



GCAP

Green City Action Plan for City of Belgrade

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Contents

Foreword	vii	3	Action Plan	45
Executive Summary	8	3.1	Identification of Actions	46
What are the priority environmental challenges?	8	3.2	Evaluation of “Long List”	47
What are the plan’s goals?	9	3.2.1	Multicriteria Assessment	47
1 Introduction	11	3.2.2	Application of Weightings	49
1.1 What is a green city?	12	3.2.3	Ranking of GCAP Options	49
1.2 How this plan was produced	13	3.2.4	Overall Assessment of GCAP Actions	50
1.3 Relationship to SECAP	17	3.3	Urban Planning and Mobility	51
2 Baseline	19	3.3.1	Current framework	52
2.1 General Facts	20	3.3.2	Key Challenges	53
2.2 Spatial coverage of SECAP/GCAP in Belgrade	21	3.3.3	Objectives and Actions	55
2.3 Current Policies and Strategies	22	3.3.4	Actions	57
2.4 Current performance	24	3.4	Energy and Efficiency	84
2.4.1 How is the current State of the Environment?	24	3.4.1	Current framework	85
2.4.2 What are the current Pressures on the Environment?	27	3.4.2	Key Challenges	86
2.4.3 Social and Gender Considerations	40	3.4.3	Objectives and Actions	87
2.4.4 Smart Cities Potential	41	3.4.4	Actions	89
2.5 Priorities and Strategic objectives	42	3.5	Water and Waste	114
		3.5.1	Current framework	115
		3.5.2	Key Challenges	115
		3.5.3	Objectives and Actions	117
		3.5.4	Actions	118
		3.6	Greening and Resilience	139
		3.6.1	Current framework	140
		3.6.2	Key Challenges	141
		3.6.3	Objectives and Actions	143
		3.6.4	Actions	144

4	Financing Options	149	6	Summary of Benefits	162
4.1	Summary of City's Financial Status	150	6.1	Introduction	163
4.2	Sources of Potential Finances	151	6.2	Key Environmental Benefits	165
4.3	Assessment of Actions against Financing Options	152	6.2.1	Air Quality	165
5	Implementation	156	6.2.2	Biodiversity	166
5.1	Institutional Arrangements	157	6.2.3	Water Use	166
5.1.1	GCAP Coordination Board and Sector Champions	157	6.2.4	Land Use	166
5.1.2	Green City Coordinator	158	6.2.5	Material Use	167
5.1.3	Sector Coordinators	158	6.2.6	Energy Use & Climate Change Mitigation	167
5.2	Monitoring Framework	159	6.2.7	Climate Adaptation	170
5.2.1	Institutional Measures	160	6.3	Key Social and Gender Co-Benefits	170
5.2.2	Target-setting and Data Quality Improvement Measures	160			
5.2.3	Tool-developing Measures	160			
5.2.4	Monitoring, Preventive and Corrective Measures	160			
5.2.5	Monitoring Investment Measures	161			
				Appendices	174

Foreword

Dear fellow citizens,

In front of you is the strategic document *Green City Action Plan*, which was created in a transparent and participatory way in cooperation with experts from Serbia and Europe and with representatives of the civil sector. Together we have defined projects that will improve life and work in our city in accordance with European environmental standards.

According to United Nations projections, 68% of the world's population will live in cities by 2050, suggesting that cities, as world centres of economic development, play a major role in protecting the environment and combating climate change.

The European Union has decided that all member states will be climate neutral by 2050, which means that carbon dioxide emissions must be zero. That is why it is important for Belgrade, as the capital of Serbia, to start the green transition in time, which this plan brings. With this plan, the City of Belgrade positions environmental protection as one of the strategic priorities and is also a precondition for the use of "green" funds of the European Union and other International Financing Instruments.

The main goal of the Action Plan is to improve air quality. In addition, the Plan envisions implementation of actions for improving energy efficiency, expanding district heating and introducing renewable energy sources in the City's energy mix, wastewater treatment, greening of the city, which will

result in a contribution to the fight against climate change. By implementing these actions, we will create new "green" jobs, which will accelerate the economic growth of the City.

As a doctor, I am aware that a clean environment has a positive effect on the health of our citizens, and that is why the concept of a "green city" is my vision of Belgrade. It is important that we invest in new parks, in expanding the network of bicycle and pedestrian paths and in creating conditions for better living habits and improving the health of our citizens. With this approach and by investing in ecology, we send a clear message that it is necessary to change the awareness of the environment and to preserve and improve it.

The *Green City Action Plan 2030* is also a continuity of the policy of sustainable development of Belgrade, which is one of the permanent strategic commitments of the city.



Prof. dr Zoran Radojčić,
Mayor of Belgrade

Executive Summary

This Green City Action Plan (GCAP) for the City of Belgrade, is a strategic document which diagnoses, prioritises and detects the environmental challenges of the city, presents a “Green City” vision for 2030 and provides a financially sustainable plan to meet our ambition of winning the Green City Capital Award in the near future. This plan establishes a roadmap for maximising economic, environmental, and social co-benefits.

This GCAP was developed by a team of local and international experts in close cooperation with the Belgrade Mayor and City Administration and has been formally adopted by the City Assembly. It was developed using EBRD’s Green City Action Plan Methodology, which used a combination of data driven and participatory approaches to identify key environmental challenges and to develop an Action Plan as a roadmap to achieving the Green City Vision by implementing actions to meet defined strategic objectives and mid-term targets.

As a part of the process and in consultation with city officials, stakeholders, and citizens, we have established the following Green City vision for Belgrade which has guided the development of the Green City Action Plan (GCAP):

“We are a capital city which is developing smartly for its citizens, especially children, and pursuing the ideals of an even greener, healthier, and more sustainable future.”

What are the priority environmental challenges?

A Green City Baseline was established by measuring our City’s performance against a series of Benchmarks considering the current state of the environment, the pressures placed on the environment by society and our current responses to areas of challenge. A consultation exercise was then held to discuss with a wide range of stakeholders including community organisations, city officials, infrastructure operators and key service providers.

Key areas of concern as a result of this process included:

Air Quality – With key sources of pollution including traffic and solid fuel boilers and energy generation.

GHG Emissions – Belgrade is committed to reducing its GHG emissions and has made a commitment through the EU Covenant of Mayors to reduce emissions by 40% by 2030 (from a 2015 baseline)

Green Space and Biodiversity – There was a strong aspiration from stakeholders to improve green infrastructure in the city for the benefit of citizens, biodiversity and other natural services such as drainage control.

Resource Consumption – Recycling rates are very low and there is a commitment to increasing domestic recycling to rates to 20% by 2025 as interim and 65% by 2035 (as per EU target)

Water Quality and Resources – There are challenges related to pollution of secondary watercourses from a range of sources and a lack of formal wastewater treatment.

Climate Vulnerability – Belgrade has experienced significant flooding in the past and is vulnerable to a range of other climate risks such as extreme heat and cold.

Land use pressures – There is considerable pressure on land use from sustained population growth as well as a legacy of development which has not always followed the city’s central masterplan.

What are the plan's goals?

A series of 16 Strategic Objectives have been set out to tackle the environmental challenges identified and meet the city's vision. These are arranged in three core sectors (Urban Planning and Mobility; Energy and Efficiency; and Water and Waste). There are also two additional cross cutting objectives.

Urban Planning and Mobility	S.O.T1 – Improve city mobility and reduce congestion
	S.O.T2 – Enhancing Green Mobility in Central City Area
	S.O.T3 – Increasing use of alternatively fuelled vehicles
	S.O.L1 – Higher density development
	S.O.L2 – Preventing sprawl
Energy and Efficiency	S.O.L3 – Improve the importance and capacity of Green Infrastructure and provide access to public green spaces in all parts of the city
	S.O.B1 – Take action to improve the energy efficiency of the city's buildings
	S.O.B2 – Using existing buildings to create elements of green infrastructure
	S.O.E1 – Developing and improving the efficiency of district heating distribution
	S.O.E2 – Cut Greenhouse gas emissions from the City
Water and Waste	S.O.W1 – Reduce the losses in the network to achieve water saving and reuse
	S.O.W2 – Protect more of the city from the risk of flooding
	S.O.W3 – Capture and treat wastewater
	S.O.SW1 – Improvement of infrastructure for separate collection, sorting, reuse and recycling of waste
Cross Cutting	S.O. CCA1 – The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning)
	S.O.GS1 – Substantially increase the "tree cover" territory and level of porosity of Belgrade's territory

What is in the plan?

A total of 35 Actions across 6 sectors have been identified. 27 are capital/infrastructure investments and 8 are supporting activities such as policies, guidance or studies. These include:

Action	Costs (€M) -10-year horizon Estimated CAPEX (Total & 2021-2026) ¹	Additional Annual OPEX
Sustainable Mobility		
Investments in public transport including extension of the train and tram system, purchasing electric buses, preparation for Electric Vehicles, and encouraging walking and cycling.	€1,204.95M/ € 611M	€4.15M
Urban Planning		
Supporting brownfield development, strengthening policy frameworks and planning rules, supporting green infrastructure and specific investments such as the Dorćol Superblok and Linear Park projects.	€ 78.1M/ € 78.1M	€ 0.25M
Energy and Efficiency		
Investment in rehabilitation of both residential and municipal building stock (including incentives to private owners to take part), greening city buildings, improving the district heating system and public lighting infrastructure.	€ 2,921.18M/ € 1,668.37M	€ 0.17M
Water		
Reducing per capita consumption through efficiency measures; rehabilitating small watercourses; flood prevention thorough both traditional defenses & sustainable urban drainage; and investment in wastewater treatment.	€ 860.25M/ € 462.25M	€ 2.55M
Waste		
Investments to support recycling and hazardous waste; and exploiting green waste for energy.	€ 46.25 M/ € 46.25M	€ 2.34 M
Cross Cutting		
Strengthening responses to climate change and implementing an expanded programme of afforestation and greening.	€ 100.25M/ € 55.8M	€ 0.05M
Totals	€ 5,210.98M € 2,921.77M	€ 9.51M

¹ Total Capex is over the full life of the project. 2021 – 2026 Capex is for this period of the GCAP implementation only.

What are the main benefits of the plan?

Environmental Benefits - The GCAP process has specifically focused on the development of measures to achieve environmental benefit and address the key areas of concern described above. Some of the key benefits identified include:

- Air Quality – Improved air quality from reduced vehicle emissions and reduced reliance on fossil fuel boilers connections to gas and district heating.
- Climate Mitigation – Generate **approximately 2.3 tonnes CO₂eq / year** in carbon savings from energy and transport savings by 2030.
- Green Space & biodiversity – improved greenspace through provision of new spaces and encouragement of green infrastructure to benefit from natural ecosystem services
- Resource Consumption – Promoting recycling and responsible waste disposal with improved segregated collection/deposit services.
- Water quality and resources – improved water quality in rivers from improved wastewater treatment and better management of secondary watercourses.
- Climate Vulnerability – Integrate existing adaptation and resilience plans into planning processes to ensure that all plans are climate ready.
- Land Use – Improved consideration of green infrastructure in the General Urban Plan and encouragement of more compact sustainable development reusing land and reducing sprawl.

Social and Economic Co-Benefits – In addition to environmental benefits it is also important to consider and recognise potential economic and social co-benefits. Selected benefits include:

- Education, apprenticeships and jobs – Green industry employment opportunities in areas such as insulation and renewable technologies.
- Access to Finance – Opportunities for citizens to access finance for environmental investments such as electric vehicles or insulation.

- Public health - benefits from reduced exposure to pollution, improved wellbeing through improved green space, as well as opportunities to promote more active lifestyles.
- Gender equality - by improving engagement to better hear citizens voices and providing infrastructure that is designed to meet the different needs of both men and women.
- Accessibility - benefits by providing infrastructure and equipment which is designed to modern standards which facilitate better accessibility for users with restricted mobility.

How did we engage stakeholders?

We have worked with stakeholders, within the city administration, public companies, Civil Society Organisations, academic and professional experts.

Activity	No of Attendees/ Respondents	By stakeholder type
Public Launch Event (Oct '18)	99 Participants	22% CSO's 45% female
Prioritization Workshop (Dec '19)	32 Participants	13% CSO's 47% female
Strategy Workshop (Dec;'19)	43 Participants	19% CSO's 33% female
Visioning Consultation (public exercise led by social media) (Apr '20)	128 Responses	Not captured
Online options workshop (July '20)	Approximately 20	Not captured

1 Introduction

What does this chapter tell me?

- **Why did the City of Belgrade join the EBRD Green Cities Programme?**
- **What vision has been set out of the Belgrade Green City Action Plan (GCAP)?**
- **How was the Plan developed?**
- **What is the relationship between the GCAP and the Sustainable Energy and Climate Action Plan (SECAP)?**

The City of Belgrade is determined to provide a safe, healthy and clean environment for our citizens, and we have undertaken a significant amount of work in recent years to improve the quality of the urban fabric. In order to increase the environmental performance of our city and secure more effective coordination, we announced our objective to compete and win Green Capital of Europe Award, we have made a commitment to the EU's Covenant of Mayors and we have become one of the European Bank for Reconstruction and Development's "Green Cities".

These initiatives will help us to focus on our environmental performance and our response to the challenges that global climate change presents to us as a city and will also help us to attract additional investment necessary to create a truly sustainable city. A critical part of this process is planning and as a part of the Green Cities Programme this Green City Action Plan (GCAP) has been produced to map out necessary investment. Similarly, as a part of our commitments to the EU's Covenant of Mayors programme, we have agreed to develop a Sustainable Energy and Climate Action Plan (SECAP) in parallel to this GCAP.

These plans will help us to build on the investments we have already made in improving infrastructure and services for the citizens of Belgrade including: continuous investments in public transport renewal programme, reconstruction and rehabilitation of streets and underground infrastructure, energy efficiency programme, public lighting, green space enhancement, water and wastewater infrastructure development, solid waste and recycling measures. All this is considered as a solid baseline for successful future "green" investments which will help the City environment to flourish.

Our involvement with both the EBRD Green Cities programme and the EU Covenant of Mayors programme is supported by EBRD with funding from the Government of Japan. This has helped to fund a team of consultants, to work with us, service providers and other stakeholders to systematically analyse and prioritise environmental challenges in the city and propose both policy measures and bankable investments that the city can make to improve its environmental performance and respond to climate change. This document has been prepared to meet the requirements of the EBRD Green Cities programme but cross references the work undertaken in the SECAP for the Covenant of Mayors throughout.

To guide this process, we have set out the following Green City vision for Belgrade which was developed in a consultative process with citizens (described later in the document):

"We are a capital city which is developing smartly for its citizens, especially children, and pursuing the ideals of an even greener, healthier, and more sustainable future."

1.1 What is a green city?

As an EBRD Green City, Belgrade has agreed to strive towards building a better and more sustainable future for its residents. The Green Cities programme aims to achieve this by identifying, prioritising and connecting cities' environmental challenges with sustainable infrastructure investments and policy measures.

EBRD Green City Aims To:

1. Preserve the quality of environmental assets (air, water, land and biodiversity) and use these resources sustainably.
2. Mitigate and adapt to the risks of climate change.
3. Ensure that environmental policies and developments contribute to the social and economic well-being of residents.

The GCAP is based around three principles of planning, investment and capacity building (as set out overleaf).

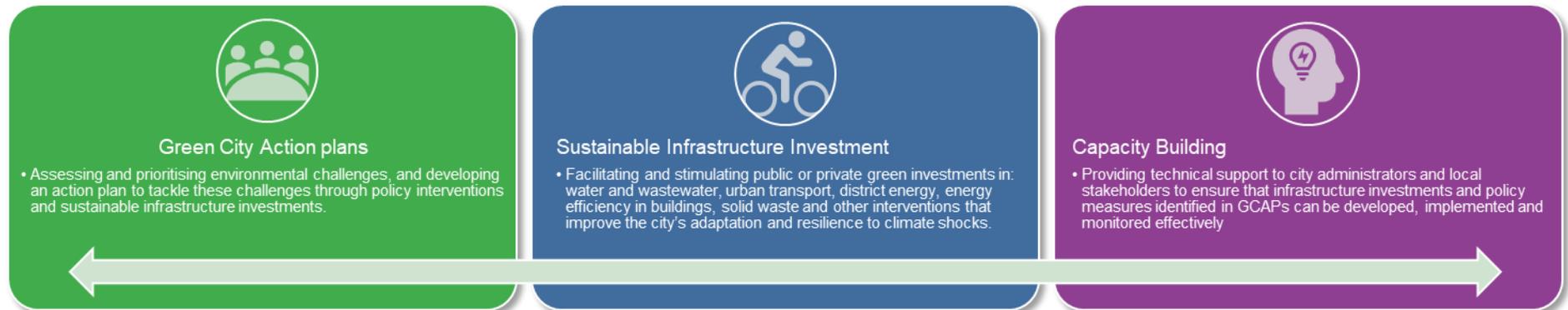
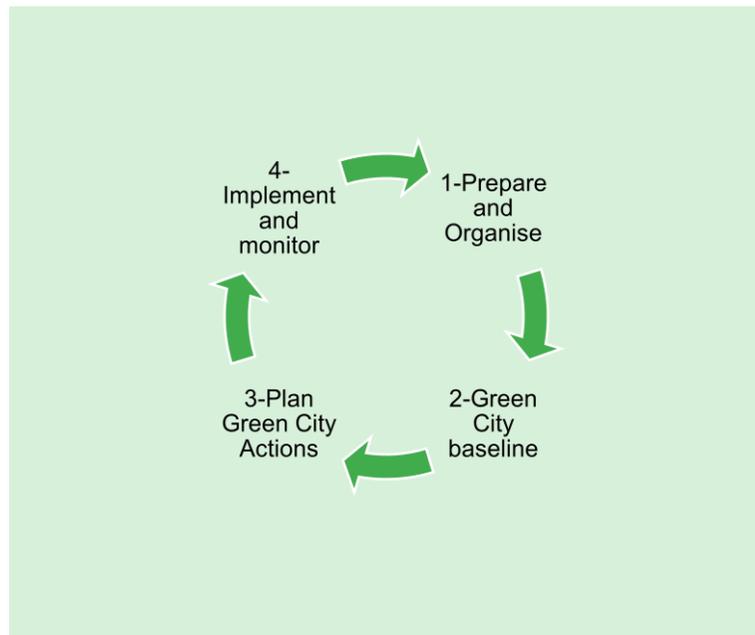


Figure 1-1: Key Components of the Green Cities Programme



1.2 How this plan was produced

The development of this GCAP involved assessing the city's environmental performance using 35 core indicators that covered a wide range of urban issues. The indicators evaluated the state of the city's environmental assets, its overall resource efficiency and climate change risks. These indicators were combined with local stakeholder input from civil society organisations, private-sector partners and municipal and national actors to identify and prioritise the city's environmental challenges. This was achieved in four stages, described below.

1. Prepare and organise

At an early stage in the process we made a commitment, as a part of the GCAP process, to commit time and resources to the development of the plan. This firstly involved establishing a City "Working Group" for the development of the GCAP, this consisting of senior members of various municipal departments. They were supported by technical experts from their teams who worked with the Consultant to provide data and feedback on the technical elements of the Green City Action Plan.

A group of consultants was appointed (with support from the EBRD and the Government of Japan) to provide technical support in undertaking the necessary assessments, identifying and evaluating opportunities and developing the Green City Action Plan.

Table 1.1 Key Working Group members

Member	Department	Role
Katarina Kulić	Mayor's cabinet	Working group coordinator
Vesna Šabanović	Secretariat for Environmental protection	Head of sector
Srećko Šević	Energy Secretariat	Head of sector
Filip Rojević	Secretariat for Public Transport	Engineer
Gordana Marković	Secretariat for Transport	Head of sector

A review of existing policies was conducted by EBRD in cooperation with the City. The review ensured that the GCAP builds on urban policies previously developed. The policy review also assessed political support within the municipal government, legal and political risks related to the GCAP and the potential for subsequent investment.

A stakeholder analysis was performed to identify key individuals and stakeholder groups, including private-sector representatives, local academics, civil society organisations (CSOs) and organisations responsible for municipal services such as energy, water, waste and transport utilities.

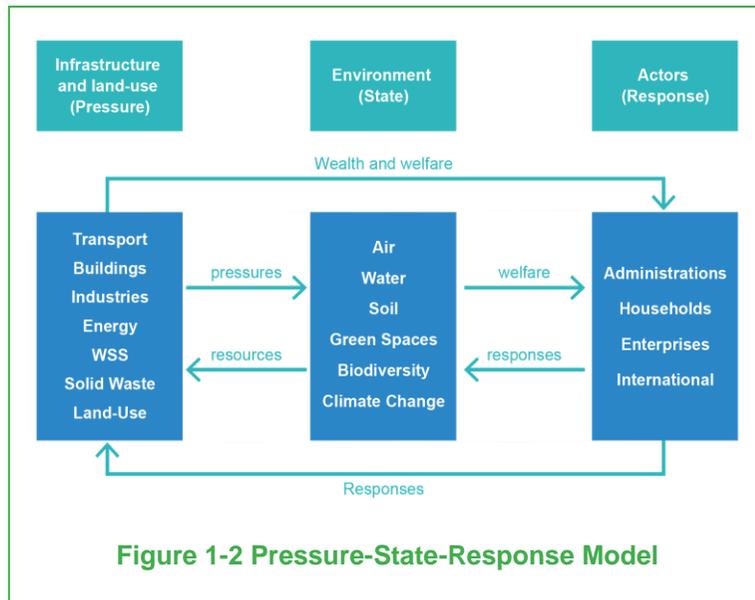
The GCAP process was formally launched in 5th October 2018 with a presentation of the process and a series of stakeholder engagement session which sought to collect preliminary views from internal and external stakeholders on the current situation of the environmental quality, urban planning and infrastructure development of the City. This included non-governmental organisations, universities and research institutions, as well as international and bilateral organisations conducting similar work in the city.

Photo 1.1: Mayor Radojicic and representatives of the EBRD, Japanese embassy and Stakeholders during the launch event



2. Identifying and prioritising challenges – setting the Green City baseline

The Green City baseline is the diagnostic component of the GCAP process and documents the city's current environmental performance, including the governance and policy frameworks in place that affect it, and identifies a set of priority environmental challenges that we will address through this GCAP.



To determine the baseline, firstly, we mapped out relevant political, legal, economic, social and environmental conditions, as well as emerging issues and policies which could affect this GCAP.

Next, we mapped the city's environmental performance by collecting and benchmarking environmental performance against indicators defined by the EBRD's GCAP methodology. These indicators are design around the OECD "Pressure-State-Response" model which is a commonly used framework to define environmental performance that examines relationships between the Pressures we place on the environment (through activities such as transport, energy use, resource consumption), the State of the environment (for example the quality of the air or the availability of resources such as water) and the Responses in place to manage the pressures we place on the environment.

The methodology targets 35 core indicators, across the State and Pressure categories but as not all indicators are available in all cities, there are a further 55 optional indicators to provide alternative measures for key areas of performance. The list of indicators collected for this study is included in Appendix A.

A technical assessment was undertaken to identify Green City challenges. This explored the drivers of performance, which included a description of the current quality of the city's infrastructure; and existing management approaches, including exploring policies, directives, standards and legal frameworks governing or affecting the indicators. The Green City challenges we identified highlighted areas of concern with respect to the current quality of environmental assets, potential future pressures from development, climate change, and gaps in policy or strategies in relevant sectors.

Next, we held a stakeholder consultation exercise to present our baseline findings and experts and citizen representatives were given the opportunity to confirm or dispute the relevance of Green City challenges that had been identified. This was aided by a first draft of the Green City priorities, based on a technical assessment produced largely by the consultant (using data collected and supplied through the Working Group) and then by a series of workshop sessions held on the 3rd December 2019 to finalise the technical assessment, prioritise the challenges to be addressed in the Green City Action Plan and identify strategic goals.

Workshops	Purpose	Stakeholders
Technical Assessment Presentation Session	The consultant's Technical Assessment of indicators was presented to a range of official and civil society stakeholders to set out an objective baseline for the environmental performance of the city.	99 participants 22% CSO's 45% female
Prioritisation Session	Four technical groups were established to talk through the technical assessment and a preliminary prioritisation undertaken by the consultant to a) confirm the results of the technical assessment b) agree the level of priority that should be afforded to the topics that had been identified in the technical assessment.	32 participants 13% CSO's 47% female
Strategy Session	Sectoral discussions were held to begin drafting Strategic Goals to address the priorities identified in the previous session.	43 participants 19% CSO's 33% female

The Green City baseline was then finalised by the Consultant's team and reviewed and confirmed by the City's working group to ensure there was buy-in from key stakeholders and experts. The Green City Baseline analysis is presented in Section 2 of this report.

Photo 1.2: Prioritisation Workshop



3. Planning Green City actions

We planned Green City actions to improve Belgrade's environmental performance through targeted actions. This involved developing a long-term vision (10 to 15 years) for green city development. We then identified specific, short-term actions (1 to 5 years) that can be taken to reach the long-term vision, as well as medium-term targets (5-10 years).

The Green City Vision and Strategic Goals were developed by the consultants following their technical analysis and the stakeholder workshops described which took account of Working Group, Technical Stakeholders, Civil Society Groups, Mayor and our own staff.

Our approach for developing the Vision was to hold broad consultation to collect ideas and concepts. These were subsequently formulated into a

draft Vision for discussion in a workshop. Also, direct inputs from the Mayor on his vision for a Green Belgrade were made.

Consultation was conducted to a wide audience through popular social media channels, with guidance provided by the City on the most appropriate channels. This included:

- Facebook: <https://www.facebook.com/bg.gradonacelnik>
- Twitter: @beograd_RS
- Instagram: https://www.instagram.com/dr_gradonacelnik/?hl=en

After collating responses, basic qualitative analysis of the responses was conducted to identify and classify themes. The results from the public consultations and voting were presented to the Mayor, who selected preferred vision:

“ We are a capital city which is developing smartly for its citizens, especially children, and pursuing the ideals of an even greener, healthier, and more sustainable future.”

A long list of Green City actions was then developed in collaboration with the consultant team to meet this vision and the strategic objectives and ideas that had come out of the workshops in December 2019.

This longlist was circulated via the Working Group to collect feedback from technical stakeholders which involved additional information on the status and technical details of ongoing initiatives as well as an opportunity to review and consider some of the new proposals being developed. Unfortunately, due to the Coronavirus pandemic, much of this discussion with the consultant had to be conducted remotely rather than through direct consultation and wider workshops which may have been the case under different circumstances.

The long list of options was analysed by the Consultant's team using a Multi-Criteria-Analysis (MCA) to provide an objective basis for prioritising and ultimately selecting the projects to be included in this GCAP. This included consideration of the level of **Benefit** that a project might deliver, its **Potential to Receive Finance** (from any source), its **Technical Deliverability**, whether it achieved **“Additionality”** (i.e. whether the GCAP

was duplicating benefit already being achieved or if inclusion in the GCAP would genuinely achieve new benefit) and **Policy Alignment** to avoid including actions that did not align with established policy.

Based on a combination of the percentage score and notes, each Action was reviewed to determine whether it should be a High Priority (i.e. that it is a key intervention), Medium Priority (it is a valuable intervention), Low Priority (it is a constructive intervention but of limited value), or if it should be excluded (it is not aligned to the Strategic Objectives or it is perceived to perform poorly on a number of the criteria). A conclusion for each option is provided in the “GCAP Conclusion” column of Appendix B and the selected actions are presented in the Action plan section (Chapter 3) of this report.

Any projects scoring zero in any of the MCA categories described above were considered to be “non-aligned” and were excluded on the basis of this score. The detailed assessment table presented in Appendix B records these projects (31 in total) and identifies the explicit rationale for excluding them.

An additional 6 options were “manually” screened, because despite the scoring indicating that they had some benefit, it was felt that this benefit wasn’t sufficient or sufficiently well aligned to the Strategic Objectives to justify inclusion. Where this was the case a justification has been provided in the “GCAP Conclusion” column of Appendix B.

39 Actions were ultimately proposed for inclusion in the GCAP. After Options workshop and consultation with stakeholders, **finally 35 Actions were selected for this action plan.**

This analysis and stakeholder engagement were then used to develop summary proposals for a series of “Actions” which address the Strategic Goals and are presented in the Section 3 of this report.

