Citizens	Inform, Collaborate

Indicative costs [EUR]	**CAPEX**	**OPEX**
	18,000,000 This includes: costs for a preliminary study, infrastructure costs (bins and smart censors).	695,000

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU: Cohesion Fund	97% of CAPEX
	Own source	Municipal budget	3% of CAPEX; 100% of OPEX

Revenue opportunities	Yes	**Increased Revenue from Collection Fees:** Generate revenue through variable collection fees based on the amount of waste produced, encouraging residents to minimize waste.

		Cost Savings on Waste Management: Save on disposal costs, allowing for the reallocation of funds to enhance recycling programs, indirectly boosting overall revenue. **Higher Recycling Rates:** Increase revenue from the sale of recyclables as residents are incentivized to recycle more due to financial incentives associated with PAYT. **Community Engagement:** Foster public support for PAYT, leading to increased participation in recycling programs and generating additional revenue from recyclables as community involvement grows.
Impact of the action: Quantitative and Qualitative	State indicators	N.A.
	Pressure indicators	• Total municipal solid waste generation per capita
	Estimated Carbon Emissions Reduction	Estimated emissions are included in SW 4
	Physical annual savings	**Waste Volume Savings:** Encourages waste separation at source, leading to a reduction in the total volume of waste generated and sent to landfills. **Recyclable Material Savings:** Increases the quantity of dry recyclables and biowaste collected, enhancing resource recovery and reducing the need for new raw materials. **Environmental Impact Savings:** Reduces greenhouse gas emissions by promoting recycling, contributing to improved air quality. **Transportation Savings:** Minimizes transportation emissions and costs by optimizing waste collection routes based on actual waste output. **Public Health Savings:** Decreases risks associated with improper waste disposal, contributing to overall community health improvements. **Community Engagement Savings:** Fosters greater community participation in waste management efforts, leading to a more informed public and increased recycling rates.
	Climate resilience benefits	• Less waste: Reduces landfill needs and methane emissions. • More recycling: Conserves resources and lowers environmental impact. • Resource awareness: Encourages sustainable consumption. • Less pollution: Cleaner air, water, and soil. • Reliable waste disposal: Reduces landfill vulnerability to extreme weather. • Healthier city: Minimizes disease risk from improper waste handling.
	Reductions in operating expenditures	**Lower Landfill Expenditures:** Decreases costs associated with landfill disposal by incentivizing waste reduction and increasing recycling rates. **Reduced Transportation Expenditures:** Cuts fuel and maintenance costs through optimized collection routes based on actual waste generation. **Lower Processing Expenditures:** Minimizes costs related to processing waste by increasing the efficiency of recycling operations. **Decreased Environmental Compliance Expenditures:** Reduces costs related to meeting environmental regulations by promoting effective waste separation and management practices.

		Potential for Grants and Funding Expenditures: Aligning with EU directives makes the project eligible for various funding opportunities that can offset operational costs.
	Social and economic benefits/Gender considerations	Implementing "pay-as-you-throw" (PAYT) schemes encourages waste reduction and promotes recycling, as residents pay based on the amount of waste they generate. This approach can foster environmental responsibility, reduce landfill use, and lower community-wide waste management costs over time. Economically, it creates a fairer system by aligning fees with waste production, potentially lowering costs for households that minimize waste and recycle effectively. Approximately 8 new jobs could potentially be created in fields requiring skills in behavioural economics, billing systems and waste tracking technologies, public engagement.
Potential risk of the action	**Area**	**Risk**
	Social	The PAYT scheme may be challenging for low-income households or larger families, who may face higher costs despite limited waste reduction options, raising concerns about equity. Additionally, there may be a risk of illegal dumping to avoid fees. To address these issues, offering support for vulnerable groups, providing clear guidance on waste reduction, and ensuring adequate enforcement and community outreach are essential for effective implementation and public acceptance.

	Environmental	• Illegal dumping: If fees are perceived as too high or inconvenient, some residents might resort to illegal dumping to avoid paying. This can lead to:
		  ○ Pollution of natural areas: Waste dumped in forests, rivers, or other natural areas can contaminate soil and water, harm wildlife, and create eyesores.
		  ○ Public health hazards: Illegal dumpsites can attract pests and create unsanitary conditions, posing risks to public health.
		• Increased burning of waste: To avoid paying for waste collection, some residents might resort to burning their waste, especially in areas with limited collection services. This can contribute to:
		  ○ Air pollution: Burning waste releases harmful pollutants into the air, including particulate matter, carbon monoxide, and dioxins, which can cause respiratory problems and other health issues.
		  ○ Greenhouse gas emissions: Burning waste contributes to climate change by releasing greenhouse gases like carbon dioxide and methane.
		• Reduced biological treatment: If PAYT schemes don't incentivize biological treatment specifically, residents might focus solely on reducing waste volume, potentially leading to less treatment of organic materials. This can result in:
		  • Loss of valuable resources: Organic waste that could be treated and used to improve soil health ends up in landfills.
		  ○ Increased methane emissions: Organic waste decomposing in landfills produces methane, a potent greenhouse gas.
		• Impacts on waste composition: PAYT schemes can alter the composition of waste streams, potentially making it

		more difficult to recycle effectively. For example: Contamination of recyclables - Residents might try to avoid fees by putting non-recyclable items in recycling bins, leading to contamination and reducing the value of recovered materials.
	Economic	The cost of remedying illegal dumping which may result from the PAYT scheme.

4.5. GCAP Buildings actions

The buildings sector contains **three actions** related to the energy efficiency of buildings and addressing the seismic risk specific to Bucharest, as the city has a substantial building stock in a vulnerable state to seismic risks. The nature of the actions in the buildings sector is a combination of capital investments and elaboration of guidelines and standards to be used both for the existing stock and for the new buildings. The actions in the buildings sector are coded from **B 1 to B 3**.

B 1	**Energy audits and proactive measures for existing buildings** Conduct energy audits, including proactive measures for existing buildings, such as rules for energy-efficiency for existing buildings
Sector	Buildings
Action Type	Policy/Investment
GCAP Action Classification	Standards, guidelines, and regulations/Capital Investment
Priority environmental challenges addressed	Increased energy use for heating and cooling
Strategic objective supported	Increase the energy efficiency of buildings and decrease the share of fossil fuels in district heating production, along with improving the related information to offer transparency about the energy performance of the existing building stock
Linkage to existing policies /plans	• EU Energy Efficiency Directive 2018/2002 • National Strategy for Mobilizing Investments in the Renovation of Buildings (2017).

Description

To enhance energy efficiency across its building portfolio, the City of Bucharest should prioritize comprehensive energy audits and establish proactive measures for existing constructions. Given the city's high energy consumption rates, especially for heating and cooling, these audits are essential for identifying areas of inefficiency and recommending tailored improvements. Integrating energy performance assessments into the design and construction phases will help ensure existing buildings meet rigorous energy efficiency standards from the outset, thereby avoiding future inefficiencies. This approach is aligned with national and EU directives, including the EU Energy Efficiency Directive 2018/2002, aiming to mitigate Bucharest's dependency on fossil fuels in heating and cooling systems, which currently exceeds international benchmarks at 144 kWh/m² annually.

This action will include the pilot implementation of Audits and seismic risk assessment of 500 public buildings. To facilitate the implementation of these audits, the City could enforce legal mandates or offer financial incentives to private building owners, encouraging widespread participation. The immediate focus should be on auditing public buildings, with the results recorded in a centralized national database. This transparency will not only foster data-driven decision-making but also allow for the integration of seismic risk assessments (using the Rapid Visual Assessment method), ensuring that energy efficiency upgrades are prioritized alongside necessary structural retrofitting. By coupling energy audits with ongoing assessments for seismic risks, Bucharest can effectively address both energy and safety concerns, creating a more resilient urban infrastructure.

Moreover, the action plan should include the adoption of stringent energy-efficient building regulations for new constructions, modelled after Cluj-Napoca's approach. These regulations will mandate minimum energy performance standards, such as energy class B, minimum thermal insulation levels, and consumption limits.

They will also require the integration of renewable energy sources, like photovoltaic systems, solar collectors, and geothermal energy, to meet a portion of energy needs. Additional guidelines promoting the use of sustainable materials, passive solar design, and smart technologies will further bolster long-term energy sustainability in Bucharest's urban landscape.
Implementing these comprehensive measures will not only improve energy efficiency but also deliver significant co-benefits, such as reducing carbon emissions, enhancing indoor comfort, and lowering utility costs for occupants. By targeting energy performance certificates (EPCs) for at least 30% of buildings within seven years, Bucharest can significantly reduce electricity consumption across both residential and public sectors. The introduction of smart meters and energy-efficient smart developments will further facilitate better energy monitoring and management, ultimately contributing to a sustainable urban environment that is well-prepared for future energy challenges.

Required DATA collection for action B1: Data collection for B1 includes energy performance metrics, audit outcomes, and seismic risk assessments. Information on building occupancy, vulnerable groups, and compliance with energy standards is vital. Smart technology data, such as from meters and energy management systems, supports real-time monitoring and optimization.

Linkage to other GCAP actions	B2: Addressing seismic and climate-change risks. B3: Upgrades of HVAC systems		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* By identifying areas for energy efficiency improvements and enforcing energy standards in existing buildings, the City of Bucharest can expect measurable reductions in carbon emissions, thereby supporting broader climate goals	**Directly targeted** *Reason:* The audits will also consider collecting gender disaggregated data (who owns the buildings, who lives in certain buildings, number of children, elderly people, disable persons, social and economic status of the inhabitants) so that the rehabilitation to integrate a gender and intersectional perspective. Spaces that find people from the vulnerable groups mention above will be prioritize so the impact on increasing their quality of life will be significant.	**Directly targeted** *Reason:* The implementation of smart metering systems is acknowledged as smart development in this action. The creation of a centralized database for energy audits and the integration of smart technologies in existing buildings (e.g., automated energy management) will enhance Bucharest's capacity to monitor, optimize, and control energy use in public buildings.

	Step	**Duration (months)**	**Step owner/support required**
Implementation steps and timeline	**Step 1: Planning and preparation**		
	Establish Project Team and Stakeholder Engagement	2 months	City of Bucharest, Energy Experts, Legal Advisors, Financial Consultants
	Develop Legal Framework for Energy Audits	3 months	
	Design Financial Incentives and Support Schemes for Private Building Owners	1 months	
	Step 2: Conducting Energy Audits and Integration with Seismic Risk Assessment		
	Develop Energy Audit Methodology (including integration with seismic risk)	1 months	Energy Auditors, Seismic experts, Facility Managers, Data Analysts, City of Bucharest
	Conduct Energy Audits	8 months	
	Compile and Analyze Audit Results, Prioritize Buildings for Upgrades	1 months	
	Step 3: Development of Centralized Database		
	Design and Build Centralized Database for Energy Audit Results	3 months	IT Consultants, Data Management

	Input Audit Data and Ensure Accessibility	2 months	Experts, City of Bucharest
	Step 4: Adoption of Proactive Measures for existing Buildings		
	Draft Energy-Efficiency Rules for New Buildings (based on Cluj-Napoca model)	1 months	Building Regulation Experts, Industry Experts, City of Bucharest
	Public Consultation and Finalization of Energy-Efficiency Rules	2 months	

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	City Government	Collaborate
	Energy Auditors	Involve
	Structural Experts	Involve
	Local Contractors	Collaborate
	Community Representatives	Empower
	Regulatory Bodies	Collaborate
	Developers	Consult
	Financial Institutions	Consult

Indicative costs [EUR]	**CAPEX**	**OPEX**
	4,450,000	1,030,000

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Loans	EBRD, EIB, UNDP, World Bank or other IFIs	2,225,000 (50%)
	TA instruments	European Funds	1,557,500 (35%)
	Municipal Own Budget	Bucharest Municipality	667,500 (15%)

Revenue opportunities	Yes	While not a direct part of the action, the implementation of energy efficiency measures identified through energy audits and proactive measures for existing public buildings can lead to reduced energy costs for public sector entities. This results in long-term savings on utility bills and enhances the overall quality of public services. Furthermore, improving the energy efficiency of public buildings can increase their attractiveness to the community, potentially leading to higher utilization rates and better allocation of public resources.
Impact of the action: Quantitative and Qualitative	State indicators	N.A.
	Pressure indicators	• Share of buildings with Energy Performance Certificate
	Estimated Carbon Emissions Reduction	Potential annual reduction of CO_2 emissions of **39,150 tCO_2e per year** from the 500 buildings. This estimate reflects the anticipated reduction achieved once energy efficiency measures from audits are implemented and proactive measures for existing buildings are enforced.
	Physical annual savings	• Savings in energy consumption: Anticipated savings in energy consumption will become evident after the implementation of the energy audit recommendations and the proactive energy efficiency measures for existing constructions, resulting in significant reductions in buildings utility bills.
	Climate resilience benefits	• Enhanced resilience against climate impacts: The integration of energy audits with seismic risk assessments will lead to improved safety and energy efficiency in buildings, thus making them more

		capable of withstanding extreme weather events. Additionally, these measures will enhance thermal comfort for occupants, reducing energy needs and promoting well-being.
	Reductions in operating expenditures	• Lower operating costs: The energy-efficient measures and smart technologies identified through audits will lead to decreased long-term maintenance and operational expenses.
	Social and economic benefits/Gender considerations	Energy audits and proactive measures for existing buildings can significantly enhance energy efficiency, reducing utility costs for residents and businesses while lowering greenhouse gas emissions. These measures can promote sustainable building practices and improve indoor air quality, contributing to public health and comfort. Economically, energy-efficient buildings can attract investment and increase property values, while also creating jobs in construction and retrofitting. This action can also generate employment opportunities in energy auditing, construction, and technology sectors during the implementation phase of audit findings and proactive measures. Approximately 5 new jobs could potentially be created in fields such as energy audit certification, use of building energy modelling software, application of sustainable building standards.
Potential risk of the action	**Area**	**Risk**
	Social	• The initial costs may pose financial burdens for developers and homeowners, potentially leading to higher housing prices. • Disruption to Building Operations: Conducting energy audits in public buildings, such as schools and hospitals, may cause temporary disruptions, affecting access to essential services. • Public Resistance: Building occupants or owners may resist participation in energy audits due to concerns over potential follow-up costs or inconveniences associated with recommended upgrades, especially when it comes to vulnerable groups of lower income. • To mitigate these risks, it's essential to provide financial incentives, resources, and education to stakeholders, ensuring that the benefits of energy efficiency are well-communicated and accessible to all. Limited awareness of the benefits of energy audits could result in low participation rates, especially among private building owners, reducing the effectiveness of the action.
	Environmental	• Inaccurate or Incomplete Data Collection: If energy audits are not conducted thoroughly or consistently, the resulting data may lead to incomplete or incorrect assessments of a building's energy performance, reducing the overall environmental impact of the action. • Overlooking Environmental Impacts of Retrofitting: Audits may focus solely on energy performance, potentially overlooking the environmental impact of using non-sustainable materials or methods in the subsequent retrofitting process.

	Economic	• High Initial Costs for Private Owners: Despite potential financial incentives, the upfront cost of implementing energy audits and subsequent upgrades could be a deterrent for private building owners, leading to lower participation rates. • Inaccurate Cost Estimates: If audits fail to provide accurate assessments of energy inefficiencies, the recommended improvements might be misaligned with the actual needs of the building, leading to unnecessary costs or ineffective investments.
	Other	• Regulatory Delays: Legal mandates and regulatory frameworks for enforcing audits or implementing energy-efficiency standards could be delayed, which would hinder the timely execution of audits and follow-up actions. • Lack of Qualified Personnel: A shortage of qualified energy auditors and seismic assessment experts could slow down the auditing process, leading to delays in execution. • Technological Challenges: If auditing tools and methods are outdated or inconsistent with international best practices, the quality and effectiveness of audits could be compromised, resulting in suboptimal energy performance recommendations.

B 2	**Addressing seismic and climate-change risks** Integrated approach to improving seismic and climate change response following building renovation.
Sector	Buildings
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Potential damage to buildings, due to floods, fire, storms, earthquake
Strategic objective supported	Increase the energy efficiency of buildings and decrease the share of fossil fuels in district heating production, along with improving the related information to offer transparency about the energy performance of the building stock
Linkage to existing policies /plans	• Seismic Risk Assessment Plan for Bucharest (2025) • EU Energy Efficiency Directive 2018/2002 • National Strategy for Mobilizing Investments in the Renovation of Buildings (2017) • National Strategy & Action Plan on Adaptation to Climate Change (2024-2030)

Description

The City of Bucharest faces a dual challenge of addressing significant seismic risks and the growing impacts of climate change. With over 100,000 buildings constructed before modern seismic codes were introduced in 1978, these structures are highly vulnerable to earthquake damage. Moreover, the changing climate introduces new risks, including extreme weather events that can affect the structural integrity and energy efficiency of buildings. Therefore, a comprehensive rehabilitation plan is essential to ensure both seismic safety and climate resilience.

This action prioritizes a multi-faceted approach to rehabilitate high-risk buildings, focusing on structural retrofitting and energy efficiency enhancements. Following a thorough seismic risk assessment, using the Rapid Visual Assessment method (Action L75/S18 *"Energy audits and proactive measures for new buildings"*), this prioritization will identify the most vulnerable buildings, particularly critical infrastructure such as hospitals, schools, and emergency services buildings. At the same time, the retrofitting action should consider the additional load due to energy performance upgrades that will be integrated as part of the action S19: "Upgrades of HVAC systems", ensuring that renovated buildings not only meet seismic safety standards but also improve energy efficiency.

This action will focus on the seismic risk assessment and prioritization of retrofitting actions to the 500 pilot building cases that have been audited as part of action S18.

To support property owners in these efforts, the City of Bucharest will offer a range of financial incentives, including grants, subsidies, low-interest loans, and tax relief measures. Public-private partnerships will also be developed with academic institutions, engineering firms, and international donors to provide technical and financial expertise. Additionally, public awareness campaigns and educational programs will be implemented to raise awareness about the importance of both seismic and climate risk mitigation and to offer guidance on retrofitting best practices.

Seismic and energy efficiency retrofitting actions will significantly reduce the long-term carbon footprint by preventing the need for post-disaster rebuilding and ensuring that Bucharest's buildings are both safer and more energy efficient. The holistic integration of seismic retrofitting with energy efficiency improvements will position Bucharest as a forward-thinking, resilient city capable of withstanding both natural disasters and the impacts of climate change.

Required Data collection for action B2: Data on completed upgrades, focusing on energy performance and seismic retrofits, must be monitored alongside timelines and associated costs. Social impact data, particularly for buildings serving vulnerable populations, guide equitable prioritization. Real-time performance data from retrofitted structures and integration of climate resilience indicators ensure the city's adaptive capacity is enhanced against both seismic and climate risks.