4. Implementing and monitoring Green City actions

We have developed an implementation monitoring plan to track the status and progress of the GCAP projects. We have also developed an impact

monitoring plan which measures the impact of GCAP projects and policies on the city’s environmental performance.

This section also sets out responsibilities within the City Hall to ensure that activity is coordinated across each municipal department and appropriate leadership is given to implementing the GCAP. We will also report on progress against the plan and collect required data to determine the level of impact that the investments carried out have had.

This team may also update and revise the plans as necessary through the implementation period. Budgets and timescales will be set in each department and they will report back on the performance of the GCAP actions which are their responsibility.

The monitoring and reporting tools used to track progress will be used to inform future cycles of the Green City Action Plan

1.3 Relationship to SECAP

The City of Belgrade has committed to developing a Green City Action Plan (GCAP) under the EBRD Green Cities Programme and a Sustainable Energy and Climate Action Plan (SECAP) as a part of its commitment to the Covenant of Mayors.

While these two processes are distinct in terms of their outputs and commitments, there is significant overlap in the methodologies and the City of Belgrade with support of consultants had run both processes in parallel.

Both GCAP and SECAP processes require the city to:

- identify a current baseline of Environmental or Climate related challenges,
- determine a vision strategic objectives and priority areas
- develop tangible interventions to improve the city’s performance
- approve a plan which will support the implementation of those measures
- report progress of implementation of the measures and the beneficial effect they have had

For development of both action plans, a range of data is collected and analysed aligned to both the benchmarking indicators required by the EBRD Green Cities Action Plan methodology (i.e. the Green Cities Baseline Indicators) and the Covenant of Mayors Baseline Emissions Inventory and Climate Vulnerability and Risk Assessment (VRA).

These analyses were included in two preceding reports for the GCAP and SECAP referred to as the GCAP Technical Assessment Report and SECAP Technical Assessment Report respectively and constitute a summary of the performance of the city against the GCAP Benchmarks and provides the evidence base for the SECAP baseline. Stakeholder engagement for the confirmation of the technical assessment and priority areas, was conducted within the same event for both GCAP and SECAP processes.

Following this engagement with stakeholders' strategic objectives and ultimately tangible actions, were identified and included in both the GCAP and SECAP plans. As there is considerable synergy between the two processes and their objectives, the same "long list" has been used to develop the list of Actions to be considered in more detail for each. However, the measurement of benefit considered, with the SECAP focused strongly on Mitigation and Adaptation opportunities, rather than broader environmental benefit which is used for the GCAP. This has resulted in a slightly different long list. In particular there are options and actions that have already secured finance which qualify for consideration in the SECAP, but which would not be considered in the GCAP as they would not be considered "additional", whereas the SECAP is aiming to capture existing investments that have carbon and adaptation benefit.

The SECAP has its own reporting mechanisms also which align to the requirements of the EU Covenant of Mayors, however data from this process will also be fed into the GCAP monitoring and reporting mechanism to demonstrate progress on climate related objectives.

2 Baseline

What does this chapter tell me?

- General facts about the city
- What is the spatial scope of the GCAP?
- What other policies and plans have been considered in the development of the GCAP?
- What is the City's Current Environmental Performance?
- What Priorities and Strategic Objectives have been addressed in this plan?

2.1 General Facts

Belgrade is the **capital of the Republic of Serbia** and one of the regions defined for regional development purposes and statistical data collection (NUTS level 2). Belgrade has a population of **1,687,132 inhabitants (2017)²** and acts as the political, economic, cultural, educational, logistical and scientific centre of the country. It also contributes about 40% to the national Gross Domestic Product (GDP).

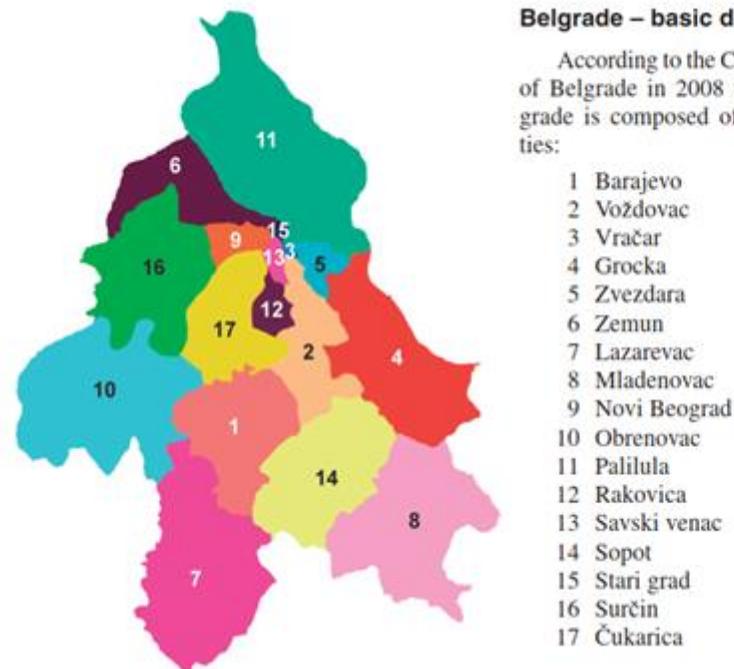
The City holds a unique geographical location on the confluence of the Sava and the Danube rivers and is **connected to important trans-European transport networks** (corridor VII and corridor X (E70, E75, E80)).

Belgrade is a city with significant development potential and is currently the largest “construction site” in the country.

Administratively and legally Belgrade is a region and local self-government that consists of urban municipalities. There are three distinctive zones: (1) central zone that consists of municipalities entirely covered by the Belgrade settlement; (2) suburban zone where municipalities are partially covered by the Belgrade settlement and in other discontinuous parts by other settlements; and (3) the rest of Belgrade’s agglomeration with urban municipalities that consist of many settlements physically detached from the Belgrade settlement.

The overall number of urban municipalities is 17 and they have a certain degree of administrative independence.

Photo 2.1: Belgrade municipalities



Source: [Belgrade in figures, 2018](#)

According to the last Census (2011) Belgrade was populated with 1,659,440 citizens, which is 23.1% of total population in Serbia. There were 785,826 males and 873,614 females in Belgrade. According to data from 2017, the population grew to 1,687,132 (Statistical Office 2018).

² Estimation by the Statistical Office of Serbia



Size

- Population ~ 1,687,132 (2018)
- Stable growth with flattening trend
- Territory ~ 3.222,68 km²

Key Natural Assets

- Danube and Sava River
- 46 protected natural areas
- Groundwater, thermo-mineral water springs and geo-thermal water accumulations



Employment:

- leading position with 39.8% of state GDP per capita or 1,007,000 RSD (8,535 EUR)
- Poverty rate in Belgrade in 2016 was 4%
- 700,000 employees
- Commerce 22%
- Industry 10%
- Education, science 11%

Key Economic Contributors:

- IT sector regional hub (incl Microsoft, Asus, Intel, Dell, Huawei, Nutanix, NCR etc)
- Energy (major power plant)
- Tertiary Education
- Important role in economic and agricultural capacities, especially metal, metal processing and electronic industry, then trade and banking.

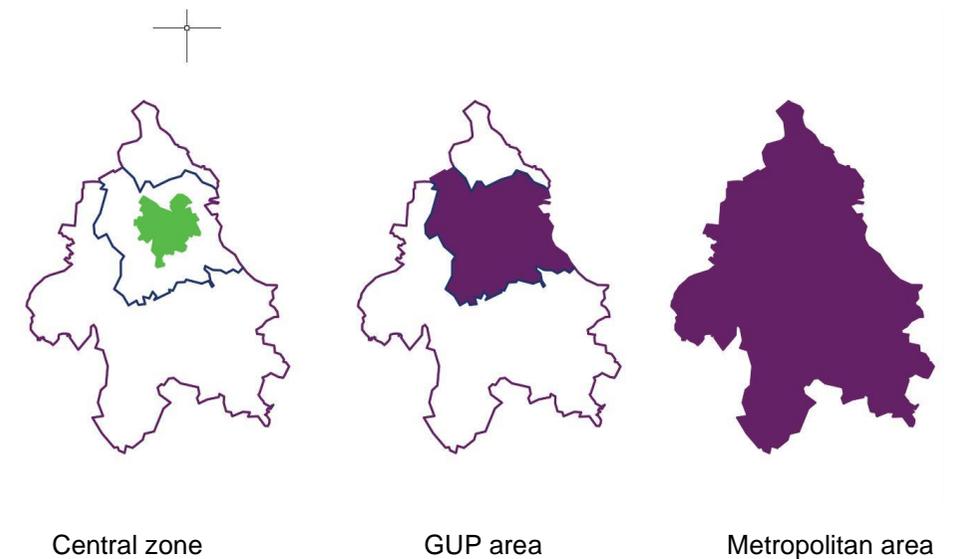


2.2 Spatial coverage of SECAP/GCAP in Belgrade

Belgrade municipalities have different density (inhabitants per km²). The least dense municipality is Vračar (19,462 inhabitants per km²) and the smallest density is Sopot (75 inhabitants per km²). The largest municipality is Palilula - 447 km² and the smallest is Vračar – 3 km². Some municipalities are divided into urban and rural areas - Vozdovac, Palilula, Zemun. Some municipalities are separate towns - Mladenovac, Obrenovac, Lazarevac, Sopot, Barajevo and Grocka.

As Belgrade's administrative structure is complex, we have identified three key zones which are used to identify the spatial scope of challenges and actions throughout the GCAP. These are the Central Zone (comprising the core metropolis), the "GUP area" (identifying the wider metropolitan area covered by the General Urban Plan) and the total Administrative area of Belgrade which includes a substantial amount of rural territory and satellite towns/settlements.

Figure 2-1: Spatial coverage of GCAP



2.3 Current Policies and Strategies

The principal of identifying and managing environmental risks is not new to the City of Belgrade and, while the EBRD Green Cities programme has provided a useful way of consolidating some of the actions, the plan builds upon some of the existing strategies and activities that we have undertaken. A full analysis of policies and strategies is provided in Appendix B however a summary of some of the key documents and their outcomes is provided below. These are:

Name of document	Timeframe	Scope	Coverage
Belgrade Master Plan (General Urban Plan GUP) ("Official Gazette of the City of Belgrade" No. 11/16)	2016-2021 New GUP 2021-2031 under preparation	The most general urban planning document that encompasses settlement of Belgrade and its vicinity. It focuses on building-land and elaborates development and protection concept for the quality of different urban zones, rational use of land, sustainable use of resources, modernisation of transport and communal infrastructure.	Land use, traffic, (heating)energy supply, electro-energy supply, telecommunications, water supply, waste-water disposal
City of Belgrade Development Strategy ("Official Gazette of the City of Belgrade" No. 47/17, rev. 55/2017)	2017-2021	This is a mid-term plan for the City sustainable development, elaborated in 2016/2017 and approved by the City authorities. Covers all aspects of the City sustainable and smart development.	All sectors
Belgrade SMARTPLAN*	2017-2021-2027-2033	The main objective of the document is sustainable development of traffic and transport in the City. It represents master plan for public transport, followed by the Strategic Environmental Assessment. The focus is on different means of public transport (metro/tram/trolleybus/bus/train/parking), parallelly taking care of environmental, economic and social aspect.	Transport, traffic, environment, economy

Belgrade City Environmental Protection Program ("Official Gazette of the City of Belgrade" No. 72/15)	2015-2025	The aim of this document is to determine state of the art and reveal impacts of other sectors (urban and spatial planning, industry, energetics, etc.) to environment, and based on it to set vision, principles, define instruments of implementation and monitoring in order to secure synchronized environmental policy with other sectors.	Environment
Sustainable Urban Mobility Plan (SUMP)	2020-2030	The Sustainable Urban Mobility Plan (POUM) is an innovative way of planning urban transport and an urban system that sustainably meets, first and foremost, the needs of the people. The goals of such transport system planning are accessibility to the destination and services, increasing traffic safety, reducing the greenhouse effect and fossil fuel consumption, attractiveness of urban facilities, increased quality of life, healthier environment and reduced harmful impact on the health of citizens.	Transport, Urban Planning
Plan of General Regulation of Green Areas of Belgrade	2018-2028	The plan encompasses 7 urban municipalities in total, and another 6 municipalities in part, with the aim to develop City's "green infrastructure". It classifies green areas, determines their locations and regulates building activities on them together with some technical solutions.	Environment, land use, biodiversity, landscape
Regional Spatial Plan for the Administrative Region of the City of Belgrade	2011-2015-2030	Long-term planning document which defines the City's spatial development vision, principles, goals, measures and implementation instruments regarding environment, demography, economy, tourism, public services, transport and infrastructure.	All sectors

Climate Change Adaptation Action Plan and Vulnerability Assessment ("Official Gazette of the City of Belgrade" No 65/15)	2015-	The plan lists existing and estimates future extreme weather events, also presenting potentially expected risks and its consequences. The action plan gives list of measures, locations, responsible institutions, level of priority and timeframe for their execution (short-, mid-, or long-term).	Environment , climate change
Belgrade Area Afforestation Strategy ("Official Gazette of the City of Belgrade" No. 20/11)	2010-2020	This is a ten-year document that defines measures for rational use of forest resources and improvement of biodiversity overall environment. The measures are primarily directed towards enrichment of productive, qualitative and structural characteristics of forests and green spaces, which were in earlier studies estimated as unsatisfactory.	Environment , forestry, public greenery
Local Waste Management Plan of the City of Belgrade 2011-2020 ("Official Gazette of the City of Belgrade" No. 28/11)	2011-2020	This is a strategic document, which defines the objectives of waste management in accordance with the adopted Waste Management Strategy of the Republic of Serbia, establishes sustainable waste management and adopts priorities in practice. It includes situation analysis, strategic framework, necessary changes in waste management and institutional framework, financial analysis, action plan and plan for implementation supervision and monitoring. New local plan 2021-2030 is near to adoption.	Communal services, waste management, governance
Air Quality Plan for the Agglomeration of Belgrade	2016-2018 Biannually	The plan bases on the assessment of state of the art regarding air quality. It includes all the main pollutants and main sources of air pollution. Finally, the plan states the measures to be taken in order to prevent or	Environment (air), transport, energy, governance

		reduce pollution and improve air quality.	
Monitoring Program (for Environmental Quality)	Biannually	This document determines precise locations and aspects of environmental monitoring: noise, surface water, ground water, radioactivity, UV radiation, air and soil pollution.	Environment
Report on Strategic Environmental Assessment for the Energy Sector Development Strategy of the Republic of Serbia by 2025 with Projections until 2030, for the Period 2017–2023	2017 - 2030	Strategic Environmental Assessment	Energy

2.4 Current performance

2.4.1 How is the current State of the Environment?

Environmental Quality: Air

Within the air quality analysis in Belgrade, it is impossible to make an unambiguous estimate and average values, primarily because of the large differences between densely populated urban areas and suburban settlements. In recent years, and perhaps due to prevailing meteorological conditions, air quality in Belgrade has not improved, but it has not decreased dramatically either, according to the annual reports of the City Institute for Public Health and SEPA.



Air quality indicators are elevated and in the Case of PM_{2.5} (the core indicator), significantly so. Key contributors are likely to be Traffic (particularly centrally), Industrial Emissions (including energy generation at the TENT site) and domestic combustion of solid fuels.



Air quality monitoring in Belgrade is provided by the State and the City monitoring stations. The methodology of monitoring of the quality of air in Belgrade is defined in: *The program of air quality control in the territory of Belgrade*, published annually.

Environmental Quality/Resource: Water Bodies

According to the Law on waters, the catchment area of the city of Belgrade includes a part of the **Danube River Basin**, a part of the **Sava River sub-basin** and various secondary basins which drain into these rivers and lay within the administrative boundaries of the city.



Environmental Quality/Resource: Water Bodies

Watercourses include both large and small watercourses which intersect or frame the territory of the city. There are also many small watercourses that originate within the city's territory and several lakes and other surface reservoirs. 50 km of Danube (the second largest river in Europe), and 30 km of Sava River, is within the territory of the city.

There are a number of lakes in the city which are significant water bodies for the supply of water to the wider city. The Sava Lake was created in 1967 when two dykes connected the right Sava bank to the river island Ada. With an 8 km long beach, it is the largest and most important recreational centre in Belgrade.

Wastewater in Belgrade is discharged without treatment and smaller watercourses are heavily contaminated with red indicators in both core and secondary GCAP indicators. However in contrast BOD and NH₄ levels in the rivers Danube and Sava rivers and in the Sava lake are reasonably good thanks to the very large volumes that they discharge and the associated dilution capacity that provides.

Environmental Quality/Resource: Drinking Water

Water supply is from the Sava river and from groundwater which is treated to reach the drinking water quality standards and supplied to more than 1,5 M users connected to the Belgrade water supply system. The average annual flow of delivered water is about 6.4 m³/s. Today the contribution of the two sources is almost equal. The total annual production of drinking water in the past few years is about 200 million m³ of water. Groundwater is extracted from 98 dug wells (RENI BUNAR) with horizontal drains and 45 drilled wells.

Existing ground water wells often exceed their capacity and as a result the production capacity is reducing. There is an existing aquifer in Makiško



polje which is currently not being utilised. The available flow rate of the Sava river is also significant. Water from the Sava river is treated in the drinking water treatment plants Makis 1 and 2. Overall the Water Exploitation index of for Belgrade was calculated to be 11% which is well under the green threshold against the EBRD benchmark.

While there are a small number of exceedances of standards, drinking water quality is generally considered to be good

Environmental Quality: Soil

Based on the Land Monitoring Studies carried out annually, levels of harmful and dangerous substances in soil in Belgrade is generally satisfactory, although the surface layer of soil (depth up to 50 cm) is contaminated in some locations, typically nickel which is likely to be a result of the city's industrial heritage.

A smaller number of samples show increased concentration of other pollutants: heavy metals (Cu, Zn, Pb, Cr, Cd, Hg and As) and organic parameters (hydrocarbon index C10-C40, degradation products DDT -a, PCB and PAU). However there is **no central database** of contaminated sites within the city.



The responsibility for the management of contaminated sites in Serbia rests with site owners. In line with the Serbian regulation, soils at industrial areas must be tested and the results reported to the responsible government agency on an annual basis. Soil must be restored to its original condition after decommissioning of production. Owners registered in the National System of Environmental Monitoring are required to test and report on soil quality every 1-3 years.

Resources: Green Space

While creating the Belgrade Master Plan 2021, it was identified that there was no consolidated strategy or financing policy on green spaces. To address this, the Belgrade Town Planning Institute created the "Green Regulation of Belgrade" project and the General Regulation Plan was adopted in August 2019.

However it remains difficult to assess the dynamics trends in the coverage of the City's green areas as some of the green areas have been acquired for construction, but this is offset by expansion into new undeveloped areas which add open green space. Current data in the Plan for the General Regulation of the System of Green Areas of Belgrade, shows that green areas represent up to 12.38% (9.55% forested territory, 2.83% other green spaces) of the City's land cover, but **the largest green areas are located out of populated areas**, making them less accessible for the City's residents. There is also considerable pressure on green spaces from development.

A public utility company manages the city's green spaces in the municipalities which are covered by the "Belgrade Master Plan and General regulation plan". In total there are 2,552.3 ha of managed greenspace.

There is a stated objective to reach 125 m² of open green space (i.e. green areas and forests with forest land) per capita by 2021.

Average wood bio-mass collected from the green spaces treated by the utility company is 4,950 t per annum, and it is primarily deposited in bio-base of the company, while about 10% goes to the landfill in Vinča.



Running parallel to the development of the "Green Regulation of Belgrade" project, a cadastral tool for green areas (also using GIS) has been developed. The main goal of this initiative is to secure an integrated database on green spaces for further processing of planning, use, maintenance and protection, whilst simultaneously enabling open access to the data. This will significantly improvement management of green space in the city.

Resources: Biodiversity



Indicator data for biodiversity is difficult to collect and generally biodiversity quality and abundance considered in terms of the overall environmental quality in the City. Some data was available for the city which indicate that biodiversity (measured in % annual change of the abundance of bird species) was broadly stable or even growing very marginally (<1%/year).

The city has a variety of ecosystems some of which are natural, and others are modified by anthropological activities. Within the wider territory there are various types of ecosystems including forests on the hills, inundation zone forests, swamp ecosystems, artificial water ecosystems, plantation forests, river ecosystems, abandoned agricultural lands and ruderal ecosystems.

There are nature and environmental protection laws and regulations adopted at the national level, which are supported by local initiatives. Relevant documents adopted at the City level include the Regional Plan for the Administrative Area of the City of Belgrade, the Belgrade Master Plan with the Report on Strategic Environmental Impact Assessment, the Afforestation Strategy for the Belgrade Area, Environmental Protection Program for the Belgrade City with the Action Plan Draft, the Climate Change Adaptation Action Plan with Vulnerability Assessment, the Risk Management Strategy of the City of and the Air Quality Plan for the Belgrade's Agglomeration.

Climate Change: Mitigation

Currently per-capita emissions for CO₂ equivalent is reported as being 5.2tCO₂e which is marginally below the "Green" benchmark of 5 tCO₂e/capita

The Republic of Serbia has been a signatory to **The United Nations Framework Convention on Climate Change** ("UNFCCC"), since 2001 and **the Kyoto Protocol** since 2008. As a Non-Annex I country, Serbia

did not have legally binding quantitative greenhouse gas ("GHG") reductions in the first commitment period. However, Serbia was committed to the establishing measures and activities to achieve the objectives of the Kyoto Protocol.

Serbia has also accepted to **be bound by the Paris Agreement** in 2017 which aims to limit the global temperature rise to well below 2°C and "endeavour to limit" it to 1.5°C.

In 2018, the City joined the **EU Covenant of Mayors for Climate and Energy** in 2018. This commits the City of a reduction of at least 40% in GHG emissions by 2030 alongside adopting a joint approach to tackle climate change mitigation and adaptation. As part of the commitments, the City is also required to submit a **Sustainable Energy and Climate Change Action Plan** ("SECAP") to outline the key actions they plan to undertake and will include a Baseline Emission Inventory to track mitigation.

The Republic of Serbia is preparing a cross-sectoral **National Climate Change Strategy and Action Plan** to provide a strategic and legal framework for action of climate change. It will identify priorities for emission reduction measures and assign responsibilities alongside financial resources.

A **National Energy Efficiency Action Plan** ("NEEAP") for Serbia was first introduced in 2010 with subsequent updates covering the period 2010-2018. Under the Law on Energy Efficiency, the City of Belgrade, is to implement an **Energy Efficiency Programme** for three years in line with the NEEAP.

Serbia has committed to an ambitious target to generate 27% of gross final energy consumption from renewable energy sources by 2020. The **National Renewable Action Plan** ("REAP") has been prepared for the Republic of Serbia sets out the targets and the pathway for achievement.

Climate Change: Adaptation and Resilience

Belgrade is already subject to longer periods of extreme heat and increased heavy precipitation events leading to flooding. Eight heatwave events have occurred over the last 20 years.

A series of relevant climate impacts or vulnerability assessments have been carried out at the national level for Serbia and local level for Belgrade, each looking at some of the same key sectors expected to be the worst affected.

The 2012 **Climate Change Vulnerability Assessment of Serbia** sets out a series of specific adaptation measures for a different list of affected key sectors including: water management, public health, agriculture, energy and biodiversity.

Serbia's Second national communication to the United Nations **Convention on Climate Change** in 2017 identifies four key sectors affected by climate change at the national level, and the subsequent for urgent adaptation action: hydrology and water resources, forestry, agriculture and health care.

In 2015, the City of Belgrade (led by the Secretariat for Environmental Protection) developed a specific **climate change adaptation action plan and vulnerability assessment** (CCAAP) which highlighted that the following sectors are particularly vulnerable to climate change in Belgrade, setting out specific adaptation activities for them as part of the Action Plan:

- Population
- Infrastructure
- Built environment
- Economy
- Natural resources



2.4.2 What are the current Pressures on the Environment?

Pressures have been analysed by sector. In each sector the indicators point towards a series of typical challenges that cities face. The challenges for Belgrade are summarised below:

Transport

Overview

Belgrade holds a strategic geographical location as a centre of Western Balkans and is well connected to the important trans-European transport networks (E70, E75, E763). Serbia is a transit country, with many local and foreign vehicles travelling on its road network. Three major motorways and 17 state roads are passing/ending in the wider City area. The road network of Serbia has 16,200.000 km of length. The streets network in Belgrade is 2,500 km long.



- **The Belgrade Bypass motorway** has been in process of planning and construction for more than 30 years. Construction was interrupted many times during the 90's crisis and because of lack of funds and coordination afterwards. Out of three planned sectors, Sector A (west) was completed, Sector B (south) has one carriageway under traffic and the second is under construction and Sector C (east) is still in the feasibility study and preliminary design stage. Construction of the Bypass is prerequisite for solving some of the traffic issues in Belgrade. The City's Bypass has huge national and international significance.
- **The Smart Plan and the Belgrade Master Plan** (GUP) include radial routes to connect suburbs to the City centre and to increase the capacity of freight routes on the City's ring roads (SMT and UMP are partially completed). Infrastructure to facilitate intermodal shift of freight to rail is also considered with intermodal centres (Batajnica, Vrčin, Airport zone), and a new Port on Danube and logistic centres.
- **Development of the Railway** network is based on relocation of the Central station (finished) and completing construction of new Central "Prokop" station. The length of the railway network within the City limits

is 161km. Construction of 44km of the new lines and reconstruction of 70km of the existing lines are planned. Modernisation of the “Beovoz” railway system which connects suburbs to the city centre is also planned. Despite 30 years of planning of the “Belgrade Metro” project, no construction has started yet.

- A recent concession signed by Vinci Airports and **Belgrade airport** will secure expansion of the airport infrastructure and increase its capacity. Development of the rail connection remains City’s obligation. The airport’s increased capacity has to be matched with the increased capacity of the city to airport connection.

The major infrastructure projects described above will improve the traffic situation in the city.

Is the vehicle fleet efficient?

While there are some new vehicles on the roads, neither the public transport fleet nor the private vehicle fleet is efficient. Our public transport fleet (both busses and trams) has a high proportion of older vehicles, with some well past their intended operational lives, including a number of pre-Euro standard buses.

The average age of the private car in Belgrade is high, but there is a positive trend. According to the recent statistics, the number of new cars registered in Belgrade is rising every year. Still, most of the purchased vehicles are old, used, imported from Western Europe. The EURO 5 standard for fuel is adopted and although many vehicles do not conform to this standard; this is the only fuel available at the gas stations. Old vehicles create a major air pollution problem within the City, especially in the City centre. Improvement of this indicator for commercial vehicles is directly related to the overall state of the economy.

Vehicle Fleet

Core Indicator:	Average Age of Fleet
Stakeholder Prioritisation	High Priority - Significant progress has been made in the public transport fleet, but private vehicles remain a challenge and there is considerable further opportunity to improve.

What is the preferred choice of transport mode?

The share of private transport (cars and motorcycles) in the City is 25.36%, which is relatively low. There has been an increase in private vehicle ownership in the last ten years observed (21.55% in 2008), a trend which is set to continue according to the projections. The increase is result of a general growth in wealth and increased number of people living outside of the City centre, which are more likely to choose private cars to access the City centre. A decrease in public transport use has been recorded. Investment in schemes that dissuade private vehicles from the centre and promote public transport use is key to control traffic and air quality issues.



Lack of underground parking in the central zone and development of metro and railway system may increase “park and ride” behaviour. This is particularly relevant for those who live in satellite cities and commute into Belgrade.

Modal Share

Core Indicator:	Transport modal share in commuting cars motorcycles taxi bus metro tram bicycle pedestrian
Stakeholder Prioritisation	Medium Priority - The city has a high modal share for public transport, but this is declining due to rising private car use, partly due to service provision not keeping up with growth in trips but also linked to increased socioeconomic status.

Is there significant congestion?

The average speed of cars on primary roads is 27.2km/h, with a negative trend in the last 10 years. Current growth in car ownership as well as the growth of the City population in general is likely to put pressure on movement within the City. Without the major infrastructure investments described previously the congestion will continue.



Congestion

Core Indicator:	Average vehicle speed on major thoroughfares
Stakeholder Prioritisation	High Priority - Congestion is increasing and while there are projects such as the Inner Ring Road and Metro, these are very long-term solutions and there is a need for medium term action in the interim.

Is the transport network resilient to climate change?