Linkage to other GCAP actions	B1: Energy audits and proactive measures for new buildings B3: Upgrades of HVAC systems

Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* By integrating seismic retrofitting with energy efficiency improvements, this action will significantly reduce greenhouse gas emissions. As buildings are upgraded to meet modern safety and energy standards, they will consume less energy for heating and cooling, thus decreasing reliance on fossil fuels.	**Directly targeted** *Reason:* The detailed seismic risk assessment will include the collection of gender-sensitive data and its analysis from a gender-sensitive perspective as well as other elements such as ethnicity, disability, age so that these data can be used in prioritizing actions concerning the rehabilitation of buildings at seismic risk. The citizens living in buildings at seismic risk are most likely to be people who cannot afford a safer dwelling or who cannot afford the consolidation costs (elderly people, single-parent families, and low-income families). Consequently, these categories of people will be the main beneficiaries of this measure. Furthermore, prioritizing the renovation of social infrastructure will have a clear impact in increasing gender equality given that women are the ones who most frequently come into contact with such infrastructure - schools, hospitals etc.	**Directly targeted** *Reason:* The action will integrate smart energy management systems in rehabilitated buildings, allowing for real-time monitoring of energy consumption and performance. This integration not only enhances the efficiency of energy use but also provides data that can inform future policy and investment decisions.

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	Step 1: Planning and preparation		
	Establish Project Team and Stakeholder Engagement	2 months	City of Bucharest, Energy Experts, Legal Advisors
	Develop legal framework for retrofitting	2 months	
	Identification of 200 Critical Buildings out of 500	2 months	
	Step 2: Detailed Seismic Evaluation	6 months	Structural experts, Energy Auditors, Facility Managers
	Step 3: Retrofitting Prioritization and Planning		
	Prioritize Retrofitting Actions	2 months	Structural experts, Contractors, Local Builders, City of Bucharest
	Develop Detailed Retrofitting Plans	2 months	
	Step 4: Implementation and Monitoring		
	Implement Retrofitting Actions	24 months	Contractors, Local Builders, City of Bucharest, Monitoring team, City Inspectors
	Post-Retrofit Evaluations	6 months	

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	City Government	Collaborate
	Energy Auditors	Involve
	Structural Experts	Involve
	Local Contractors	Collaborate
	Community Representatives	Empower
	Regulatory Bodies	Collaborate
	Developers	Consult
	Financial Institutions	Consult

	CAPEX	**OPEX**

Indicative costs [EUR]	44,100,000 This includes: Pilot implementation for 200 public buildings (detailed seismic evaluations, retrofitting, structural reinforcements and foundation strengthening, monitoring and Quality Assurance during construction)	600,000	
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Loan	EBRD, EIB, UNDP, World Bank or other IFIs	18,963,000 22,050,000(50%)
	TA instruments	European Funds	15,435,000 (35%)
	Municipal Own Budget	Bucharest Municipality	6,615,000 (15%)
Revenue opportunities	Yes	While the action focuses primarily on improving building safety, the long-term benefits include reduced costs from avoided damages during seismic events, enhanced property values. The initiative may also create business opportunities in the construction and retrofitting sectors, leading to job creation.	
Impact of the action: Quantitative and Qualitative	State indicators	• Estimated economic damage from natural disasters floods droughts earthquakes etc. as a share of GDP • Percentage of public infrastructure at risk • Percentage of households at risk	
	Pressure indicators	N.A.	
	Estimated Carbon Emissions Reduction	Preventing building collapse and the resulting need for reconstruction after a major earthquake can avoid significant embodied carbon emissions. **Estimated emissions are included in B 1**	
	Physical annual savings	• By avoiding the need for energy-intensive reconstruction processes (e.g., producing and transporting new materials), there are indirect savings in terms of energy use across the construction sector. However, specific energy savings would be tied to any associated energy efficiency measures in subsequent actions.	
	Climate resilience benefits	• Protection of critical infrastructure (hospitals, schools, emergency services) in the event of seismic activity. • Ensures the city can maintain essential services and public safety during and after earthquakes. • Reduces long-term vulnerability to climate-related disasters such as storms, which may affect the structural integrity of older, vulnerable buildings.	
	Reductions in operating expenditures	• Reductions in post-disaster maintenance, insurance premiums, and emergency repair costs.	
	Social and economic benefits/Gender considerations	• Improved Public Safety: Seismic retrofitting protects not only the infrastructure but also the lives of residents, employees, and users of critical public buildings. By safeguarding schools, hospitals, and emergency services, the action improves the community's overall security and ability to respond to disasters. • As a proactive approach can also reduce future repair and insurance costs for homeowners and municipalities, leading to long-term economic savings.	

		• Economic Stability: The avoidance of catastrophic building damage during earthquakes means that local economies can continue to function, as public services (e.g., hospitals, schools) remain operational. This minimizes economic disruptions in the wake of natural disasters. Furthermore, retrofitting buildings for resilience can promote local job creation in construction and engineering sectors, contributing to community development and economic growth. • Approximately 15 new jobs could be created for structural engineers, specialists in climate vulnerability, retrofit practitioners, emergency planning.
Potential risk of the action	**Area**	**Risk**
	Social	• The financial burden of rehabilitation projects may strain family budgets or increase costs for homeowners, potentially leading to affordability issues, especially in low-income communities. • Socially, there may be resistance from property owners who perceive these measures as intrusive or unnecessary, particularly if they lack awareness of the risks involved. • Community resistance and displacement of vulnerable populations may create social tension. • Ensuring equitable access to benefits will be crucial to prevent exacerbating existing inequalities.
	Environmental	• Construction activities can lead to increased waste and resource consumption, impacting the environment. • Noise and air pollution may affect the quality of life for nearby residents and local ecosystems.
	Economic	• High upfront costs and potential for budget overruns could deter participation and strain municipal finances. • Economic disruption may occur during the construction period, affecting local businesses and services.
	Other	• Regulatory challenges and a shortage of skilled labour could delay project timelines. • Unforeseen structural issues may complicate retrofitting plans, leading to additional costs.

B 3	**Upgrades of HVAC systems for public buildings** Modernise the heating, ventilation and air conditioning (HVAC) systems for public buildings with more energy-efficient, electric based technologies ones
Sector	Buildings
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Increased energy use for heating and cooling
Strategic objective supported	Increase the energy efficiency of buildings and decrease the share of fossil fuels in district heating production
Linkage to existing policies /plans	National Plan for Recovery and Resilience, Energy Performance Standards for HVAC systems National Strategy & Action Plan on Adaptation to Climate Change (2024-2030)

Description

The modernization of heating, ventilation, and air conditioning (HVAC) systems in Bucharest's public buildings is essential to reducing energy consumption and enhancing energy efficiency. Currently, these buildings consume an average of 212 kWh/m² annually, which significantly exceeds international standards. This action focuses on replacing outdated and inefficient HVAC systems with advanced, energy-efficient, electric-based technologies, such as heat pumps and variable refrigerant volume (VRV) systems. By implementing these upgrades, the City aims to cut energy costs and carbon emissions while supporting its strategic goal of reducing electricity consumption in public buildings to under 100 kWh/m².

The modernization process follows the action *"L75/S18: Energy audits and proactive measures for new buildings"* that focus on comprehensive energy audits to assess the current HVAC systems *and is in parallel with action "L80/S19: Addressing seismic and climate-change risks"*. Following the audits, a Priority Investment Programme will be developed to detail the upgrade of these systems across 500 public buildings. This program will encompass a thorough analysis of technical solutions, timelines for implementation, and the identification of priority locations for the upgrades. Additionally, technical and economic assessments will evaluate the financial benefits of each project, ensuring transparency and fostering wider adoption of energy-efficient technologies through published feasibility studies in an open database.

Another critical component of this action is the creation of a Building Rehabilitation Priority List, which will be developed through detailed technical, financial, and legal analyses. This list will help the City assess the specific energy efficiency needs of each building and generate estimates of the required upgrades. By prioritizing energy efficiency projects based on their urgency and potential impact, resources can be allocated effectively, ensuring that the most critical improvements are addressed first. Pilot investments will also be initiated in select public buildings, showcasing practical demonstrations of cost savings and energy efficiency enhancements.

Incorporating smart energy management technologies alongside these HVAC upgrades will further optimize performance, reduce energy wastage, and enable real-time monitoring of energy use. This comprehensive approach not only lays the groundwork for future integration of RES like solar and geothermal energy but also aligns with Bucharest's long-term sustainability goals. Overall, the modernization of HVAC systems represents a significant step towards electrification in heating and cooling, reducing reliance on fossil fuels and advancing the city's green energy ambitions while improving indoor air quality and occupant comfort.

Required Data collection for action B3: B3 requires data on HVAC system performance, energy-efficient upgrades, and pilot project results, including energy savings. Smart energy management system data and renewable energy integration details support monitoring and scalability for public buildings.

Linkage to other GCAP actions	B1: Energy audits and proactive measures for new buildings B2: Addressing seismic and climate-change risks.		
	Climate action	**Gender and economic inclusion**	**Smart maturity**

<table>
<tr><td>Cross-cutting themes/co-benefits</td><td colspan="2">Directly targeted
<u>Reason:</u>
Upgrading to energy-efficient, electric-based HVAC systems reduces greenhouse gas emissions and reliance on fossil fuels, contributing directly to climate goals.</td><td>Directly targeted
<u>Reason:</u>
Energy-efficient HVAC systems can reduce the unpaid care burden disproportionately carried by women by providing affordable electricity and better living conditions. For low-income households, improved access to basic infrastructure, such as affordable heating and electricity, can ease the time and effort associated with unpaid domestic work, supporting both gender equality and overall well-being.</td><td>Directly targeted
<u>Reason:</u>
Electric-based HVAC systems are compatible with smart technologies, making public buildings "smart-ready" for energy monitoring and optimization.</td></tr>
<tr><td rowspan="15">Implementation steps and timeline</td><td>Step</td><td>Duration (months)</td><td colspan="2">Step owner/support required</td></tr>
<tr><td colspan="4">Step 1: Planning and initial assessments</td></tr>
<tr><td>Establish Project Team and Stakeholder Engagement</td><td>3 months</td><td colspan="2" rowspan="3">City of Bucharest, Energy Experts, Legal Advisors, Financial Consultants</td></tr>
<tr><td>Building Inventory and Data Collection</td><td>6 months</td></tr>
<tr><td>Feasibility Studies and Technical Assessments for 500 buildings</td><td>12 months</td></tr>
<tr><td colspan="4">Step 2: Development of the Priority Investment Programme</td></tr>
<tr><td>Finalize Priority Investment Programme</td><td>6 months</td><td colspan="2" rowspan="3">Project Management Team, Energy Efficiency Consultants, Financial Analysts</td></tr>
<tr><td>Financial Planning and Securing Funding</td><td>3 months</td></tr>
<tr><td>Regulatory and Legal Preparations</td><td>3 months</td></tr>
<tr><td colspan="4">Step 3: Pilot Projects and Monitoring</td></tr>
<tr><td>Pilot Project Implementation</td><td>6 months</td><td colspan="2" rowspan="3">Facility Managers, HVAC Technicians, Data Analysts, City of Bucharest</td></tr>
<tr><td>Monitoring and Evaluation</td><td>3 months</td></tr>
<tr><td>Training and Capacity Building</td><td>3 months</td></tr>
<tr><td colspan="4">Step 4: Full-Scale Implementation</td></tr>
<tr><td>Begin Full-Scale HVAC Upgrades to all 500 buildings</td><td>24 months</td><td colspan="2" rowspan="2">Project Implementation Team, Contractors, Local Builders</td></tr>
<tr><td>Monitoring and Data Collection</td><td>6 months</td></tr>
<tr><td colspan="4">Step 5: Review, Reporting, and Future Planning</td></tr>
<tr><td>Final Evaluation and Replicability</td><td>6 months</td><td colspan="2">Monitoring and Evaluation Team, City Inspectors, External Evaluators</td></tr>
<tr><td rowspan="9">Stakeholders</td><td colspan="2">Stakeholder category</td><td colspan="2">Engagement (Inform, Consults, Involve, Collaborate or Empower)</td></tr>
<tr><td colspan="2">City Government</td><td colspan="2">Collaborate</td></tr>
<tr><td colspan="2">Energy Auditors</td><td colspan="2">Involve</td></tr>
<tr><td colspan="2">Structural Experts</td><td colspan="2">Involve</td></tr>
<tr><td colspan="2">Local Contractors</td><td colspan="2">Collaborate</td></tr>
<tr><td colspan="2">Community Representatives</td><td colspan="2">Empower</td></tr>
<tr><td colspan="2">Regulatory Bodies</td><td colspan="2">Collaborate</td></tr>
<tr><td colspan="2">Developers</td><td colspan="2">Collaborate</td></tr>
<tr><td colspan="2">Financial Institutions</td><td colspan="2">Consult</td></tr>
</table>

Indicative costs [EUR]	**CAPEX**		**OPEX**
	77,650,000 This includes: Pilot implementation for 500 public buildings (upgrade costs, priority Investment Programme). Energy consumption is assumed to be reduced by approximately 30% after upgrades.		1,000,000
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Loan	EEBRD, EIB, UNDP, World Bank or other IFIS	38,825,000 (50%)
	Grant TA Instrument	European Funds	27,177,500 (35%)
	Municipal Own Budget	Bucharest Municipality	11,647,500 (15%)
Revenue opportunities	Yes	Energy savings from modernized HVAC systems can reduce costs and be monetized through energy performance contracts. The initiative may also attract investments and create business opportunities in energy-efficient technologies and services.	
Impact of the action: Quantitative and Qualitative	State indicators	• Annual CO_2 equivalent emissions per capita / per unit GDP	
	Pressure indicators	• Electricity consumption in public buildings • Average fossil fuel consumption for heating and cooling in all types of buildings per square meter measured over the year	
	Estimated Carbon Emissions Reduction	• The modernization of HVAC systems aims to significantly reduce energy consumption and associated carbon emissions. The current average energy consumption for public buildings in Bucharest is 212 kWh/m² annually, and the goal is to reduce this to under 100 kWh/m². Total Estimated Carbon Emissions Reduction: **39,150 tCO_2e per year.**	
	Physical annual savings	• Savings in heating/cooling consumption: Improved HVAV efficiency is expected to yield significant reductions in utility bills for public buildings.	
	Climate resilience benefits	• Improved Indoor Air Quality: Enhanced HVAC systems help maintain better indoor air quality, which is vital for public health, especially during extreme weather events. • Adaptability to Extreme Weather: Upgraded systems are often more robust and capable of handling increased loads from extreme temperature fluctuations, improving comfort and safety for occupants. • Reduced Dependency on Fossil Fuels: By transitioning to electric-based HVAC systems, Bucharest can reduce reliance on fossil fuels for heating and cooling, aligning with broader climate goals. • Alignment with Renewable Energy Integration: The upgrades will pave the way for future integration of renewable energy sources (like solar and geothermal), further enhancing climate resilience.	
	Reductions in operating expenditures	• Lower operating costs: Energy-efficient designs and smart technologies will lead to reduced maintenance and operational costs for public building HVAC systems.	
	Social and economic benefits/Gender considerations	• Creation of new jobs: The action is labour-intensive and can provide employment opportunities in installation, maintenance, and related sectors. Improving women's skills and opportunities in the underserved segments will be considered to promote gender equality and develop fair and inclusive public policies.	

		• More equitable access to comfortable public spaces: Improved HVAC systems will enhance the quality of public buildings, benefiting all users, including disadvantaged groups. • Increased capacity for public services: Enhanced building conditions may lead to improved service delivery in educational and healthcare facilities. • Economic Stability: Cost savings from energy and maintenance reductions can be redirected to other essential services, benefiting the broader community. • Approximately 18 new jobs could be created for technicians and administrators in the following fields: HVAC design and optimisation, retrofitting of energy efficiency systems, and monitoring and control of HVAC systems.
Potential risk of the action	**Area**	**Risk**
	Social	• Community Disruption: Upgrading HVAC systems may require temporary closures of public buildings, affecting access to essential services (e.g., schools, hospitals) and causing inconvenience to the public. • Public Resistance: There may be opposition from building occupants or local communities regarding the perceived inconvenience or disruption during the renovation process. • Equity Issues: If certain public buildings are prioritized over others without transparent criteria, some community members may feel that their needs are being overlooked, potentially leading to social discontent.
	Environmental	• Resource Use: The installation of new HVAC systems can lead to the consumption of significant resources (e.g., materials, energy), impacting the environment if not managed sustainably. • Waste Generation: Old HVAC systems will need to be disposed of, potentially leading to increased waste if not recycled properly. • Noise and Air Pollution: The installation process can generate noise and dust, potentially affecting nearby residents and wildlife.
	Economic	• High Upfront Costs: The initial investment for modernizing HVAC systems may be substantial, leading to budget constraints for the city if financial support is not adequately secured. • Potential Cost Overruns: Unexpected complications during the upgrade process (e.g., structural issues, longer installation times) may lead to project delays and increased costs. • Disruption to Local Economy: If public buildings, such as schools or hospitals, are temporarily closed or disrupted during installation, it may affect local economies, particularly businesses reliant on foot traffic.
	Other	• Regulatory Challenges: Delays in obtaining necessary permits and approvals can impede project timelines and increase costs. • Technical Challenges: There may be unforeseen technical issues during the installation of new HVAC systems, such as compatibility with existing building infrastructure or unforeseen structural issues. • Insufficient Expertise: A lack of qualified technicians and engineers with experience in modern HVAC systems may hinder the effective implementation of the upgrades.

4.6. GCAP Water actions

In the water sector **five actions** have been prioritised from the long list of actions and they target circular use of water, the implementation of nature-based solutions for climate adaptation in the city, as well as the upgrade and modernization of the water services infrastructure. The actions in the water sector are coded from **W 1 to W 5**.

W 1	**Modernisation of the drinking water network** Modernise the existing networks and establish smart technologies for water management
Sector	Water
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Need for replacements of the existing old and obsolete parts of the distribution network and sewer network. Need for further reduction of leakages and minimizing the quantities of non-revenue water Increase the connectivity to the drinking water network in order to achieve the rate close to 100%
Strategic objective supported	Ensure full coverage of the city with drinking water supply networks, while modernising and improving the performance of the existing drinking water and wastewater networks to protect the surface water bodies and promote a sustainable water resources management.
Linkage to existing policies /plans	Master plan for water supply and wastewater 2019-2049 National Strategy & Action Plan on Adaptation to Climate Change (2024-2030)

Description

The basis of the implementation of this action is the establishment of an accurate picture of the current operational situation of the network so that a multitude of targeted interventions can be proposed in order to ameliorate the network performance. First step to this will be the collection and analysis of data regarding the network performance. This includes network monitoring, mapping of existing assets and survey/inspection of network pipes integrity. Based on the results of the aforementioned step, analysis of the data, risk assessment for the network (identification of vulnerable points/areas prone to breakages, leakage/illegal connections detection) will be performed. The conclusion of this step will provide the basis for design and implementation of programs for targeted interventions and renovation of problematic or obsolete parts of the network.