Bus and rail transit systems can run in case of disaster, but with reduced efficiency. The main problems are caused during wintertime and heavy snow. This is likely to be exacerbated by climate change. A changing climate is likely to produce harsher winters and growing levels of precipitation, as well as more variable rainfall patterns and temperatures which are likely to put assets at risk and put additional strain on emergency services.

Resilience to Climate in Transport

Core Indicator:	Interruption of public transport systems in case of disaster
Stakeholder Prioritisation	Medium Priority - There is recognition that there are vulnerabilities in the network and measures such Intelligent Traffic Systems have begun to be implemented which provides flexibility but there is a need for a mainstreaming of responses into planning.

Buildings

Overview

The largest energy consumers in Serbia are households, subsequently they are also a substantial source of CO₂ emissions. This is the field where significant energy efficiency improvements could be made. Residential buildings construction was the most intensive during the 1960s, 1970s and 1980s. Like other eastern states of that time, Serbia and Belgrade built multi-store buildings whose goal was to secure the largest number of apartments possible in the shortest



amount of time. A modular system – panel houses made of prefabricated elements – were common but did not consider energy efficiency.

Between 1960 and 1985, building construction in Belgrade was the most intense, but unfortunately the buildings from this period have the most inefficient heating. The building quality in terms of thermal insulation of the buildings is low, with additional deterioration over time due to inadequate maintenance. Thermal insulation was often not used at all or it was poorly installed, while the windows and doors today are also in inadequate condition. It is also evident that some heating installations are oversized, or the furnaces are in poor condition. High electric consumption per unit area in apartments is also associated with relatively low electricity prices compared to other energy sources, which is why citizens whose apartment is not connected to the district heating system opt for electric heating. Even in apartments that are part of large residential buildings connected to the district heating system, domestic hot water is heated in the boilers, which also increases its consumption.

Between 1985 and 1999, buildings were constructed following the standard that is practically the same as the current EU standards. Nevertheless, inappropriate application of regulations and high number of mistakes in construction has led to poor energy efficiency characteristics of housing funded in Belgrade. Thus, the energy spent in an average house in Serbia nowadays is sufficient to heat 3-4 low-energy-houses or 8-10 passive houses.

Investors in new buildings are obliged to obtain an energy passport for the house and to take care that the building is going to be constructed under energy efficiency rules. In order to establish more rational energy expenses, new buildings must have a system for measuring heat and expenditure. In contrast, the number of buildings that were built before the new regulation and in which the heat expenses are calculated per surface unit, is still substantial.

Electrical Efficiency in Buildings

The value of electricity consumption in buildings is higher than the GCAP red benchmark value, which indicates the need for adopting measures to reduce electricity consumption.



Residential buildings are a major contributor to the overall electricity consumption because about 28% of households in Serbia use electric power as energy source for heating. There is no data for electricity consumption for cooling which is significant and has increasing trend.

Electrical Efficiency

Core Indicator:	Electricity consumption in buildings
Stakeholder Prioritisation	Medium Priority - There are measures that can be taken including awareness and potentially small-scale renewables schemes (particularly for heating). There are some ongoing projects to improve efficiency in public buildings. It was also noted that private commercial buildings are out of the City's scope

Thermal Efficiency in Residential Buildings

The consultant was able to obtain data only for **heating** consumption in Serbia. Values higher than the green benchmark value indicate the need for adopting measures to reduce heat consumption accordingly. It was noted that non-residential buildings use significantly more fossil fuels per m² for heating than the residential buildings.

There are still a significant number of buildings and homes using solid fuel boilers in the city for heating which contributes significantly to local air quality issue as well as Carbon Emissions. There is a programme to replace them, but this could be usefully accelerated.

There is no formal green buildings certification in Serbia. Some investors with the ambition to build green buildings are applying for the LEED (Leadership in Energy & Environmental Design) Certificate. The certificate has been issued by the United States Green Building Council (USGBC) since 1994. Currently, no other initiative is present in the City.

Heating in Buildings

Core Indicator:	Heating cooling consumption in residential buildings, fossil fuels
Stakeholder Prioritisation	High Priority (highest) – There are many buildings which are thermally inefficient and there is considerable scope for improvement. The models are in place, but funding is insufficient.

Industry

Overview

Industrial development in Serbia in the last 20 years has been lagging behind most European economies and has been affected by the global recession that started in 2008. The economic crisis has effect not only on industry, but also on other aspects that are preconditions for positive economic and industrial development – such as demographic regression, education quality, undefined institutional responsibilities.

The share of industry in the City's GDP dropped by 5.5% between 2003 and 2014. In 2014, Belgrade's industry accounted for 12,373 companies, 95,000 employees (21.1%), and generated about 20% of turnover in the City. The biggest number of companies is in manufacturing – 11,738 companies that employ 68.8% of employees and produces a half of the industry's GDP in the City. Since 2011, direct foreign investments in manufacturing have increased, with very diverse distribution among sub-

sectors. Manufacturing generally has four sectors: food production, clothing production, printing and reproduction of audio and video records, and production of metal products (except machines). Among the sectors the one that stands out is the industrial production of food which employs almost 18,000 workers in 1,929 companies (15.6% companies, 18.6% employees, 13.4% turnover and 15.2% GDP of Belgrade's industries). There was little or no investment in high-technology industries.



City programs for the 2016-2018 include development of industrial zones. There is a significant area reserved for industrial development: 146 ha in Zemun, 600 ha along the motorways, 245 ha in Surčin, 166 ha in Bujanj Potok, and 132 ha along the "Ibarska magistrala" (regional road in the south part of the City). The City established the first free zone that offers special customs and tax reliefs to investors. The zone covers 100 ha and is adapted to receive more than 1,500 employees. The first investment came from the Chinese company Meita that invested 30 million Euros into building an auto parts factory with 800 employees and is in the process of building another factory for another 2,500 employees.

In terms of the GCAP, the absence of data monitored and reported about environmental aspects in industrial production represents a large issue. The industry sector in Belgrade used 15,055,000 m³ of water, but there is no information on the percentage of water that was filtered, again used or properly disposed of. There is however some information on electricity and heat consumption, and these results rank the City in the "red zone".

Is industry using energy efficiently?

Belgrade industry requires a meaningful improvement in order to get close to energy efficiency standards. Unfortunately, there is not enough data provided and therefore it is not possible to give an analysis of trends in energy consumption in industry.

Industrial Energy

Core Indicator: Electricity consumption in industries per unit of industrial GDP

Stakeholder Prioritisation Low Priority– In the cases of energy, heat and decoupling of pollution from economic activity, it is proposed to exclude industrial activity as it is outside the jurisdiction and influence of the city authorities.

Does industry manage its waste well?

The analysis showed that there is no data available when it comes to the share of industrial waste recycled as a share of total industrial waste produced. However, it is not expected that relevant amount of waste is recycled, therefore, there is significant importance to regulate treatment of waste in industry and monitor it for regular reporting routine.



Industrial Waste

Core Indicator: Share of Industrial Waste Recycled as a Share of Total Industrial Waste Produced (no data)

Stakeholder Prioritisation Medium Priority - Very limited information available however it is assumed that industry is not segregating solid waste and therefore recycling rates will be very low. Green policies for industry could be developed.

Does industry manage its wastewater well??

The analysis showed that there is no data available when it comes to the percentage of industrial wastewater treatment according to applicable standards. However, it is important to note that there may be sites discharging directly into the natural environment (with or without treatment) and the extent to which this might happen is not currently clear. The state of small streams in the territory of the City indicates that there is significant need for action in regulation of water treatment and monitoring for regular reporting.

Industrial wastewater

Core Indicator: Percentage of Industrial Wastewater Treated According to applicable standards (no data)

Stakeholder Prioritisation Medium Priority - There is a lack of understanding of the level of pollution coming from industrial sites but with severely degraded watercourses it would be beneficial to investigate options further for implementing green policies/regulatory measures. However, the consultant notes that similar constraints may apply in jurisdiction terms as with energy use.

Energy

Overview

The energy policy framework in Serbia is defined by the Law on Energy (Official Gazette No. 145/2014) and the Energy Development Strategy of the Republic of Serbia to 2025 and the Projections up to 2030. Belgrade participates with cc. 30% (4,435 kWh/inhabitants) of the energy

consumption in Serbia, which is expected to increase by 7-18% to 2025 when compared to 2010.

There are several power plants in Belgrade, owned by the state, with capacity of 3,200 MW. These plants produce more than 50% of total electricity production in Serbia and have significantly higher capacity than the City's demand. Serbia has the lowest electricity price for households in Europe and has one of the lowest electricity prices for industry, which have led to irrational consumption for heating (20-25% out of total electricity produced).

Wood is another heating energy source that is used more than it is desirable. It is estimated that between 10% and 20% of households in Belgrade use wood for heating. Share of the other fuels used for heating are natural gas (86%), oil (13%), coal (0.4%), biomass - pellets (0.24%), briquettes (0.2%) and fuel oil (0.13%). On average, annual energy production reaches 3,500 GWh. The district heating system has 730 km of pipes (or 1,460 km with return pipes) and provides heating for 21 million m², divided between residential (81%) and business (19%) consumers. There are large losses of energy in the system, which diminishes energy efficiency efforts.



The existing natural gas system has excess capacity. It can cover up to 200,000 households, but currently covers less than 50% of that number. Serbia is heavily reliant on the Russian Federation for oil and natural gas.

When it comes to renewable energy sources, the City's potential is substantial, but not utilised. Among the resources are geo-thermal capacity of ground water of 30°C, wind energy, energy of the Sun (sunshine hours range from 2,000 to 2,100 hours annually), bio-mass from agriculture and

communal waste that is estimated as the most relevant renewable energy source in Belgrade.

There is a new public private partnership for an Energy from Waste scheme which the City has signed with Suez, this will contribute:

1. Energy from waste plant, with capacity of 30.24 MW (electricity) and 56.5MW (heating)
2. Landfill gas power plant, with capacity of 3.09 MW (electricity) and 1.8MW (heating), with Landfill Gas Collection system.



Do People have adequate access to electricity?

The share of the population with authorised connection to electricity is reported to be 96%. There are illegal electricity connections, particularly within the Roma population. There is potential for improvement on this indicator.

Access to Electricity

Core Indicator:	Share of population with an authorised connection to electricity
Stakeholder Prioritisation	Low Priority – Stakeholders concur that access to energy is good.

Do people have adequate access to heating systems?

Some households still use individual heating systems in the buildings not serviced by the centralised network, but the largest environmental challenge represents individual furnaces that burn wood and coal.

During the prioritisation phase Stakeholders considered this a medium priority, however the consultant's judgement is that **high** is more appropriate as DH connections are a core part of the city's air quality strategy.

Access to heating systems

Core Indicator: Share of population with access to heating and cooling

Stakeholder Prioritisation High Priority- There is an ongoing programme to improve the district heating system (losses) but coverage is generally good. A key benefit is replacing solid fuel boilers as a source of heating and increasing district heating connections has been identified as a key measure in the city's air quality strategy.

How much energy is derived from renewable sources?

Renewable energy provision for Belgrade's energy consumption is currently not being reported. However, this is unlikely to indicate that there are no renewable energy sources. There is a desire to continue to increase renewable energy capacity in harmony with the cogeneration in energy production and higher use of biofuels.

Renewables

Core Indicator: Proportion of total energy derived from RES as a share of total city energy consumption in TJ

Stakeholder Prioritisation High Priority - There is very little consideration of renewables but believed to be lots of potential with large scale solar thermal, heat pumps, biomass and geothermal sources (particularly for district heating biomass and geothermal sources (particularly for district heating). There are ad-hoc schemes for ground source heat pumps and small scale solar.

How resilient is the electricity network to extreme climate events?

Climatic extremes causing power outage due to climate change are still not reported in Serbia. However, there is potential for this matter to become more frequent with the climate impacts predicted for the City.

Energy Resilience

Core Indicator: Average share of population undergoing prolonged power outage (No data)

Stakeholder Prioritisation High Priority - There are potential resilience issues in the heating network which could be significant. Particularly resilience of heating plants to flooding. Continuity in cold weather could potentially become critical at the city level.

Water

Overview

Belgrade has a reliable drinking water supply, storm drainage and flood protection systems. At the same time there is a level of neglect over environmental issues and efficiency. There is **no wastewater treatment**, **small rivers** are turned into **open collectors** of wastewater and there are only limited attempts to **improve efficiency**.

Is the water consumption too high?

Water consumption is relatively high whilst the price of water is relatively low at 80 dinars (€0.67) per m³ of drinking water for citizens. It is 144 dinars per m³ for other users. This price includes both drinking water supply and collection / conveyance of wastewater. Apartment buildings typically have one water meter and the bill for individual apartments is calculated based on the size of the apartment and the number of people



living in it. There is little or no incentive to save water, meaning that there are no significant plans to **reduce the water consumption** per capita or non-revenue water and no plans were made to start **reusing grey water**

Water Consumption

Core Indicator:	Water Consumption per Capita
Stakeholder Prioritisation	Medium Priority – Water consumption is high and there is a case for improving efficiency. Against GCAP benchmarks the case is more likely to be energy related than water availability related in Belgrade as supply appears very resilient.

Is the water distribution system efficient?

Belgrade's water company annual reports indicate that technical and administrative water losses are moderate. There is some doubt whether part of this information which relates to the technical losses is reliable. The bulk water meters in the Belgrade water supply network may not cover the whole of the system and in particular, the volume of water at all intakes, prior and after the treatment plants. It is not certain whether all water use is properly metered. There has also been an issue with the inadequate capacity of the unit for calibration and repair of the consumer water meters.



Distribution Network

Core Indicator:	% Non-revenue water
Stakeholder Prioritisation	Medium Priority – There are significant opportunities to improve leakage and to improve coverage of the network.

Is wastewater treated effectively?

There is no treatment of the municipal wastewater in Belgrade. Wastewater is discharged directly into the Sava and the Danube rivers, and into the small water courses in the urban city area. There are plans to build a major system of interceptors along the banks of Sava and Danube, a wastewater treatment plant (WwTP) at the location of Veliko Selo and few smaller WwTPs in other locations. That has not happened, and the available infrastructure at that location is almost non-existent.

The wastewater network in the old part of the town (the right bank of Sava) is conveying both wastewater and storm water. The networks in New Belgrade (the left bank of Sava) are separate for wastewater and storm water.

Wastewater Treatment

Core Indicator:	% of residential and commercial wastewater that is treated according to applicable standards
Stakeholder Prioritisation	High Priority – The absence of a wastewater treatment works means that sewage is discharge directly from combined sewer networks to waterbodies causing significant degradation, particularly in smaller watercourses. This is likely to be impacting biodiversity in smaller watercourses and potentially downstream.

Is the city resilient to natural disasters?

The most intense flooding took place in May 2014. The river Sava and its tributaries flooded the region in Croatia, Bosnia and Herzegovina and Serbia, east from Belgrade. In Belgrade, the municipalities of Obrenovac and Lazarevac suffered the most. The most intense precipitation in whole Serbia was 100 litres per m² in 24 hours. There were 30 casualties, 30,000 people were evacuated,



infrastructure and buildings were damaged and numerous landslides occurred. The open coal mine in Obrenovac was flooded. The total damage was estimated at € 1bn. Officially 2,260 dwellings and industrial buildings were flooded and 1,800 were under threat of being flooded. For this indicator we used the information that 5,000 families asked for financial assistance to repair their dwellings, which brought the indicator to the yellow zone.

Flooding risks

Core Indicator: % dwellings damaged by flooding in the last 10 years

Stakeholder Prioritisation Medium Priority – In 2014 there was significant flooding and property damage and there is a recognised risk of fluvial flooding from major watercourses in the city. The city has prepared Vulnerability and Risk Assessment, but implementation of management measures is piecemeal.

Solid Waste

Overview

The collection and disposal of solid waste in Belgrade is conducted by the Public Utility Company at the City level – “Gradska čistoća”. The daily amount collected weights about 1,500 tons, or 510,000 tons annually. With the construction and demolition waste the total weight goes up to 1,500,000 tons per year. The City has only one organized landfill in use since 1977. It occupies area of 130 ha located in Vinča (east part of the City) and is one of the largest landfills in Europe. It has reached its capacity and it is already non-sanitary, without lining, gas collection, gas release facility



or leachate treatment. Therefore, the land-fill causes series of environmental issues.

Inadequate waste disposal causes soil and groundwater pollution. Precipitation filtrated through the landfill brings harmful elements to the groundwater polluting both water and soil and influencing flora and fauna. Wind is additional transmitter of harmful materials that it spreads to soil and water surfaces. The location is near the Danube river, which is likely receiving significant volumes of untreated leachate. Finally, activities of machinery at the landfill produce noise.

The landfill is located on top of the important archaeological site of the earliest European civilisation dating back an estimated 7,000 years.

Due to its status, age and capacity, the landfill is in the process of being closed down, remediated, extended and management measures including leachate treatment and landfill gas collection implemented. An EfW (Energy from Waste) plant is under development that will generate up to 29 MW of electricity and 56 MA of heat. The closure of the old Vinca landfill site and the installation of a modern energy production facility is expected to result in significant environmental and social benefits for the City and Belgrade's citizens.

Waste management in Belgrade provides for regular collection and removal of waste which is carried out daily in residential apartment blocks. Removal of household waste in private residential areas is carried out less frequently. Therefore, only a small portion of the population receives a service of household waste removal less than once a week. However, the share of recycled household waste is low due to the lack of a separate collection system and public interest in recycling.

An additional issue in the field of solid waste are illegal and also non-sanitary dumps. There are more than 350 locations on the territory of the City – officially registered, but their actual number is expected to go beyond 500 and to be changing together with their location on daily bases. Due to their status and speed of changes, there are no precise data on their size or volume.

How much waste do we generate?

Municipal solid waste (“MSW”) production decreased in Serbia between 2011 and 2016. This trend is likely the same in Belgrade, some assessments declares 1-1.2kg per citizen daily. There is uncertainty concerning its amount and trend in the City. According to the available data for the year 2016, Belgrade belongs in the yellow flag category, which indicates that there is possibility for improvement. Especially when considering that the volume at illegal dumps is not registered.

Waste Generation

Core Indicator:	Waste Generation Per-Capita
Stakeholder Prioritisation	Medium Priority – There is a significant challenge with the disposal of waste, particularly in the short term with limited existing capacity at Vinča, prior to new facilities coming online. However overall waste reduction is desirable more broadly, irrespective of these challenges and education is probably the key tool to be employed.

Is waste collected efficiently?

There are comprehensive domestic solid waste collection services in the city. Awareness raising, education, encouraging people to recycling and pay fees could all be improved.

Waste Collection

Core Indicator:	Share of the population with weekly municipal solid waste (MSW) collection
Stakeholder Prioritisation:	Medium Priority – Waste collection is reported to be adequate although this is generally not segregate.

Does waste treatment include reasonable levels of sorting and recycling?



Separation of waste in Belgrade was optional, but aligned with the Draft National Waste Strategy, the PPP agreement includes a responsibility for the City to establish a separation system for the disposal of waste. Separated waste is distributed and treated in two recycling centres. There is informal waste collection which includes recycling. Collection of waste by the citizens is not recorded in statistics as “waste recycling”, because it is regarded as “sale and purchase transaction” and most of such transactions are not properly recorded. Therefore, data for informal recycling is not available.

Waste Collection

Core Indicator:	Proportion of MSW that is sorted and recycled Recycling Rates
Stakeholder Prioritisation	High Priority – There are limited measures to date to implement recycling. There is a proposal to install recycling centres in each municipality. Significant role in educating people to segregated waste and dispose of appropriately (once facilities exist)

Is there sufficient landfill capacity?

The old landfill at Vinča has already reached its maximum capacity. There is an ongoing programme of rehabilitation and extension of the site at Vinca which involves closing down and remediating the existing landfill and constructing new landfill facilities and an Energy from Waste plant. These facilities are due to be delivered and operated (over a 25 year period) under a PPP contract with an initial interim phase of operation due to commence at the end of 2021 and full operation of the site commencing in 2024.

Landfill Capacity

Core Indicator:	Remaining Life of Landfill
Stakeholder Prioritisation	Low Priority – The existing landfill is in the process of closure and remediation. However, there is an on - going public private partnership project involving construction of an Energy from Waste plant, remediation/demolition of existing waste plant, new landfill and remediation of the existing one, that is due to commence initial operations late this year. Rated as low priority as there is a strong existing response.

Land Use

Overview

The main goal of the City in terms of urban development and land use is to improve use of riverbanks and activate non-built and brownfield locations. There are 330,000 ha of land planned for urban development, out of which 77,581 ha are in central Belgrade. Belgrade is divided by its two large rivers – the Danube and the Sava river – into three geographical areas that, besides geography also have different histories in terms of urban development.

Land use change between 2010 and 2021, defined by the current Belgrade Master Plan, indicates that the urban development is seen

through sprawl of land intended for economic activities and housing, but also by significant increase of forest land. The land use category that is planned to undergo the biggest decrease in surface is agricultural land, which can significantly change environmental quality in the City.

Does the city have an optimal population Density?



Given the age of the General Urban Plan has made it difficult to establish an accurate view of the current population density. However, in general terms across the Belgrade metropolitan area, population density is below the level that is optimal for a city. However due to the very varied nature of the municipalities within the metropolitan area, there are different population densities across the City. As a general trend, density is growing as a result of urban transformation led by private investments which generally aim to turn one-family or a few-family houses into multi-storey buildings. This trend influences not only density, but also brings new activities into neighbourhoods.

Population Density

Core Indicator:	Density
Stakeholder Prioritisation	High Priority – There has been a significant amount of development outside the bounds of normal planning processes over the last 30 years and urban planning is trying to correct the challenges this has created. A new general urban plan is in preparation and provides a strong opportunity to bring Green City principals to future development

Is the city “sprawling”?

According to the Belgrade Master Plan, the total area considered by the plan should not change, but there will be internal changes within the boundaries. The increase of housing and residential land is planned for 3% percent, even though population number increase significantly depends on population in peripheral municipalities that are outside of the area Belgrade Master Plan area. As such, the rate of growth is well below the pace of change which would be a concern when considered against GCAP Indicators, but there is a risk that at some point it will need to increase.



Sprawl

Core Indicator:	Average annual growth rate of built-up areas
Stakeholder Prioritisation	Moderate Priority – The masterplan does not envisage sprawl but there has been a trend for development outside this plan over recent years. Detailed smaller scale masterplans are developed for the areas, but they do not respect the broader strategic principals at a city level.

Is current land use efficient?

We do not have data on the use of brownfield land, but the defined goals in the Development Strategy for the City of Belgrade suggests that there is a commitment to reuse industrial sites and neglected locations. The plan not to increase the area under the Master Plan, raises the possibility that part of the future development will occur in brownfields.



Commuting distance: The radius of the main living areas is around 7 km, but the City is large and certain percentage of daily commuters travel much larger distances (up to 50 km).

The City has a diverse public transport system that includes buses, trams, trolleybuses and trains serving the existing urban area. However, the number of vehicles available is not sufficient. The system needs to expand to provide a more efficient means of transport (metro). Otherwise the level of service may not keep up with growth in the outskirts of the City and there is a risk that outer suburbs and urban extensions become car dependent

Efficiency of existing land use

Core Indicator: Percentage of urban development that occurs on existing urban land rather than on greenfield land (no data)

Stakeholder Prioritisation High Priority - There are areas not being developed with practices such as “land banking” which are blocking development on inner city sites and creating additional pressure to sprawl and pressure on greenspace. Stronger urban planning policies are required and should be contained in the General Urban Plan – and then enforced.

2.4.3 Social and Gender Considerations

Current social and gender inequalities in the City of Belgrade create vulnerabilities and marginalisation of specific communities that result in individuals being at-risk on a number of fronts related to access and

affordability of urban services. Vulnerable groups include: women and girls (related especially to gender based violence, femicide, low participation in decision making and a gender pay gap in the labour market), children, youth, elderly (19% of the city population is 65+ years; 3,000 65+ lived in 100 licensed care homes in 2016), marginalised (e.g. LGBTI especially trans and intersex individuals), Persons with Disabilities (PWD), persons with chronic diseases, low income households (especially low educated and single headed households), unemployed persons (especially 15- 24 years), persons living in substandard housing (in 2016, 3.5% of shared homes did not have a bathroom, 51% of homes were not connected to water, 11% were not connected to sewage and many homes were not covered by regular solid waste management services), and migrants and displaced people (especially the 1.7% of the population that is Roma).

Social and gender vulnerabilities in the City manifest in a variety of ways. For example, the City of Belgrade has a poverty rate of 4% and an unemployment rate of 11.9% (and a national unemployment rate of 20.7% for 15-24 year olds³, trailing behind that of the EU-27 – though this has fallen significantly from levels of 52.5% in 2014). Furthermore, according to the “Third National Report on Social Inclusion and Poverty Reduction in The Republic of Serbia”, 2018, Serbia remains behind the EU-27 average for the following: income inequality with a Gini co-efficient of 38.6 (the EU’s Gini co-efficient is 30.7), unmet medical needs at 10.5% (the EU is at 4.5%), unmet dentistry needs at 14.8% (EU is at 5.6%) and the average life expectancy is 76 years (the EU is at 80 years).

To combat these exclusions, and to complement the accession negotiations for the EU, a number of national strategies and programmes have been developed which will positively impact the City of Belgrade. The Government of Serbia, supported by the Social Inclusion and Poverty Reduction Unit (SIPRU), has developed strategies targeting vulnerable social and gender groups. These include: Law on Housing and Maintenance of Buildings, Gender Equality 2016-2020, Improvement of the Position of Persons with Disabilities, Resolving the Issues of Refugees and IDPs and Social Inclusion of Roma Men and Women 2016-2025. National

³ “The youth unemployment rate is at a record low”, Isti Nomer, 13 October 2020
<https://www.istinomer.rs/izjava/stopa-nezaposlenosti-mladih-je-rekordno-niska/>

programming partnerships include: the UN Women Programme Office in Serbia and the programme “the Gender Equality Facility - GEF, 2018-2020, funded by the European Commission; and the International Labour Organisation (ILO) with the “Decent Work Country Programme for Serbia 2019-2022” (DWCP), which specifically addresses: high youth unemployment and inactivity, generally low employment rates with a pronounced gender gap, informal employment and the risk of poverty or social exclusion. International level commitments to the Sustainable Development Goals and Paris Agreement obviously filter down to the City of Belgrade and also provide opportunities for collaborations that promote social and gender inclusion.

Given that the City of Belgrade has a growing population driven by rural migration and emigration, the suggested GCAP measures are critical in providing efficient and effective climate responsive services and facilities that positively impact social and gender exclusion.

2.4.4 Smart Cities Potential

Smart cities utilise smart, interconnected devices that communicate with one another to connect disparate utility, infrastructure and public services to generate real-time data. This data can help cities manage their services more effectively to deliver a range of benefits for their citizens including reducing pollution and improving the environment of a city.

There is an emerging trend of using technology in infrastructure projects to provide improved value for money, better utility and improved performance against key indicators. For example, in recent 2018 McKinsey report⁴ it was claimed that smart applications in infrastructure could cut greenhouse emissions by 10-15%.

The concept of Smart Cities is not new to Belgrade with the vision for the Belgrade Development Plan (2017- 2021) strongly emphasising the need for investment in Smart Technologies stating that “[The] City of Belgrade is a competitive, sustainable and smart city devoted to life quality

improvement for its citizens, what is generally planned through minimal waste of resources and maximal use of ICT”.

One of the main objectives is smart governance that provides good quality, efficient and effective service provision to all users. Furthermore, transparency, user participation, involvement of all stakeholders, direct communication between government and citizens and an early involvement of public in planning processes permeate priorities and measures were set⁵. There is also an emphasis on strengthening collaboration and building skills in the city to be able to deliver high tech services.

While a detailed analysis of Belgrade’s “Smart City” capability was not a part of the formal GCAP analysis process, this plan does identify where smart city opportunities exist within each of the GCAP Actions to ensure that further consideration is given to technological opportunities during the development of individual projects. Nearly all of the actions have potential to benefit from technology. A key challenge will be coordination of technologies to ensure that data is effectively captured and used to its full potential which may mean ensuring compatibility across platforms and critically, accessibility of data beyond the organisation collecting it (ideally into open-source domains).