The subsequent step will be the elaboration of technical studies for the design and implementation of the following actions:

1. Expansion of water supply networks to areas, especially in the suburbs, currently not covered by existing networks.
   Replacement/rehabilitation of damaged or old parts of the networks.
   Use of materials such as PVC, PP, HDPE
2. Implementation of targeted smart technologies on the network that produce significant water savings and performance enhancement with low investment costs. Procurement, installation and commissioning of a system for leakage control (remote monitoring control using technics such as smart meters for detecting water losses and illegal connections, IoT, telemetry etc.), monitoring and automatic control of all hydraulic and operational parameters of the water supply system in all critical nodes.
   This measure concerns the networks throughout the city of Bucharest.

<table>
<tr><td>Linkage to other GCAP actions</td><td colspan="3">W3: Technology upgrade for industrial wastewater management</td></tr>
<tr><td rowspan="2">Cross-cutting themes/co-benefits</td><td>Climate action</td><td>Gender and economic inclusion</td><td>Smart maturity</td></tr>
<tr><td>Some elements
<u>Reason:</u>
Modernizing Bucharest's water network with smart technologies is a crucial step towards achieving climate action goals while ensuring a sustainable and resilient water supply for the city. By improving efficiency, reducing waste, and enhancing adaptability to climate change impacts, this action contributes to a more sustainable and liveable urban environment.</td><td>Some elements
<u>Reason:</u>
A more equitable distribution of water can reduce women’s workload in the domestic area, but also can increase their (and others) mobility and access to the city when talking about (see here women as primary caregivers).
Analysing the usage of water public fountains and understanding the profile of persons who are using these facilities (women, children) in order to improve their accessibility is also highly important and is related to mobility partners, social infrastructure distribution, and land use.</td><td>Directly targeted
<u>Reason:</u>
Integrating Internet of Things devices and sensors throughout the critical nodes of the water supply system will enable continuous monitoring of water-related, hydraulic and operational parameters and the detection of leakages. A ‘smart’ water leakage control system will incorporate flow meters, pressure and acoustic sensors to measure water usage, detect leaks and illegal connections and optimize water management. The data collected will be transmitted in real-time to a centralized system, where it will be processed, analysed, and made accessible to relevant stakeholders. This streamlined process significantly aim to reduce the time needed to detect and address water leaks, while enhancing the efficiency of water network maintenance and overall operational management.
The data from this action will feed in the database proposed in action SC1:
• Water quantity in central parts of the water supply network for the detection of NRW
• Water supply network operational data (pressures, breakages, leaks, outages, damages etc)
• Real-time monitoring of quality in sources of potable water</td></tr>
<tr><td rowspan="7">Implementation steps and timeline</td><td colspan="2">Step</td><td>Duration (months)</td><td>Step owner /support required</td></tr>
<tr><td colspan="2">Procurement of feasibility study</td><td>3 months</td><td>APA Nova/Municipality</td></tr>
<tr><td colspan="2">Feasibility study for the selection of interventions in the network</td><td>4 months</td><td>APA Nova/Municipality</td></tr>
<tr><td colspan="2">Procurement of technical studies</td><td>3 months</td><td>APA Nova/Municipality</td></tr>
<tr><td colspan="2">Technical studies of interventions</td><td>9 months</td><td>APA Nova/Municipality</td></tr>
<tr><td colspan="2">Procurement of proposed works</td><td>6 months</td><td>APA Nova/Municipality</td></tr>
<tr><td colspan="2">Implementation of proposed works</td><td>12 months</td><td>APA Nova/Municipality</td></tr>
<tr><td rowspan="3">Stakeholders</td><td colspan="2">Stakeholder category</td><td colspan="2">Engagement (Inform, Consults, Involve, Collaborate or Empower)</td></tr>
<tr><td colspan="2">Bucharest Municipality</td><td colspan="2">Collaborate, Empower</td></tr>
<tr><td colspan="2">Sector Municipalities</td><td colspan="2">Collaborate, Empower</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td>Water and sewerage operator</td><td>Collaborate, Empower</td></tr>
<tr><td></td><td>Ministry of Environment</td><td>Involve, Collaborate</td></tr>
<tr><td rowspan="2">Indicative costs [EUR]</td><td>CAPEX</td><td>OPEX</td></tr>
<tr><td>193,000,000
This includes: feasibility and technical studies, the expansion and modernisation of distribution and sewer network (assumption of expansion of network to 200,000 inhabitants and modernisation of network on 25km)</td><td>335,000</td></tr>
<tr><td rowspan="3">Potential funding</td><td>Instrument</td><td>Source</td><td>Amount [EUR]/ share [%]</td></tr>
<tr><td>Grant / loan</td><td>EU: Cohesion Fund</td><td>99% of CAPEX; 100% of OPEX</td></tr>
<tr><td>Own source</td><td>Municipal budget</td><td>1% of CAPEX</td></tr>
<tr><td>Revenue opportunities</td><td>Yes</td><td colspan="2">Enhanced Billing Accuracy: Smart meters improve billing precision, reducing illegal connections, disputes and increasing revenue collection efficiency.
Attracting Investment: Modernized infrastructure can attract public and private investments, enhancing financial resources available for further development.
New Service Offerings: The introduction of smart water management can lead to value-added services (e.g., real-time usage analytics), creating additional revenue channels.</td></tr>
<tr><td rowspan="5">Impact of the action: Quantitative and Qualitative</td><td>State indicators</td><td colspan="2">• Water samples complying with national potable water quality standards
• Water Exploitation Index</td></tr>
<tr><td>Pressure indicators</td><td colspan="2">• Non-revenue water</td></tr>
<tr><td>Estimated Carbon Emissions Reduction</td><td colspan="2">Estimated emissions are included in W 3</td></tr>
<tr><td>Physical annual savings</td><td colspan="2">Water Savings: Implementation of smart leak detection systems and monitoring technologies will significantly reduce water losses.
Energy Savings: Optimizing the hydraulic parameters of the water supply system will reduce the energy required for pumping and treating water, resulting in a substantial decrease in energy consumption across the network.</td></tr>
<tr><td>Climate resilience benefits</td><td colspan="2">• Reduced water loss due to leakages or illegal connections: Smart leak detection and repair minimizes Non-Revenue-Water (NRW), crucial during droughts and increasing water scarcity.
• Improved drainage: Upgraded systems can better handle intense rainfall and reduce the risk of urban flooding.
• Water quality protection: Smart sensors can monitor pollution levels and trigger alerts, protecting public health and ecosystems.
• Adaptive water supply: Smart systems can optimize water distribution based on real-time demand and weather patterns, ensuring a reliable supply even during droughts.
• Reduced energy consumption: Optimized pumping and treatment processes can lower the energy footprint of water management.</td></tr>
</table>

	Reductions in operating expenditures	**Water Loss Expenditures**: Reduction of non-revenue water. By minimizing water losses through effective leak/illegal connection detection and repair strategies, the expenditures related to purchasing additional water supplies or treating water that is lost later in the network will be significantly reduced **Energy cost reduction:** Optimizing the water supply system can decrease energy consumption, directly impacting overall operational costs. **Maintenance Expenditures**: The adoption of smart monitoring technologies will lead to fewer emergency repairs and maintenance interventions, significantly lowering ongoing maintenance costs associated with the water network. **Labour Expenditures:** Automation and remote monitoring capabilities will reduce the need for on-site personnel for routine inspections and monitoring, thereby decreasing labour costs associated with network management.
	Social and economic benefits/Gender considerations	Significantly enhanced water efficiency and reduction of leaks, ensuring a more reliable supply for communities. These improvements can lead to lower operational costs, resulting in potential savings for the municipality and consumers alike. Enhanced monitoring can provide real-time data, improving response times to issues and contributing to better public health by ensuring safe water quality. Additionally, modern systems can support sustainable water practices and contribute to environmental conservation. Approximately 20 new jobs could be created for people with technical and administrative skills in hydraulic engineering, leak detection technology, use of water system analytic software, community outreach and engagement.
Potential risk of the action	**Area**	**Risk**
	Social	Community disruption is a concern, leading to inconvenience for residents and businesses. There may also be public resistance to changes, particularly if residents are unfamiliar with new technologies or perceive them as intrusive. Moreover, if modernization efforts do not equitably address the needs of all neighbourhoods, it could lead to feelings of neglect or inequity among underserved communities.
	Environmental	• Increased energy demand: While potentially reducing energy overall, some smart technologies (like advanced sensors and control systems) require electricity, potentially increasing demand. • E-waste generation: Sensors and other electronic components have a limited lifespan, generating electronic waste that needs responsible disposal. • Disruption of ecosystems: Construction and installation of new infrastructure can temporarily disrupt aquatic ecosystems and habitats. • Dependence on technology: Over-reliance on complex technology can create vulnerabilities to power outages or cyberattacks.

		• Data security and privacy: Collecting and transmitting water usage data raises potential privacy concerns that need careful management.
	Economic	The initial investment may press the municipal budget, particularly if funding sources are limited resulting in a potential consumer price raise, including smart equipment for houses.

W 2	**Nature-based solutions for stormwater management** Develop a regulatory framework for stormwater retention and for redesigning public spaces to enable permeable surfaces and stormwater retention and invest accordingly in Sustainable Drainage Systems (raingardens, swales, green roofs etc.)
Sector	Water
Action Type	Investment
GCAP Action Classification	Capital Investment/Standards, guidelines and regulations
Priority environmental challenges addressed	Increase the adoption of the Nature Based Solution in the built environment in order to retain as much as possible the stormwater flow and to lower the pressure on the sewer network and consequently to minimize the urban flooding risk
Strategic objective supported	Development and implementation of Nature Based Solutions, especially Sustainable Urban Drainage Systems in order to decrease the urban flooding risk.
Linkage to existing policies /plans	Bucharest 2035 Development Strategy (strategic concept), General Urbanistic Plan (GUP), Zonal Urban Plans (ZUPs) World Bank (2021): ROMANIA, Reimbursable Advisory Services Agreement on the Bucharest Urban Development Program (P169577), COMPONENT 1. Elaboration of Bucharest's IUDS, Capital Investment Planning and Management, Output 3. Master plan for water supply and wastewater 2019-2049 National Strategy & Action Plan on Adaptation to Climate Change (2024-2030, with the perspective of 2050)

Description

Regulatory measures for the creation of incentives/drives for the use of Sustainable Drainage Systems (SuDS) in the urban/architectural/landscape design will be proposed. This means that retention ponds, swales, raingardens and permeable surfaces in general will be incorporated in the design. These arrangements enhance flood protection, enhance infiltration, enrich groundwater and provide an integrated stormwater management.
Moreover, a feasibility study will be elaborated for the proposal and prioritisation of possible areas for the implementation of SUDS (especially areas and parks located around the old town of Bucharest – central part of the city). Apart from the above the feasibility study will investigate the possibility of stormwater collection and reuse in irrigation.
The action will also include the Issuing of a design handbook for engineers for SuDS design.
Moreover, and in linkage with any other actions of the present GCAP that include urban interventions in green areas/parks etc, the identification of possible areas for the implementation of SuDS will be performed. Then the design and construction of all relevant works that provide stormwater treatment, limit traditional storm sewer and drainage infrastructure, control water quantity and flash flooding, enhance infiltration and enrich groundwater, provide an integrated stormwater management will be implemented. Such investments will contribute to adaptation to climate change.

Linkage to other GCAP actions	LU 1: Centre for urban planning LU 2: Urban regeneration and coherent spatial planning LU 3: Additional green spaces in high-density neighbourhoods LU 4: Parks rehabilitation LU 5: Urban renewal pilot concepts

	Climate action	**Gender and economic inclusion**	**Smart maturity**
Cross-cutting themes/co-benefits	**Some elements** *Reason:* By mitigating the urban heat island effect, enhancing carbon sequestration, and increasing adaptability to	**Some elements** *Reason:* Any formula that leads to a better protection of living spaces, but also of public spaces frequented by families with children,	**Directly targeted** *Reason:* The city could potentially invest in a combined hydraulic system that models how water flows and interacts between the natural watershed and the urban drainage system. Simulating different

<table>
<tr><td></td><td>climate change impacts, this project contributes to a more sustainable and liveable city.</td><td>elderly people, people with disabilities has a direct impact on reducing social inequalities, even more so when it comes to protection against phenomena that can seriously affect life in the city such as earthquakes or floods.</td><td>scenarios would help design and implement NBS in the most effective location for managing stormwater and improve the city's resilience to flooding.</td></tr>
<tr><td rowspan="10">Implementation steps and timeline</td><td>Step</td><td>Duration (months)</td><td>Step owner/ support required</td></tr>
<tr><td>Procurement of regulatory measures and handbook design</td><td>3 months</td><td>Government/competent ministry, Municipality</td></tr>
<tr><td>Regulatory measures and handbook design</td><td>6 months</td><td>Government/competent ministry, Municipality</td></tr>
<tr><td>Procurement of feasibility study of interventions (identification of areas and coordination with other actions)</td><td>3 months</td><td>Municipality</td></tr>
<tr><td>Feasibility study for the selection of city areas for the implementation of SUDS</td><td>4 months</td><td>Municipality</td></tr>
<tr><td>Procurement of technical studies</td><td>3 months</td><td>Municipality</td></tr>
<tr><td>Technical studies of interventions</td><td>9 months</td><td>Municipality</td></tr>
<tr><td>Procurement of proposed works</td><td>6 months</td><td>Municipality</td></tr>
<tr><td>Implementation of proposed works</td><td>12 months</td><td>Municipality</td></tr>
<tr><td rowspan="5">Stakeholders</td><td colspan="2">Stakeholder category</td><td>Engagement (Inform, Consults, Involve, Collaborate or Empower)</td></tr>
<tr><td colspan="2">Bucharest Municipality</td><td>Empower, Collaborate</td></tr>
<tr><td colspan="2">Sector Municipalities</td><td>Empower, Collaborate</td></tr>
<tr><td colspan="2">Water and sewerage operator</td><td>Empower, Collaborate</td></tr>
<tr><td colspan="2">Citizens</td><td>Informed</td></tr>
<tr><td rowspan="2">Indicative costs [EUR]</td><td colspan="2">CAPEX</td><td>OPEX</td></tr>
<tr><td colspan="2">2,100,000</td><td>35,000</td></tr>
<tr><td rowspan="3">Potential funding</td><td>Instrument</td><td>Source</td><td>Amount [EUR]/ share [%]</td></tr>
<tr><td>Grant / loan</td><td>EU: Cohesion Fund</td><td>57% of CAPEX</td></tr>
<tr><td>Own source</td><td>Municipal budget</td><td>43% of CAPEX; 100% of OPEX</td></tr>
<tr><td>Revenue opportunities</td><td>Yes</td><td colspan="2">New Revenue Streams from Eco-Tourism: Well-designed parks and green spaces can attract visitors, generating revenue through tourism-related activities and local businesses.
Enhanced Property Values: Improved public spaces with permeable surfaces and green infrastructure can increase property values in surrounding areas, leading to higher property tax revenues.
Market Growth in Sustainable Solutions: As demand for stormwater management solutions rises, local businesses involved in the production and installation of Sustainable</td></tr>
</table>

		Drainage Systems (SuDS) can benefit from increased sales and service contracts.
Impact of the action: Quantitative and Qualitative	State indicators	• Open green space area per capita
	Pressure indicators	• Percentage of dwellings damaged by the most intense flooding in the last 10 years • Annual number of storm water or sewerage overflows per 100 km of network length
	Estimated Carbon Emissions Reduction	Estimated emissions are included in W 3
	Physical annual savings	**Flood Mitigation Savings:** Incorporating retention ponds and swales will lead to significant reductions in flood occurrences, saving physical infrastructure from damage and preserving community safety. **Water Savings:** The implementation of SuDS such as rain gardens and permeable surfaces will significantly reduce stormwater runoff, leading to substantial annual savings in water volume that can be reused or naturally infiltrated into the groundwater. **Biodiversity Savings:** Enhancing public spaces with green infrastructure will create habitats for various species, contributing to increased biodiversity in urban areas, thus saving existing ecosystems and promoting new ones.
	Climate resilience benefits	• Reduced flood risk: SuDS help to manage heavy rainfall and reduce the risk of urban flooding, protecting people, property, and infrastructure. This is especially important as climate change is projected to increase the frequency and intensity of extreme rainfall events in Bucharest. • Improved water quality: SuDS filter and clean stormwater runoff, removing pollutants and improving the quality of water in rivers and lakes. • Increased green spaces: Raingardens, swales, and green roofs create valuable green spaces in the urban environment, enhancing biodiversity, improving air quality, and mitigating the urban heat island effect. • Groundwater recharge: SuDS can help to replenish groundwater supplies, which is important for maintaining water resources during dry periods. • Enhanced quality of urban life: SuDS contribute to a more attractive and sustainable urban environment, improving quality of life for residents.
	Reductions in operating expenditures	**Infrastructure Expenditures:** The integration of permeable surfaces and green infrastructure can limit the need for extensive traditional drainage infrastructure investments, resulting in significant savings on construction and installation costs **Flood Management Expenditures:** By effectively managing stormwater at its source, municipalities can reduce expenditures related to flood response and recovery efforts, including emergency services and infrastructure repairs. **Water Treatment Expenditures:** Enhanced stormwater management reduces the volume of polluted runoff entering treatment facilities, thereby decreasing operational costs associated with water treatment processes
	Social and economic benefits/Gender considerations	• Enhanced urban resilience to flooding and reduced stormwater runoff, leading to improved water quality in local waterways. Nature-based solutions can enhance biodiversity and provide green spaces that improve community well-being and quality of life. Economically, these solutions can reduce the costs associated with traditional stormwater management and infrastructure, while also potentially

		increasing property values in areas with enhanced green features. • Active participation of women and underserved groups in the decision-making process behind the preparation and implementation of regulatory frameworks for stormwater retention and for redesigning public spaces to enable permeable surfaces and stormwater retention will be promoted, consolidated and approached as a priority. Approximately 5 new jobs could be created in ecosystem design and planning, for people with skills in hydrology and water cycle management, biodiversity integration in urban environments, community engagement.
Potential risk of the action	**Area**	**Risk**
	Social	Community disruption is also a concern. Additionally, there may be public resistance from community members who are unfamiliar with or sceptical of these new approaches, viewing them as unproven or burdensome. Moreover, if the benefits of stormwater management investments are not equitably distributed, some neighbourhoods might feel neglected, potentially leading to social discontent.
	Environmental	• Improper design or implementation: Poorly designed or implemented SuDS can be ineffective or even counterproductive, potentially leading to increased runoff or water quality problems. • Maintenance challenges: SuDS require regular maintenance to ensure their continued effectiveness. Neglecting maintenance can lead to reduced performance and potential environmental issues. • Mosquito breeding: Standing water in some SuDS, such as raingardens, can create breeding grounds for mosquitoes if not properly managed. • Invasive species: SuDS can sometimes provide habitat for invasive plant species, which can outcompete native vegetation and disrupt local ecosystems. • Public acceptance: There may be public resistance to SuDS if they are perceived as unsightly or inconvenient
	Economic	The initial investment required to implement nature-based solutions may strain the municipal budget.