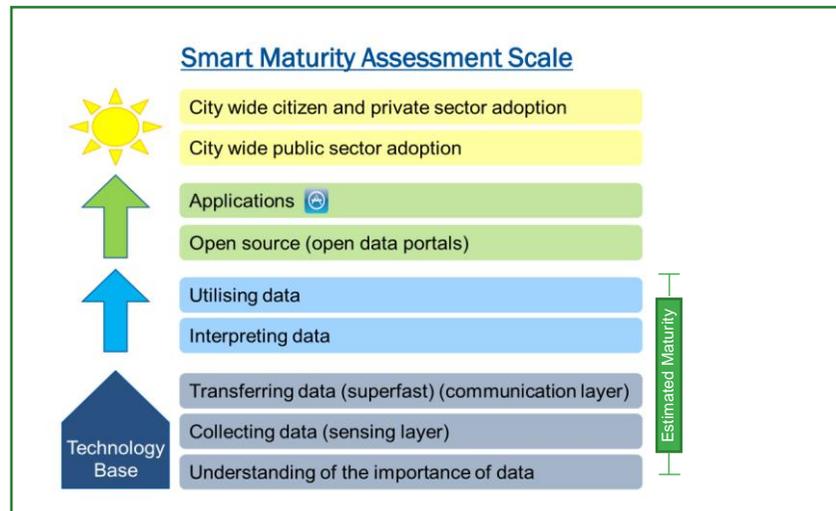
Supplementary guidance to the Green Cities Methodology recommends that cities undertake a “Maturity Assessment” to understand the extent to which a city has integrated and benefited from smart technologies in their service provision to date and evaluate capacity to adopt smart technologies and over what timescale that might be reasonable. This could then be used to determine the extent to which Smart Technologies could be deployed in GCAP actions or whether planning to achieve actions which are “Smart Ready” is a preferable strategy. This will vary from sector to sector, with some delivery agencies having advance capacities and some agencies requiring further capacity development to fully benefit from technological opportunities.

⁴ [“Smart Cities: Digital Solutions for a more liveable future”. McKinsey Global Institute 2018](#)

⁵ “Smart City Concept in the Strategic Urban Planning Process: The Case study of the City of Belgrade, Serbia” Damjanovic et al 2017 <https://www.researchgate.net/publication/330841591>

The scale against which the city's maturity could be measured is presented in Figure 2-2 below. This sets out a series of milestones against the way the city uses data starting from a basic understanding of the importance of data, through several stages of sharing data, then using and analysing data, then publicising and openly sharing data for third parties to use and finally a state where the data is open and there is wide use of common datasets across public sector, private sector and citizen networks to plan activities, whether that is planning a journey as a citizen, making an investment decision in the private sector or designing a policy.

Figure 2-2 Smart maturity assessment scale and basic analysis of Belgrade's position on the scale



The consultant's initial assessment is that the city has a traditional understanding of the importance of data and has developed some fairly sophisticated databases (particularly in greenspace and land use management). However, there is not widespread open sharing of data which could inhibit the potential effectiveness of technology driven solutions

2.5 Priorities and Strategic objectives

The GCAP process sets out that Strategic Objectives are required to define long term goals (10-15 years) and guide the direction of the GCAP to contribute to the Vision. These should relate to the priority areas and policy gaps identified in the Technical Assessment Report.

These Strategic Objectives are then supported by Mid-Term Targets (5-10 years) which set more tangible targets to build towards achieving the Strategic Objectives.

A range of potential Strategic Objectives and Mid-Term Targets for the GCAP was identified, based purely on the outcome of the Technical Assessment process, which was largely based on the analysis of internationally benchmarked indicators, which were collected as a part of the technical assessment processes.

Subsequent engagement with stakeholders, through a prioritisation workshop helped to refine the City's key priorities and provided additional information with which to refine the proposed strategic objectives. Based on the outcome of this process the following Strategic Objectives and Mid Term Measures were defined.

Strategic Objective	Mid Term target
S.O.T1 – Improve city mobility and reduce congestion	Cut journey times around the city so that the average commute for citizens is below 30 minutes (currently 32.5)
S.O.T2 – Enhancing Green Mobility in Central City Area	Improve green mobility in the central area by increasing the share of trips by green modes (walking, cycling) by 5% (currently <2%), with share of 80% for cycling and 20% for walking and 100% “clean” public transport in the central area
S.O.T3 – Increasing use of alternatively fuelled vehicles	Encourage a transition to e-vehicles, achieving 40% for bus, 80% for taxi, 100% for city owned vehicles, 80% of commercial transport vehicles and 20% in private vehicles of vehicle fleet by 2030
S.O.L1 – More intensive use of existing underused urban structures by increasing compactness, density and overall urban quality on selected planned locations/zones (along the main public transportation corridors)	Champion reuse of land in urban areas over greenfield development. On average 40% of development should be on brownfield land by 2025 raising to 50% by 2030.
S.O.L2 – Preventing sprawl by limiting unnecessary suburban land take and expansion of construction land.	In order to rationally consume land and protect green and open areas such as forests, agricultural land and important ecosystems, it is not possible to expand construction land until the existing construction areas of the city are used for at least 80% of their area.
S.O.L3 – Improve the importance and capacity of Green Infrastructure and provide access to public green spaces in all parts of the city	Develop a planned network of urban green infrastructure and open space to provide ecological (e.g. Climate Resilience) and social benefits (e.g. access) to achieve at least 23% of the cities total area to include elements of green infrastructure at the city level in accordance with the PGR of green areas.
S.O.B1 – Take action to improve the energy efficiency of the city's buildings	Achieve the reduction in final energy consumption in municipal buildings by 40% compared to 2015 and by 20% in residential buildings beyond the ambition of national legal requirements through encouraging renovation and nearly zero energy buildings where possible.
S.O.B2 – Using existing buildings to create elements of green infrastructure	Maximise opportunities for green infrastructure in and around buildings including green roofs, vertical spaces, and other localised green spaces for building users in accordance with the existing CCAP.
S.O.E1 – Developing and improving the efficiency of the district heating distribution network	Rehabilitation of the district heating distribution network to create programmes, tailored to various groups of consumers, to result in efficient, accessible connections for 97,000 new customers (half for heating and half for heating and hot water) of various types of end-users by 2030 - and thereby reduce air pollution.

Strategic Objective	Mid Term target
S.O.E2 – Cut Greenhouse gas emissions from the City	Reduce greenhouse gas emissions for the city by at least 40% by 2030– by broad means but particularly through improvements to district heating and adoption of renewables.
S.O.W1 – Reduce the losses in the network to achieve water saving and reuse	Reduce the losses in the water network to less than 20%
S.O.W2 – Protect more of the city from the risk of flooding	Reduction in the number of properties at risk of flooding (particularly from stormwater flooding) in the city in line with the Conclusions of the national flood strategy which is currently under development
S.O.W3 – Capture and treat wastewater	Achieve at least a 40% connection rate for residential and commercial properties connected to a sewage network with treatment
S.O.SW1 – Improvement of infrastructure for separate collection, sorting, reuse and recycling of waste	Implement infrastructure investments to enable at least 20% Municipal Solid Waste recycling rates by 2025 as interim and 65% by 2035 (as per EU target)
S.O. CCA1 – The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning)	Consideration of adaptation, resilience and disaster risk is clearly mainstreamed into all of the city's major decision-making processes evidenced by a clear mandates and institutional structures to operationalise the plan.
S.O.GS1 – Substantially increase the "tree cover" territory and level of porosity of Belgrade's territory	Increase the forested area of Belgrade by 10% between 2020 to 2025

3 Action Plan

What does this chapter tell me?

- How were the GCAP actions identified?
- How were the GCAP Actions filtered and selected?
- What are the actions themselves?

This chapter also includes the details of each proposed action in the following sectors:

- Urban Planning and Mobility
- Energy and Efficiency
- Water and Waste
- Greening and Resilience

The Green City Baseline presented helped us to understand and prioritise challenges within the city. The next important task was to understand and prioritise the opportunities to address those challenges. To do this we have followed the Green Cities Programme's process to formulate Green City Actions. This involved identifying a long term vision for the city, setting strategic goals for the next 10 to 15 years, establishing mid-term targets so that we can monitor progress towards our vision and finally establishing the specific short term actions that we need to take to make the long term vision a reality.



The following approach was followed to develop a shortlist of short term GCAP Actions. Each component is described in more detail below.



3.1 Identification of Actions

The first step was a review of key current plans by sector to identify potential projects that could be included in the GCAP. This was based on information collected as a part of the political framework report. Key documents included:

- Belgrade City Environmental Protection Program
- The Development Strategy of the City of Belgrade
- Climate Change Adaption Action Plan and Vulnerability Assessment

This was also informed by engagement with stakeholders primarily through a prioritisation workshop held in December 2019, but also by technical engagement throughout the process of developing the policy and regulatory framework and the technical assessment reports.

These options were then collated into a "questionnaire" which took the format of a table containing all potential projects and highlighting gaps in the Consultant's understanding of the challenges. Requests were then directed to technical experts within the City and the City managed enterprises (via the City's "Working Group"), to solicit feedback on the "long list".

The initial "long list" of options totalled 109 potential Actions based on the research done during the Technical Assessment and Prioritisation (of challenges), stakeholder workshops and bilateral engagement with City officials.

A further activity was undertaken to refine and rationalise these Actions into a shorter list of potential projects. Projects were aggregated for the following key reasons:

- Several projects could be usefully rationalised into as one programme of Actions delivered together
- Identified Actions had duplicated similar or identical objectives and could be usefully rationalised into one Action
- The actions had a Climate Adaptation driver, but it was possible to embed them in another Action following the principle of “mainstreaming” Adaptation and Resilience rather than addressing it as a separate issue.

This aggregation resulted in a list of 76 Actions in total which we considered as the “Long List” of projects to be considered in the Options Analysis. This full list (and the analysis described below), is presented in Appendix B.

3.2 Evaluation of “Long List”

The Long List of Actions was correlated against the Strategic Objectives, evaluated against a series of qualitative criteria (defined below), ranked based on relative scores against the qualitative criteria, and filtered to ensure that actions to be included in the GCAP or SECAP are likely to be effective and appropriate to the GCAP or SECAPs objective. The results of this evaluation are presented in detail in Appendix B.

3.2.1 Multicriteria Assessment

Each potential Action was subjected to a basic multicriteria analysis, testing each proposal against five key criteria to determine their level of suitability for inclusion in the GCAP. These include:

- **GCAP benefit** – Will it have a meaningful impact on a priority area or strategic objective that has been identified in the GCAP development process?
- **Additionality** – Will inclusion in the GCAP significantly improve the probability of the project being delivered? Projects that are already being delivered under other programmes should not be included unless they could be scaled up.

- **Deliverability** – Based on expert opinion and the limited data available, is it likely to be technically deliverable?
- **Indicative likelihood of financing** – Is it likely to be within the capacity of the city to afford the project or for other financing entities (government, IFIs, donors) to finance it?
- **Political alignment** – are there significant political factors that mean the project should not be included?

Alternative Criteria were set out to determine whether or not projects should be considered for inclusion in the SECAP, which has a narrower focus on Climate Change issues. These included

- **Mitigation potential** – is the project likely to meaningfully contribute to reducing or offsetting the City’s carbon emissions?
- **Adaptation potential** – is the project likely to meaningfully contribute to the City’s potential to adapt or be resilient to climate vulnerabilities?

The full qualitative framework for this analysis is set out in Table 3.1

Table 3.1: MCA Criteria

	0 (Eliminate) – None	1 – Limited/Low	2 Good/Moderate	3 Excellent/High
GCAP Criteria				
Benefit	The project will not contribute to delivering strategic objectives or could damage the prospects of achieving a strategic objective	The project will contribute to strategic objectives but is unlikely to make a material impact.	The project is well aligned and will have a notable and measurable impact on a strategic objective	The project is very well aligned with strategic objectives and will have a transformative impact on a single objective or a notable and measurable impact on multiple objectives
Additionality	The project is ongoing and already funded or has secure funds committed and cannot / should not be scaled up	Inclusion in the GCAP may provide an alternative source of funding and make a project more likely to happen or be scaled up	Inclusion in the GCAP will likely improve the scale of a project or significantly improve its prospects of going ahead	The project is not otherwise included in existing / ongoing programmes or is at a low scale and will not happen / be scaled up without inclusion in the GCAP and subsequent implementation.
Deliverability	The project is unlikely to be technically feasible or relies on technologies that are not yet available.	The project is deliverable in principal but would be extremely technically challenging and high risk.	The project is feasible in principal and deliverable with a 5-10-year timeline but may require additional capacity amongst key implementing actors.	The project is proven to be feasible and could be delivered quickly (i.e. <5 years) given capacity of the key implementing actors.
Indicative likelihood of financing	The project is likely to be outside the City's budget and / or does is not likely to be interesting for other sources of finance.	The project is potentially affordable for the city and / or interesting for other sources of finance, but it is likely that it would significantly diminish the city's ability to implement other projects.	The project is likely to be comfortably within the limits of resources for the city and / or would be interesting for other sources of finance.	The project is easily within the limits of resources of the city and / or is highly likely to be interesting for other sources of finance.
Political alignment	The project is counter to a key political position of the Mayor or the Council and is highly likely to be rejected.	The project would be politically contentious and is likely to face significant political opposition.	The project is well aligned and is unlikely to face substantial political objection.	The project is fully aligned with existing political commitments and would be uncontentious during the approval process.
Additional SECAP Criteria				
Mitigation potential	Likely to create significant additional GHG emissions	Neutral or Marginal benefit for GHG emissions potential	Notable and measurable impact on GHG emissions	Very large impact on GHG emissions
Adaptation potential	Likely to reduce resilience to climate change	Neutral or Marginal benefit adaptation / resilience potential	A clear direct benefit in terms of adaptation/resilience benefit.	Significant adaptation / resilience benefit.

Assessors used the multicriteria assessment (MCA) framework to score each option from zero to three to indicate the extent to which it aligned to the Green Cities programme's broad objectives. The scoring mechanism was adjusted for each criterion, as described in Table 3.1, but followed the principals below:

- 0. **No alignment** (projects which are not aligned with the criteria and therefore scored zero above were recommended to be excluded from the GCAP)
- 1. **Limited/Low Alignment**
- 2. **Good/Moderate Alignment**
- 3. **Excellent/High Alignment**

As the assessment was qualitative, there was a risk of subjective bias from different reviewers. To mitigate this, an online workshop was undertaken amongst the assessors to understand the methodology and several examples from a range of sectors were analysed collectively to form a common understanding of the criteria amongst the assessment team. The ratings were subsequently reviewed by the Team Leader and the Financial Expert to identify areas where inconsistencies in approach may have emerged. These were then adjusted by the team to form the final scoring.

3.2.2 Application of Weightings

The results of the MCA provide an objective basis for proposing a technical prioritisation of options. However, due to the narrow band of scoring (0-3) there was limited differentiation between the scores, and it was considered beneficial by the Consultant's team to apply weightings to the overall scores to provide a mechanism for further differentiating between the "Proposed Actions".

Weightings (x5) were added to:

- **Benefit** – the importance of benefit (which relates to the objective's ability to address Strategic Objectives) was elevated as this is the fundamental purpose of the plan
- **Deliverability** –elevated to ensure that implementable projects were prioritised

- **Indicative likelihood of financing** –elevated to ensure that projects which were likely to attract finance were prioritised

A neutral weighting (x1) was added to other criteria:

- **Additionality** - Not elevated as it was of most use as a binary measure for exclusion (i.e. if it added nothing to existing plans, it should not be considered). While it is useful to differentiate scales of additionality for prioritisation of selected Actions, it was not felt to be a critical screening criterion.
- **Political Alignment** - Our assessment provides an indication of likely political challenge based on the Consultants' experience. This is useful in understanding if projects may be politically contentious. Therefore, minimal additional weight was added to this criterion.

3.2.3 Ranking of GCAP Options

Weighted scores derived from the process above were then summed for each Action, to give an indicative level of priority and provide a common basis on which to rank Actions. We have chosen to use a percentage score to approximately indicate where an Action ranks within the list of options (with 100% being most favourable and 0% being least favourable). However, there are a number of important limitations to this method which should be highlighted:

- The scoring used is qualitative and while based on expert opinion, is therefore subjective.
- The data available to make decisions on individual actions is limited and therefore it is based on the Consultant's experience of the type of project, rather than being a detailed assessment of the specific Action.
- The scores allocated are not a linear scale - i.e. one cannot infer that the difference between a score of 1 and 2 represents the same scale of change as the difference between 2 and 3, or that differences between categories are similar. As a result, "summing" the scores across categories (as we have) and providing a numerical value may inaccurately infer a level of analytical rigour that is not intended.

Consideration was given to developing thresholds for categories of projects to help provide a stronger objective basis for categorising Actions into high,

medium, or low priority groups (and ultimately where appropriate to screen out Actions). However, based on the limitations described above we concluded that this was not appropriate and that the ranked scores should only be used as a broad guide to the assessor when developing conclusions about each Action.

3.2.4 Overall Assessment of GCAP Actions

Based on a combination of the percentage score and notes provided by assessors and expert judgement, each Action was reviewed to determine whether it should be a High Priority (i.e. that it is a key intervention), Medium Priority (it is a valuable intervention), Low Priority (it is a constructive intervention but of limited value), or if it should be excluded (it is not aligned to the Strategic Objectives or it is perceived to perform poorly on a number of the criteria). A conclusion for each option is provided in the "GCAP Conclusion" column of Appendix B.

Any projects scoring zero in any of the MCA categories described above were considered to be "non-aligned" and were excluded on the basis of this score. The detailed assessment table presented in Appendix B records these projects (31 in total) and identifies the explicit rationale for excluding them.

39 Actions were proposed for inclusion in the GCAP. 39 Actions were ultimately proposed for inclusion in the GCAP.

After Options workshop and consultation with stakeholders, **finally 35 Actions were selected for this action plan** and these are presented in this Action Plan.

3.3 Urban Planning and Mobility



3.3.1 Current framework

Transport

The **Belgrade Master Plan** for 2021 defined the following key transport infrastructure improvements:

- Completion of construction of the Belgrade Bypass from Dobanovci to Bubanj Potok (Sector B) and start of construction for Sector C – from Bubanj Potok to Pančevo;
- Construction of the connection with the E763 Motorway in vicinity of Surčin,
- Continuation of the development of the Inner City's Ring Roads (SMT and UMP);
- Planning and designing of the new "Avala" road;
- A total 218 km of new roads and 308 reconstructed roads;
- Infrastructure to facilitate intermodal shift of freight to rail including intermodal centres (Batajnica, Vrčin, Airport zone);
- Development of a new Port on the Danube and logistics centres;
- Relocation of the Central station and completion and of the new Central "Prokop" station to its full capacity;
- Modernization of the "Beovoz" suburban railway system, 44km of new railway;
- Development of the "Belgrade Metro" project;
- Improved parking capacity – 58 new garages, 17885 parking spaces, and Park & Ride development;
- Belgrade Airport expansion improving infrastructure and capacity;
- 258 km of new Bicycle Paths

The **Belgrade Smart Plan** is the approved mid/long-term development strategy for urban municipal transport. The Smart Plan was published in 2015, therefore progress of its implementation can be measured. Three key milestone dates are defined in the plan, for years 2021, 2027 and 2033. Focus is placed on the following key development projects:

- New bridge on the Sava in the Belgrade Waterfront area with a tunnel connection to the Danube hillside area;
- Development of the "Beovoz" railway system;
- Development of the Inner City's Ring Road – UMP;
- Development of the Inner City's Ring Road – SMT;

These projects are estimated at 500 million Euros excluding the Metro project which was not considered in terms of costs.

Urban planning

The current documents that regulate land use are the **Regional Spatial Plan of the Administrative Areas** of the City of Belgrade, the **Belgrade Master Plan** for Belgrade 2021 and other more detailed plans. In addition, the Serbian Parliament has adopted a legislative act – **Lex specialis** – that defines land use in the Sava amphitheatre as a project of national importance. Therefore, this is one of the priority development zones and is undergoing through significant infrastructural, land use and development transformation. Other zones of interest are parts of New Belgrade (blocks 18, 18a, 68, 69, Staro Sajmište), the harbour area and Ada Huja at the Danube river, commercial zones alongside the highway and Makiš.

In the past few years, there has been intensified activity in the creation and adoption of urban plans for areas of the City's. In 2013, the Regional Spatial Plan of the Administrative Area of the City of Belgrade was revised, as well as seven spatial plans for city municipalities on the outskirts of the city (Lazarevac, Surčin, Barajevo, Mladenovac, Sopot, Grocka and Obrenovac.

Potential locations for large projects and interventions in the City were defined in the Belgrade Master Plan with the aim of rehabilitating it and transforming areas of former industry and military complexes. Besides that, the plan has recognized the importance in defining economic activity zones and green areas. Simultaneously the General Regulation Plan of Built-up Area for Units of Local Self-government of the City of Belgrade was adopted. In comparison to 2009, when 36% of built-up areas was covered by plans, adoption of this document increased coverage to over 55,000 ha or about 70% of its territory. This act also enabled direct application of building regulations on the more than 27% of the city's territory.

One of the goals of the previous **Development Strategy** (2011) was the adaption of the Sava amphitheatre for public use, which was inherited from the current Strategy under the **Special Purpose Area Spatial Plan for the Part of the City of Belgrade's Riverbanks**, which covers part of the Sava riverbank and the "Belgrade Waterfront" project. Besides a large number of apartments, this project also includes reconstruction of the Old Railway Bridge, entire urban infrastructure in the area, etc. The City has also created a detailed regulation plan which covers the relocation of the bus station, railway terminals in New Belgrade, relocation of the main railway station, location of new underground garages, and widening of pedestrian zone in the city centres, etc.

Significant changes to land use planning and the urban development system were made in 2015 at the national level. The procedure for obtaining a building permit was simplified and speeded-up, which was one of the necessary enablers for foreign investors to build in Serbia and Belgrade. Other innovations that the City is working on include a GIS system for Belgrade, a small publication "Brochure for the open public spaces" and "Urban Mobilier Catalogue". Also, the application of the Identity, Mobility, Ecology or "IME" project⁶ makes changes in land use because it aims at the removal of illegally built buildings in public spaces.

3.3.2 Key Challenges

The key perceived challenges and response gaps for the transport sector in Belgrade are as follows:

- **The average private car in Serbia is old but are getting newer.** Each year the number of new cars registered is rising. However, most of the purchased vehicles are aged used cars imported from Western Europe with significant mileage. In public transportation, City owned operator (GSP) fleet is on average 9.5-years-old, but Private operators own newer, modern busses with an average age of 4.5 years.
- The main pressure from transportation on air quality and overall environmental quality is driven by the fact **that 64% of all vehicles are run on diesel fuel. In addition, EURO3 fuel standards are still in**

place, meaning that vehicle running on EURO3 fuel can be officially be registered. To break this negative trend, regulation of high-polluting vehicles is envisaged at a state level, to prohibit the import of used cars with poor emission classes.

- Related to the previous challenge **there are not enough fiscal instruments** to encourage the wide usage of newer and more efficient hybrid or electric cars.
- With 95 km of bicycle network in Belgrade and 258 km planned, there is a need to promote healthy non-motorized transport. Due to topography and urban limitations **a key challenge is to relieve the Central City area of motorized transport and introduce bike sharing schemes.**
- As a result of the constant growth in Belgrade's population and unrealized major infrastructure projects which are necessary for urban sustainability, **travel speed of Bus services is expected to reduce in the next period.** Bus lanes dedicated to public transport have not been developed in the last 10 years. This is an important measure to sustain current speed until longer term projects are finished (Metro, City rail, Belgrade Bypass., etc.).
- An overall **lack of Parking spaces** requires rapid implementation of existing plans and the development of additional in-depth CBA analysis.

The key perceived challenges and response gaps for land use in Belgrade are as follows:

- **Illegal buildings** occupy land regardless of its status as building land, agricultural land or green areas.
- Indicators such as vacancy rates of offices, average commuting time, proportion of the population living within 20 minutes of everyday services, grocery stores, clinics, etc., and the proportion of urban development that occurs on existing urban land rather than on greenfield land, are not monitored. This data is relevant for shaping further development and plays significant role in life quality of the City's citizens, therefore, monitoring is required to support in good quality, **evidence-based planning.**

⁶ https://www.beograd.rs/images/file/b41dd8dfe4a5f7beff586c8ccc794ab5_1523818262.pdf

- **Public transport** should be proportional to daily number of users and its **efficiency** (speed and speed of repair) should be improved. In addition, the average age of the vehicles indicates that public transport could be a significant source of air pollution in the City.
- **Sprawl of built-up areas** should be **controlled**. This type of growth has tendency to enlarge spontaneously, in contrast to green areas that are usually established through formal planning processes.
- Increases in the number of multi-family housing and multi-storey buildings requires diversification of facilities and activities in an area. At the City level, this diversity is not considered sufficient, which suggests that more emphasis should be put on **timely planning and implementation of plans**.
- The gravitational zone of the City is large, therefore, the **definition of commuting time** should be adapted to this fact and monitored so that activities and traffic are more successfully planned and distributed.

3.3.3 Objectives and Actions

The following objectives and actions have been defined for the Urban Planning and Mobility sector

ID	Strategic Objective	Action	Key action components	Estimated CAPEX (Total & 2021-2026)	Annual OPEX (EUR)	Timeline
Mobility - Transportation						
T1	S.O.T1. Improve city mobility and reduce congestion	Extension and development of the Belgrade Train and Tram	Investment, Study	200 M 100 M	1.5 M	Q4 2021 – Q4 2030
T6		Commercial transport policy – City Logistics	Study, Policy	0.5 M 0.5 M	N/A	Q3 2021 – Q3 2022
T4	S.O.T2. Enhancing Green Mobility in Central City Area	Bicycle-Sharing System	Investment, Study, Policy	6.45 M 4.61 M	0.2 M	Q3 2021 – Q2 2027
T5		Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycleways	Investment, Study, Policy	33 M 16.5 M	0.25 M	Q3 2021 – Q4 2030
T3	S.O.T3. Increasing use of alternatively fuelled vehicles	Purchase of electric buses and busses that use RES with infrastructure development	Investment, Study, Policy	950 M 475 M	2.0 M	Q3 2021 – Q4 2030
T7		Plan for a network of public chargers for electric vehicles	Investment, Study, Policy	10 M 10M	0.2 M	Q3 2021 – Q3 2026
T8		Incentives and financing of e-vehicles for public and private commercial vehicles	Investment, Study, Policy	5 M 5 M	N/A	Q3 2021 – Q3 2026
TOTAL				1,204.95 M 611.61 M	4.15 M	
Urban Planning - Land Use						
L2	S.O.L1. More intensive use of existing underused urban structures by increasing compactness, density and overall urban quality on selected planned locations/zones (along the main public transportation corridors)	Brownfield Development Programme	Study, Policy	0.5 M 0.5 M	N/A	Q3 2021 – Q3 2024
L5	S.O.L2. Preventing sprawl by limiting unnecessary suburban land take and expansion of construction land	Urban Land Management Policies and Instruments	Study, Policy	0.1 M 0.1 M	N/A	Q3 2021 – Q1 2022
L1	S.O.L3. Improve the importance and capacity of Green Infrastructure and provide access to public green spaces in all parts of the city	Linear Park Project	Investment	50.0 M 50.0 M	0.05 M	Q3 2021 – Q3 2023
L6		Dorćol Superblok	Investment	15.0 M 15.0 M	0.20 M	Q3 2021 – Q3 2024
L7		Green Market Kalenić	Investment	12.0 M	Tbc	Q3 2021 – Q3 2024
L4		Study for a City-wide programme for urban green infrastructure (GI) development	Study, Policy	0.5 M 0.5 M	N/A	Q3 2021 – Q3 2023
TOTAL				78.1 M 78.1 M	0.25 M	

Table 3.2 Impacts of urban planning and mobility actions in 2030, as compared to the baseline scenario

No	Action	Energy savings MWh/a	RE production MWh/a	CO ₂ reduction t CO ₂ /a
1	T1- Extension and development of the Belgrade Train and tram	3,577,649	0	684,861
2	T3 - Purchase of electric buses/trams and busses that use RES with infrastructure development	236,449	55,180	44,265
3	T4 - Bicycle-Sharing System	676,628	0	158,339
4	T5 - Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycle ways			
5	T6 - Commercial transport policy – City logistics	111,469	3,497	67,320
6	T7 - Plan for a network of public chargers for electric vehicles			
7	T8 - Incentives and financing of e-vehicles for public and private commercial vehicles (range 200km/day)			
8	L1 - Linear Park	Not estimated, supporting measure		
9	L2 - Brownfield Development Programme	Not estimated, supporting measure		
10	L4 - Study for a City-wide programme for urban green infrastructure development	Not estimated, supporting measure		
11	L5 – Study on Urban Land Management Policies and Instruments	Not estimated, supporting measure		
12	L6: Donji Dorćol Superblock project	Not estimated, supporting measure		
13	L7: Green Market Kalenić	Not estimated, supporting measure		
Total effect of all actions		4,602,195	58,677	954,785

3.3.4 Actions

T1: Extension and development of Belgrade Train and Tram

Purpose – Extend urban train and tram services to create additional capacity to react to growth

Benefits – Reduced private car use leading to reduced pressure on air quality and congestion. GHG savings of 680k tCO₂/a equivalent

Costs – CAPEX: € 200M; OPEX: € 1.5M/annually



2021			2022			2023			2024			By 2030		
			Planning			Implementation			Implementation					

Description

The first component of this action is the expansion of the BG train line with 2 new lines which are currently planned:

- Makiš – Rakovica – Karaburma, length 13.7 km,
- Novi Beograd-Nikola Tesla Airport-national stadium length 16.2 km (in perspective up to 2033 to Obrenovac)

The second component is the expansion of the existing tram network by 28.7 km

This action will support investment in the construction of the planned lines. The planning and design status of this project is known, and there is an assumption that this will be delivered through a Design & build contract.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Design

Strategic objectives targeted

- S.O.T.1. Improving City's Mobility and reduce of congestion;

- S.O.T.2. Enhancing Green Mobility in Central City Area;
- S.O.E.2. Cut Greenhouse gas emissions from the city;
- S.O.L.2. Preventing sprawl by limiting unnecessary suburban land take

Key indicators & targets:

11 - Transport modal share in commuting cars, motorcycles, taxi, bus, metro, tram, bicycle, and pedestrian; 12 - Average travel speed on primary thoroughfares during peak hour; 13 - Interruption of public transport systems in case of disaster; 33.1 - Average commuting distance; 33.2 – Average commuting time.

Cut journey times around the city so that the average commute for citizens is below 30 minutes (currently 32.5).

Current Context

The Development of the Metro Belgrade project has been a key topic in all recent City Development Strategies, including the latest one. Up to now, there have been no funds for the subway system development. In recent years, the planning and design documents have been in development and the prioritization of staged construction has been included in the relevant urban and development plans. It is expected that construction will start in 2021. The basis for this project is the General Regulation Plan for Mass

Rapid and Light Rail systems in Belgrade (“PGR Šinskih Sistema“). A significant part of the plan is the further extension and reconstruction of tram and BG-train railway. It has significant potential to benefit a range of the strategic objectives. It is likely to go ahead and there are likely to be elements that would benefit from international finance.

Investment Costs

CAPEX: € 200 M (period 2021-2026, € 100 M)

OPEX: € 15 M (to be covered mostly through user fees)

Fit with Funding sources

Government to Government funds, IFI and Donors, State budget, potential PPP arrangement for part of the project (e.g. tram / train procurement).

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q4 2021 – Q4 2030

Implementing bodies:

BG Metro and train, Secretariat for Public Transport.

Key stakeholders:

Government of the Republic of Serbia, City of Belgrade, Secretariat for Investment, Secretariat for Public transport.

Delivery risks:

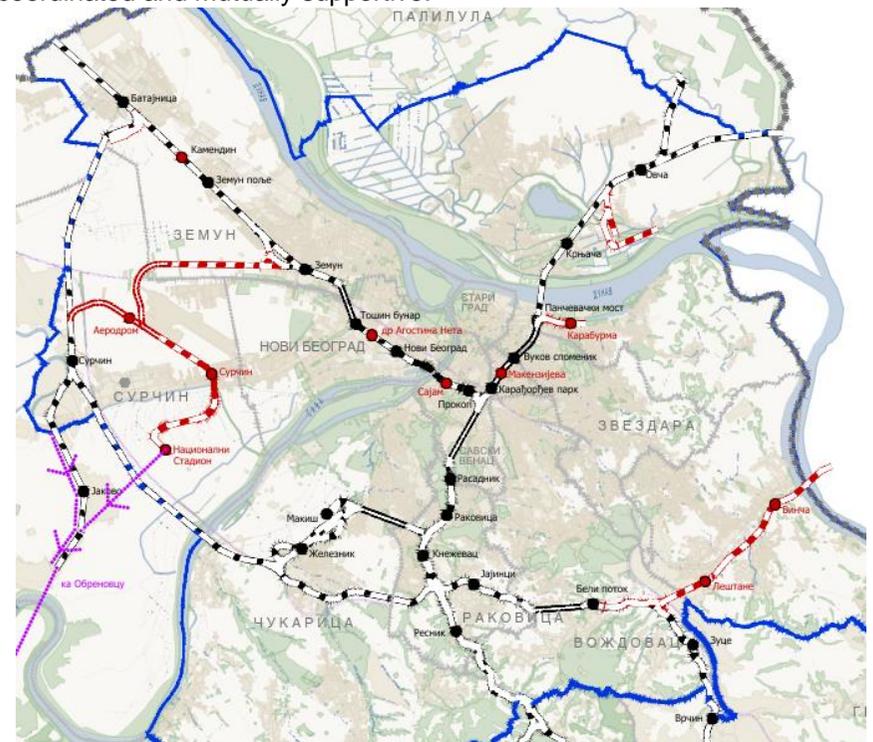
Huge projects are always followed with risks. At the moment project has a strong political support. Spatial plan (“PGR Sinskih Sistema“) is near to adaption, which is prerequisite for design stages.

Smart City Potential - Potential to Benefit

Potential for SMART infrastructure to be further development of existing real-time passenger information and online journey planners with the introduction of new routes/timetables.

Synergy with Other Actions

There is considerable correlation of this Action with Action T3: Purchase of electric buses and busses that use RES. Both Actions should be coordinated and mutually supportive.



T3: Purchase of electric buses/trams and busses that use RES with infrastructure

Purpose –Improve the quality, efficiency and cleanliness of the public transport fleet to match rising population and demand

Benefits – Cleaner technologies will improvement air quality and emissions (44k t/CO2/a e) as well as encouraging modal shift

Costs – CAPEX: € 950M; OPEX: € 2M/annually



2021		2022		2023		2024		By 2030
	Planning			Implementation				Implementation

Description

Phase 1 is planning and investing in e-vehicle infrastructure (chargers, maintenance depots, etc.). This will include the renovation of 5400 existing bus-stops, (according to the study received from Secretariat for Public Transport), to include modern solar lighting with info-displays, chargers for mobiles, etc.

Phase 2 is aligned with currently planned purchase for City public transport which will include:

- Component 1. Jointed e-Bus vehicles (25 pcs)
- Component 2. Solo e-Bus vehicles (25 pcs)
- Component 3. Trolleybuses with autonomous driving (80 pcs)
- Component 4. Secretariat for public transport with the JKP "GSP Beograd" has a plan to renew the GSP bus fleet. Procurement is planned over a period from 2021-2025: jointed buses with KPG (Euro 6) propulsion -310 vehicles, solo buses on KPG (Euro 6) – 110 vehicles, buses for school transportation with KPG (Euro 6) – 25 vehicles
- Component 5. There is also consideration of investment in a substantial number of Trams (150 trams in 10years)

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.T.3. Increasing use of alternatively fuelled vehicles;
- S.O.T.1. Improving City's Mobility and reduce of congestion;
- S.O.T.2. Enhancing Green Mobility in Central City Area;
- S.O.E.2. Cut Greenhouse gas emissions from the city

Key indicators & targets:

11- Transport modal share in commuting cars motorcycles taxi bus metro tram bicycle pedestrian; 33.1 - Average commuting distance; 33.2 – Average commuting time

Encourage a transition to e-vehicles, achieving 40% for bus, 80% for taxi, 100% for city owned vehicles, 80% of commercial transport vehicles and 20% in private vehicles of vehicle fleet by 2030

Current Context

Purchase of vehicles is a popular financing measure as it often comes with a clear revenue model, can deliver carbon benefits (dependent on the

source of energy for Electric Vehicles) and encourage higher rates of public transport ridership. It is well aligned to GCAP objectives. There is however an additional programme ongoing, and while it is scalable, it may be that enough resources are in place to achieve desired outcomes.

Investment Costs

Phase 1 CAPEX INFRA (€ 50 M)

Phase 2. 1-4 CAPEX : € 375 M EUR

Phase 2. 5 CAPEX (150 trams X € 3.5 M = € 525 M EUR)

TOTAL CAPEX 950 million EUR (period 2021-2026, € 475 M)

OPEX: € 20 M to be covered mostly (or entirely) by user fees (expected maximum of € 2 M annual subsidy)

Fit with Funding sources

City/State funds, IFI and Donors, possible private sector via PPP (for PV Infrastructure)

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q4 2030

Phase 1 – Q3 2021 – Q2 2022 – planning stage

Phase 2 – Component 1 – 4, Q3 2021 – Q4 2025

Phase 2 – Component 5, Q3 2021 – Q4 2030

Implementing bodies:

JKP "GSP
Beograd"

Key stakeholders:

City of Belgrade;
Secretariat for
Public Transport

Delivery risks:

Large

procurement activities carry the risk that targets will not be completely achieved. Preparatory studies for e-infrastructure must also be in place also and in form policy before implementation.

Smart City Potential - Potential to Benefit

Potential for users in improved connectivity, e-ticketing and live scheduling information. Potential for operators in monitoring demand and service quality and power management. Potential for intelligent asset management and maintenance for the vehicles themselves. Many of these issues would need consideration at a whole fleet level, however new vehicles should be purchased "smart ready".

Synergy with Other Actions

A considerable correlation of this Action with Action T7: both Actions should be coordinated and mutually supportive.



T4: Bicycle-Sharing System

Purpose – Create the facilities to introduce cycling as a part of the public transport network and an alternative to private car use

Benefits – Reduced emissions (158k tCO₂/a e) and congestion as well as public health benefits from active commuting

Costs – CAPEX: € 6.45M; OPEX: € 0.2M/annually



2021		2022			2023			2024		By 2026	
	Planning	Implementation			Implementation		Implementation		Implementation		

Description

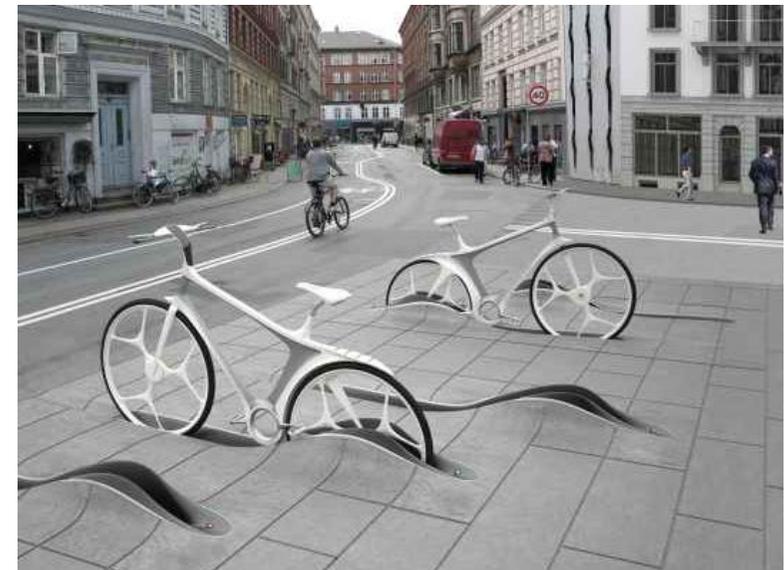
This measure envisages the introduction of a public bicycle-sharing system in the transport offer of the city, as an alternative mode of transport as one of the options for improving the existing traffic system. A bicycle-sharing system is a service that allows users to rent bicycles for short distances, which expands the tourist offer of the city and has been successfully implemented across many European cities. The implementation includes:

- Construction of bicycle rental stations.
- Monitoring the effects of the implementation of the system
- Defining measures for maintenance and improvement of the future system

The description is harmonized with the city's current aspiration for a Public Bicycle System which envisages:

- Planned 150 docking stations⁷ in two phases (Phase 1 – 100 stations, Phase 2 – 50 Stations)
- The fleet will be electric bicycles

- The selection of equipment and operators would be achieved through a competitive process
- The system must be integrated into the public transport ITS



⁷ <http://bgsaobracaj.rs/index.php/kampanja-manifestacija/42/%D1%98avni-bicikli>

The primary goal of bicycle-sharing systems is to reduce traffic congestion and promote clean air and healthy lifestyles, particularly in large urban areas. It is a popular and relative low-cost option for supporting transition from private car use (and potentially public reluctance to use public transport in the wake of the Covid-19 pandemic) and could be a significant “quick win” investment.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Design

Strategic objectives targeted

- S.O.T.2. Enhancing Green Mobility in Central City Area;
- S.O.T.1. Improving City’s Mobility and reduce of congestion;
- S.O.E.2. Cut Greenhouse gas emissions from the city

Key indicators & targets:

11- Transport modal share in commuting cars motorcycles taxi bus metro tram bicycle pedestrian; 33.1 - Average commuting distance; 33.2 – Average commuting time.

Improve green mobility in the central area by increasing the share of trips by green modes (walking, cycling) by 5% (currently <2%), with share of 80% for cycling and 20% for walking and 100% “clean” public transport in the central area.

Current Context

As with most cities, growing private car use is a challenge. Encouraging walking and cycling as alternatives has wide ranging benefits as well as being relatively inexpensive. The principal appears to enjoy political support with existing proposals to increase pedestrianised areas and cycle lanes, but these could be usefully scaled up. There are well established

public and private models for such schemes which would ideally be introduced in parallel with additional cycle friendly infrastructure (such as cycle paths).

Investment Costs

CAPEX: **€ 6.45 M** – representing 150 stations at € 35,000, 1000 bicycles at € 600 each, € 200,000 for software development, and € 400,000 for a depot⁸ (period 2021-2026, **€ 4.61 M**)

OPEX: € 1 M assuming € 1,000 per bicycle per year – which could be taken up by a private company (expect a maximum of € 200,000 in annual costs).

Fit with Funding sources

City funding, national or regional funds, Donors. Possible support from, IFIs, and potential for private sector involvement/PPP. Ultimately revenue will be generated from users

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q2 2027

Implementing bodies:

Secretariat for Transport

Key stakeholders:

City of Belgrade, Secretariat for Public Transport; Private partners, CSO’s

⁸ See, for example, ITDP (2018) The Bikeshare Planning Guide - <https://www.transformative-mobility.org/assets/publications/The-Bikeshare-Planning-Guide-ITDP-Datei.pdf>

Delivery risks:

No significant risks if financing is secured based on existing development plans

Smart City Potential - Potential to Benefit

App based location of bicycles and payment process (if applicable). Tracking of assets and asset management. User information such as cycle paths and quickest routes. Integration with existing public transport ITS systems.

Synergy with Other Actions

A considerable correlation of this Action with Action T5 - Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycleways: both Actions should be coordinated and mutually supportive.

T5: Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycleways



Purpose – Planning and investment in walking and cycling routes to encourage uptake of active transport modes

Benefits – Reduced emissions and congestion from motorised vehicles as well as public health benefits from active commuting

Costs – CAPEX: € 33M; OPEX: € 0.25M/annually



Description

This option considers the development of new and enhancing existing walking and cycling infrastructure. About 493 km is planned in the next 10 years, according to the Sustainable Urban Mobility Plan in the following phases.

1. Phase 1 – by 2022, 133km, € 8 million
2. Phase 2 – by 2027, 80km, € 5 million
3. Phase 3 – by 2030, 280km, € 17 million

Additional enhancement of pedestrian areas is also planned by 2030, with a budget of € 3 million

The action itself will require a planning and design phase, followed by investment in construction of new routes. This process require both policy changes and to be supported by public awareness campaigns to encourage uptake.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.T.2. Enhancing Green Mobility in Central City Area;
- S.O.T.1. Improving City’s Mobility and reduce of congestion;
- S.O.E.2. Cut Greenhouse gas emissions from the city;
- S.O.L.2. Preventing sprawl by limiting unnecessary suburban land take

Key indicators & targets:

11- Transport modal share in commuting cars motorcycles taxi bus metro tram bicycle pedestrian; 12 - Average travel speed on primary thoroughfares during peak hour; 33.1 - Average commuting distance; 33.2 – Average commuting time



Improve green mobility in the central area by increasing the share of trips by green modes (walking,

cycling) by 5% (currently <2%), with share of 80% for cycling and 20% for walking and 100% “clean” public transport in the central area

Current Context

As with most cities, growing private car use is a challenge (which may be exacerbated post COVID-19 if people are uncomfortable using public transport). Encouraging walking and cycling as alternatives has wide ranging benefits as well as being relatively inexpensive. The principal appears to enjoy political support with existing proposals to increase pedestrianised areas and cycle lanes, but these could be usefully scaled up.

Investment Costs

CAPEX: **€ 33 M** – representing approximately 60,000 €/ km of bicycle lane⁹, plus € 3 M for pedestrian areas (period 2021-2026, **€ 16.5 M**)

OPEX: € 1.2 M through 2030 years (€ 250,000 annually for 6 years)

Fit with Funding sources

City budget, IFI (likely via a policy-based programme) and Donors

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q1 2021 – Q4 2030

1. Phase 1 – by 2022,
2. Phase 2 – by 2027,
3. Phase 3 – by 2030

Implementing bodies:

Secretariat for Transport

Key stakeholders:

Secretariat for Public Transport; Belgrade Land Development Public Agency, Secretariat for Urbanism, Secretariat for investments, CSO's

Delivery risks:

No significant risks if financing is secured based on existing development plans

Smart City Potential - Potential to Benefit

Opportunities to monitor usage using either direct collected monitoring data (e.g. through road coils or IR sensors) or through third party data gathering (such as via google or apps such as Strava). Linkages to technology-based bike sharing schemes (e.g. T.04).

Synergy with Other Actions

A considerable correlation of this Action with Action T4 - Bicycle-Sharing System and L4 - City wide programme for urban green infrastructure (GI) development - both Actions should be coordinated and mutually supportive

⁹ These would mostly be medium-level interventions - See, for example costs in the UK at Taylor and Hiblin (2017) Typical Costs of Cycling Interventions - Interim analysis of Cycle City Ambition schemes -

T6: Commercial transport policy – City logistics

Purpose – Reduce freight traffic by improving distribution of goods around the city through policy measures

Benefits – Reduced peak traffic and therefore lower emissions and congestion.

Costs – CAPEX: €0.5M; OPEX: N/A



2021			2022			2023			2024		
		Planning									

Description

Development of a new policy with an action plan. The objective is to cut the number of lorries and vans entering the Belgrade's urban area in the morning peak by 40% by 2026. Another target is to cut daily vehicle movements by coordinating rubbish collection. This measure includes planning and development for logistics so space will be available for consolidation. Having depots (consolidation centres) in the right places (near ring-roads, such as Belgrade bypass, UMT SMT) will reduce the miles travelled by freight vehicles. With this measure HDV's will not be able to enter the city. All deliveries would be supported by LDV's and preferably e-vehicles. This policy applies to all freight, including transport of construction materials.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

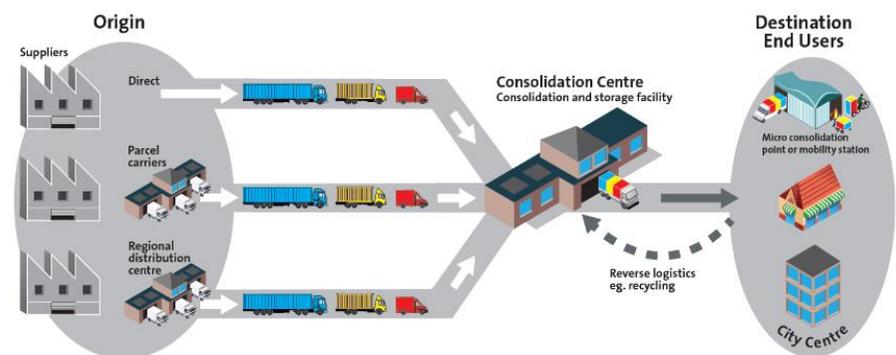
- S.O.T.1. Improving City's Mobility and reduce of congestion;
- S.O.T.2. Enhancing Green Mobility in Central City Area;
- S.O.E.2. Cut Greenhouse gas emissions from the city;

- S.O.L.2. Preventing sprawl by limiting unnecessary suburban land take

Key indicators & targets:

12 - Average travel speed on primary thoroughfares during peak hour

Cut journey times around the city so that the average commute for citizens is below 30 minutes (currently 32.5)



Current Context

Local authorities are encouraging deliveries at different times with current policies. The problem is in implementation. There are existing policies in place to reduce commercial traffic into the city centre both operationally (in

terms of restricting commercial traffic) and in planning terms (e.g. planned logistics hubs). Further measures to distribute commercial traffic through less busy times would be beneficial for air quality and congestion and inclusion of such measures in the GCAP could act as a catalyst for this to happen more quickly.

Investment Costs

CAPEX: € 500,000 for policy study / adoption. Additional investment amount for logistics centres would likely be necessary - likely mobilised via the private sector (not estimated here).

OPEX: N/A

Fit with Funding sources

City budget, IFI (potentially via a policy-based programme) and Donors

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q3 2022

Implementing bodies:

Secretariat for Transport

Key stakeholders:

City of Belgrade; Secretariat for Public Transport; Serbian Chamber of Commerce, CSO's

Delivery risks:

No significant risks if stakeholder engagement process is well run.

Smart City Potential - Potential to Benefit

Opportunities may include monitoring of commercial traffic, intelligent traffic systems directing commercial traffic. In the long term there could be opportunities for coordination between logistics providers or even adoption of newer technologies such as autonomous delivery vehicles or even drone delivery services.

Synergy with Other Actions

A considerable correlation of this Action with Action T7 and T8: Actions should be coordinated and mutually supportive.

T7: Plan for the network of public chargers for electric vehicles

Purpose – Create a network of sustainable powered charging stations as a catalyst for transition to Electric Vehicles

Benefits – Supports readiness for a transition to EVs which have significant Air Quality and Carbon benefits

Costs – CAPEX: € 10M; OPEX: € 0.2M/annually



2021		2022		2023		2024		By 2026	
	Planning			Implementation				Implementation	

Description

The aim of this measure is to support the planning of charging stations for electric vehicles (EV) in the city. The objective is to maximize the number of serviced vehicles under a fixed budget for building the stations.

Phase 1 – Operationalization plan for E-chargers (with policy changes)

The initial stage is to develop a study to examine potential charging sites considering potential number of charging stations, and the distance from that location and centres of demand, which is measured in walking time. This would involve development a charging demand model based on parking usage data, including length of stay, considering the time taken to charge an EV. A parallel assessment would be carried out using an existing mobility survey to extract parking data and establish a demand grid. We would then apply the models that give us optimal locations for charging stations for the entire city allowing us to compare the proposed sites with overall parking demand.

Phase 2 – Purchase and Construction of needed infrastructure

A programme of delivery will be rolled out based on the conclusions of the study. It is anticipated this will involve covered car parking topped with solar panels (possibly supplemented by grid energy) to provide a sustainable energy source for the charging stations.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.T.3. Increase use of alternatively fuelled vehicles;
- S.O.T.2. Enhancing Green Mobility in Central City Area;
- S.O.E.2. Cut Greenhouse gas emissions from the city;

Key indicators & targets:

- 10 - Average age of car fleet total and by type
- Encourage a transition to e-vehicles, achieving 40% for bus, 80% for taxi, 100% for city owned vehicles, 80% of commercial transport vehicles and 20% in private vehicles of vehicle fleet by 2030

Current Context

Encouraging electric vehicles is likely to have long term benefits in terms of both local air pollution and potentially climate emissions (noting that currently grid based energy in Belgrade has a high emissions factor and therefore a linkage to RES is critical to achieve benefits). Currently there are no known programmes of this type ongoing and therefore inclusion in the GCAP could be a catalyst to start rolling out low carbon charging

infrastructure and help make the city ready for the transition to electric vehicles which is likely to occur in the coming years.

Investment Costs

CAPEX: **€ 10 M** – representing approximate investments of € 25,000 per station (mix of fast charging and slower charging) for 400 stations¹⁰

OPEX: € 1 M through 2030 (€ 200,000 annually for 5 years of full operation)

Fit with Funding sources

City budget, and Donors. Possible IFI support.

City funds	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q3 2026

Implementing bodies:

Secretariat for Transport

Key stakeholders:

City of Belgrade; Secretariat for Public Transport; owners of the electric vehicles – the City, private companies, taxi drivers etc.

Delivery risks:

New technology creating challenges for implementation

Ability to identify a good distribution of sites which match demand for parking and charging.

Uptake by users – it is likely that the infrastructure is an enabler but the first few years of operation could see chronic underuse if there are not enough EVs operating on the roads.

Smart City Potential - Potential to Benefit

Opportunities include energy management across fleets, billing systems, live availability / booking of charging stations, monitoring of energy consumption.



Synergy with Other Actions

A considerable correlation of this Action with Action T3 and T8: both Actions should be coordinated and mutually supportive.

¹⁰ See, for example: Nicholas (2019) Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf

T8: Incentives and financing of e-vehicles for public and private commercial vehicles

Purpose – Create a subsidy for commercial/utility vehicles to encourage adoption of EV technologies

Benefits – Supports the transition to electric vehicles which have significant air quality and carbon benefits (subject to energy source)

Costs – CAPEX: € 1M/annually; OPEX: € n/a - covered by vehicle owners



2021		2022		2023		2024		By 2026	
	Planning			Implementation				Implementation	

Description

Establishment of a fund which will subsidise the purchase of commercial vehicles (public and private), with a daily mileage of not more than 200km per day. This would cover a wide range of stakeholders including delivery services, taxis, cargo, Public enterprises, public utility companies, city owned vehicles, e-cargo bikes, etc.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.T.3. Increase use of alternatively fuelled vehicles;
- S.O.T.2. Enhancing Green Mobility in Central City Area;
- S.O.E.2. Cut Greenhouse gas emissions from the city;

Key indicators & targets:

10 - Average age of car fleet total and by type

Encourage a transition to e-vehicles, achieving 40% for bus, 80% for taxi, 100% for city owned vehicles, 80% of commercial transport vehicles and 20% in private vehicles of vehicle fleet by 2030

Current Context

From March 2020 the Serbian government is introducing purchase premiums for electric and hybrid vehicles, including electric mopeds and motorcycles. The budget for the grants is one million euro for 2020. An important set of incentives for people to purchase and use alternatively fuelled vehicles, this (in conjunction with enabling measures such as T7) should not be particularly contentious. However further work will be necessary to understand the extent of existing city powers to provide such incentives.



Investment Costs

CAPEX: € 1 M annually (€ 5,000 per unit)

OPEX: n/a - covered by vehicle owners

Fit with Funding sources

City budget, national funding, and Donors. Possible IFI support if capitalising a fund but unlikely to lend directly.

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q3 2026

Implementing bodies:

New Implementing agency

Key stakeholders:

City of Belgrade; Serbian Chamber of commerce, Ministry of Mining and Energy

Delivery risks:

No significant risks if stakeholder engagement process is running appropriately.

Smart City Potential - No Foreseeable Opportunity

The subsidy of alternatively fuelled vehicles does not in itself create an opportunity for Smart Cities applications (noting that conditionality attached

to subsidies could be used to encourage uptake of parallel smart city applications)

Synergy with Other Actions

A considerable correlation of this Action with Action T3 - Purchase of electric buses and buses that use RES and T7 - Plan for a network of public chargers for electric vehicles: both Actions should be coordinated and mutually supportive

L1: Linear Park

Purpose – Implementation of a 46.7ha linear urban park from the Concrete Hall to Pančevo Bridge

Benefits – Improved greenspace providing ecological, flood storage and an urban ventilation corridor

Costs – CAPEX: € 50M; OPEX: € 50K/year



2021			2022			2023			2024			2030		
			Implementation											

Description

The linear park is a green urban redevelopment project covering a distance of 4.6 km from the Concrete Hall to the Pančevo Bridge, with an area of 46.7 ha. The planning proposal for the park protects the area of the ecological network of the Republic of Serbia of international importance as well as important ecological corridors. The linear park will provide public green areas, within which intervention zones have been proposed including 10 thematic units, intended for park, cultural, educational, sports and commercial facilities. These 10 thematic units have been developed by different architectural teams. The total estimated value of the investment is 40-50 million Euros, of which it is estimated that about half of that amount will be provided by property owners along the park, the value of which will increase with its realization. The Park design has been developed in a participatory process involving citizens, NGOs, and other interest groups and the same applies to development of Detailed Regulation Plan which is underway. This will be followed by detailed Park design documentation and then investment for delivery.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Design

Strategic objectives targeted

- S.O.L3 - Improve the importance and capacity of Green Infrastructure and provide access to public green spaces in all parts of the city

Key indicators & targets:

The main indicator is the implementation of the “Linear Park” project but it is also relevant to Indicator 6. Open green space area ratio per 100,000 inhabitants (forests, forest land and public green spaces), currently 6.9 km²/100,000 inh, target 12.5 km²/100,000 inh and Indicator 6.1. Share of green space areas within urban limits, currently 12.4%, target 22.7% (30%).