<table>
<tr><td>W 3</td><td colspan="3">Technology upgrade for industrial wastewater management
Introduce smart technology for monitoring quality of industrial wastewater or other sensitive parts of the network</td></tr>
<tr><td>Sector</td><td colspan="3">Water</td></tr>
<tr><td>Action Type</td><td colspan="3">Investment</td></tr>
<tr><td>GCAP Action Classification</td><td colspan="3">Capital Investment</td></tr>
<tr><td>Priority environmental challenges addressed</td><td colspan="3">Need for rehabilitation and protection of surface water bodies</td></tr>
<tr><td>Strategic objective supported</td><td colspan="3">Modernising and improving the performance of the existing drinking water and wastewater networks to protect the surface water bodies and promote a sustainable water resources management.</td></tr>
<tr><td>Linkage to existing policies /plans</td><td colspan="3">Master plan for water supply and wastewater 2019-2049</td></tr>
<tr><td colspan="4">Description</td></tr>
<tr><td colspan="4">Remote and real-time monitoring of the performance of the pretreatment and the quality of wastewater (in industrial units/areas) discharged in the sewer network. Measures in the industrial sewerage networks for the assurance of the quality of the effluent of the final treatment and the subsequent quality of the treated effluent discharged in the surface water bodies. Automated, continuous and online water quality monitoring for effective water pollution control, across Colentina and Dâmbovita rivers and other surface water bodies.</td></tr>
<tr><td>Linkage to other GCAP actions</td><td colspan="3">W 1: Modernisation of the water network</td></tr>
<tr><td rowspan="2">Cross-cutting themes/co-benefits</td><td>Climate action</td><td>Gender and economic inclusion</td><td>Smart maturity</td></tr>
<tr><td>Some elements
<u>Reason:</u>
Implementing smart technology for water quality monitoring in industrial areas/ large industrial units of and in the receptors of this wastewater in Bucharest could bring benefits for preventing pollution, optimizing treatment processes, and protecting water resources, this project contributes to a healthier environment and a more resilient city in the face of climate change.</td><td>N.A.</td><td>Directly targeted
<u>Reason:</u>
Real-time water quality monitoring systems will be deployed to continuously collect and analyse key parameters related to water pollution, such as temperature, electrical conductivity, pH, and dissolved oxygen. In industrial areas/ large industrial units and in the receptors of this wastewater this continuous monitoring will provide up-to-date insights into the health and quality of water bodies, enabling the early detection and prevention of potential water contamination. The data will be transmitted in real-time to a centralized platform, where it will undergo further processing and analysis, delivering decision-ready information.
The data from this action will feed in the database proposed in action SC1:
• Wastewater quality in specific points of the network (industrial areas)</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td>• Water quality in the receptors.
The status of the receiving water body can be shared online. However, the quality of the effluent cannot be shared in real-time, as immediate deviations (which can be addressed by the operator) may be misinterpreted by the general public. This type of data should be accessible to city officials, but not distributed in its raw form to the public. Official reports containing processed data, issued by the authorities, will be available and accessible.</td></tr>
<tr><td rowspan="5">Implementation steps and timeline</td><td>Step</td><td>Duration (months)</td><td>Step owner/support required</td></tr>
<tr><td>Procurement of technical studies</td><td>3 months</td><td>APA Nova/Municipality</td></tr>
<tr><td>Technical studies of interventions</td><td>2 months</td><td>APA Nova/Municipality</td></tr>
<tr><td>Procurement of proposed works</td><td>3 months</td><td>APA Nova/Municipality</td></tr>
<tr><td>Implementation of proposed works</td><td>5 months</td><td>APA Nova/Municipality</td></tr>
<tr><td rowspan="4">Stakeholders</td><td colspan="2">Stakeholder category</td><td>Engagement (Inform, Consults, Involve, Collaborate or Empower)</td></tr>
<tr><td colspan="2">Bucharest Municipality</td><td>Inform</td></tr>
<tr><td colspan="2">Water and sewerage operator</td><td>Collaborate, Empower</td></tr>
<tr><td colspan="2">Environmental Protection Agency</td><td>Collaborate, Empower</td></tr>
<tr><td colspan="2">Private sector</td><td>Collaborate, Empower</td></tr>
<tr><td rowspan="2">Indicative costs [EUR]</td><td colspan="2">CAPEX</td><td>OPEX</td></tr>
<tr><td colspan="2">600,000</td><td>23,000</td></tr>
<tr><td rowspan="3">Potential funding</td><td>Instrument</td><td>Source</td><td>Amount [EUR]/ share [%]</td></tr>
<tr><td>Grant / loan</td><td>EU: Cohesion Fund</td><td>17% of CAPEX</td></tr>
<tr><td>Own source</td><td>Municipal budget</td><td>83% of CAPEX; 100% of OPEX</td></tr>
<tr><td>Revenue opportunities</td><td>Yes</td><td colspan="2">Tracking of non-compliant effluents from industries: Charging of additional fees for the handling of the excessive loads and non-compliant types of wastewater.</td></tr>
<tr><td rowspan="4">Impact of the action: Quantitative and Qualitative</td><td>State indicators</td><td colspan="2">• Biochemical Oxygen Demand BOD in rivers and lakes
• Ammonium NH_4 concentration in rivers and lakes</td></tr>
<tr><td>Pressure indicators</td><td colspan="2">• Percentage of industrial wastewater that is treated according to applicable national standards</td></tr>
<tr><td>Estimated Carbon Emissions Reduction</td><td colspan="2">57,200 tCO_2e per year</td></tr>
<tr><td>Physical annual savings</td><td colspan="2">Water Quality Savings: Implementing smart monitoring technologies will ensure continuous tracking of industrial wastewater quality, leading to improved compliance with environmental standards, increase of the percentage of industrial wastewater treated according to national and EU standards and</td></tr>
</table>

		subsequently significant reductions in the volume of untreated or poorly treated wastewater released into surface water bodies. **Pollution Reduction Savings:** Real-time monitoring allows for immediate detection of contaminants, resulting in timely interventions that prevent pollution events, thus saving ecosystems from degradation and preserving biodiversity. **Resource Savings:** Enhanced monitoring can optimize the use of chemicals and resources in wastewater treatment processes, reducing the overall consumption of materials necessary for effective treatment.
	Climate resilience benefits	• Early warning system for contamination: Smart sensors can detect pollutants and changes in water quality in real-time, allowing for rapid response to prevent widespread contamination and protect public health. This is particularly important during extreme weather events that can cause overflows and increase the risk of pollution. • Optimized water management: Real-time data allows for more efficient water management, reducing waste and ensuring adequate supply during droughts or periods of high demand. • Improved infrastructure resilience: Continuous monitoring helps identify weaknesses in the water network, enabling proactive maintenance and preventing costly failures that could disrupt services and compromise public health. • Reduced pollution and ecosystem protection: By quickly identifying and addressing pollution sources, smart monitoring helps protect Bucharest's rivers and surrounding ecosystems, which are vital for the city's long-term resilience. • Data-driven decision-making: The data collected can inform long-term planning and investment in water infrastructure, ensuring that Bucharest's water system is prepared for future climate challenges
	Reductions in operating expenditures	**Emergency Response Expenditures:** With predictive analytics and real-time alerts, facilities can prevent costly emergency responses to equipment failures or pollution incidents, leading to significant savings on emergency repair and response efforts. **Regulatory Compliance Expenditures:** Enhanced monitoring capabilities will improve compliance with environmental regulations, minimizing the risk of fines or penalties associated with non-compliance and reducing legal expenditures. **Labour Expenditures:** Automation of monitoring processes allows for a reduction in staffing needs for routine checks, thereby decreasing labour costs while maintaining effective oversight of wastewater management systems.
	Social and economic benefits/Gender considerations	Improved monitoring can foster community trust in local industries by demonstrating a commitment to environmental responsibility and public safety. Additionally, engaging with the community

		throughout the process can raise awareness about the importance of wastewater management, promoting a culture of sustainability. Approximately 2 new jobs could be created with skills in advanced wastewater treatment technologies, environmental monitoring systems, optimization of industrial processes.
Potential risk of the action	**Area**	**Risk**
	Social	Socially, there may be resistance from workers and community members who view increased monitoring as intrusive or who fear job losses due to automation.
	Environmental	• E-waste generation: The sensors and other electronic components used in smart monitoring systems have a limited lifespan and will eventually become electronic waste (e-waste). Proper e-waste management is crucial to prevent environmental harm. • Energy consumption: Operating the monitoring systems requires energy, which could contribute to greenhouse gas emissions if not powered by renewable sources. • Data security and privacy: Collecting and transmitting sensitive data about water quality raises concerns about data security and potential breaches. • Reliance on technology: Over-reliance on technology could lead to complacency and a lack of preparedness for situations where the technology fails. • Potential for unintended consequences: The deployment of new technologies can sometimes have unforeseen environmental impacts, requiring careful monitoring and evaluation.
	Economic	The initial investment in smart monitoring technologies may strain budgets for some industries, particularly smaller enterprises, potentially leading to job insecurity if cost-cutting measures are necessary.

W 4	**Reuse of treated wastewater** Create the legal framework and the necessary infrastructure for the reuse of treated wastewater
Sector	Water
Action Type	Policy/Investment
GCAP Action Classification	Standards, guidelines and regulations Capital Investment
Priority environmental challenges addressed	Need for sustainable management of water resources and implementation of circular economy practices.
Strategic objective supported	Ensure full coverage of the city with drinking water supply networks, while modernising and improving the performance of the existing drinking water and wastewater networks to protect the surface water bodies and promote a sustainable water resources management.
Linkage to existing policies /plans	Master plan for water supply and wastewater 2019-2049 National Strategy & Action Plan on Adaptation to Climate Change (2024-2030, with the perspective of 2050)

Description

The basis of any future implementation of treated effluent reuse projects is the design and implementation of legal amendments and regulatory measures for the creation of incentives for reuse of treated effluent in agriculture, as well as the establishment of the necessary technical specifications for the reuse of treated effluent according to the various types of reuse possibilities (irrigation, aquifer enrichment etc).
Subsequently, master planning (in the framework of a feasibility study) for possible uses of treated effluent can be performed.
Based on the findings of the master plan (feasibility study) the detailed design and construction of interventions in WWTP and new networks for distributing the discharge to the final receptors. This step includes the upgrade of Glina WWTP, construction of irrigation networks, boreholes, tanks. The re-use for public services (i.e. irrigation of parks, irrigation of agricultural areas at eastern part of Bucharest) is included also in the present action.

Linkage to other GCAP actions	N.A.		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Some elements *Reason:* The utilization of treated wastewater effluent, leads to significant water resources and energy savings, promotes a more efficient water management and supports sustainable urban development. Additionally, the deceased treated effluent discharge that ends up to the water bodies, ensures higher quality of the receiving waters, as effluent, even after being treated according to the highest possible standards, still contains small concentration of pollutants.	**Some elements** *Reason:* Better water management (costs and distribution) has an impact on fair and equal access to water resources in the city. The (unequal) coverage by the water supply networks has a different impact on women and men due to the unequal distribution of household work (women are primary users and managers of water for productive and domestic uses), but also since unsafe water management can impact sanitation and hygiene services which are also feminized fields. If not properly provided, collecting, storing and distributing water also becomes the responsibility of women. A more equitable distribution and water management can reduce women's workload in the domestic area, but also can increase	**Some elements** *Reason:* Smart technologies in WWTPs, irrigation networks, boreholes, and tanks can greatly enhance system performance and efficiency by allowing real-time monitoring of water quality, flow rates, and consumption patterns. For irrigation systems, smart controllers can optimize water use while in boreholes and tanks, automated pumps and sensors can ensure efficient water extraction and storage, The data from this action will feed in the

		their (and others') mobility and access to the city.	database proposed in action SC1: Real-time monitoring of WWTP's
Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	Procurement of regulatory measures and handbook design	3 months	Government/competent ministry, Municipality
	Regulatory measures and specifications design	6 months	Government/competent ministry, Municipality
	Procurement of feasibility study of interventions (identification of areas and types of reuse)	3 months	Municipality
	Feasibility study (incl. master planning of interventions)	4 months	Municipality
	Procurement of technical studies	3 months	Municipality
	Technical studies of interventions	9 months	Municipality
	Procurement of proposed works	6 months	Municipality
	Implementation of proposed works	12 months	Municipality
Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**	
	Bucharest Municipality	Collaborate, Empower	
	Ministry of Environment	Collaborate, Empower	
	Environmental Protection Agency	Involve	
	Water and sewage operator	Collaborate, Empower	
	Citizens	Inform	
Indicative costs [EUR]	**CAPEX**	**OPEX**	
	3,400,000	490,000	
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU: Cohesion Fund	64% of CAPEX
	Own source	Municipal budget	36% of CAPEX; 100% of OPEX
Revenue opportunities	Yes	**Sale of Treated Wastewater:** Establishing a legal framework allows for the sale of treated wastewater to agricultural sectors, generating significant revenue from irrigation and other non-potable uses. **Increased Agricultural Yield:** Utilizing treated wastewater for irrigation can enhance crop yields, resulting in increased agricultural output and associated revenue from higher sales of produce. **Market for Nutrient Recovery:** The process of treating wastewater can yield valuable nutrients that can be sold as fertilizers, creating an additional revenue stream for wastewater treatment facilities.	
Impact of the action:	State indicators	• Biochemical Oxygen Demand BOD in rivers and lakes • Ammonium NH_4 concentration in rivers and lakes	

Quantitative and Qualitative		• Water Exploitation Index
	Pressure indicators	N.A.
	Estimated Carbon Emissions Reduction	Estimated emissions are included in W 3
	Physical annual savings	**Water Savings:** Reusing treated wastewater for irrigation and aquifer recharge will significantly reduce the demand for freshwater resources, resulting in substantial annual savings in water usage across agricultural and urban sectors. **Nutrient Savings:** Treated wastewater often contains valuable nutrients such as nitrogen and phosphorus, which can enhance soil fertility. This reuse leads to savings in chemical fertilizers, promoting more sustainable agricultural practices. **Energy Savings:** Reusing treated wastewater reduces the energy required for treatment and transportation freshwater from distant sources, resulting in significant energy conservation annually.
	Climate resilience benefits	• Enhanced water security: Reduces reliance on freshwater sources, which are vulnerable to climate change impacts like drought and reduced rainfall. • Drought mitigation: Provides an alternative water source for irrigation, industrial processes, and even potable uses (with advanced treatment), increasing resilience to drought conditions. • Reduced strain on water infrastructure: Decreases the demand on existing water treatment and distribution systems, extending their lifespan and reducing the need for costly upgrades. • Improved groundwater recharge: Can be used to replenish groundwater aquifers, mitigating land subsidence and enhancing water availability. • Reduced energy consumption: Treating wastewater for reuse often requires less energy than desalinating seawater or transporting water over long distances
	Reductions in operating expenditures	**Water Treatment Expenditures:** By utilizing treated wastewater for non-potable uses, facilities can decrease the volume of freshwater that requires treatment, leading to lower overall water treatment costs. **Operational Expenditures:** The integration of treated wastewater reuse systems can streamline operations at wastewater treatment plants, leading to lower operational costs through improved efficiency and reduced labour needs.
	Social and economic benefits/Gender considerations	Establishing a legal framework and infrastructure for the reuse of treated wastewater can significantly enhance water sustainability and security, particularly in regions facing water scarcity. This approach can reduce the demand for freshwater resources, supporting agricultural, industrial, and municipal needs. Socially, it can promote community awareness and acceptance of water reuse as a viable practice, contributing to a culture of conservation. Furthermore, implementing such systems can create job opportunities in infrastructure development and maintenance, boosting local economies. Approximately 2 new jobs could be created for people with skills in infrastructure planning for water reuse, cost benefit analysis and financial planning.

	Area	Risk
Potential risk of the action	Social	The creation of a legal framework and the necessary infrastructure may require substantial initial investments. Socially, there may be resistance or scepticism from the community regarding the safety and quality of reused wastewater, leading to concerns about public health and environmental impacts. Additionally, if the framework does not equitably distribute benefits across all communities, marginalized groups may feel overlooked, leading to social discontent.
	Environmental	• **Public health concerns**: If not treated adequately, reused wastewater can pose risks to public health through the presence of pathogens, pharmaceuticals, or other contaminants. • **Environmental contamination**: Improperly treated or managed wastewater can contaminate soil and water bodies with pollutants, harming ecosystems and potentially affecting drinking water sources. • **Salinity buildup**: Long-term use of treated wastewater for irrigation can lead to the accumulation of salts in the soil, affecting agricultural productivity. • **Nutrient imbalances**: Treated wastewater may contain high levels of nutrients like nitrogen and phosphorus, which can contribute to algal blooms and eutrophication in water bodies. • **Public perception**: Overcoming public concerns about the safety and acceptability of reused wastewater can be a challenge
	Economic	N.A.

W 5	**Rehabilitation and protection of surface water resources** Investment in programs and equipment for the rehabilitation and protection of surface water

Sector	Water
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Need for rehabilitation and protection of surface water bodies
Strategic objective supported	Modernising and improving the performance of the existing drinking water and wastewater networks to protect the surface water bodies and promote a sustainable water resources management.
Linkage to existing policies /plans	Master plan for water supply and wastewater 2019-2049 National Strategy & Action Plan on Adaptation to Climate Change (2024-2030, with the perspective of 2050)

Description

Tackling pollution of the surface water bodies around Bucharest requires a holistic approach on river basin level according to EU guidelines and legislation. For this reason, a step-by-step approach is proposed, by the elaboration of a feasibility study (master plan) for the detection and register of the basic possible pollution sources. Based on the above, a set of interventions will be proposed on the level of specific measures, as well as on the level of implementation/installation of monitoring arrangements and specific projects for the rehabilitation of the polluted water bodies. This action includes the design and implementation of all necessary arrangements and equipment for monitoring of surface water bodies, configuring appropriate rehabilitation measures reducing the effect of various sources of pollution in the catchment basin and ensuring good quality of effluents from Glina WWTP.