The action can also have a positive impact in terms of improved flood prevention (due the increased greenspace) and improvements to urban ventilation corridors. There would also be some energy savings from LED lighting (though the impact would be expected to be marginal in comparison to the entire city’s lighting infrastructure),

Current Context

The Belgrade Land Development Agency has initiated the development of a Detailed Regulation Plan (PDR) for this area, which is currently being developed by the Urban Institute of Belgrade. The planning basis for the development and adoption of this Plan is:

- Plan of general regulation of the construction land of the City of Belgrade,
- Plan of general regulation of the green area system of Belgrade.



Investment Costs

CAPEX: € 50 M

OPEX: € 50,000/ year assuming approximately € 1/m² of maintenance¹¹ (€0.5 M over 10 years)

Fit with Funding sources

City budget, land value capture, national / regional funds, IFI investment (likely via a policy-based programme), potentially donors and SPV as well

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q3 2023

Specific milestones will be confirmed but can be expected to include:

- (1) DRP adoption (Q2 2021)
- (2) Completion of project documentation (Q4 2021)
- (3) building permit, at least for 1st phase and land value capture agreements with property owners (Q2 2022), then
- (4) construction / implementation (Q2 2023)

Implementing bodies:

City of Belgrade, Secretariat for Urban Planning and Construction, **Directorate for Construction Land and Construction of Belgrade (PC)**

Key stakeholders:

Urban Planning Institute of Belgrade

Delivery risks: Private investors might change their mind regarding investing into the Linear Park Project. Attainment of the land procedure might be time-consuming.

Smart City Potential - Potential to Benefit

Depending on the final design the architect teams chose, smart technology might be significantly integrated into the project.

Synergy with Other Actions

- L2 – Brownfield Development Programme;
- L4 – City wide programme for urban green infrastructure (GI) development;
- GS1 – Afforestation and Greening programmes

¹¹ See, for example: Tempesta (2014) Benefits and costs of urban parks - <https://rm.coe.int/16802faf1a> which has a range from 0.28 EUR / m² to 2.73 EUR

L2: Brownfield Development Programme

Purpose – Develop a register of brownfield sites and promote their redevelopment to improve urban density and limit sprawl

Benefits – Limits sprawl and protects greenfield development sites which has ecological, climate resilience and transportation benefits

Costs – CAPEX: € 500K; OPEX: €n/a



2021		2022		2023		2024		2030	
					Planning				

Description

Development of a programme to activate abandoned, derelict or underused sites in order to increase urban density and provide compact, mixed use urban spaces. Brownfield and infill development will reduce urban sprawl and land take at urban edges limiting the loss of open space, natural land and habitat. The Programme includes preparation of a register of potential brownfield development sites (Step 1) as a basis for a feasibility study including assessment of sites including remediation needs/costs and land ownership issues, sites re-use scenarios and financing options depending on the viability and profitability as well as public sector role (infrastructural prerequisites and possible PPPs) (Step 2). Priority sites will be identified, taking into account proximity to public transport hubs. Inputs for GUP amendments will be defined including possible density bonuses (for example, for use of green infrastructure elements as climate adaptation measures), participatory analysis of broader socio-cultural context of proposed sites and elaboration of development briefs as a basis for urban design competitions (Step 3). The Programme also includes the establishment of a system of incentives for qualified brownfield development projects as well as identification of 2-3 pilot projects. Funding sources for pilot projects will be established including, where appropriate, land value capture and financial instruments at preferential conditions, blending IFI, pre-accession EU and national sources (including grant-based TA) (Step 4).

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.L1 - Getting the most out of urban space by increasing density and compactness through redevelopment
- S.O.L2 - Preventing unnecessary suburban land take and sprawl development

Key indicators & targets:

- 33 - Population density on urban land inh/km², currently 3,219, target 7,000 (4,000)

Current Context

The Programme is in line with the intentions and aims of current urban planning documents (GUP and PGR) for the Belgrade area. In addition, it is fully in line with the provisions of Spatial Plan for the Republic of Serbia Act (2010), but the majority of these provisions have not been implemented so far. The Belgrade Climate Change Adaptation Action Plan (2015) under Land use and urban planning measures also points out that urban renewal projects should address climate adaptation measures.

Some potential brownfield development zones (old sugar factory and old shipyard) are shown in the picture

Investment Costs

CAPEX: € 500,000 plus investment in redevelopment (not estimated)

OPEX: n/a

Fit with Funding sources

City, IFI, Donors, EU sources – followed by private investment in actual site development and potentially land value capture / property taxes

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q3 2024

Implementing bodies:

City of Belgrade, **Secretariat for Environmental Protection**, Secretariat for Urban Planning and Construction, Urban Planning Institute of Belgrade

Key stakeholders:

Ministry of Economy, Institute of Cultural Heritage Protection – Belgrade, University of Belgrade – Faculty of Architecture, Institute of Architecture and Urban and Spatial Planning of Serbia

Delivery risks:

Conflict between protection of brownfield locations with historical/cultural background and investors' expectations. Densification of the current construction land might easily lead to the cutting off of necessary green

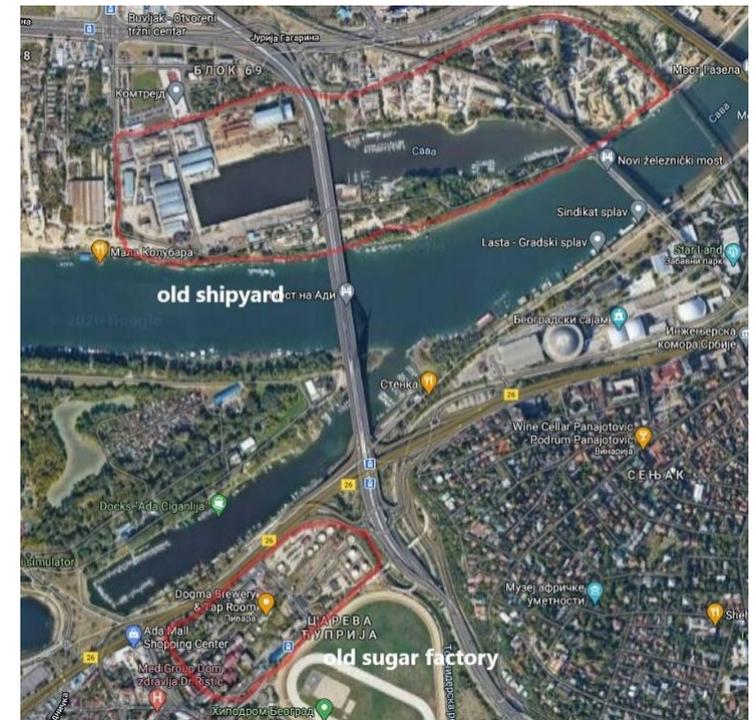
areas within urban blocks – this is already a trend, especially in the suburbs.

Smart City Potential - No Foreseeable Opportunity

While clearly the study will require data and analysis at this stage, there is no clear smart city opportunity. Opportunities could perhaps be considered further during this study.

Synergy with Other Actions

T1– Extension and development of the Belgrade train and tram, L1 – Linear park project, T5 – Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycleways, T6 – Commercial transport policy, L4 – City wide programme for urban green infrastructure development



L4: Study for a City-wide programme for urban green infrastructure development

Purpose – Incentivise the development of green infrastructure through financial and policy support

Benefits – Benefits in terms of ecosystem service support including, but not limited to, biodiversity and climate resilience

Costs – CAPEX: € 0.5M; OPEX: € n/a



2021			2022			2023			2024		
		Planning									

Description

Development of a programme supporting private and public sector green infrastructure (GI) projects, from individual building/site interventions, urban areas and redevelopment projects to large urban green corridors and networks. The Programme will also cover development of urban farming and gardening projects and encourage involvement of local community groups in green areas for collaborative management (planning, maintenance, biodiversity awareness and participatory monitoring).

The steps for carrying this out will be as follows:

Step 1: Develop a typology of GI projects, mainly based on the Plan of general regulation (PGR) for green areas.

Step 2: A group of 50-60 GI projects covering all types (from single plot interventions to urban scale corridors and networks) will be identified and assessed according to established criteria, including contribution to urban natural capital and ecosystem services, biodiversity conservation, increased climate resilience through adaptation, public green space provision, air quality and urban cultural landscape values.

Step 3: Implementation instruments for a subset of 10-15 pilot projects will be developed including supporting access to EU funding sources, financial instruments (preferential loans) and TA grants for innovative projects, and

other incentives such as reduced urban impact fees, density bonus and faster permitting processes.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O. L3 - Substantially increasing the role that Green Infrastructure and open space play in the operation of the city

Key indicators & targets:

6. Open green space area ratio per 100,000 inhabitants (forests, forest land and public green spaces), currently 6.9 km²/100,000 inh, target 12.5 km²/100,000 inh.; 6.1. Share of green space areas within urban limits, currently 12.4%, target 22.7% (30%)

Current Context

The key document that regulates development of green infrastructure is the Plan of general regulation (PGR) of green areas system of Belgrade (2019). The Programme for urban green infrastructure development will serve as an implementation instrument for the PGR. The PGR is to be

implemented directly or through the more detailed plans/projects. The concept of an ecological index introduced in the PGR will be further developed and applied on GI projects participating in the Programme.

Investment Costs

CAPEX: € 500,000 for the study (programme)

OPEX: N/A

Fit with Funding sources

City budget, IFI, Donors, EU sources

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q3 2023 (to develop the programme to an implementable stage)

Implementing bodies:

City of Belgrade, **Secretariat for Environmental Protection**, PUC “Zelenilo-Beograd”, Secretariat for Urban Planning and Construction.

Key stakeholders:

Urban Planning Institute of Belgrade, NGOs

Delivery risks:

Land acquisition for green infrastructure is challenging, which can delay the realization of the projects; air quality within central urban fabric might be discouraging for agricultural production, thus hindering development of urban gardening. Unresolved ownership rights at cadastral parcels can jeopardize development.

Smart City Potential - Potential to Benefit

Potential for online engagement tools for networking and stakeholder consultation. There is also potential for any “digital twin” tools to integrate green infrastructure and factor in the ecological services provided in both blue and green infrastructure.

Synergy with Other Actions

- E4 – Afforestation and Greening Programmes,
- L1 – Linear Park Project,
- B2 – Greening city buildings,
- T4 – Public Cycling System,
- T5 – Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycleways,
- WW3 – Water drainage,
- WW6 – Rainwater storage and retention



L5: Study on Urban Land Management Policies and Instruments

Purpose – Introduction of urban land management policies to disincentivise excessive urban land take and sprawl

Benefits – Improved land use planning leading to more compact efficient development and associated environmental benefits

Costs – CAPEX: € 100K; OPEX: n/a



2021			2022			2023			2024			2030		
		Planning												

Description

The action is focused on introduction of new urban land management instruments that will facilitate sustainable urban development and implementation of urban plans. The study will be prepared to analyse policy options and possible instruments in addressing excessive urban land take (construction land expansion), low density and sprawl development, private land banking, urban land readjustment and general implementation deficit. The priority instrument will be the introduction of an easily calculated, reported and monitored indicator of urban land take sustainability that can be implemented through existing General urban plan (GUP). This instrument prevents the unjustified expansion of construction land unless at least, for example, 80% of it has already been built. By doing so it reduces conversion of open space, farmland and woodland thereby limiting habitat loss and fragmentation due to urban land take. The second simple and proven instrument is urban land development density bonus in exchange for open and green space provision which can also be implemented through statutory urban plans. The study should result in specific proposals for policy / regulatory changes which could be adopted.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.L.2 - Preventing unnecessary suburban land take and sprawl development
- S.O.L.1 - Getting the most out of urban space by increasing density and compactness through redevelopment



Key indicators & targets:

Key indicator would be the implementation and enforcement of policies (preferably through the General Urban Plan). However, it is also relevant to indicator 33 - Population density on urban land inh/km2, currently 3,219, target 7,000 (4,000)

Current Context

This action aims at improving the existing urban planning system and addresses some of the weaknesses identified through the technical assessment and application of Green City indicators. In addition, this action directly complements Brownfield Development Programme (L1) which supports redevelopment and more intensive use of existing urban structures by increasing density and compactness, through transformation of abandoned or under-used sites, brownfield (grey and green) and in-fill development. The action is fully in line with the provisions of Spatial Plan for the Republic of Serbia Act (2010) regarding urban land management.

Investment Costs

CAPEX: € 100,000

OPEX: N/A at this stage however there may be enforcement costs when implemented

Fit with Funding sources

Most likely from City budget or via technical assistance support from a donor. Possible support also from IFIs or National sources but less likely.

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q1 2022

Implementing bodies:

City of Belgrade, **Secretariat for Urban Planning and Construction, Directorate for Construction Land and Construction of Belgrade (PC)**

Key stakeholders:

Urban Planning Institute of Belgrade, Institute of Architecture and Urban & Spatial Planning of Serbia, City municipalities.

Delivery risks:

Densification of the current construction land might easily lead to cut off of necessary green areas within urban blocks – this is already a trend, especially in suburbia.

There may be resistance to regulatory measures which could be perceived as reducing the value of some private land holdings which are in low density areas.

Smart City Potential - No Foreseeable Opportunity

Opportunities may exist as a conclusion of the study but for the study itself there is no specific opportunity identified – these would include developing / operating an Open cadastral database and Digital land-use and building permitting.

Synergy with Other Actions

L2 – Brownfield Development Programme,

L6: Donji Dorćol Superblock project

Purpose – Creation of a “superblock” which discourages transit traffic and creates more local space for people

Benefits – Improved quality of urban environment including air quality, greenspace and public safety benefits

Costs – CAPEX: € 15M; OPEX: €0.2M/year



2021		2022		2023		2024		2030	
		Planning		Implementation					

Description

This is an urban redevelopment pilot project that introduces principles of sustainable urban mobility in the Donji Dorćol urban block. It is based on the idea of redirecting transit traffic to the main city roads and opening secondary city streets within the block for people with their closure to motorized traffic. This significantly improves the local quality of life - valuable public space is conquered, walking, cycling and socializing are stimulated, while reducing the negative consequences of traffic, such as accidents, noise and polluted air. This project is linked to ambitious plans for the development of the Linear Park in the immediate vicinity of Donji Dorćol, which means great potential for synergy for both projects, in particular through extension of green infrastructure elements from Linear park towards Donji Dorćol. Part of the street parking places will be moved to underground garages and 2 garage houses on the edges of the block thus freeing up valuable public spaces with street trees and other types of greenery which also provide climate resilience benefits in terms of urban cooling and rainwater retention. The total estimated value of the investment is 12-15 million Euros, of which it is estimated that about 40% will be spent for the construction of 2 multistorey car parks with 400 parking places.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Design

Strategic objectives targeted

- S.O.L3. Improve the importance and capacity of Green Infrastructure and provide access to public green spaces in all parts of the city
- S.O.L2. Preventing sprawl by limiting unnecessary suburban land take and expansion of construction land
- S.O.T2. Enhancing Green Mobility in Central City Area



Key indicators & targets:

The main output indicator is timely implementation of the project. Project implementation will also contribute to achieving city wide targets, namely Open green space area ratio per 100,000 inhabitants (forests, forest land and public green spaces), currently 6.9 km²/100,000 inh, target 12.5 km²/100,000 inh and Share of green space areas within urban limits, currently 12.4%, target 22.7% (30%).

Current Context

Currently the project is in conceptual design stage and it follows the principles established in the Sustainable Urban Mobility Plan for Belgrade which is expected to be completed in the year 2020. Detailed Regulation Plan (PDR) for this area will be prepared in line with the GUP provisions on urban redevelopment and PGR for green area system as regards green infrastructure elements

Investment Costs

CAPEX: € 12-15 M¹² (€ 6M – as received info)

OPEX: Likely to be included as a marginal increase in operating expenses for the upkeep of the public areas. OPEX for garage management would be covered by user fees / as part of a potential PPP arrangement. Expected as no more than € 200,000 per year (€ 1 M over 5 years).

Fit with Funding sources

City budget, with possible support from IFIs.

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q3 2024

Implementing bodies:

City of Belgrade, Secretariat for Urban Planning and Construction, **Directorate for Construction Land and Construction of Belgrade (PC)**

Key stakeholders:

Citizens, Secretariat for Transport.

Delivery risks:

Private sector concession for construction of 2 garage houses depends on the interest of car owners who live in the block and who currently use on-street parking places to buy garage parking places.

Smart City Potential - Potential to Benefit

Depending on the final design the architect teams chose, smart technology might be significantly integrated into the project.

Synergy with Other Actions

L2 – Brownfield Development Programme; L4 – Study for a City-wide programme for urban green infrastructure (GI) development; L1 - Linear Park; T5 – Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycleways; T9 – Encouraging modal shift from private cars to public transport

¹² This includes approximately 400 parking spaces in garages to allow removal from the streets (10,000 m² x cca EUR 500 / m² = EUR 5mil) as well as between EUR 7 and 10 million for remodelling the urban space (walking areas, greenery, etc.)

L7: Green Market Kalenić

Purpose - Transforming the existing market into a sustainable and green centre of the urban area of Vračar

Benefits - Improving accessibility, quality of urban facilities and green spaces

Costs – CAPEX: € 12M; OPEX: to be determined



2021			2022			2023			2024			2030	
			Planning			Implementation							

Description

The project includes the reconstruction and recontextualization of this famous Belgrade market into a modern technological and functional space, with an emphasis on the traditional spirit of the Kalenić market, setting a traditional urban space (the “green market”) and modern public multifunctional space, in a new sustainable context. This will harmonise the operational needs of the market trade, and blend with the public realm associated with the green market into the wider city space.

Project components include:

- Urban redevelopment of the surrounding streets to the green Green Market (Njegoševa, Viška and Maksima Gorkog). The concept being to divert transit traffic to other streets and open the surrounding streets with controlled access of motorized traffic. This will significantly improve local quality of life creating valuable public space, stimulating walking, cycling and socializing, while reducing the negative consequences of traffic, such as accidents, noise and air pollution.
- Introduction of green infrastructure in these streets, green walls at the entrances to the market, and public fountains as adaptation measures.
- Enhancement of energy efficiency through the introduction of solar panels on the market roof, selection of construction materials (to reduce embodied carbon), heating and cooling from the distribution network, use of new high-pressure lamps or LEDs for lighting

- Encouraging E-mobility with Charging stations for electric vehicles (EV) in front of and in the underground garage (155 parking spaces)
- Inclusion of cycling infrastructure such as secure cycle parking and changing facilities within the market to encourage active modes of transport

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Design

Strategic objectives targeted

- S.O.L3. Improve the importance and capacity of Green Infrastructure and provide access to public green spaces in all parts of the city
- S.O.L2. Preventing sprawl by limiting unnecessary suburban land take and expansion of construction land
- S.O.T2. Enhancing Green Mobility in Central City Area
- S.O.E2. Cut Greenhouse gas emissions from the City
- S.O.B1. Take action to improve the energy efficiency of the city’s buildings

Key indicators & targets:

The main output indicator is timely implementation of the project.

Current Context

The project is currently in the phase of drafting project documentation and is expected to be completed by the end of 2021. It is necessary to harmonize the Detailed Regulation Plan (PDR) for this area with regard to the elements of green infrastructure.

Investment Costs

CAPEX: € 12M

OPEX: To be determined during studies - we assume this is a marginal increase in operating costs for the maintenance of public areas. OPEX for garage management will be covered by user fees.

Fit with Funding sources

City budget, with possible support from IFIs.

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q3 2024

Implementing bodies:

Directorate for Construction Land and Construction of Belgrade (PE),
City of Belgrade, Secretariat for Urban Planning and Construction

Key stakeholders:

Citizens, Secretariat for Transport.

Delivery risks: It is necessary to cooperate with all interested parties, primarily tenants who live in the immediate vicinity.

Smart City Potential - Potential to Benefit

Obvious opportunities for smart technologies include Energy Management (BMS), and traffic and parking management however further consideration will be given to this during the design by the selected team of architects.

Synergy with Other Actions

L2 – Brownfield Development Programme; L4 – Study for a City-wide programme for urban green infrastructure (GI) development; T5 – Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycleways; B1 - Renovation / Energy efficiency and use of RES in municipal buildings; B2 - Greening city buildings and its surrounding



3.4 Energy and Efficiency



3.4.1 Current framework

Energy

According to the Law on Efficient Energy Use, the City is obliged to establish an energy management system with the Secretariat for Energy as the leader. The main part of the infrastructure represents an **Information System** on the City of Belgrade Energy (ISCBE), which is developed, but not completed. So far, the system has 1,700 public buildings and 700 active users, and already contains energy efficiency indicators for the mentioned buildings. More than 70% has been already tested, but the intention is that entire system is automated, thus collecting information from different public institutions. Once the ISCBE is completed it will set and monitor energy efficiency criteria, monitor performance of energy entities (public buildings, public utility companies, city traffic, etc.), monitor the efficacy of energy efficiency control, support analysis and planning of measures, and generate operational and systematic reports on energy efficiency reports.

Another area of activity in energy management is the establishment of an **Energy Efficiency Fund**, which is in development. The aim of the Fund is to support and incentivise the efficient use of energy and energy resources (electricity, heating). Primarily, the Fund would support refurbishment of buildings (both public and private).

In the area of heating, the City is working on diversification of energy sources, refurbishment of heating systems (primarily pipes) and identification of furnaces that use woods and coal. Potential for the use of wind energy has been identified in eight locations with total potential energy production capacity of 111 MW and net utilisation factor ranging from 25 to 30%. The City plans to improve the use of municipal waste by integrating it into the production of heat and electricity (cogeneration) at Vinča. Currently, the district heating system uses <1% renewable energy despite it having a much higher potential.

For district heating consumers, billing is still a lump sum payment (per m²) for most users which does not incentivise energy conservation and results in inefficient energy use. Unfortunately, the necessary transition to

consumption-based billing is problematic for the majority of buildings without insulation (about 33%) and these require refurbishment into increase their energy efficiency. Otherwise, heating costs would be unacceptably high for affected citizens.

In order to secure stability of electricity distribution, the City built the “Belgrade 20” electrical substation.

Efficiency

In Serbia, energy efficiency is set as one of the priorities within the **National Sustainable Development Strategy** from 2008. Several national action plans for energy efficiency have been adopted since then. At the national level, the **Regulation on Building Energy Efficiency** has been introduced. Belgrade has also published the **Brochure on Energy Efficiency** in Residential Buildings and Houses.

The legislation has defined preconditions for the application of energy efficiency measures in buildings and construction through adaptation of the methodology for building energy efficiency performance and a methodology for calculation of energy needed for building heating. The Brochure was a result of an international project called **Building Efficiency Accelerator** (BEA), which was conducted in partnership between the City, UN Environmental Programme and World Resources Institute. The main purpose was to raise awareness and educate citizens. Besides the basic information on the current state of building energy efficiency, the Brochure also contains recommendations on action that citizens can take to improve energy efficiency in the buildings they are living in. The measures are relate to both architectural and engineering interventions in buildings, as well as smaller scale actions such as smaller scale interventions changing appliances for heating, cooling, and lightning, and addressing consumer habits and behaviours.

The first act that promoted the energy efficiency issue in Serbia was the **Law on Planning and Building**; this introduced the energy passport (“Certificate on Energy Features of Buildings”). Another legislative act that is relevant in energy efficiency policy is the Law on Housing and Building Maintenance which allows for a building to have a status of legal entity,

(similar to a company), which enables the building itself to apply for subsidies in the field of energy efficiency. The Law defined several financing models – in addition to regular sources such as revenue for monthly maintenance of the building or renting special parts of a building, it also defines the possibility of investments in buildings from loans, donations or other sources. In the case of energy efficiency improvement works, financing is also enabled for the contracting of Energy Service Companies who manage energy performance as a service.

3.4.2 Key Challenges

The key perceived challenges and response gaps for the energy sector in Belgrade are as follows:

General

- Preparation of the Energy Efficiency Fund to improve energy efficiency (largely through building refurbishment programmes) which is not yet complete.
- A consolidated strategy for energy development is not yet adopted.

Renewable Energy Sources (RES)

- Use of renewable energy resources is not well considered in Belgrade and its potential is likely to be significantly underutilised.
- The City lacks incentives for private production of energy from renewable sources.
- There is little awareness and a lack of information about RES.

Heating

- There is a high degree of dependence on Russian Federation natural gas and low diversification of energy supply.
- Many households use furnaces for burning solid fuels (wood and coal) that are significant CO₂ emitters and contributors to air quality challenges.
- District heating system requires investment for capital and maintenance costs.
- District heating network suffers significant losses.

- A lack of consumption-based billing means there is little motivation for consumers to save heating energy.
- Many buildings have inefficient thermal insulation and consequently inefficient heating.
- RES is significantly underexploited in the district heating system (less than 1%) and there is a high potential for improving RES contributions.

Electricity

- Electricity is a source of energy for heating for large number of buildings.
- There is rise of electricity use in summer months for air conditioning.
- There are large losses in the electricity distribution system.

The key perceived challenges and response gaps for the buildings sector are as follows:

- **Electricity consumption in buildings** for both residential and non-residential – is high. This indicates that awareness of citizens needs to be raised particularly regarding use of energy efficient lightning and a shift from electricity as a main source of heating energy, to other fuels with lesser impact on the environment.
- **Heating consumption in residential buildings** using fossil fuels needs to be reduced. Since the change in consumption depends on decisions of a great number of individuals, it might take time until a substantial shift happens. The state or the City should consider incentive models that would speed up the process.
- There are **no proclaimed certificates or green building standards**. The energy passport should be added to other internationally recognized certificates, so that improvements in this field could be comparable in the international context.
- Even though **metering and billing** for personal energy use is regulated, a significant share of households and buildings are charged for heating energy consumption by heated area and not by real energy consumption.

3.4.3 Objectives and Actions

ID	Strategic Objective	Action	Key action components	Indicative		Timeline
				Estimated CAPEX (Total & 2021-2026)	Annual OPEX (EUR)	
Energy and Efficiency						
B1	S.O.B1. Take action to improve the energy efficiency of the city's buildings	Renovation / Energy efficiency and use of RES in municipal buildings	Investment, Study, Policy	300 M 150 M	N/A	Q3 2021– Q4 2030
B3		Energy efficiency and use of RES in residential buildings	Investment, Study, Policy	930 M 465 M	0.08 M	Q3 2021– Q4 2030
B4		Regulations and incentive measures in residential and tertiary buildings	Investment, Study, Policy	540 M 270 M	0.04 M	Q3 2021– Q4 2030
B2	S.O.B2. Using buildings to create green space	Greening city buildings and its surrounding	Study, Policy	0.15 M 0.15 M	N/A	Q3 2021 – Q1 2022
E1	S.O.E1. Developing and improving the efficiency of the district heating distribution network	Connecting to the natural gas distribution network with a gradual increase in the share of gas from renewable energy sources	Investment, Study, Policy	300 M 150 M	N/A	Q3 2021– Q4 2030
E2		Air Quality Data system	Study	0.20 M 0.20 M	0.05 M	Q3 2021– Q2 2022
LE1		Development and improvement of the district heating distribution network	Investment, Study	400 M 200 M	N/A	Q3 2021– Q4 2030
LE2	S.O.E2. Cut Greenhouse gas emissions from the City	Improvement energy efficiency district heating heat sources	Investment, Study, Policy	400 M 400 M	N/A	Q3 2021– Q3 2025
PL1		Energy efficiency in public lighting	Investment, Study	15.2 M 15.2 M	N/A	Q3 2021– Q1 2025
PL2		Smart lighting switches	Investment, Study	35.63 M 17.82 M	N/A	Q3 2021– Q4 2030
TOTAL				2,921.18 M 1,668.37 M	0.17 M	

The table below shows the expected impacts of the actions in terms of energy saved, renewable energy produced, and CO₂ reduction in 2030 versus the baseline.