Linkage to other GCAP actions	W 1 : Nature-based solutions for stormwater W 4: Reuse of treated water SC 1: Integrated digital infrastructure/databases

Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Some elements *Reason:* Investing in the rehabilitation and protection of surface water in Bucharest is a crucial step towards climate action and sustainable urban development. By enhancing carbon sequestration, increasing climate resilience, and improving ecosystem services, this project contributes to a healthier environment and a more liveable city for present and future generations.	**Some elements** *Reason:* Better water management (costs and distribution) has an impact on fair and equal access to water resources in the city. The (unequal) coverage by the water supply networks has a different impact on women and men due to the unequal distribution of household work (women are primary users and managers of water for productive and domestic uses), but also since unsafe water management can impact sanitation and hygiene services which are also feminized fields. If not properly provided, collecting, storing and distributing water also becomes the responsibility of women. A more equitable distribution and water management can reduce women's workload in the domestic area, but also can increase their (and others') mobility and access to the city.	**Directly targeted** *Reason:* The integration of advanced monitoring systems and data-driven interventions will enhance real-time detection and management of pollution sources, accelerating the transition to a more resilient and adaptive water management system. The data from this action will feed in the database proposed in action SC1: • Real-time monitoring of WWTP's • Water quality in the receptors

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/ support required**
	Procurement of feasibility study	3 months	APA Nova/Municipality
	Feasibility study for the design of measures and selection of interventions	4 months	APA Nova/Municipality
	Procurement of technical studies	3 months	APA Nova/Municipality
	Technical studies of interventions	6 months	APA Nova/Municipality
	Procurement of proposed works	4 months	APA Nova/Municipality
	Implementation of proposed works	9 months	APA Nova/Municipality
Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**	
	Bucharest Municipality	Involve, Collaborate	
	Sector Muncipalities	Involve, Collaborate	
	Water and sewerage operator	Involve, Collaborate, Empower	
	Sanitation companies	Involve, Collaborate, Empower	
	Environmental Guard	Involve, Collaborate, Empower	
	Citizens	Inform, Collaborate	
Indicative costs [EUR]	**CAPEX**	**OPEX**	
	2,150,000	160,000	
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU: Cohesion Fund	67% of CAPEX
	Own source	Municipal budget	33% of CAPEX; 100% of OPEX
Revenue opportunities	Yes	**Eco-Tourism Development:** Clean and rehabilitated water bodies can attract eco-tourism, generating revenue through increased visitor spending on recreational activities and local businesses. **Government Grants and Funding:** Investing in surface water rehabilitation can qualify for state and federal grants aimed at environmental protection, providing additional financial resources.	
Impact of the action: Quantitative and Qualitative	State indicators	• Biochemical Oxygen Demand BOD in rivers and lakes • Ammonium NH_4 concentration in rivers and lakes	
	Pressure indicators	N.A.	
	Estimated Carbon Emissions Reduction	Estimated emissions are included in W 3	
	Physical annual savings	**Pollution Reduction Savings:** Implementing monitoring and rehabilitation measures will significantly decrease the levels of pollutants entering surface water bodies, leading to substantial annual savings in environmental degradation and restoration efforts. **Water Quality Savings:** Enhanced treatment processes and monitoring will improve the quality of effluents discharged into rivers, ensuring cleaner water bodies and saving ecosystems from the adverse effects of pollution. **Biodiversity Savings:** By reducing pollution in surface waters, there will be a notable increase in aquatic biodiversity, saving various species from habitat loss and promoting healthier ecosystems.	

	Climate resilience benefits	• Reduced flood risk: Healthy waterways can better manage increased rainfall and storm surges associated with climate change, reducing the risk of flooding in the city. • Improved water security: Protecting and restoring surface water sources ensures a reliable supply of clean water for the city, even during droughts which may become more frequent with climate change. • Urban heat island mitigation: Water bodies help cool the urban environment, mitigating the urban heat island effect, which is expected to worsen with climate change. • Enhanced biodiversity: Healthy waterways support diverse ecosystems, which are more resilient to climate change impacts and provide valuable ecosystem services. • Recreational opportunities: Rehabilitated water bodies can provide recreational spaces for residents, promoting well-being and contributing to a more liveable city.
	Reductions in operating expenditures	**Monitoring Expenditures:** The introduction of automated monitoring systems will lower ongoing costs related to manual sampling and analysis, streamlining operational expenditures for water quality management. **Remediation Expenditures:** By proactively addressing pollution sources through targeted interventions, future expenditures on extensive remediation projects will be significantly reduced. **Compliance Expenditures:** Enhanced monitoring capabilities ensure compliance with environmental regulations, minimizing potential fines or penalties associated with violations, thus lowering regulatory compliance costs. **Maintenance Expenditures:** Regular monitoring and early detection of pollution sources will reduce the need for extensive maintenance and emergency response efforts, leading to lower operational costs over time.
	Social and economic benefits/Gender considerations	Investing in programs and equipment for the rehabilitation and protection of surface water can enhance water quality, restore ecosystems, and promote public health by reducing pollution. These efforts can create recreational opportunities for all and increase property values in surrounding areas. Additionally, such investments can foster community engagement and awareness about environmental stewardship, leading to greater public support for sustainability initiatives. Approximately 2 new jobs could be created for people with watershed management skills, expertise in ecological restoration and water quality monitoring.
Potential risk of the action	**Area**	**Risk**
	Social	Potential concerns from community members about temporary disruptions during rehabilitation efforts or perceived inequities in how resources are allocated across different neighbourhoods.
	Environmental	• Disruption of existing ecosystems: Rehabilitation projects can sometimes unintentionally disrupt existing ecosystems if not carefully planned.

		• Construction impacts: Construction activities can generate noise, dust, and waste, temporarily impacting the surrounding environment. • Material sourcing: The materials used for rehabilitation projects (e.g., concrete, pipes) have an environmental footprint associated with extraction, manufacturing, and transportation. • Changes to water flow: Altering waterways can sometimes have unintended consequences for downstream ecosystems and water availability. • Introduction of invasive species: Rehabilitation activities can sometimes inadvertently introduce invasive species that can harm native ecosystems.
	Economic	N.A.

4.7. GCAP Land use and green space actions

Along with the transportation sector, the land use and green space sector has been highlighted as a key domain with potential to improve the life of Bucharest citizens and to alleviate the pressure of high population density. The low amount of green space per capita and the continuous degradation of the existing green space has triggered the need for a substantial number of actions to tackle the many issues uncovered through the technical analysis and stakeholder consultation. Thus, the land use and green space sector has **five actions** that contain both elaboration of policies and capital investments. The actions in the land use and green space sector are coded from **LU 1 to LU 5**.

LU 1	**Centre for urban planning** Establish a Centre for urban planning to coordinate the implementation of integrated urban projects and policies
Sector	Land use and green space
Action Type	Policy and Investment
GCAP Action Classification	Strategies, plans, and programmes Standards, guidelines, and regulations
Priority environmental challenges addressed	• Poor planning governance, land inventory not integrated, planning documents are outdated, additional legal implementation issues. Targets addressed: • Supporting coordinated, forward-thinking urban development planning and integrated planning at municipal level • Increasing coordination between governance levels • Establishing an updated General Urbanistic Plan (GUP) and an up-to-date cadastre registry
Strategic objective supported	Elaborate and implement governance models, strategies and plans to address the needs for investments and soft measures that make the urban environment more resilient to climate and other natural shocks
Linkage to existing policies /plans	Bucharest 2035 Development Strategy (strategic concept), GUP, Zonal Urban Plans (ZUPs), cadastre registry, Bucharest-Ilfov Regional Development Plan, Sustainable Urban Mobility Plan 2016-2030 for the Bucharest-Ilfov Region, Municipal Energy Strategy *Furthermore: Bucharest Parking Strategy, Strategy for the development of the metro transport infrastructure in Bucharest, Bucharest Green Belt, The Bucharest Smart City Strategy*

Description

(1) Establish a Centre for Urban Planning in Bucharest in order to foster coordinated planning
Responsibility for the different tasks related to urban planning is spread across several departments, making coordinated planning difficult and time-consuming. As a first step the city of Bucharest is therefore planning to set up a coordination centre as a new formal structure within the city which will be equipped with a common office and additional human resources.
The new centre will e.g. combine knowledge and specific tasks from the General Directorate for Urban Planning and Spatial Planning with responsibilities of the Environment Directorate, the Real Estate Fund Administration, the Heritage Directorate and the Legal Department.
(2) Prepare a sound and coordinated basis for sustainable planning, legally binding for controlled urban development.
Strategic planning

- Elaborating updated overarching, spatial-strategic concepts and policies for the city, including overall objectives for the development and regional aspects, cooperation and coordination with specialized city departments, processing and updating spatial information

- Most important contents: urban development (housing, commercial areas, mixed use, land reserves), green/blue space, transport infrastructure and mobility, energy infrastructure/smart city, main social infrastructure, etc.

Detailed and focussed planning

- Identifying and prioritising new main development areas within the city (aligned with overall concepts and policies, including transport-oriented-development and spatial energy planning)
- Update of the GUP as a binding basis for the municipality and the sectors.

Basis for further urban development planning

- Digitalisation of all spatial contents for further use and adaptation (GUP, spatially relevant strategies, projects)
- Setting up and implementing an urban monitoring system in order to follow and provide transparent information on ongoing spatial / urban development

Linkage to other GCAP actions	UT 3: Implementation of the Velo Master Plan UT 5: UT 7: Mobility Hubs and Park&Ride facilities E 1: Expansion and improvement of district heating W 2: Nature-based solutions for stormwater LU 2: Urban regeneration and coherent spatial planning LU 3: Additional green spaces in high-density neighbourhoods LU 5: Urban renewal pilot concepts SC 1: Integrated digital infrastructure / databases AQ 2: Green belt of the city

Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* Establishing a Centre for Urban Planning in Bucharest is a strategic investment that can significantly advance climate action goals while promoting sustainable and resilient urban development. By fostering integrated planning, collaboration, and innovation, the Centre can help create a more livable and thriving city for present and future generations.	**Directly targeted** *Reason:* The legal framework in Romania not only premises, but even provides for the need to integrate the gender perspective in all areas (gender mainstreaming), urban planning and environmental policies being no exception. In this context, smart and sustainable infrastructure development becomes a key issue for citizens' well-being and economic growth. A well-developed social infrastructure can have an important role in fighting poverty, improving citizens opportunities in having flexibility, mobility, in achieving equality and justice, in accessing public good and services, and overall, in living a good life. At the same time, if not considering the reality of social inequalities (gender, class, ethnicity, disability, sexual orientation etc.) in the development of the city, in designing public policies and infrastructure projects, different gaps can be perpetuated or even deepened like gender pay gap, the regional disparities, the gaps in accessing different public goods and services.	**Directly targeted** *Reason:* The digitalization of urban areas combined to the extensive utilization of Geographical Information Systems will provide necessary information to urban planners, decision-makers, air-quality managers etc. The information will be combined to other data collected by the various urban sectors. Important geodata comprises various sectors (including transport and energy). Data on urban planning: e.g. zoning and development plans, building related information (usage, age, storeys, floor space, heating system), location of public and social infrastructure, green urban areas and type of surfaces, tree registry, registry of green maintenance agreements with property owners, etc.

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner /support required**
	Establish centre for urban planning	6 months	General Directorate for Urban Planning and Spatial Planning
	Strategic planning	12 months	Centre for urban planning

	Detailed and focussed planning	18 months	Centre for urban planning
	Basis for further urban development planning	6 months	Centre for urban planning

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	Specialised city departments	Collaborate
	Sector authorities/councils	Collaborate
	Public utilities (transport, energy etc.)	Consults/Involve
	Regional authority	Consults/Involve

Indicative costs [EUR]	**CAPEX**	**OPEX**
	91,000	238,000

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Own source	Municipal budget	100%

Revenue opportunities	No	Responsibility and task of municipal authorities
Impact of the action: Quantitative and Qualitative	State indicators	• Open green space area per capita • Share of green space areas within urban limits • Share of population living within 300 m of open green space of at least 0.5 ha
	Pressure indicators	• Population density on urban land • Proportion of the population living within 20 minutes to everyday services grocery stores clinics etc. • Average annual growth rate of built areas • Share of brownfield development
	Estimated Carbon Emissions Reduction	N.A.
	Physical annual savings	Potential for savings by actions linked to a sound, legally binding basis for urban development
	Climate resilience benefits	• Integrated planning: A central authority can ensure climate considerations are integrated into all urban projects, from transportation to housing to green spaces. This leads to more holistic and effective climate adaptation strategies. • Improved coordination: Reduces the risk of conflicting projects and ensures that different initiatives work together to enhance resilience, avoiding duplicated efforts and maximizing impact. • Expertise and knowledge sharing: The Centre can become a hub for expertise on climate change and urban planning, facilitating knowledge sharing and promoting best practices. • Strategic vision: Enables the development of a long-term vision for a climate-resilient Bucharest, guiding investment and ensuring consistent action over time. • Streamlined implementation: By coordinating efforts, the Centre can streamline the implementation of climate-resilient projects, reducing bureaucratic hurdles and accelerating progress. • Enhanced funding opportunities: A dedicated Centre can increase access to national and international funding for climate resilience projects.
	Reductions in operating expenditures	No direct reductions

	Social and economic benefits/Gender considerations	Enhanced collaboration and coordination among stakeholders, leading to more effective implementation of integrated urban projects and policies. The centre can facilitate community engagement in the planning process, ensuring that diverse voices are heard and considered, which fosters a sense of ownership and investment among residents. By prioritizing sustainable and inclusive development, the centre can help create vibrant public spaces, improve local infrastructure, and enhance overall quality of life for all community members. 2 new jobs are expected to be created in fields requiring skills in spatial analysis and GIS, integrated urban design approaches.
Potential risk of the action	**Area**	**Risk**
	Social	There may be concerns about the transparency and inclusivity of the decision-making process, particularly if certain groups feel marginalized or overlooked in planning discussions. Initial resistance might arise from residents who are wary of changes to their neighbourhoods or fear that new developments could lead to gentrification. Additionally, if the centre does not effectively communicate its goals and progress, it could lose public trust.
	Environmental	• Top-down approach: If not implemented carefully, a centralized planning approach could disregard local needs and community input, potentially leading to environmentally unsustainable solutions. • Focus on large-scale projects: The Centre may prioritize large infrastructure projects over smaller-scale, nature-based solutions that can be equally important for climate resilience. • Bureaucracy and delays: Creating a new bureaucracy could lead to delays and inefficiencies in project implementation. • Potential for misaligned priorities: If the Centre's priorities are not aligned with broader environmental goals, it could inadvertently support projects with negative environmental impacts.
	Economic	N.A.

LU 2	**Urban regeneration and coherent spatial planning** Develop an Integrated Urban Regeneration Strategy for a coherent spatial planning and better land use, including green corridors and prioritizing urban quarters with poor living quality
Sector	Land use and green space
Action Type	Policy
GCAP Action Classification	Strategies, plans, and programmes
Priority environmental challenges addressed	• Poor planning governance, land inventory not integrated, planning documents are outdated, additional legal implementation issues • Low share of green urban areas, poor accessibility of green areas for recreation of inhabitants for many parts in the city. Targets addressed: • Supporting coordinated, forward-thinking urban development planning and integrated planning at sector-level • Increasing coordination between governance levels • Establishing updated zonal urban plans (ZUPs) and a prioritisation of neighbourhoods to be regenerated
Strategic objective supported	Elaborate and implement governance models, strategies and plans to address the needs for investments and soft measures that make the urban environment more resilient to climate and other natural shocks Improve the use of urban land to address the high population density by rehabilitating uninhabited or abandoned buildings and by ensuring access to high-quality green public spaces in all residential areas and to all categories of population
Linkage to existing policies /plans	Bucharest 2035 Development Strategy (strategic concept), GUP, ZUP, cadastre registry, Bucharest-Ilfov Regional Development Plan, Sustainable Urban Mobility Plan 2016-2030 for the Bucharest-Ilfov Region, Municipal Energy Strategy *Furthermore: Bucharest Parking Strategy, Strategy for the development of the metro transport infrastructure in Bucharest, Bucharest Green Belt, The Bucharest Smart City Strategy, National Strategy & Action Plan on Adaptation to Climate Change (2024-2030, with the perspective of 2050)*

Description

Prepare a coordinated basis for sustainable planning, legally binding for controlled urban development (in line with the updated GUP).
Identification of targeted regeneration areas:

- Carry out an analysis of existing urban quarters in terms of building stock, infrastructure and living quality. Analyse relevant factors for poor conditions and weaknesses.
- Define priorities in terms of most relevant conditions and order of neighbourhoods to be regenerated and enhanced.

General strategy development:

- Elaborate an overall strategy to regenerate identified neighbourhoods in cooperation with sectors
- Define relevant actions and measures: necessary partners, framework conditions, technical infrastructure and renovation measures, social infrastructure, enhancement actions for green and public space, public participation etc.