Table 3.3: Impacts of energy and efficiency actions in 2030, as compared to the baseline scenario

No	Action	Energy savings	Renewable energy production	CO ₂ reduction
		MWh/a	MWh/a	t CO ₂ /a
1	E1 - Connecting to the natural gas distribution network with a gradual increase in the share of gas from renewable energy sources	Not estimated, partially included in LE2		
2	LE1 - Development and improvement of the district heating distribution network	0	0	300,048
3	LE2 - Improvement energy efficiency district heating heat sources	0	0	535,964
4	PL1 - Energy efficiency in public lighting	28,529	0	31,382
5	PL2 - Smart lighting switches	22,123	0	24,335
6	B1 - Renovation / Energy efficiency and use of RES in municipal buildings	338,487	84,622	407,470
7	B3 - Energy efficiency and use of RES in residential buildings	1,350,078	34,460	553,033
8	B4 - Regulations and incentive measures in residential buildings			
Total effect of all actions		1,739,217	119,082	1,852,232

3.4.4 Actions

B1: Renovation / Energy efficiency and use of RES in municipal buildings

Purpose – Wholistic programme of renovation for public buildings covering thermal performance, energy consumption and RES

Benefits – Reductions of CO₂ emissions by c400,000 tCO₂e/year by 2030 as well as operational energy and cost savings

Costs – CAPEX: € 300M; OPEX: The measure results in net savings for the operating budget of the city.



2021		2022		2023		2024		By 2030
		Planning		Implementation		Implementation		Implementation

Description

This action involves a wholistic approach to renovation of public buildings in the city through a combination of analysis (i.e. investment-grade energy audits) followed by investments in measures including:

1. Renovation / Energy efficiency of municipal buildings – This can include the building envelope, replacement of windows, roofs, heating / cooling improvements, lighting, appliances, green procurement rules
2. Building management and energy monitoring in municipal buildings – This would include training and awareness raising for management of building. Required under Serbian legislation.
3. Use of renewable energy / efficient energy supply in municipal buildings - Typical measures include solar PV or water heating, or biomass, and heat pumps.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study



Strategic objectives targeted

- S.O.E.2 - Cut Greenhouse gas emissions from the City
- S.O.B.1 - Take action to improve the energy efficiency of the city's buildings

Key indicators & targets:

Reduction of CO₂ emissions by 407,000 t per year in the municipally owned buildings by 2030

The main goals are to treat all municipal buildings by this measure and to decrease energy demands in them up to 40% by 2030 – encompassing over 4.2 million m² in total.

Share of RES in total energy consumption in municipal buildings should be 17% by 2030.

Current Context

There are hundreds of buildings owned by the City of Belgrade including schools, kindergartens, sport centres, cultural, sports, social and health care institutions. Many of them were built several decades ago when there were no energy efficiency standards, and many of them have no or poor insulation and a high reliance on fossil fuels. One third of total number of buildings in Belgrade has no insulation. As a result the energy efficiency of the building stock is poor, but because of that it is a huge reservoir of opportunities to meet the goal of reducing emissions by 40% by 2030.

This measure is deeply aligned with all relevant state and city strategic documents, related to the energy, energy efficiency, environmental protection, air quality, climate change, etc

Investment Costs

CAPEX: **€ 300 M** assuming € 50 – 100 / m² (There are a number of municipal buildings under the heritage protection, for which the costs are slightly higher than for ordinary buildings. However, the upper limit of this interval would also likely cover these costs (period 2021-2026, **€ 150 M**)

OPEX: N/A - the measures will result in net savings for the operating budget of the city.

Fit with Funding sources

Multiple Options including IFIs, commercial banks/funds, and the City budget & Private sector models might include Energy Performance Contracts

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021– Q4 2030

Implementing bodies:

City administration - Secretariat for Energy, as the leading entity, then Secretariat for Environmental Protection, Secretariat for Investments, Secretariat for Education and Children's Welfare, Secretariat for General Affairs, as these secretariats can also lead such projects

Key stakeholders:

Building users, Ministry of Mining and Energy, international financial institutions, banks, manufacturers and sellers of equipment etc.

Delivery risks:

Financially resource intensive to achieve large scale (however there is appetite from donors and lenders)

Technical delivery capacity within the city administration

Potential low profitability of investments in RES, though this is not a large risk since technologies that are already well known would be implemented.

Smart City Potential - Potential to Benefit

Potential Smart aspects of investment could include:

(a) Building automation systems: embedded sensors and controls to mitigate energy and water inefficiencies in buildings; (b) Embedded ICT networks and WiFi to ensure that buildings have superfast connections such that utility usage data can be transferred; (c) Smart metering to encourage demand-side energy management (including time of usage and total demand);(d) Integrated renewables: building-based renewable energy applications with automated controls to switch between local and grid power depending on tariff and generating conditions.

Synergy with Other Actions

There is significant correlation between this measure and measures LE1, LE2, B2, B3, B4, E1 and E2.

Connecting municipal buildings to the district heating network or natural gas distribution network gives excellent results if it is realized simultaneously with the energy rehabilitation of these buildings and/or the introduction of renewable energy sources in them.

In addition, green roofs are one of the possible and effective measures to increase energy efficiency in many buildings in Belgrade, and in addition contribute to adaptation to climate change in urban areas.

Many measures and activities are similar in public and residential buildings.

B2: Greening buildings and its surrounding

Purpose – Technical assessment of opportunities to incentivise the use of green technologies (such as green walls/roofs)

Benefits – Climate adaptation benefits, potential pollution mitigation potential, thermal insulation and improved water retention

Costs – CAPEX: € 150K; OPEX: n/a



2021			2022			2023			2024			2030		
		Planning												

Description

Development of green roofs and installation of greenery on the vertical spaces of buildings (green walls – involving either vertical gardens or greenery installed on various levels for the outward-facing walls) can have notable environmental benefits in terms of adaptation to climate change, providing additional insulation which reduces heating/cooling loads, providing retention space for water and therefore slowing urban runoff and assisting in mitigating urban heat island effects. Other benefits include biodiversity, recreational and aesthetic benefits and improvements to local air quality conditions (particularly in “urban canyon” arrangements).

Encouraging the update of walls with greenery amongst the private sector can be challenging with increased capital costs, concerns over long term maintenance and additional effort required to deliver what has been a non-standard technology. However, many cities have actively encouraged developers to develop green walls. This could take the form of:

- Incentives such as more rapid approval of green wall/green roofed projects
- Technical guidance specific to Belgrade to align with local climatic conditions and regulations (such as fire safety)
- Clear information on whole life costs relative to traditional methods in a local context (noting that while capital costs may be high, whole life costs of some technologies can be comparable to traditional methods).

- Possible financial incentives to encourage developers to employ green roof or green technologies on the vertical spaces (e.g. outward walls).

A detailed study will be carried out to determine which policy interventions would have the optimal impact on uptake and then a process for adopting such policies in the General Urban Plan or other appropriate procedures in the city.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.L.3 – Substantially increasing the role that Green Infrastructure and open space play in provide in the operation of the city
- S.O.B.1 – Take action to improve the energy efficiency of the city’s buildings
- S.O.B.2 – Using buildings to create green space

Key indicators & targets

Implementation of enabling policies and guidance

Installation of 30,000 m² of green vertical space and/or Green roof space in the city - representing approximately 300 m² per building for 100 buildings.

Current Context

There is clear existing political support in Belgrade for making better use of Green infrastructure and for expanding a programme development of green walls and green roofs existing commitments to create such infrastructure. However, there is scope to enhance private sector uptake of these technologies in particular by creating enabling policies and incentives to do so. Significant uptake could also create green jobs in both the specialist installation and maintenance of such structures.



Investment Costs

CAPEX: EUR 150,000 (study only)

OPEX: N/A

Fit with Funding sources

City Budget, Donors. Ultimately private sector (but not at study stage).

City Budget	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q1 2022

Implementing bodies:

Secretariat for Environmental Protection, as the leading entity, then Secretariat for Energy, Secretariat for Utilities and Housing Services

Key stakeholders:

Secretariat for Environmental Protection, Ministry of Agriculture, Forestry and Water Management, University of Belgrade – Faculty of Forestry, University of Belgrade – Faculty of Biology

Delivery risks:

Risk of delivery of the study is low. The challenge is ensuring that the policy measures are implemented and successful.

Smart City Potential - Potential to Benefit

Asset management services of green spaces treating green and blue assets as economic assets and proactively managing them. Potential for improving quality and costs of maintenance in the case of green walls, a system that contains self-watering option might be installed.

Synergy with Other Actions

- L4 – City wide programme for urban green infrastructure development;
- L5 – Study on Urban Land Management Policies and Instruments

B3: Energy efficiency and use of RES in residential buildings

Purpose – Wholistic programme of rehabilitation to improve thermal and energy performance of residential buildings

Benefits – Reduction of CO2 emissions by 341,000 t per year in the residential sector by 2030

Costs – CAPEX: € 930M; OPEX: 80K/year



2021		2022		2023		2024		By 2030	
		Planning		Implementation		Implementation		Implementation	

Description

This action involves a wholistic approach to renovation of existing residential buildings from residents themselves with the city's support through a combination of analysis (i.e. investment-grade energy audits) followed by investments in measures including:

1. Encouraging the use of efficient equipment in residential buildings - Typical measures can include heating/cooling, lighting, appliances and can be implemented through grants, loans, or information campaigns
2. Renovation program for residential buildings - Typical measures can be implemented by the municipality with co-investments from the residents
3. Introduction of end-use heat metering and consumption-based billing
4. Realization of the project of reducing the number of individual heat sources by introducing renewable energy sources (heat pumps etc.)

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.B.1 - Take action to improve the energy efficiency of the city's buildings;
- S.O.E.2 - Cut Greenhouse gas emissions from the City;

- S.O.CCA.1 - The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning)

Key indicators & targets:



The main goals are to improve efficiency of at least 40% of residential buildings through this measure, to decrease energy demands in them up to 50% per building, and to have at least 20,000 households that use RES by 2030.

Consumption based billing for all residential consumers can provide savings of the heat consumption up to 20%.

Reduction of CO2 emissions by 341,000 t per year in the residential sector by 2030

Current Context

There are approximately 300,000 houses (and many apartment buildings) in Serbia without insulation. Roughly, 20% of them are situated in the territory of Belgrade. The residential building stock in Belgrade consists of a total of 251,000 houses and 157,000 multi-apartment buildings (355,000 dwellings) – a total of 606,000 dwellings. Many of these use fossil fuels as their primary heating source and energy efficiency is poor, meaning there is a huge reservoir of opportunities to meet the goal of reducing emissions by 40% by 2030. There are also related climate change adaptation benefits in terms of improving the resilience of the energy system, the buildings themselves, and improving human health.

About 325,000 households in Belgrade (50% of the total number of apartments) use district heating. Consumption based metering equipment is installed in all of 9,000 heat substations, but only 10% of households pay bills based on consumption – these are buildings have been built in last 10 years since new regulations came into force. By switching all residential buildings to the consumption-based billing, about 100,000 residents would pay higher bills than now, because their buildings are not energy efficient. In order to have all apartments charged according to consumption, which would lead to a reduction in fuel consumption and thus GHG emissions of up to 20%. To achieve this it is necessary to improve energy efficiency of buildings, and in the transition period to offer support in terms of payment models and incentives for increasing the energy efficiency to building owners.

This measure is directly aligned with all existing policies, city objectives and relevant state and city strategic documents, related to the energy, energy efficiency, environmental protection, air quality, and climate change.

Investment Costs

CAPEX: €930 M assuming 46.4 million m² of residential area – of which 40% would be renovated at 50 EUR/m² – much of the investment coming from building owners. Perhaps 20 – 40% from the city / other sources. (period 2021-2026, **€ 465 M**)

OPEX: The measure results in net savings for the population. If a subsidy programme is instituted, a monitoring and verification scheme needs to be implemented – approx. € 80,000 per year – € 640,000 over 8 years.

Fit with Funding sources

Multiple Options including IFIs, commercial banks/funds, and the City budget.

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q1 2021– Q4 2030

Implementing bodies:

City administration - Secretariat for Energy, as the leading entity, then Secretariat for Investments and parts of the city administration that conduct the implementation by the Law on planning and construction and participate in issuing the necessary conditions, permits and consent during the construction

Key stakeholders:

Housing communities (building associations), Ministry of Mining and Energy, international financial institutions, banks, manufacturers and sellers of equipment etc.

Delivery risks:

There are some potential challenges in terms of users being comfortable with domestic level metering and also in persuading private residents to commit to schemes. However, there are examples of successful schemes in Serbia suggesting it could be relative "quick win".

Financially resource intensive to achieve large scale – rehabilitation (however there is likely appetite from donors and lenders)

Institutional barriers to delivering a large programme across disparate housing communities. May require PMU support to achieve at scale.

Cost-effectiveness in investing in RES

Smart City Potential - Potential to Benefit

Potential Smart aspects of investment could include:

- a. Building automation systems: embedded sensors and controls to mitigate energy and water inefficiencies in buildings
- b. Embedded ICT networks and WiFi to ensure that buildings have superfast connections such that utility usage data can be transferred
- c. Smart metering to encourage demand-side energy management (including time of usage and total demand).
- d. Integrated renewables: building-based renewable energy applications with automated controls to switch between local and grid power depending on tariff and generating conditions.

Synergy with Other Actions

There is significant correlation between this measure and measures LE1, LE2, B1, B2, B4, E1 and E2.

Connecting residential buildings to the district heating network or natural gas distribution network gives excellent results if it is realized simultaneously with the energy rehabilitation of these buildings and/or the introduction of renewable energy sources in them.

In addition, green roofs are one of the possible and effective measures to increase energy efficiency in many buildings in Belgrade, and in addition contribute to adaptation to climate change in urban areas.

There is also potential to combine energy efficiency awareness with water efficiency awareness as promoted in WW2 including promoting water/energy efficient appliances and promoting/installing water saving devices (such as low flow taps/showers/water butts) in parallel with energy

efficiency improvements to buildings. Improved water efficiency also creates energy efficiency benefits at the city scale as it can reduce energy costs related to water distribution.

B4: Regulations and incentive measures in residential buildings

Purpose – Regulatory and policy measures to improve the energy efficiency of newly buildings

Benefits – Reduction of CO2 emissions by 260,000 t per year in the residential buildings by 2030

Costs – CAPEX: € 540M; OPEX: 40K/year



2021		2022		2023		2024		By 2030	
		Planning		Implementation		Implementation		Implementation	

Description

This action involves a wholistic approach to ensuring that new residential buildings are sustainable and go beyond current national standards, including:

1. Building regulations that consider energy use in new constructions / major renovations of existing buildings (residential buildings) – going beyond the requirements of national legislation
2. Encouraging through financial support the use of renewable energy / efficient energy sources (residential buildings) - Typical measure usually includes solar PV or water heating, or biomass, or heat pumps.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

S.O.E.2 - Cut Greenhouse gas emissions from the City;

S.O.CCA.1 - The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning)

Key indicators & targets:

- Decrease energy demand through the improved insulation up to 50%.
- Share of new households affected – 100%.
- Number of households that use RES – 20,000
- Reduction of CO2 emissions by 260,000 t per year in the residential buildings by 2030

Current Context

Regulatory measures are in the process of being adopted at national levels – though the municipality may play a role in enforcement. This measure would involve the city developing either tougher targets or incentive schemes to encourage private uptake of RES and energy efficiency measures in new buildings / those that undergo major renovations that go beyond basic compliance – expected to impact over 225,000 dwellings from 2020 – 2030, with expected savings of 37.5% per dwelling.

There are also benefits related climate change adaptation in terms of improving the resilience of the energy system, the buildings themselves, and improving human health.

Note this was not a high priority in previous studies.

Investment Costs

CAPEX: € 540 M assuming 13.5 million m² of new / completely renovated buildings – of which 100% would be impacted at 40 EUR/m² – much of the

investment coming from building owners. Perhaps 10% from the city / other sources. (period 2021-2026, € 270 M)

OPEX: Estimated € 40,000 per year for management for 8 years (€ 320,000)

Fit with Funding sources

Private investment for new buildings / renovation, with probable IFI / local FI involvement & Municipality (or State) budget for any incentive scheme.

City funds	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit



Implementation

Timescale:

Q3 2021– Q4 2030

Implementing bodies:

City administration - Secretariat for Energy, as the leading entity, then Secretariat for Investments and parts of the city administration that conduct

the implementation by the Law on planning and construction and participate in issuing the necessary conditions, permits and consent during the construction.

Key stakeholders:

Ministry of Mining and Energy, Ministry of Construction, Transport and Infrastructure, building owners, real estate developers, manufacturers and sellers of equipment, etc.

Delivery risks:

Dependent upon quick resolution of national regulatory framework and enforcement. This includes addressing issues related to net metering and the electricity grid.

Implementation of additional incentives requires capacity at a city level and interest from applicants.

Smart City Potential - Potential to Benefit

Potential for usage data to be collected and published to indicate to building users, the utility companies, and the city to facilitate measurement and verification / provide information.

Synergy with Other Actions

There is significant correlation between this measure and measures LE1, LE2, B1, B2, B3, E1 and E2.

Many measures and activities are similar in municipal and residential buildings

E1: Connecting to the natural gas distribution network with a gradual increase in the share of gas from renewable energy sources



Purpose – Expanding the natural gas network to support connections and reduce reliance on less clean energy sources

Benefits – Improvements in local air quality and GHG emissions

Costs – CAPEX: € 300M; OPEX: n/a

2021			2022			2023			2024			By 2030		
			Planning			Implementation			Implementation			Implementation		

Description

This action involves an investment by the city to expand the natural gas distribution network. The city would be responsible for investment in its own buildings and develop a policy / incentive programme to support the residential sector and other commercial sector based on demonstrated interest.

Connecting buildings (municipal, public or residential) to the natural gas distribution network is significantly preferable to solid fuel (coal), diesel, and electricity-based heating which is currently wide-spread. Switching to natural gas would reduce GHG emissions and provide much cleaner and more efficient use of energy.

There is a longer-term aspiration to include renewably derived biogas into the network to support future decarbonisation however this is not explicitly factored into this stage of the proposals and would need further study.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.E.1 - Developing and improving the efficiency of the district heating distribution network;
- S.O.E.2 - Cut Greenhouse gas emissions from the City

Key indicators & targets:

Double the current number of facilities connected to the natural gas distribution network by 2030

Current Context

The individual heat sources that use solid and liquid fossil fuels, together with transportation, are the key sources of GHG emissions and air pollution in the city.

There are less than 40,000 households connected to the natural gas distribution network in the City of Belgrade, supplied by 5 licenced supply companies for various sectors of the city. This fuel is much more environmentally and climatically acceptable than alternative such as coal, wood and oil fuels or electricity (which is predominantly generated from coal) which are used by households not connected to district heating. A

positive trend is that in recent years, large new business centres have been connected to the natural gas network.



There is significant scope for this measure to positively impact on GHG emissions, and potentially, have a substantial impact on air quality by displacing heavily polluting coal, wood and oil-fired boilers. This measure is aligned with all relevant state and city strategic documents, related to the energy, energy efficiency, environmental protection, air quality, climate change.¹³

¹³ It is important to note that this action involves extending the fossil-fuel based natural gas infrastructure. In theory, the same infrastructure could also be used for distribution of organic-based natural gas., have inefficient boilers that use environmentally very unfavourable solid and liquid fuels (coal, kerosene, and wood). In many buildings, the gas network is perhaps the only realistic and technically available solution to improved heating sources unless electricity is used (since efficient pellet stoves will not fit in most apartments for example). Since the gas used in Serbia does not contain sulphur, its use reduces significantly emissions of the sulphur dioxide, as well as emissions of other pollutions. The City has been implementing this measure for years, and proposed E1 is based on good experience of the effects of shutting down boiler rooms. By shutting down about

Investment Costs

CAPEX: **€ 300M** based on doubling the number of consumers – 30,000-40,000 new consumers, € 5,000-7,000 per connection, or more for some big consumers. Most of this would be paid for by customers but some small subsidies from the city (e.g. 10%) could trigger increased uptake. (period 2021-2026, **€ 150 M**)

OPEX: Would be recovered through revenue to the natural gas distributors who would be responsible for supplying customers.

Fit with Funding sources

Building owners / real estate developers with possible support from IFIs / local FIs and with City budget support.

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

It is important to highlight that many IFIs (including EBRD who provided support to the development of this GCAP) are becoming increasingly reluctant to support fossil fuel-based solutions as they strengthen their response to climate change. As a result, there are likely to be a limited number of international lenders willing to consider investment in a project such as this.

1,100 boiler rooms since 1990, by connecting users to the district heating network (which uses gas), as well as partly to the gas network, the soot emissions have been reduced below acceptable limits. Though natural gas does result in GHG emissions, it is noteworthy that unless sustainable biomass is an option, then the only other "clean option" would be electricity. However, electricity has a much higher GHG emissions factor than natural gas (approximately 1.1 tCO₂/MWh for electricity versus 0.202 tCO₂/MWh for natural gas). Even with electric-based heat pumps with a Coefficient of Performance of 5, the GHG balance would still favour natural gas over electricity. If a heat pump were to also address cooling demand, there may be an argument for using electricity.

Implementation

Timescale:

Q3 2021– Q4 2030

Implementing bodies:

City of Belgrade – Secretariat for Environmental Protection primarily and parts of the City administration - Secretariat for Energy, Secretariat for Investments, Secretariat for Education and Children's Welfare.

Key stakeholders:

Ministry of Mining and Energy, owners of the public and tertiary buildings, citizens, international financial institutions, investors in the construction of new buildings

Delivery risks:

There is a small risk that there will not be enough funds to achieve the anticipated number of connections. There is also a small risk that gas companies will not renew their gas distribution licenses, as a result of which they would not be able to connect new consumers to their network.

Smart City Potential - Potential to Benefit

Potential for smart metering of natural gas connections to allow usage data to be collected and published to indicate to building users, the utility companies, and the city to facilitate measurement and verification / provide information. This could include building automation systems which would be embedded sensors and controls to mitigate energy and water inefficiencies in buildings.

Synergy with Other Actions

There is significant correlation between this measure and measures B1, B3 and even B4. Development of the natural gas distribution network and connection of new consumers makes much more sense if the level of energy efficiency in buildings is increased at the same time.

E2: Air Quality Data system

Purpose – Strengthening the city’s system of air quality monitoring to improve air quality management

Benefits – Improved air quality (and associated public health benefits) through better informed decision making

Costs – CAPEX: € 200K; OPEX: 50K/year



2021			2022			2023			2024			By 2030	
		Planning											

Description

Establish an air quality information system as part of Belgrade's integral environmental information system with more than 50 measuring points.

This would build up on existing projects such as the projects "GIS air quality" (developed in 2016/17), "GIS Quality of Environmental Factors" (2018/19), which also included air quality. Contractors are obliged to enter monthly and annual air quality data regularly.

More emphasis is necessary on the impact of measures to improve air quality so that the tangible results of investment are clear through the results of the air quality monitoring. The number of measuring points also needs to be increased both in terms of their number but also in terms of the parameters that are measured at each location, in order to get a better picture of air quality, but also of the implemented measures

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.E.2 – Cut greenhouse gas emissions from the City

Key indicators & targets:

Regular air quality data entry 12 times a year (monthly) and annual review.

Establishing 3 times more measuring points

Also, may indirectly support the reduction of GHG emissions for the city by at least 40% by 2030



Current Context

In recent years, according to some criteria, Belgrade has been one of the most polluted cities in the world in terms of air pollution. Climate change exacerbates the retention of pollutants in the lower layers of the atmosphere which leads to an increased number of days with poor quality of air. Air quality data provide a basis for action to change this situation. There is an existing system and the cost of upscaling it would be relatively small. The suggestion is that it would be better to include systems such as this in a wider smart city objective (L3 rather than have a separate activity), however considering the priority given to air quality by stakeholders, a separate action has been retained.

This measure is aligned with the city strategic documents, related to the environmental protection and air quality. We can mention the Environmental Protection Program and the Air Quality Plan, which are strategic documents of the city of Belgrade in this area.

In the future, an Air Quality Forecasting System should be developed so that measures can be taken preventively, but also to inform the public in advance, especially vulnerable groups – children, old, chronic patients, about the upcoming air pollution, so that they can plan their activities accordingly.

Investment Costs

CAPEX: € 200,000 – based on experience to date of the system

OPEX: Likely to be marginal given the existing system (under € 50,000 per year or € 400,000 over 8 years)

Fit with Funding sources

City budget with potential support from national / regional funds or donors

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021– Q2 2022

Implementing bodies:

City of Belgrade – Secretariat for Environmental Protection

Key stakeholders:

Institute of Public Health of Belgrade, Republic Hydrometeorological Service of Serbia, Ministry of Health, City of Belgrade – Secretariat of Health

Delivery risks:

There is a small risk related to the lack of human resources for dealing with this.

Smart City Potential – Potential to Benefit

Potential for data to be collected and published via smart systems to indicate the City and to the population aspects related to air quality – available on mobile apps.

Synergy with Other Actions

There is correlation between this measure and most other measures, especially measures related to the sectors of Energy, Buildings, Transport, and even Waste, as these sectors are responsible for the largest emissions. Also, data on the air quality are very much related to the GHG emissions and health (as the burning of fossil fuels and hot days contribute to ground-level ozone), so there is a clear synergy of this measure with measures in the sector of adaptation to climate change (CCA).

LE 1: Development and improvement of the district heating (DH) distribution network

Purpose – Rehabilitation and expansion of the District Heating network to improve efficiency and reduce reliance on independent boilers

Benefits – Significant potential to contribute to CO2 emissions reductions and improve air quality

Costs – CAPEX: € 400M; OPEX: n/a



2021		2022		2023		2024		By 2030	
		Planning		Implementation		Implementation		Implementation	

Description

This measure proposes to address four key areas of activity in one programme. Namely:

- Reduction of losses in the heat distribution network** - The works are carried out in accordance with the existing district heating plan containing sections to be replaced (as an integral part of the Rehabilitation program), with adjustments to the new condition determined in the previous heating seasons.
- Expansion of the heat distribution network** - Within existing plans, it is envisioned that the distribution network will be developed in line with development of the city's construction land and land for public purpose (during 2018 and 2019 the conditions for joining have been issued for 1,950,000 m²)
- Interconnection of existing heating plants** – Development of technical documentation in two phases to cover the construction/reconstruction of large diameter heat pipes connecting the following areas:
 - Phase 1:** Interconnection of heating plants Novi Beograd – Dunav – Konjarnik
 - Phase 2:** Voždovac, Novi Beograd-Banovo Brdo, Novi Beograd (Zemun)-Galenika, Cerak-Miljakovac.

- Shutting down boiler rooms** – Reducing reliance on older solid and liquid fuel boilers by connecting consumers to the DH system. This is in process (3 more schools will be added) this year but should be scaled up.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.E.1 - Developing and improving the efficiency of the district heating distribution network
- S.O.E.2 - Cut Greenhouse gas emissions from the City
- S.O.CCA.1 - The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning)

Key indicators & targets:

Rehabilitation of the DH distribution network to create efficient, accessible connections for 50% of properties in the city.

Provide new 32,000 consumers of DH and new 32,000 consumers of DH and hot water by 2030 (i.e. connection % rising to 60.7% for DH and 11.1% for DH + hot water).

Reduce CO₂ emissions for the city by at least 40% by 2030– by broad means but particularly through improvements to district heating and adoption of renewables (this measure results in reduction of CO₂ emissions by 300,000 t per year in the residential buildings by 2030)

Current Context

District heating (DH) covers 50% of the city of Belgrade (and under 5% for DH + hot water). About 94% of the heat energy from Belgrade's DH system is obtained from natural gas, which, although a fossil fuel, is much more environmentally and climatically acceptable than solid and liquid fuels and is therefore less carbon intensive than alternatives. In addition to a less carbon intensive fuel source, there are also efficiency benefits to a centralised heat generation over decentralised boilers, creating additional opportunities for reductions in emissions if more customers connect. This comprehensive measure, which contains several components, has the one of the largest amounts of CO₂ reduction potential of all measures considered.