Prepare the basis for implementation:

- Update of the sector plans to develop projects and documentation for urbanism
- Define land use options legally binding for public and private investors

Linkage to other GCAP actions	Basis: LU 1: Centre for urban planning Further linkages: UT 3 Implementation of the Velo Master Plan UT 5: UT 7: Mobility Hubs and Park&Ride facilities

<table>
<tr><td></td><td colspan="3">E 1: Expansion and improvement of district heating
W 2: Nature-based solutions for stormwater
LU 3: Additional green spaces in high-density neighbourhoods
LU 5: Urban renewal pilot concepts
SC 1: Integrated digital infrastructure / databases
AQ 2: Green belt of the city</td></tr>
<tr><td rowspan="2">Cross-cutting themes/co-benefits</td><td>Climate action</td><td>Gender and economic inclusion</td><td>Smart maturity</td></tr>
<tr><td>Some elements
<u>Reason:</u>
By promoting compact development, green infrastructure, and social inclusion, this project can contribute to a healthier environment and a higher quality of life for all residents.</td><td>Some elements
<u>Reason:</u>
A well-developed, for-people land use can have an important role in fighting poverty, improving citizens opportunities in having flexibility, mobility, in achieving equality and justice, in accessing public good and services, and overall, in living a good life. Better land use and public space management leads to improved quality of life for women, who due to the traditional gender roles women are more likely to use squares or playgrounds for children, to need stroller-accessible sidewalks and public transport, and to access health and education infrastructure.</td><td>Directly targeted
<u>Reason:</u>
The digitalization of urban areas combined to the extensive utilization of Geographical Information Systems will provide necessary information to urban planners, decision-makers, air-quality managers etc. The information will be combined to other data collected by the various urban sectors.</td></tr>
<tr><td rowspan="4">Implementation steps and timeline</td><td>Step</td><td>Duration (months)</td><td>Step owner/ support required</td></tr>
<tr><td>Identification of targeted regeneration areas</td><td>12 months</td><td>Municipality (Centre for urban planning) and sector authorities / councils</td></tr>
<tr><td>General strategy development</td><td>18 months</td><td>Municipality (Centre for urban planning) and sector authorities / councils</td></tr>
<tr><td>Prepare the basis for implementation</td><td>18-24 months</td><td>Sector authorities / councils</td></tr>
<tr><td rowspan="5">Stakeholders</td><td colspan="2">Stakeholder category</td><td>Engagement (Inform, Consults, Involve, Collaborate or Empower)</td></tr>
<tr><td colspan="2">Municipality (centre for urban planning)</td><td>Collaborate</td></tr>
<tr><td colspan="2">Specialised city departments</td><td>Collaborate</td></tr>
<tr><td colspan="2">Public utilities (transport, energy etc.)</td><td>Consults/Involve</td></tr>
<tr><td colspan="2">Local groups, residents</td><td>Inform/Empower</td></tr>
<tr><td rowspan="2">Indicative costs [EUR]</td><td colspan="2">CAPEX</td><td>OPEX</td></tr>
<tr><td colspan="2">200,000</td><td>0</td></tr>
<tr><td rowspan="2">Potential funding</td><td>Instrument</td><td>Source</td><td>Amount [EUR]/ share [%]</td></tr>
<tr><td>Own source</td><td>Municipal budget</td><td>100%</td></tr>
<tr><td>Revenue opportunities</td><td>No</td><td colspan="2">Responsibility and task of municipal and sector authorities</td></tr>
<tr><td rowspan="2">Impact of the action: Quantitative and Qualitative</td><td>State indicators</td><td colspan="2">• Open green space area per capita
• Share of green space areas within urban limits
  • Share of population living within 300 m of open green space of at least 0.5 ha</td></tr>
<tr><td>Pressure indicators</td><td colspan="2">• Population density on urban land
• Proportion of the population living within 20 minutes to everyday services grocery stores clinics etc.
• Average annual growth rate of built-up areas
• Share of brownfield development
• Vacancy rates of commercial buildings
• Vacancy rates of residential buildings</td></tr>
</table>

	Estimated Carbon Emissions Reduction	no direct reductions
	Physical annual savings	Potential for savings by actions linked to a sound, legally binding basis for urban development at the level of quarters
	Climate resilience benefits	• This is a crucial action for building a climate-resilient Bucharest. If focusing on climate resilience benefits and environmental risks, the benefits may touch upon: • Cooler city: Green corridors combat urban heat islands. • Cleaner air: More plants, fewer cars. • Better water management: Reduces flooding risk. • More nature: Boosts biodiversity. • Fairer city: Improves disadvantaged areas. • Less energy use: Well-designed spaces.
	Reductions in operating expenditures	No direct reductions
	Social and economic benefits/Gender considerations	Revitalisation of underdeveloped areas and improvement of living conditions, enhancing overall quality of life for residents. By prioritizing coherent spatial planning and incorporating green corridors, the strategy can promote sustainable land use, increase access to green spaces, and foster community well-being for all. This approach can also attract investment and stimulate local economies, creating jobs and improving property values in targeted neighbourhoods. No new jobs are expected to be created.
Potential risk of the action	**Area**	**Risk**
	Social	There may be resistance from existing residents who fear displacement or changes to their communities, particularly in areas identified for regeneration. If the strategy does not include transparent criteria for prioritizing neighbourhoods, it may lead to perceptions of inequity and social discontent. Additionally, without adequate community engagement, the strategy could fail to address the specific needs and desires of the local residents.
	Environmental	• Gentrification and Displacement: Urban regeneration can lead to rising property values and displacement of existing residents if not managed carefully. • Loss of Existing Green Spaces: While the goal is to increase green spaces, poorly planned regeneration could lead to the loss of valuable existing green areas. • Construction Impacts: The regeneration process itself can generate waste, pollution, and disrupt existing ecosystems. • Increased Impermeable Surfaces: If not designed with permeability in mind, regeneration could increase impermeable surfaces and worsen urban flooding. • Material Sourcing: The environmental impact of materials used in construction and regeneration projects needs to be considered.
	Economic	N.A.

LU 3	**Additional green spaces in high-density neighbourhoods** Build additional green spaces in high-density neighbourhoods with low accessibility to parks, including making use of green-blue infrastructure options
Sector	Land use and green space
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	• Low share of green urban areas, poor accessibility of green areas for recreation of inhabitants for many parts in the city. Targets addressed: • Provision of green space for densely populated urban areas • Increasing quality of stay, recreation and public health • Aiming at potential climate and environmental benefits including minimising heat island effect (local climate) and flooding incidences, reduction of air pollution and of groundwater-pollution, increasing urban biodiversity
Strategic objective supported	Improve the use of urban land to address the high population density by ensuring access to high-quality green public spaces in all residential areas and to all categories of population
Linkage to existing policies /plans	Bucharest 2035 Development Strategy (strategic concept), GUP, ZUPs, cadastre registry, Bucharest Green Belt, National Strategy & Action Plan on Adaptation to Climate Change (2024-2030, with the perspective of 2050)

Description

Identification of relevant neighbourhoods and options for green spaces

- Based on and in line with the overall strategic planning at municipal level and the urban regeneration and coherent spatial planning at the level of sectors, relevant neighbourhoods with poor accessibility and high density/multifamily housing are identified.
- Environmental metrics are identified and evaluated for residual green space, pending grayfields, re-naturalized land in relevant low-access, high-density neighbourhoods/multifamily housing;
- In addition to new (and existing) green spaces, other greening options are being examined (tree planting in streets, unsealing, green façades or roofs, etc.) in order to create a complete and dense network of green and blue infrastructure throughout the city.

Planning/implementing of selected new green space projects

- The city selects priority areas for new park areas, identifies strategies for legal implementation and carries out detailed planning in order to provide space for recreation of inhabitants and reduce heat island effects.
- Nature-based solutions (such as rain gardens, urban meadows, protected natural areas, community gardens, etc.) are prioritized by landscaping and making accessible residual green spaces, abandoned or renatured lands, in order to obtain green spaces resilient to climate change and efficient in terms of maintenance cost/ecosystem services provided (e.g. Pajiștea Petricani, Saulei Valley, Dobroești Reeds - Sector 2, Dâmboviței Meadow upstream of Morii Lake, Ghencea Greenhouses - Sector 6, etc.);In addition to the construction of parks, the measure can also comprise greening and reduction of soil sealing of public spaces, inclusion of blue infrastructure through access to water or construction of fountains in public spaces, implementation of vertical greening and green roofs, etc.

Linkage to other GCAP actions	Basis: LU 1: Centre for urban planning LU 2: Urban regeneration and coherent spatial planning Further linkages: W 2: Nature-based solutions for stormwater LU 5: Urban renewal pilot concepts AQ 2: Green belt of the city

Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Some elements *Reason:*	**Directly targeted** *Reason:*	N.A.

	Building green spaces with green-blue infrastructure in high-density neighbourhoods is a good step towards climate action, urban resilience, and improved quality of life in Bucharest. By mitigating the urban heat island effect, enhancing carbon sequestration, and providing numerous social and ecological co-benefits, this project contributes to a more sustainable and equitable city.	Equitable development of social infrastructure like rest places, green pedestrian areas, community and neighbourhood parks, adequate green spaces and places for play and recreation. Playgrounds, parks and recreational spaces with inclusive design and tailored to the needs of girls and women, but also parents for playgrounds (no back benches at playgrounds!). Gender-sensitive designed parks are designed to give girls and young women better positions in public spaces. Specific interests concerning games, sports, and other leisure-time activities are to be incorporated into public park design to give space to women and girls to spend more time this kind of spaces.	

	Step	**Duration (months)**	**Step owner/support required**
Implementation steps and timeline	Identification of relevant neighbourhoods and options for green spaces	18 months	Municipality (Centre for urban planning) and sector authorities / councils
	Planning/implementing of selected new green space projects	36 months (per park)	Municipality (Centre for urban planning) and sector authorities / councils

	Stakeholder category	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
Stakeholders	Municipality (Centre for urban planning) and sector authorities / councils	Collaborate
	Specialised city departments	Collaborate
	Local groups, residents	Inform, Empower
	Real estate developers	Collaborate, Empower

	CAPEX	**OPEX**
Indicative costs [EUR]	9,000,000 This includes: costs for initial studies, and the construction of three new parks, five new green streets, and green roofs on fifty buildings.	172,000

	Instrument	**Source**	**Amount [EUR]/ share [%]**
Potential funding	Own source	Municipal budget	2% of CAPEX; 100% of OPEX
	Grant	EU LIFE Programme	98% of CAPEX
Revenue opportunities	No	Responsibility and task of municipal and sector authorities	
Impact of the action: Quantitative and Qualitative	State indicators	• Open green space area per capita • Share of green space areas within urban limits • Share of population living within 300 m of open green space of at least 0.5 ha	
	Pressure indicators	• Population density on urban land	
	Estimated Carbon Emissions Reduction	N.A.	
	Physical annual savings	Potential for savings by reduction of heat island effect (less cooling of buildings), by providing green space nearby (less trips outside of the city)	

	Climate resilience benefits	• Urban heat island mitigation: Green spaces reduce temperatures in concrete-heavy areas, combating the "urban heat island" effect and lessening heat wave impacts. • Stormwater management: Green-blue infrastructure (like rain gardens, bioswales, and green roofs) helps absorb and filter stormwater, reducing flooding and improving water quality. • Improved air quality: Plants filter air pollution, improving respiratory health and reducing the impacts of poor air quality days. • Increased biodiversity: Provides habitat for urban wildlife, promoting a healthier ecosystem and increasing biodiversity within the city. • Mental and physical health: Access to green spaces improves mental well-being, reduces stress, and encourages physical activity, making residents more resilient overall. • Community building: Green spaces create gathering places, fostering social connections and community resilience.
	Reductions in operating expenditures	The integration of nature-based solutions (such as rain gardens, urban meadows, protected natural areas, etc.) is prioritized in the design and management of green spaces in relevant low accessibility and high density neighbourhoods/ multifamily housing, leading to a reduction of maintenance cost per square meter by at least 30% compared to a traditional park
	Social and economic benefits/Gender considerations	Creating additional green spaces in high-density neighbourhoods can significantly enhance residents' quality of life by providing accessible areas for recreation, relaxation, and community gathering. These green-blue infrastructure options, such as parks, green roofs, and rain gardens, can improve air quality, reduce urban heat, and promote biodiversity. They can also provide value to downgraded areas, opening more perspectives to the inhabitants. Socially, increased green spaces can foster community cohesion, encourage outdoor activities, and provide health benefits, such as reduced stress and improved mental well-being. Approximately 12 new jobs could be created for workers with landscape architecture and maintenance skills; maintenance planning skills; and community engagement experience.
Potential risk of the action	**Area**	**Risk**
	Social	The development of new green spaces may face challenges such as budget constraints or land use conflicts, particularly in densely populated areas where space is limited. There may also be concerns from existing residents about potential noise or disruptions during construction. Furthermore, if not carefully planned, new green spaces could lead to gentrification, displacing long-time residents and altering the character of the neighbourhood. Additionally, if rehabilitation efforts do not adequately involve the community or address the specific needs of vulnerable populations, the resulting spaces may not fully meet their requirements.
	Environmental	• **Habitat disruption**: Construction can disrupt existing ecosystems, even if the end goal is to increase green space. Careful planning is essential. • **Water use**: Maintaining green spaces, especially during dry periods, can increase water demand. Using drought-tolerant plants and efficient irrigation is crucial. • **Pesticide and fertilizer use**: Maintaining these spaces may require pesticides and fertilizers, which can pollute waterways and harm wildlife. Eco-friendly landscaping practices are important.

		• **Invasive species**: Introducing new plant species can sometimes lead to invasive species that outcompete native plants and disrupt the local ecosystem. Careful species selection is vital.
	Economic	N.A.

LU 4	**Parks rehabilitation** Rehabilitation of existing urban parks and green spaces (e.g. Văcărești, Băneasa, Herăstrau)
Sector	Land use and green space
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	• Degradation tendency of green areas, challenge of different property owners of green areas, poor cooperation and professional knowledge for maintenance Targets addressed: • Provision of attractive green space for the urban population • Increasing quality of stay, recreation and public health • Aiming at potential climate and environmental benefits including minimising heat island effect (local climate) and flooding incidences, reduction of air pollution and of groundwater-pollution, increasing urban biodiversity
Strategic objective supported	Improve the use of urban land to address the high population density by ensuring access to high-quality green public spaces in all residential areas and to all categories of population
Linkage to existing policies /plans	Bucharest 2035 Development Strategy (strategic concept), GUP, ZUPs, cadastre registry, Bucharest Green Belt, National Strategy & Action Plan on Adaptation to Climate Change (2024-2030, with the perspective of 2050)

Description

Identification of most relevant parks and green spaces to be rehabilitated: Based on available documents and knowledge, an ecological in-depth analysis of existing urban parks and green spaces will provide information on the status of relevant parks and green spaces. Urban parks and green spaces potentially targeted include, for example, Văcărești Natural Park, Băneasa Forest, Herăstrău, Tineretului, Plumbuita, as well as lakeside paths and sports facilities.
Planning and implementing of rehabilitation projects:

- For rehabilitation, selected parks and other green spaces are further analysed, including social aspects as e.g. user profiles (age, gender, residents or visitors), type and daily pattern of use, highly frequented areas, etc.
- The rehabilitation measures may include the remodelling of the park, replacement and supplementation of plants and trees (climate-adapted planting), new infrastructure (seating, lighting, footpaths, waste disposal, sanitary facilities, restauration etc.) and the addition of complementary new activity offers (e.g. for nature, education, leisure, sport activities, playgrounds etc.).
- Rehabilitation measures will also include-nature based solutions such as developing constructed wetland in parks adjacent to river or introduce reedbed water filtering on water bodies (esp. for green areas along Colentina river and Dâmbovița river).
- The rehabilitation measures will also include the elaboration of a Management Plan for the ecological management of the parks, in line with the Bucharest Development Strategy 2035 (strategic concept) and the National Strategy & Action Plan on Adaptation to Climate Change (2024-2030, with a 2050 perspective), to ensure the sustainability of the investment and the propagation of good green space maintenance practices.

Linkage to other GCAP actions	W 2: Nature-based solutions for stormwater LU 1: Centre for urban planning LU 2: Urban regeneration and coherent spatial planning AQ 2: Green belt of the city		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* Among the co-benefits of the action, there can be	**Directly targeted** *Reason:* Playgrounds, parks and recreational spaces with inclusive design and tailored to the needs of girls and women, but also parents for	N.A.

	mentioned: enhancing carbon sequestration, mitigating the urban heat island effect	playgrounds (no back benches at playgrounds!). Gender-sensitive designed parks are designed to give girls and young women better positions in public spaces. Specific interests concerning games, sports, and other leisure-time activities are to be incorporated into public park design to give space to women and girls to spend more time this kind of spaces.	

	Step	**Duration (months)**	**Step owner/support required**
Implementation steps and timeline	Identification of most relevant parks and green spaces to be rehabilitated	12 months	Municipality (Centre for urban planning) and sector authorities / councils
	Planning and implementing of rehabilitation projects	18-24 months (per park)	Municipality (Centre for urban planning) and sector authorities / councils
	Develop the management plan for the ecological management of parks, monitor its implementation and periodically reviewing it	Periodically every 5 years	Municipality (Centre for urban planning) and sector authorities / councils

	Stakeholder category	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
Stakeholders	Municipality (Centre for urban planning) and sector authorities / councils	Collaborate
	Specialised city departments	Collaborate
	Local groups, residents	Inform/Empower

	CAPEX	**OPEX**
Indicative costs [EUR]	5,780,000	32,000

	Instrument	**Source**	**Amount [EUR]/ share [%]**
Potential funding	Own source	Municipal budget	3% of CAPEX
	Grant	EU LIFE Programme	97% of CAPEX
	Private finance	Rent from businesses in park / rental of green space for events	100% of OPEX

Revenue opportunities	No	Responsibility and task of municipal and sector authorities
Impact of the action: Quantitative and Qualitative	State indicators	• Open green space area per capita • Share of green space areas within urban limits • Share of population living within 300 m of open green space of at least 0.5 ha
	Pressure indicators	• Population density on urban land
	Estimated Carbon Emissions Reduction	N.A.
	Physical annual savings	Potential for savings by providing attractive green space nearby (less trips outside of the city)

	Climate resilience benefits	**Urban heat island mitigation:** Parks and green spaces cool the city by providing shade and evapotranspiration, reducing the intensity of heat waves and improving human comfort. **Stormwater management:** Healthy parks act as natural sponges, absorbing rainwater and reducing the risk of urban flooding. **Improved air quality:** Trees and vegetation filter air pollutants, improving respiratory health and reducing the impact of air pollution during heat waves. **Carbon sequestration:** Trees and plants absorb carbon dioxide from the atmosphere, helping to mitigate climate change. **Biodiversity support:** Well-maintained parks provide habitat for various species, promoting urban biodiversity and ecological resilience. **Community well-being:** Access to green spaces improves mental and physical health, reducing stress and promoting social cohesion, which is crucial during climate-related challenges
	Reductions in operating expenditures	No direct reductions, potential for reducing expenditures using climate-resistant plants (less need for maintenance)
	Social and economic benefits/Gender considerations	Rehabilitation of existing urban parks and green spaces can enhance biodiversity, improve aesthetic appeal, and increase recreational opportunities for residents, thereby promoting physical and mental well-being. By focusing on accessibility and inclusivity, these improvements can particularly benefit vulnerable populations, ensuring they have safe and enjoyable spaces to engage with nature. Well-maintained parks can also serve as community hubs, fostering social connections and encouraging active lifestyles, which can lead to reduced health disparities. Approximately 10 new jobs could be created for ecosystem restoration, accessibility design, and in planning and design of recreational open spaces
Potential risk of the action	**Area**	**Risk**
	Social	The rehabilitation process may initially disrupt access to parks, causing inconvenience for local users and potentially leading to frustration or resistance from the community. If not managed properly, there could be concerns about the prioritization of certain areas over others, leading to perceptions of inequity among residents, particularly in underprivileged neighbourhoods. Additionally, if rehabilitation efforts do not adequately involve the community or address the specific needs of vulnerable populations, the resulting spaces may not fully meet their requirements.
	Environmental	• Rehabilitation can disrupt existing habitats and introduce invasive species if not carefully managed • Minimize light pollution impacting nocturnal wildlife through careful lighting design.
	Economic	N.A.

LU 5	**Urban renewal pilot concepts** Implementation of urban renewal pilot concepts at the level of quarters
Sector	Land use and green space
Action Type	Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	• Poor planning governance, land inventory not integrated, planning documents are outdated, additional legal implementation issues • Low share of green urban areas, poor accessibility of green areas for recreation of inhabitants for many parts in the city. Targets addressed: • Increasing living quality and social cohesion • Developing lively, attractive neighbourhoods, well embedded within the municipality • Implementing pilot actions in order to highlight possible impulse effects of measures and added value of concerted actions enabled by cooperation of different responsible actors
Strategic objective supported	Improve the use of urban land to address the high population density by rehabilitating uninhabited or abandoned buildings and by ensuring access to high-quality green public spaces in all residential areas and to all categories of population
Linkage to existing policies /plans	Bucharest 2035 Development Strategy (strategic concept), GUP, ZUPs, cadastre registry, Bucharest-Ilfov Regional Development Plan, Sustainable Urban Mobility Plan 2016-2030 for the Bucharest-Ilfov Region, Municipal Energy Strategy *Furthermore: Bucharest Parking Strategy, Strategy for the development of the metro transport infrastructure in Bucharest, Bucharest Green Belt, The Bucharest Smart City Strategy, National Strategy & Action Plan on Adaptation to Climate Change (2024-2030, with the perspective of 2050)*

Description

The objective is to focus on a local concerted action in order to pool resources and financial means, and to give an impulse for a visible and perceptible change.

Selection of pilot projects

- Pilot projects for urban renewal are located in previously identified neighbourhoods with poor living quality in line with overall strategies at municipal level and urban regeneration and coherent spatial planning concepts at sector level (S27).
- The selection of pilot quarters should be based on criteria such as poor structural condition of buildings and/or public open space, high demand for social, technical infrastructure or green space. Ideally, the pilot actions can be combined with necessary major construction measures (e.g. metro construction, expansion of sewage systems)
- Natural urban areas that are functional ecosystems will be conserved and integrated into the redevelopment plans of the quarters that are part of the pilot projects;
- The pilot projects are selected in collaboration of municipality and the relevant sectors.

Integrated, neighbourhood-specific analysis and planning

- The implementation is based on elaborating a tailor-made neighbourhood-specific analysis, which is the basis for a plan to rearrange and accomplish existing quarters from an integrated perspective.
- This includes a socio-spatial study and the analysis of potential needs for the enhancement of built urban structures, building renovation, green space, the supply with public amenities or social facilities, public transport, public space and reconfiguration of the street network, support of local shop or services etc.
- Create green-blue corridors that interconnect the natural areas of the neighbourhoods to increase the city's resilience to climate change, support biodiversity, and maximize the ecosystem services provided by urban nature.

Local collaboration and participation

- In terms of cooperation and collaboration, relevant municipal specified departments as well as public utilities should be involved in the planning process.

- A draft development plan, highlighting most important actions may be presented and discussed with local groups and stakeholders and/or residents in order to involve the local actors in planning and implementation.
- The final implementation plan (including investment projects) is elaborated in line with the updated sector plans and makes use of specifications for land use regulations, legally binding for public and private investors.

Investment and monitoring

- Local development investments in the most relevant infrastructure are foreseen as an impulse for further development. In line with the outcome of the analysis this may vary considerably for different pilot neighbourhoods.
- The implementation may consist of several phases in order to take into account the necessary sequence of actions and to optimize the development process.
- Accompanying monitoring activities are forming the basis for mutual learning and provide the opportunity to enhance planning and process of further urban renewal projects.

Linkage to other GCAP actions	Basis: LU 1: Centre for urban planning LU 2: Urban regeneration and coherent spatial planning Further linkages: UT 3: Implementation of the Velo Master Plan UT 5: UT 7: Mobility Hubs and Park&Ride facilities E 1: Expansion and improvement of district heating W 2: Nature-based solutions for stormwater LU 3: Additional green spaces in high-density neighbourhoods

Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* Urban renewal in Bucharest, creates greener, healthier, and more resilient neighbourhoods. This means lower emissions, better air quality, and a higher quality of life for residents.	**Some elements** *Reason:* In-depth stakeholder consultations and quantitative and qualitative research done with a gender and intersectional-sensitive lens. Piloting inclusive design formulas.	N.A.

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/ support required**
	Selection of pilot projects	12 months	Municipality (Centre for urban planning) and sector authorities / councils
	Integrated, neighbourhood-specific analysis and planning	18 months	Municipality (Centre for urban planning) and sector authorities / councils
	Local collaboration and participation	6 months	Municipality (Centre for urban planning) and sector authorities / councils together with various actors
	Investment and monitoring	18-36 months	Municipality (Centre for urban planning) and sector authorities / councils

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	Municipality (Centre for urban planning) and sector authorities / councils	Collaborate
	Specialised city departments, public utilities	Collaborate
	Local groups	Inform/Involve
	Residents	Inform/Empower

Indicative costs [EUR]	**CAPEX**	**OPEX**
	15,000,000	480,000

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Own source	Municipal budget	21% of CAPEX; 100% of OPEX

	Grant	EU LIFE Programme	79% of CAPEX
Revenue opportunities	No	Responsibility and task of municipal and sector authorities	
Impact of the action: Quantitative and Qualitative	State indicators	• Open green space area per capita • Share of green space areas within urban limits • Share of population living within 300 m of open green space of at least 0.5 ha	
	Pressure indicators	• Population density on urban land • Proportion of the population living within 20 minutes to everyday services grocery stores clinics etc. • Average annual growth rate of built-up areas • Share of brownfield development • Vacancy rates of commercial buildings • Vacancy rates of residential buildings	
	Estimated Carbon Emissions Reduction	N.A.	
	Physical annual savings	Potential savings by actions related to renovation of buildings, sustainable mobility, green/blue infrastructure	
	Climate resilience benefits	Urban renewal concepts offer a significant opportunity to enhance Bucharest's climate resilience. By integrating green infrastructure, promoting sustainable building practices, prioritizing sustainable transportation, fostering social equity, and incorporating adaptive capacity, urban renewal projects can contribute to a more sustainable, resilient, and liveable city for present and future generations.	
	Reductions in operating expenditures	No direct reductions	
	Social and economic benefits/Gender considerations	The pilots can serve as testing grounds for innovative ideas, improving infrastructure, public spaces, and amenities, which can enhance residents' quality of life. By engaging the community in the process (co-design), these initiatives can foster a sense of ownership and pride, stimulate local economies, and attract investment. Successful pilot projects can also provide valuable insights and models for broader urban renewal strategies. Approximately 15 new jobs could be created for people with skills in prototyping and project management skills, smart city technologies integration and management skills, urban data analytics skills.	
Potential risk of the action	**Area**	**Risk**	
	Social	Urban renewal pilots may face challenges such as limited funding or community resistance to proposed changes, especially if residents feel their needs are not adequately represented. Additionally, if pilot projects do not prioritize inclusivity, they may inadvertently benefit only certain groups while neglecting vulnerable populations. There is also a risk that temporary improvements could lead to increased property values and potential displacement of existing residents.	
	Environmental	Construction related environmental impact – atmospheric emissions, noise pollution, waste generation.	
	Economic	N.A.	

4.8. GCAP Smart city actions

There is only **one action** shortlisted under the GCAP smart city sector, albeit a very important one, with a great potential of saving human resources, providing transparency and information visible to all sectoral stakeholders in real time. Most importantly, it can contribute to an effective monitoring of emissions in the city and, potentially, to tracking their source through the integration of the relevant urban sectors. The action is coded **SC 1**.

SC 1	**Integrated digital infrastructure/ databases** Build an integrated digital infrastructure (databases) across all urban sectors (e.g. transport, buildings, energy, air quality monitoring etc.) and shared by all administrative bodies.
Sector	Smart City
Action Type	Policy/Investment
GCAP Action Classification	Capital Investment
Priority environmental challenges addressed	Poor data sharing among the various urban sectors which result to inability and delays of implementing specific inter-sector related actions and strategies.
Strategic objective supported	Integration of databases across the sectors (e.g. transport, buildings, etc.)
Linkage to existing policies /plans	N.A.

Description

The aim of this action is the creation of a comprehensive integrated digital infrastructure for urban management. More specifically, it involves the establishment of a centralized data hub that collects and manages data from various sectors, such as transportation, energy, waste management, buildings and air quality/climate. This hub aims to serve as the main repository for diverse data types provided by the various urban sectors.

Centralized data hub and data standardization

- It includes the collection, storage, and management of data from various urban sectors. A cloud-based solution is preferred for creating the hub as it offers scalability and flexibility to meet increasing data demands. The hub will integrate a wide range of data types, while the utilization of standard data formats facilitates easy assessment, transfer, combination and analysis of information from diverse sources. Additionally, the development of a metadata framework when is needed, that includes definitions, description units, collection methodologies and resources, will enhance data discoverability and ensures that users can effectively understand the context of the data.

Authorization and security

- It prioritizes access control and data governance in protecting urban data. Implementing role-based access control (RBAC) to restrict data access based on user roles can significantly enhance data security. Additionally, utilizing multi-factor authentication (MFA) will protect against unauthorized access to the collected information. In terms of data governance, the strategy emphasizes the need for comprehensive policies that ensure compliance with data privacy regulations such as GDPR and local laws, providing clear guidelines for data collection, sharing, and usage.

Integration of existing databases

- This step emphasizes the importance of connecting databases by integrating existing databases from different GCAP sectors into a central hub. This process will use techniques for extracting, transforming, and loading data to ensure compatibility and smooth data flow. Creating well-documented application programming interfaces (APIs) will be important to this integration, allowing different systems to communicate and share data effectively. These APIs will be designed to be user-friendly, making it easier for developers to implement them. Ultimately, this will lead to a more connected urban data system that encourages collaboration and data-driven decision-making across various sectors.

Linkage to other GCAP actions	All GCAP Actions

Cross-cutting themes/co-benefits

Climate action	Gender and economic inclusion	Smart maturity
Some elements *Reason:* A city-wide digital infrastructure in Bucharest allows for smarter use of resources and better planning, leading to lower emissions and a more resilient city in the face of climate change. By connecting data across departments, the city can make more informed decisions and work together more effectively to address climate challenges. This also empowers citizens with information to participate in creating a more sustainable future.	**Some elements** *Reason:* Sex-disaggregated data, gender-sensitive qualitative research and gender analysis, and also studies that substantively integrate an intersectional perspective. Interactive gender-friendly or gender-targeted applications (fear maps), designed by women (to reduce the gender gap in the field), after substantive consultation of women, with the possibility of real-time online reporting (see Waze). Data collection on safe and unsafe areas in Bucharest for women, Roma, LGBTQ+, and disabled persons (data disaggregated by gender, age, including ethnicity/sexual orientation option), and using those data for targeted interventions (street lighting, local police/public order, redesign of some spaces to be safer – see for instance the natural surveillance concept); community applications - events, community engagement, local public consultations.	**Directly targeted** *Reason:* Data collected from various urban sectors will be integrated into a centralized data hub, creating an operational system that enables full interoperability. This integrated system will gather, process, and standardize data from a wide range of sources ensuring seamless interconnectivity across the different platforms used by the urban sectors. By centralizing and harmonizing the data, the hub will significantly enhance the efficiency of project planning, management, and execution. It will streamline workflows, reduce the complexity of coordinating across different sectors, and minimize delays when inputs from multiple urban sectors are required. This will lead to more informed decision-making, faster response times, and improved overall performance in managing urban infrastructure and services.

Implementation steps and timeline

Step	Duration (months)	Step owner/support required
Planning and preparation	2 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
Assessment and standardization of data/ information from various urban sectors' databases	6 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
Centralized integration of urban sectors' databases	6 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils
Pilot testing	2 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils

Stakeholders

Stakeholder category	Engagement (Inform, Consults, Involve, Collaborate or Empower)
Bucharest Municipality -	Involve, Consult, Collaborate

	Specialised city departments	Involve, Consult, Collaborate	
	Sector Municipalities	Involve, Collaborate	
	Citizens	Inform, Consult	
	ITC companies	Consult, Empower	
Indicative costs [EUR]	**CAPEX**	**OPEX**	
	15,000,000	N.A.	
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU: Recovery and Resilience Plan	
Revenue opportunities	No	No direct revenues	
Impact of the action: Quantitative and Qualitative	State indicators	N.A.	
	Pressure indicators	N.A.	
	Estimated Carbon Emissions Reduction	N.A.	
	Physical annual savings	Person-days/hours worked: A single hub of data can save hours spent in communication dedicated to sharing of information.	
	Climate resilience benefits	Creating an integrated digital infrastructure for urban data can be a powerful tool for building climate resilience by: Improved planning and decision-making: Access to real-time data on various urban systems allows for minister more informed and proactive decision-making in response to climate change impacts. For example, data on energy consumption, traffic patterns, and weather forecasts can be used to optimize resource allocation and reduce emissions. Enhanced coordination and response: A shared database facilitates better coordination between different administrative bodies, enabling a more efficient and effective response to extreme weather events and other climate-related challenges. Early warning systems: Integrating data from various sources, such as weather stations and air quality monitors, can help develop early warning systems for extreme weather events, allowing for timely evacuations and other protective measures. Optimized resource management: Real-time data on water usage, energy consumption, and waste generation can be used to identify inefficiencies and optimize resource management, contributing to a more sustainable and resilient city. Increased public awareness: Making data accessible to the public can raise awareness about climate change impacts and encourage individual and community action.	
	Reductions in operating expenditures	Human resource expenses; office supply	
	Social and economic benefits/Gender considerations	The unified approach can improve service delivery in areas such as transport, energy, and environmental monitoring, ultimately benefiting residents through better urban management. Additionally, increased transparency and accessibility of data can foster community engagement and trust, as citizens gain insights into local governance and urban planning efforts. About 15 jobs could be created in fields requiring skills such as IT system design and operation; database management; cybersecurity.	

	Area	Risk
Potential risk of the action	Social	The implementation of integrated digital infrastructure may require significant investment and technical expertise. There may also be concerns about data privacy and security, especially if sensitive information is shared across sectors. Furthermore, if the digital platforms are not user-friendly or accessible to all community members, it could exacerbate existing inequalities.
	Environmental	Data centres require significant amounts of energy for operation, cooling, and maintenance. This contributes to greenhouse gas emissions, especially if the energy comes from non-renewable sources. Also, E-waste contains hazardous materials like lead, mercury, and cadmium, which can leach into the soil and water if not disposed of properly
	Economic	High investment with limited return.

4.9. GCAP Air quality actions

Two actions have been shortlisted for improving air quality in Bucharest. Both actions entail the development of infrastructure, albeit of different natures. For this reason, they are not generating a significant number of new jobs. The actions in the air quality theme are coded **AQ 1 to AQ 2.**

AQ 1	**Integrated pollution management and monitoring system** Create an integrated air-quality and noise pollution management and monitoring system to collect and assess pollution data from various points of measurement, along the governance model to oversee it.
Sector	Air quality
Action Type	Policy/Investment
GCAP Action Classification	Capital investment
Priority environmental challenges addressed	Poor environmental / air quality data monitoring, collection, storage, quality control and distribution
Strategic objective supported	Integration of environmental and air quality indicators parameters collected through municipal and private monitoring networks into a centralized system.
Linkage to existing policies /plans	• Law no. 104/2011 on air quality, as amended • Integrated Air Quality Plan for Bucharest • Integrated Urban Development Strategy (IUDS) • Ilfov County Development Strategy • National Strategy & Action Plan for Adaptation to Climate Change (2024-2030)

Description

The aim of this action is the creation of an integrated pollution management and monitoring system to collect, standardize, process and manage environmental and air quality parameters monitored through municipal and/or private sectors. This system will integrate the available and newly installed monitoring networks providing real-time information to the end-users and the public.

Centralized platform and integration of existing monitoring databases

- It includes the collection, storage, and management of data from environmental and air quality databases operated through various municipal and private initiatives. A cloud-based solution is preferred for creating a platform as it offers scalability and flexibility to meet increasing data demands. Several processes will be performed to extract, load and transform the collected data for ensuring compatibility and smooth data flow. Creating well-documented application programming interfaces (APIs) will be important to this integration, allowing different systems to communicate and share data effectively. These APIs will be designed to be user-friendly, making it easier for developers to implement them. Ultimately, this will lead to a system that encourages collaboration and data-driven decision-making across various urban sectors.

Authorization and security

- It prioritizes access control and data governance in protecting the collected data. Implementing role-based access control (RBAC) to restrict data access based on user roles can significantly enhance data security. Additionally, utilizing multi-factor authentication (MFA) will protect against unauthorized access to the collected information. In terms of data governance, the strategy emphasizes the need for comprehensive policies that ensure compliance with data privacy regulations such as GDPR and local laws, providing clear guidelines for data collection, sharing, and

usage. This is also very relevant when environmental / air quality measurements were conducted by citizen initiatives where anonymity is very important.

Data harmonization and standardization

- The system will standardize data collected from diverse monitoring networks to ensure consistency and compatibility among various sources. The development of a metadata framework - vocabularies is significant detailing the unique definitions and descriptions of the collected parameters, the measurement units, the measurement techniques and measuring instruments, and the data providers who hold the data ownership. By utilizing uniform protocols and standardized data formats, the system will enable straightforward assessment, transfer, integration, and analysis of the data. Furthermore, newly installed monitoring devices or networks will adhere to these established standards, ensuring that future technological advancements and upgrades can be seamlessly incorporated into the system without any compatibility issues. Quality Control/Quality Assurance will be included to ensure the data reliability and consistency over the spatio-temporal domain.

Data processing, analysis and interface

- The system will feature real-time maps of the monitored parameters including pollution maps, trends, and forecasted conditions, providing citizens with up-to-date information about the environment. Additionally, it will offer historical data and trend analyses.

Linkage to other GCAP actions	AQ 2: Green belt of the city SC 1: Integrated digital infrastructure / databases		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* This integrated system will provide numerous benefits, including improved urban planning, more effective pollution control measures, faster responses to environmental emergencies, and enhanced public awareness of environmental / air quality issues. Real-time data will allow for more dynamic management of environmental health, and long-term data collection will support research efforts and sustainable development goals.	**Some elements** *Reason:* Health problems will be avoided, reducing the burden of care work which falls mainly on women.	**Directly targeted** *Reason:* Environmental and air quality parameters collected through monitoring networks operated by the municipality or private sectors will be standardized, harmonized and integrated into the same platform. It can be interface with other smart city systems such as smart transportation platforms, energy management systems and health departments. The city will also enhance air quality monitoring through the existing services that utilize satellite imagery and air dispersion models. This will enable case-based simulations and the implementation of air-quality forecasts. It will support city planners and policy makers by providing decision-ready information. Regarding citizens, it will raise awareness and inform the public about the environmental / air quality issues of the urban environment.
Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/ support required**
	Initial Assessment and Planning	2 months	Bucharest General Council/Municipality - Bucharest S1-S6 Councils Environmental Protection Agency Environmental Fund Administration Private sector
	Networks Integration	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Specialized city departments

	Platform development	12 months	Bucharest General Council/Municipality - Bucharest S1-S6 Specialized city departments
	Pilot testing	3 months	Bucharest General Council/Municipality - Bucharest S1-S6 Specialized city departments
Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**	
	Bucharest General Council/Municipality - Bucharest S1-S6 Councils	Involve, collaborate	
	Environmental Protection Agency	Consults, Involve, collaborate	
	Environmental Guard	Involve, Empower	
	Environmental Fund Administration	Involve, collaborate	
	Specialized city departments	Involve, collaborate	
	Private sector	Involve, collaborate	
Indicative costs [EUR]	**CAPEX**	**OPEX**	
	17,000,000	N.A.	
Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant / loan	EU Recovery and Resilience Plan; EU LIFE Programme and/or InvestEU	100%
Revenue opportunities	No	No direct revenues	
Impact of the action: Quantitative and Qualitative	State indicators	• Decreasing the annual concentrations of $PM_{2,5}$ and PM_{10} • Decreasing the level of NO_x	
	Pressure indicators	N.A.	
	Estimated Carbon Emissions Reduction	Estimated emissions are included in AQ 2	
	Physical annual savings	It will reduce the time needed to identify areas with pollution exceedance and help determine the measures needed to reduce pollution	
	Climate resilience benefits	Contribute to science-based decision making	
	Reductions in operating expenditures	Reduce the costs associated with collecting and managing data from multiple sources, pinpointing the area with high level of pollution	
	Social and economic benefits/Gender considerations	Establishing an integrated air-quality and noise pollution management and monitoring system can provide real-time data to inform public health policies and improve urban planning. This system can enhance transparency and accountability, allowing citizens to access pollution data and understand its impact on their health and environment. By identifying pollution hotspots, the system can guide targeted interventions, leading to improved air quality and reduced noise levels, which can enhance overall community well-being. Additionally, effective pollution management	

		can bolster public trust in local authorities and promote community engagement in environmental stewardship. Approximately 5 new jobs could be created in fields requiring skills in environmental monitoring; and data analysis and modelling.
Potential risk of the action	**Area**	**Risk**
	Social	Concerns about data privacy and security could arise, particularly if sensitive information is collected and shared. Furthermore, if the governance model lacks clarity or inclusiveness, it could lead to community scepticism about the system's effectiveness and transparency. There may also be resistance from industries or sectors that could be affected by stricter pollution controls.
	Environmental	Data quality - ensuring the accuracy and reliability of collected data is crucial. Issues with calibration, maintenance of monitoring equipment, and data analysis can compromise the effectiveness of the system.
	Economic	The creation of such a system may require significant financial investment and technical expertise.

AQ 2	**Green belt of Bucharest-Ilfov** Creation of the Green belt of Bucharest-Ilfov – a project of critical green infrastructure for climate change adaptation
Sector	Air quality
Action Type	Policy/Investment
GCAP Action Classification	Strategies, plans, and programmes
Priority environmental challenges addressed	Poor air quality due to particulate matter emissions. Increased ambient temperature due to lack of green spaces
Strategic objective supported	Extending and protecting the green belt of the city
Linkage to existing policies /plans	• Forestry Code (law 331/2024) • National Integrated Urban Development Strategy for Resilient, Green, Inclusive and Competitive Cities 2022-2035 - Romanian Urban Policy • Bucharest 2035 Development Strategy (strategic concept) • National Strategy & Action Plan on Adaptation to Climate Change (2024-2030, with the perspective of 2050) • General Urban Plan and Zonal Urban Plans of the Sectors • Ilfov County Spatial Plan • Bucharest-Ilfov Regional Development Plan (2021-2027) • Bucharest Integrated Air Quality Plan • Air Quality Management Plan in Ilfov County • Sustainable Urban Mobility Plan 2016-2030 Bucharest-Ilfov Region • Bucharest in the EU Mission M100 • Civic platform Together for a green belt

Description

This action entails the following objectives and activities:

- Elaboration of the Master Plan for the Bucharest-Ilfov Green Belt, in collaboration with the Ilfov County Council for the development and management of the Green Belt.
- Adoption of the Forest Management Plan for the forests within the territorial radius of the administrative-territorial unit of Ilfov until the end of 2027, realized by the Ilfov County Council, in partnership with the General Municipality of Bucharest, in accordance with the provisions of Article 90 of the Forest Code.
- Adoption of the methodology for the formal designation of the Bucharest-Ilfov Green Belt, as subsequent legislation to the Forest Code.
- Creation of a financing mechanism for the implementation and development of the Bucharest - Ilfov Green Belt.
- Development of pilot projects to test a forest management adapted to climate change and to test the interconnectivity of biodiversity and of the alternative mobility infrastructure of the Green Belt.
-

Linkage to other GCAP actions	LU 1 : Centre for urban planning LU 2: Urban regeneration and coherent spatial planning LU 3: Additional green spaces in high-density neighbourhoods LU 4: Parks rehabilitation LU 5: Urban renewal pilot concepts		
Cross-cutting themes/co-benefits	**Climate action**	**Gender and economic inclusion**	**Smart maturity**
	Directly targeted *Reason:* Green belt will act as a protective curtain, absorbing CO_2, maintaining humidity, creating a favourable biodiversity shelter and	**Some elements** *Reason:* Should offer to all genders the possibility to benefit from a recreational environment in nature. Due to care activities women will benefit even more,	N.A.

	habitat, protecting against heat waves and strong air currents, reducing pollutants.	and due to inclusive designs girls will be more welcomed in the sports and recreative areas.	

Implementation steps and timeline	**Step**	**Duration (months)**	**Step owner/support required**
	Adoption of the subsequent legislation for the formal designation of the Bucharest-Ilfov Green Belt and the Forest Management Plan within the territorial radius of the Ilfov administrative-territorial unit, according to the Forest Code.	24 months	Environment Ministry, General Council /Municipality of Bucharest, Ilfov County Council
	Elaboration of a Mater Plan	24 months	General Council /Municipality of Bucharest, Ilfov County Council, ADIZMB, Civic platform Together for a green belt
	Implementation of the Master Plan	5 years	General Council /Municipality of Bucharest, Ilfov County Council, ADIZMB, Civic platform Together for a green belt –Local Councils of Bucharest S1-S6

Stakeholders	**Stakeholder category**	**Engagement (Inform, Consults, Involve, Collaborate or Empower)**
	Bucharest General Council	Involve, collaborate
	ADIZMB	Empower
	Ilfov County Council	Involve, collaborate
	Environmental Fund Administration	Involve, collaborate
	Civic platform Together for a green belt	Empower, involve, collaborate

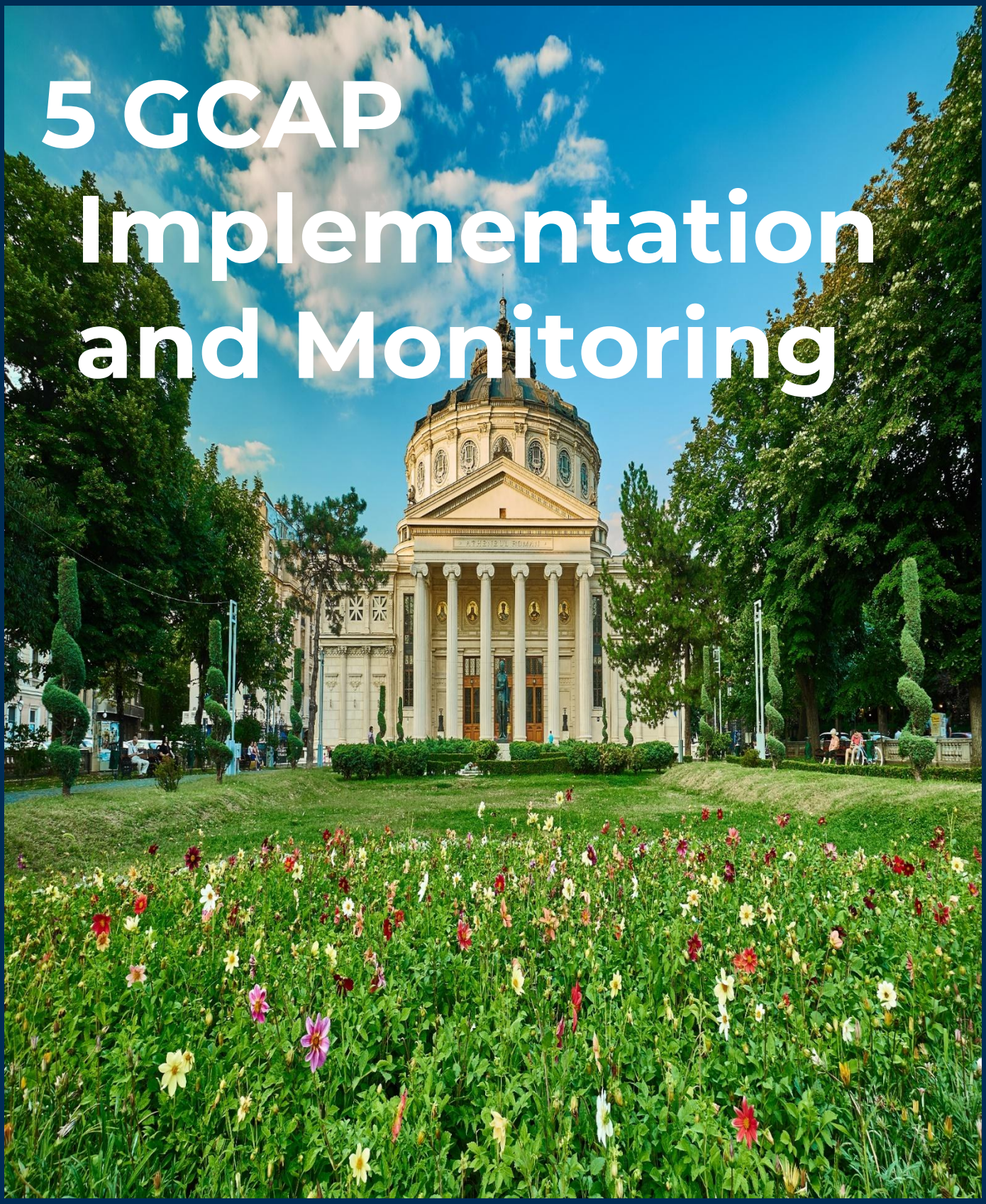
Indicative costs [EUR]	**CAPEX**	**OPEX**
	48,000,000 This includes: costs related to the legal framework, experts group, piloting some of the elements/components of the green belt	11,016,000

Potential funding	**Instrument**	**Source**	**Amount [EUR]/ share [%]**
	Grant	EU: National Recovery and Resilience Plan or EU LIFE Programme	99.9% of CAPEX
	Grant	State Domain Agency & Environmental Fund Agency	0.1% of CAPEX; 100% of OPEX
Revenue opportunities	No	Responsibility and task of municipal and sector authorities	
Impact of the action: Quantitative and Qualitative	State indicators	• Decreasing the annual concentrations of $PM_{2,5}$ & PM_{10} • Decreasing the level of NO_x	

	Pressure indicators	N.A.
	Estimated Carbon Emissions Reduction	In its present form, the project will generate **3,000 tCO_2e per year**.
	Physical annual savings	In general, it reduces the costs associated with pollution management, by removing much of the CO_2 through natural processes, providing a natural barrier against noise, lowering ambient temperature levels
	Climate resilience benefits	Green infrastructure can help buffer the impacts of extreme weather events, such as heat waves, droughts, and floods. Nonetheless, the green belt will contribute to the mitigation of the urban heat island effect and improve air and water quality (trees may act as natural air filters for air pollutants and sink for the CO_2). The green belt of Bucharest will also enhance water infiltration into the soil, replenishing groundwater resources and improving water availability, while providing habitat for a variety of plant and animal species, increasing biodiversity and ecological resilience and acting as a corridor for wildlife, allowing them to move between different habitats and promoting genetic diversity. Not to be neglected, the green belt is expected to provide social and psychological benefits like Improved well-being: improving mental and physical health, reducing stress and promoting relaxation. Recreational opportunities: providing opportunities for outdoor recreation, such as walking, cycling, and picnicking, enhancing the quality of life for residents.
	Reductions in operating expenditures	No direct reductions
	Social and economic benefits/Gender considerations	Extending and protecting the green belt of the city can enhance urban biodiversity, improve air quality, and provide residents with accessible green spaces for recreation and relaxation. By identifying protective areas and establishing limits, the initiative can help preserve natural habitats and mitigate urban sprawl, contributing to overall environmental sustainability. Socially, a well-maintained green belt can promote community cohesion and health, as residents have opportunities for outdoor activities and connection with nature. Additionally, it can increase property values in surrounding neighbourhoods, benefiting the local economy. The action could create approximately 30 extra jobs: experts of the elaboration of the Master Plan, as well as rangers positions.
Potential risk of the action	**Area**	**Risk**
	Social	The process of extending and protecting the green belt may face challenges such as land use conflicts, particularly if existing landowners feel their rights are threatened by new regulations. Community resistance may also arise if residents perceive the initiative as restricting development or limiting access to land for agricultural or recreational use. Furthermore, inadequate monitoring or enforcement of protective

		measures could lead to violations that undermine the intended benefits.
	Environmental	• **Soil and land use considerations**: The green belt will require land allocation, potentially competing with other land uses such as agriculture or urban development. • **Fire risk**: In dry conditions, the increased vegetation density can augment fuel load, potentially elevating the risk of wildfire outbreaks. • **Long-term management**: A green belt necessitates a long-term commitment to ongoing maintenance, including irrigation, pruning, pest control, and the removal of dead or diseased trees
	Economic	Lack of investment
	Other	Opposition from owners of arable land that will be converted into forests

5 GCAP Implementation and Monitoring



Romanian Atheneum

After its approval by the General Council of Bucharest Municipality, the Bucharest GCAP will commence its implementation by the City. Continuous monitoring of the actions and projects foreseen in Bucharest GCAP is part of the implementation process. The monitoring will be performed against milestones and targets of the respective indicators which mirror the strategic objectives addressed by each action.

This section presents the elements of the implementation and monitoring of the progress, along with the tool that the City will use during the monitoring process.

5.1. Implementation and Monitoring

The continuous monitoring of the GCAP actions is integral part of the implementation upon the adoption of the plan. Monitoring consists of two parts:

- **Monitoring of the implementation**, which tracks the status and progress of the GCAP projects, and,
- **Monitoring of the of the impact**, which tracks the impact of the implemented GCAP actions on the state of the environment through measurable indicators. Together with this, the impact monitoring should also consider the risk and vulnerabilities, and the extent to which the GCAP actions are contributing towards the resilience of the city.

GCAP Governance

According to the GCAP methodology, the implementation process has to start with the establishment of a governance structure for the GCAP implementation, by defining a key person at the City level, responsible for the implementation and monitoring of *all* GCAP actions, i.e. the **GCAP Officer**. Preferably, this person should be the Green City Officer who is already familiar with the actions and with the process through which they were developed. This person will serve as the implementation and monitoring coordinator and will have an advocacy role, facilitating and fostering the inclusion of the GCAP in other City relevant planning instruments such as the City budget and other City strategies and plans. This process should also be endorsed and supported by the General Council of the Bucharest Municipality.

The GCAP officer will then coordinate with the municipal departments, municipal companies and other stakeholders who have been designated as action owners/ implementing stakeholders for each action in their respective fiche (see Section 4). Within each municipal department/company, a project leader should be appointed to manage the internal staff responsible for (i) overseeing the implementation of specific actions, (ii) reporting on the progress of implementation and (iii) collecting the required impact data according to the indicators set out in the impact tool (see Section 5.4 below).

5.2. Monitoring and Reporting format, frequency and process

Each implementing stakeholder should set budgets and timelines for delivering the respective assigned actions. The assigned staff should provide regular reports, i.e. **every six months**, on the progress of implementation and on the environmental impact to the GCAP Officer. The results of this will inform the planning of subsequent stages of each action, including amendments to timescales, resources and the budget, as needed.

Thus, the monitoring will take place via the Monitoring Tool which allows tracking both the progress and the impact of GCAP actions.

5.3. Progress Monitoring Tool

The progress monitoring tool, ***GCAP Bucharest - Monitoring Tool.xlsx***, is an integral part of this GCAP, in which the City's implementation team can track the implementation progress for each action. The implementation monitoring tool lists all GCAP actions. During the implementation, for each action it will be clearly indicated its progress status and milestones: not started/ in progress / complete.

The plan provides an opportunity to assess implementation by:

- Comparing implementation efforts with original goals and targets
- Determining whether sufficient progress is being made towards achieving expected results
- Determining whether implementation is progressing according to schedule.
- Determining whether implementation is progressing in a different direction than planned, thus requiring course-correcting measures

5.4. Impact Monitoring Tool

The impact monitoring tool, ***GCAP Bucharest - Monitoring Tool.xlsx***, is an integral part of this GCAP where the City's implementation team can track the impact for each action. The impact monitoring is based on the data gathered in the Indicators Database, part of the Technical Assessment Report, which sets out the baseline for the creation of GCAP. Thus, these indicators depict the baseline of the environmental assets of Bucharest, as well as the sectoral indicators that exert pressure on the environment of the city.

The monitoring tool provides the baseline values for the indicators for which a bi-annual or an annual evaluation will be undertaken, to monitor the impact of the GCAP actions on city's environmental performance. The indicators included in this tool were selected from the Indicators Database, limited to those directly linked to the actions and which can provide measurable progress towards the strategic objectives (see Section 3.2).

The GCAP Officer responsible for the implementation of GCAP will supervise the impact monitoring, while the respective sectoral stakeholders[112] will be responsible for monitoring the indicators related to the GCAP actions for which they are responsible. The sectoral stakeholder will update the impact monitoring tool for their respective indicators in a collaborative manner and on an annual or bi-annual basis, informing the GCAP Officer. Subsequently, the GCAP Officer will provide updates to the General Council of Bucharest Municipality, on a regular basis and as required. It is important to note that while some impacts can be detected immediately, others, such as improved air quality and greenhouse gas emissions, can only be monitored in the long term.

[112] This could be departments within the municipality, utility companies or other stakeholders involved in the implementation of the GCAP actions, i.e. the implementing stakeholders or action owners.

Annex

See the accompanying Microsoft Excel document *GCAP Bucharest - Monitoring Tool.xlsx*

June 2025

EBRD GREEN CITIES

LDK CONSULTANTS

KOMMUNAL KREDIT PUBLIC CONSULTING

Trinomics