The use of independent and individual solid and liquid fuel heat sources in homes and buildings is also a significant contributor to local air quality problems in the City (which are at times severe) which makes this programme even more attractive for the GCAP. Shutting down individual heat sources that use solid and liquid fossil fuels and connecting their consumers to the district heating system provides better quality of heating, with significantly less emissions of GHG and harmful combustion products.

Investment Costs

CAPEX: € 350 - 400 M:¹⁴

1. Reduced losses in distribution network: € 100 M
2. Expansion of distribution network: € 200 - 250 M
3. Interconnection: € 45 M
4. Shutting down boiler rooms: € 5 - 15 M

(period 2021-2026, **€ 200 M**)

OPEX: The additional OPEX for this option would be covered through additional revenue for the DH companies



¹⁴ Sources of information:

- a) Losses in distribution network – Business plan of DH company for 2020 requires 10 M€ for this purpose. 10 years * € 10 M = € 100 M
- b) Expansion of distribution network - Business plan of DH company for 2020 requires € 16-17 M. 10 years * € 16-17 M = € 160-170 M. Given the higher goal than the current plan, assumed to be € 200-250 M.

c) Interconnection - Assumption submitted by the DH company.

d) Shutting down boiler rooms – based on expert experience as the manager in the City administration for this programme.

Fit with Funding sources

IFI, banks, and the City budget (potentially also involvement of Private sector via PPPs)

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021– Q4 2030

Implementing bodies:

PUC District heating company (JKP " Beogradske elektrane") and parts of the City administration - Secretariat for Energy, primarily, then Secretariat for Environmental Protection

Key stakeholders:

Ministry of Mining and Energy, IFIs, banks, PUC Electric Power Industry of Serbia (JP EPS), investors of construction of new buildings, City of Belgrade – Secretariat for Education and Children’s Welfare, Secretariat for sport (connection of schools, kindergartens, sport centers etc. to district heating system), manufacturers and sellers of equipment etc.

There has been interest from UNEP regarding the interconnection component of the project.

Delivery risks:

Interconnection of DH networks will have a smaller effect on reducing GHG emissions if a heating pipeline is not built in parallel from the thermal power plant TENT A in Obrenovac to the heating plant Novi Beograd as this would greatly relieve the DH system in Belgrade. While this is planned the commencement date for construction of this heating pipeline (involving around € 200 million of investment) is still unknown.

There is a small risk that there will not be enough funds for realization of the interconnection, which is worth several tens of millions of euros, however there has been interest from large banks, such as KfW, EBRD, EIB, etc.

Smart City Potential - Potential to Benefit

Potential for usage data to be collected and published to indicate to building users, the DH companies, and the city to facilitate measurement and verification / provide information on leaks and other inefficiencies.

Synergy with Other Actions

There is significant correlation between this measure and measures LE2, B1, B3 and even B4. Development of the DH network only makes sense if the level of energy efficiency in heat sources in the DH system is increased at the same time, as well as in all types of buildings that use DH, so that the development and increase of network efficiency would not be wasted.

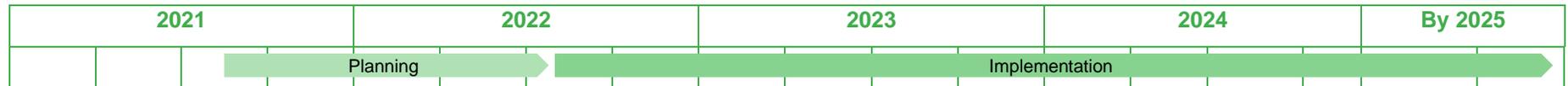
LE 2: Improvement energy efficiency of district heating (DH) heat sources



Purpose – Improving efficiency of heat sources with cogeneration, renewables and broader efficiency measures

Benefits – Substantial GHG emissions reduction possible and associated energy savings

Costs – CAPEX: € 400M; OPEX: n/a



Description

Coupled with LE1 (which covers distribution) this measure aims to improve efficiency of DH sources through co-generation, energy efficiency measures and potentially RES. There will be concerns around prolonging coal use with co-generation from international lenders, however it is likely that further improvements to the heat sources is an area of opportunity for investment through the GCAP process.

This measure includes three basic components:

1. Increasing the share of thermal energy from cogeneration
2. Increasing energy efficiency of district heating plants
3. Introducing solar energy (and other RES) into the DH system

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.E.2 - Cut Greenhouse gas emissions from the City

- S.O.E.1 - Developing and improving the efficiency of the district heating distribution network
- S.O.CCA.1 - The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning)

Key indicators & targets:

New 666.50 MWt of the installed heat capacity in district heating system from the CHP by 2030.

Improvements of efficiency of the gas plants (5%) and solid/liquid plants (10%)

10 % share of RES in district heating system. Having in mind the composition of the waste, it is estimated that 50-60 % of the produced heat energy in the Vinca Landfill (CHP – total installed heat capacity – 56 MW) will be obtained from the renewable energy sources (paper, cardboard, wood, food etc.). This increases the chances of achieving 10% RES in the district heating system.

536,000 tCO2 reduced per year from the baseline due to switching source of energy to waste heat for much of the DH system

Current Context



DH covers 50% of the city of Belgrade (and a little under 5% for hot water). About 94% of the heat energy from the Belgrade's DH system is obtained from natural gas, which, although fossil fuel, is much more environmentally and climatically acceptable than solid and liquid fuels.

Currently, the degree of efficiency of natural gas boilers in heating plants is 92-93%, while for liquid fuels it is about 85%, and for other fuels less. The share of renewable energy sources (RES - pellets and briquettes) is only 0.35%, which is negligible. Only one heating plant benefits from Cogeneration (10 MWe). There are a lot of opportunities for improvements, through the use of renewable sources, the introduction of more cogeneration plants, economizers, etc.

There is significant impact on GHG emissions and improved DH, and potentially a substantial impact on air quality. This measure is also deeply aligned with all relevant state and city strategic documents, related to the energy, energy efficiency, environmental protection, air quality, climate change etc.

Investment Costs

CAPEX: € 300-400 M:

1. CHP from TPP Nikola Tesla – € 165 M¹⁵, but later the DH company submitted proposals and estimated that the investment at € 200 M.

¹⁵ Based on the feasibility study developed by the Faculty of Mechanical Engineering, ordered by the DH company.

They also submitted data on the other two CHPs – € 25 M for Vinca landfill and € 10 M for Voždovac.

2. Increasing energy efficiency in DH plants - DH company has sent their plans to spend new € 15 M for this purpose.
3. RES¹⁶ – € 821,000 / MW - 10% of total heat production would be 160 MW, but biomass or geothermal can be cheaper

OPEX: The additional OPEX for this option would be covered through additional revenue generated by the DH companies. There would likely be negative ongoing costs (savings).

Fit with Funding sources

DH companies, IFIs, banks & City budget (potentially also involvement of Private sector via PPPs)

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021– Q3 2025

Implementing bodies:

PUC District heating company (JKP " Beogradske elektrane") and parts of the City administration - Secretariat for Energy

Key stakeholders:

Ministry of Mining and Energy, international financial institutions, banks, investors of construction of new buildings, manufacturers and sellers of equipment etc.

¹⁶ Draft study developed by the Korea DH Corp. for Belgrade's DH company found € 2.3 M for 2.8 MW of solar energy in the DH system.

Delivery risks:

Cogeneration can be a risky investment, depending on the difference between the price of used fuel and the price of produced electricity. The incentive system for cogeneration plants up to 10 MWe (feed-in tariffs) has been completed, and a new incentive system - auctions will soon be established.

As for use of solar energy (or energy source) in the DH system, in theory it can be risky, but the proposal, developed in the study for using solar energy in the heating plant Cerak (UNEP), this investment appears to be very profitable.

Smart City Potential - Potential to Benefit

Potential for improved process control in the heating sources linked to end-use smart metering.

Synergy with Other Actions

There is significant correlation between this measure and measures LE1, B1, B3 and even B4. Increasing level of the energy efficiency and use of RES in the heat sources and makes sense if the level of energy efficiency in the distribution network is increased at the same time, as well as in all types of buildings that use district heating, so that the measures in the heat sources would not be wasted.

PL 1: Energy efficiency in public lighting



Purpose – Replace approximately 38,000 mercury lamps with LED lamps

Benefits – Significant energy and GHG savings

Costs – CAPEX: € 15.2M; OPEX: n/a

2021			2022			2023			2024			By 2025		
		Planning	Implementation									Implementation		

Description

Substitution of old, inefficient lamps for more efficient ones, such as low pressure, high pressure lamps or LED lamps across the city.

- Sodium bulbs - 142,000 (112 W)
- Metal halogen - 13,500 (100 W)
- LED - 14,500 (112 W)

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.E.2 - Cut Greenhouse gas emissions from the City

Key indicators & targets:

All mercury lamps are substituted by LEDS lamps (approx. 38,000 bulbs)

Energy savings of approximately 28.5 GWh / year

CO₂ reductions of approximately 31,000 tonnes CO₂/year

Current Context

The city currently has the following breakdown of bulbs with the following estimated Wattage:

- Mercury bulbs - 38,000 (299 W)



This is a straightforward measure which is likely to be beneficial in CO2 emission terms. However, there is an ongoing programme and it is not clear how much additional benefit inclusion in the GCAP will achieve.

This measure could provide significant emissions savings and it is aligned with all relevant state and city strategic documents, related to the energy, energy efficiency, environmental protection, air quality, climate change etc

Investment Costs

CAPEX: - € **15.2M** for lamp replacement - based on the data obtained there are 38,000 mercury lamps. According to the price list of public lighting utilities adopted by the city administration, the price of the bulb replacement service per piece is € 75. To this value is added the average value of LED lamps € 200-500 (adopted total € 400) per piece, depending on quality, technical characteristics and manufacturers.

OPEX: Net OPEX is reduced due to electricity savings and the longer lifetime of LED lamps.

Fit with Funding sources

The City budget, PUC Public Lighting Company, IFI, banks, potentially PPP/ ESCOs.

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021– Q3 2025

Implementing bodies:

PUC Public Lighting Company (JKP " Javno osvetljenje") and parts of the City administration - Secretariat for Energy, primarily

Key stakeholders:

Ministry of Mining and Energy, international financial institutions, banks, possible candidates for PPP, manufacturers and sellers of equipment etc.

Delivery risks:

There is a small risk that it will be difficult to mobilize investment for the realization of this measure.

Smart City Potential - Potential to Benefit

Potential for lighting fixtures to be linked to smart monitoring technology and / or technology to dim / turn off and on given certain circumstances (see PL 2).

Synergy with Other Actions

There is a correlation between this measure and measures PL2, B1, T1 and T5.

There is a very clear connection between PL1 and PL2 as both they are related to the efficiency in the public lighting system. On the other hand, energy rehabilitation in the municipal buildings (B1) is a comprehensive measure if it includes measures related to the public lighting around those buildings. Also, measures in the transport sector that support walking and cycling (T5), as well as development of metro and train (T1) also require development of the public lighting system.

PL 2: Smart lighting switches - Remote-control in the public lighting



Purpose – Automation of lighting systems

Benefits – Reduce power consumption and extend lamp life

Costs – CAPEX: € 35.63M; OPEX: n/a

2021			2022			2023			2024			By 2030		
			Planning			Implementation			Implementation					

Description

Electronic photo-switches can reduce the electricity consumption in public lighting by reducing night burning hours (turning on later and turning off earlier). A Tele-management system enables the lighting system to automatically react to external parameters like traffic density, remaining daylight level, road construction works, accidents, or weather circumstances.

The proposal includes a remote-control device in the distribution cabinets of public lighting. This investment would be of great benefit and is a much smaller investment than the installation of smart switches in lamps. There are about 1,500 switchboards in Belgrade and 200,000 lamps and it is not possible to install smart switches for individual control of each lamp. For that reason, the proposal is to first establish control and the possibility of control on distribution cabinets and only then to consider the idea of installing individual smart devices in lamps.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.E.2 - Cut Greenhouse gas emissions from the City

Key indicators & targets:

The daily operation time will be reduced by total of 2 hours per bulb by 2030

Energy savings of approximately 22.1 GWh / year

CO₂ reductions of approximately 24,000 tonnes CO₂/year



Current Context

The city currently has approximately 208,000 lighting fixtures consuming 122 GWh / year. The benefit for energy saving and associated emissions reduction, based on experiences in other markets, show that after installing electronic photo-switches and tele-management system, a fully operative PL system only uses:

- 100% output in 25% of the operation time;
- 80% output in 28% of the operation time; and
- 60% output in 47% of the operation time.

Assuming 3,900 hours of yearly operation, the average used electricity input is 75.6% in comparison with PL system without photo-switches and tele-management. This means the yearly operation time will be reduced by 951 hours and average daily operation time will be reduced by 2 hours.

This measure is aligned with all relevant city and state strategic documents

Investment Costs

CAPEX: **€ 35.63 M** based on € 14,500 per switchboard x 2,457 switchboards – though more detail is needed on the number of light circuits in the city which would actually be implemented. Each circuit is supplied from one distribution cabinet and all connected lamps will be together remotely controlled. Controlled distribution cabinets also make it possible to remotely control from central dispatching point. (period 2021-2026, **€ 17.82 M**)

OPEX: Net OPEX is reduced due to electricity savings (through reduced operation time) and the longer lifetime of lamps. OPEX linked to the smart switches is nearly zero (only small switches consumption).

Fit with Funding sources

City budget, PUC Public Lighting Co., IFI, banks, potentially PPP/ ESCOs

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021– Q4 2030 (potentially faster via one large project)

Implementing bodies:

PUC Public Lighting Company (JKP " Javno osvetljenje") and parts of the City administration - Secretariat for Energy, primarily

Key stakeholders:

Ministry of Mining and Energy, international financial institutions, banks, possible candidates for PPP, manufacturers and sellers of equipment etc.

Delivery risks:

There is a small risk that it will be difficult to mobilize investment for the realization of this measure.

Smart City Potential - Entirely Smart

The measure involves linking lighting fixtures to smart monitoring technology and / or technology to dim / turn off and on given certain circumstances. The measure also prepares the possibility for central dispatching of public lighting system.

Synergy with Other Actions

There is correlation between this measure and measures PL1, B1, T1 and T5.

There is very clear connection between PL1 and PL2 as both they are related to the efficiency in the public lighting system. On the other hand, energy rehabilitation in the municipal buildings (B1) is a comprehensive measure if includes measures related to the public lighting around those buildings. Also, measures in the transport sector that support walking and cycling (T5), as well as development of metro and train (T1) also require development of the public lighting system.

3.5 Water and Waste



3.5.1 Current framework

Water

Improved flood protection will be achieved through the reconstruction of the existing embankments along the Danube, Sava and Kolubara riverbanks, regulation of riverbeds and provision of retention capacity in smaller water courses.

Belgrade Water and Sewerage Company is continuously replacing old pipes and other assets and further extending both drinking and wastewater networks.

The Agency for Environmental Protection at the Ministry (SEPA) publishes an annual report of water quality of Danube and Sava in Belgrade.

Belgrade's water company annual reports indicate that technical and administrative water losses are moderate. There is some doubt whether part of this information which relates to the technical losses is reliable. The bulk water meters in the Belgrade water supply network may not cover the whole of the system and in particular, the volume of water at all intakes, prior and after the treatment plants. It is not certain whether all water use is properly metered. There has been an issue with capacity of the unit to achieve calibration and repair of consumer water meters.

Waste

According to legislation on urban waste management in Serbia, local self-governance authorities are responsible for collection and disposal of solid waste within their respective territories. In Belgrade, these responsibilities are with the "Gradska čistoća" Public Utility Company, although monitoring, awareness rising and policy making responsibilities lay in the hands of the Secretariat for Environmental Protection which has a specific section for Waste Management. The Serbian Environmental Protection Agency is responsible for some national scale projects.

PUC "Gradska čistoća" has expanded the scope of collection of recyclable waste by installing collection bins including blue bins, recycling bells and sub-terranean containers.

In 2011, the City adopted the Local Waste Management Plan of Belgrade 2011-2020 and new plan for the period 2021-2030 is under preparation. It was designed to: improve waste collection and transport practices, increase waste re-use and recycling, plan the construction of waste treatment (including energy from waste) facilities, allow remediation of the existing landfill and the creation of a new sanitary landfill in Vinča. The local waste management plan 2021-2030 plans four transfer stations with waste collection centres (New Belgrade, Rakovica, Mladenovac and Palilula) and two more waste collection centres (Voždovac and New Belgrade)

The City decided to develop waste treatment and disposal facilities through a Public-Private Partnership (PPP) model. The purpose of this partnership is to negotiate the transfer of some responsibilities to private actors that should be carefully selected by the City. The private partner will deal with waste in all phases except waste collection and primary transportation which will remain the responsibility of the City. The new landfill will be suitable for disposal of all kinds of waste including communal, commercial, and industrial and will maximise the reuse of waste will rather than final disposal to landfill. By fulfilling those objectives, the City's management model will be aligned with national and EU regulations.

Prior to the construction of the new landfill, the closure and reclamation of the existing Vinča landfill is planned, and it is anticipated that other municipal waste treatment and disposal facilities will be constructed in most city municipalities, including the opening of at least one recycling centre per city municipality. This way the City will be ready for waste composting, recovery of CDW waste and compliance with the EU Waste Framework Directive, EU regulations, the Landfill Directive and the Industrial Emissions Directive.

3.5.2 Key Challenges

The key perceived challenges and response gaps for the water sector in Belgrade are as follows:

- The smaller water courses - type 3 rivers (Topčiderska, Železnička, Barička, Bolečka, Gročanska, etc. rivers) and the canals all have poor water quality. The riverbeds are often not regulated, their retention

capacity is compromised by a lack of maintenance and main wastewater collectors need to be built or rehabilitated.

- The Sava river is the primary source of drinking water but monitoring and the system of regulation of water quality upstream of the intakes and groundwater wells is insufficient. The number of water samples taken annually has steadily declined over the previous few years due to policy reforms. The recent values (2017,2018) show a rising trend in the number of samples. Better implementation of regulations, including international requirements, is needed.
- The drinking and the wastewater networks have grown rapidly with the city. While these networks reach most of the inhabitants, there is a need for increased efficiency and better management.

The key perceived challenges and response gaps for the Solid Waste sector in Belgrade are as follows:

- There is a significant challenge with the disposal of waste, particularly in the short term, with limited existing capacity at Vinča. However, a strategy of overall waste reduction is preferable to enhanced disposal capacity. Therefore, irrespective of these infrastructure challenges, there is a strong need for behavioural change and public education is probably the key tool to be employed.
- Waste collection is reported to be adequate although this is generally only partially segregated.
- Limited measures have been put in place to date, to implement recycling. There is a proposal to install recycling centres in each municipality. Education of people on the importance of and process for segregation of waste will need to play a significant role, once the facilities to do so exist.
- The landfill is at or very near capacity and does not meet sanitary standards and so requires urgent remediation. There is an on - going public private partnership project involving the construction of an Energy from Waste plant, remediation/demolition of the existing waste plant, a new landfill and remediation of the existing one. This is under implementation and is expected to be completed by the end of 2022 at Vinča.

- There is a significant challenge with illegal disposal of waste. The city has a budget for removal of waste but there needs to be stronger enforcement and removal as well as initiatives to challenge the behaviours that lead to illegal dumping.

3.5.3 Objectives and Actions

ID	Strategic Objective	Action	Key action components	Indicative		Timeline
				Estimated CAPEX (Total & 2021-2026)	OPEX per year (€)	
Water and Wastewater						
WW2	S.O.W1 – Reduce the losses in the network to achieve water saving and reuse	Water saving and Loss reduction	Investment, Study, Policy	40.0 M 40.0 M	N/A	Q3 2021 – Q1 2025
WW1	S.O.W2 – Protect more of the city from the risk of flooding	Small watercourse and drainage channel rehabilitation	Investment, Study, Policy	25.0 M 12.5 M	2 M	Q3 2021 – Q4 2030
WW3		Sustainable Urban Drainage Policy	Study, Policy	0.25 M 0.25 M	N/A	Q3 2021 – Q2 2022
WW4		Development of flood protection measures	Investment, Study, Policy	18.0 M 18.0 M	0.50 M	Q3 2021 – Q1 2025
WW6		Rainwater storage and retention	Investment, Policy	6.0 M 6.0 M	0.05 M	Q3 2021 – Q1 2025
WW5	S.O.W3 – Capture and treat wastewater	Wastewater Treatment Programme	Investment, Study	771.0 M 385.50 M	N/A	Q3 2021 – Q4 2029
TOTAL				860.25 M 462.25 M	2.55 M	
Solid Waste						
W2/5	S.O.SW1 – Improvement of infrastructure for separate collection, sorting, reuse and recycling of waste	Recyclable Waste collection	Investment, Policy	9.20 M 9.20 M	N/A	Q3 2021 – Q4 2025
W9/11		Green Energy from Waste	Investment	12.8 M 12.8 M	N/A	Q3 2021 – Q4 2023
W6		Household Hazardous Waste	Investment, Study, Policy	4.25 M 4.25 M	1.5 M	Q1 2022 – Q1 2026
W12		Recycling Collection Centres	Investment	20.0 M 20.0 M	0.84 M	Q3 2021 – Q4 2026
TOTAL				46.25 M 46.25 M	2.34 M	

3.5.4 Actions

WW 1: Small watercourse and drainage channel rehabilitation

Purpose – Rehabilitate channels to ensure good flow and enhance monitoring of smaller pollution sources to improve quality

Benefits – Improved urban drainage and resilience to localised flooding as well as improved water quality

Costs – CAPEX: € 25M; OPEX: 2M/year



2021		2022		2023		2024		By 2030	
		Planning		Implementation		Implementation		Implementation	

Description

Range of measures to improve the performance of secondary watercourses in the city. This would include

- i. a programme of water management facilities for the regulation of watercourses related to flood protection, erosion and flash floods on category II watercourses in the city of Belgrade in 2020
- ii. a review of diffuse pollution sources including wastewater and surface water contributions (such as road runoff) which should be considered in conjunction with WW3 (SUDS) and WW5 (Wastewater Treatment incl conveyance).
- iii. the development of a register of pollution sources for the most endangered small watercourses including “small” sources of pollution (Topčiderska, Železnička, Bolečica, Gročica, Galovica kanal, kanal Sibnica, etc.) to tackle cumulative impacts of multiple small polluters.
- iv. quality improvement for the most endangered small watercourses (Čukarički rukavac, Dunavac kanal etc.) and taking protection measures.

This would occur over two phases.

1. The first phase is a study to prioritise water courses and developed a design, prioritising nature-based solutions where viable.
2. The second phase is implementation where the aspiration is to achieve 40km of rehabilitation per year.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

S.O.W2. Protect more of the city from the risk of flooding; S.O.CCA1. The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning); S.O.W3. Achieve at least a 40% connection rate for residential and commercial properties connected to a sewage network with treatment

Key indicators & targets:

2. Biochemical oxygen demand (BOD) in rivers and lakes; 28. Percentage of dwellings damaged by the most intense flooding in last 10 years

Current Context

On the administrative territory of Belgrade there are about 180 small torrential streams, which pose a threat of flooding to populated areas, with short-term but highly dangerous effects. The small watersheds of the Topčider and Barič River, Kumodraž Stream and other, are particularly vulnerable to floods and stormwater. BOD value as an indicator shows that,

other than posing a threat of flooding, small watercourses are polluted, and water quality needs improvement. Pollution is likely to be coming from both diffuse sources (including but not limited to losses from the wastewater network/septic tanks, contaminated surface water runoff and agricultural products such as fertilisers and pesticides/herbicide) and point sources (including the cumulative effect of multiple small industrial contributors as well as large point sources).

Investment Costs

CAPEX: € 2.5 M/year (capital maintenance costs) – € 25 million over 10 years (period 2021-2026, **€ 12.5 M**)

OPEX: <10% of CAPEX / year – estimated at € 2 million annually

Fit with Funding sources

Municipally owned company investment with IFI and Donor involvement (Grant financing), likely national / regional funds as well

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q4 2030

Implementing bodies:

PWC "Beograd vode",
Serbian Water Company owned by the City of Belgrade

Key stakeholders:

City of Belgrade – Secretariat for Environmental Protection, Secretariat for Investments

Delivery risks:

No substantial risks perceived this is a straightforward rehabilitation programme

Smart City Potential - Potential to Benefit

Significant potential for smart technologies, particularly in real time water quality monitoring, flow data and asset performance and maintenance. [e.g. MOATA in New Zealand]

Synergy with Other Actions

This measure would be beneficial reducing the overall risk of flooding in Belgrade from storm water. Hopefully, once primary infrastructure for WW5 (Wastewater Treatment Programme) is finished, small watercourses will be able to be used as drainage channels for storm water.



WW 2: Water saving and loss reduction

Purpose – Investments to reduce per capita water consumption through a mix of infrastructure, billing and awareness measures

Benefits – Reduced water consumption

Costs – CAPEX: € 40M; OPEX: n/a



2021			2022			2023			2024			By 2025	
			Planning			Implementation							

Description

Development and implementation of a Water conservation plan for Belgrade, including measures for water distribution optimization, water harvesting and reuse, water saving measures in households; water consumption monitoring systems in industry and households, etc.; Improvement of water distribution systems and better water management; Reduction of losses through better leakage management;

1. Reconstruction of 50 km/year of the water supply network in order to reduce losses;
2. Awareness campaign for water saving (which could be linked to wider environmental awareness campaigns such as energy efficiency awareness promoted under BE3);
3. Promotion and distribution of home water saving devices (e.g. low flow taps/shower heads/water butts);
4. Household level metering/billing.
5. Investigate the use of Smart Metering in the network to improve monitoring and management of the distribution network itself and ensure these principals are embedded in new projects and ongoing reconstruction work.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

S.O.W1. Reduce the losses in the network to achieve water saving and reuse; S.O.E2. Cut Greenhouse gas emissions from the city – by broad means but



particularly through improvements to district heating and adoption of renewables; S.O.CCA1. The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning); S.O.W3. Achieve at least a 40% connection rate for residential and commercial properties connected to a sewage network with treatment

Key indicators & targets:

27.1 Percentage of buildings non-industrial equipped to reuse grey water

Current Context

There are no significant plans to reduce the water consumption per capita and non-revenue water currently under implementation. Also, there are no plans to start reusing grey water. Most of the Belgrade water supply network is in need of improvement. There is also substantial scope to improve water management in households, particularly in suburban and rural communities as well as in Industrial facilities with high water usage rates.

Investment Costs

CAPEX: € 40 million

OPEX: N/A – negative ongoing costs (savings)

Fit with Funding sources

City Budget (via city owned company), IFI and Donors. Private suppliers on service contract.

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q4 2025

Implementing bodies:

City of Belgrade Secretariat for housing and communal utilities; **Belgrade Waterworks and Sewerage Company**
Belgrade Land Development Public Agency, PE

Key stakeholders:

City of Belgrade - Secretariat for Environmental Protection, Secretariat for Investments

Delivery risks:

Unexpected water network problems/ issues can increase the forecasted CAPEX/ OPEX costs. Difficulties in finding appropriate service providers for Performance based Service Contracts. The cost of repair generally needs to be lower than the cost of production to be economically viable in short term budget cycles.

Smart City Potential - Potential to Benefit

Potential for usage of smart water metering technologies. Other IoT sensors can monitor pressure, flow volume and direction, delivering considerable information and insight into the conditions within the water supply networks.

Synergy with Other Actions

Potential overlap with BE3 both in terms of promoting efficient devices (such as washing machines/dishwashers) and installing water saving devices (such as low flow taps or cisterns) as part of building rehabilitation programmes.

WW 3: Sustainable Urban Drainage Policy

Purpose – Development of SUDS policies to minimise contributions of runoff to the public drainage network from new development

Benefits – Reduced risk of localised flooding and may create additional benefits in terms of localised greenspace and biodiversity

Costs – CAPEX: € 250K; OPEX: n/a



2021			2022			2023			2024			By 2030	
		Planning											

Description

Policy measures to implement the principals of Sustainable Urban Drainage within the city. This would be in conjunction with improved management of urban rainwater collectors and open canals for draining rainwater, including the regulation of streams (WW1). This would require the incorporation of SUDS principals into planning processes (and particularly into the General Urban Plan) such as requiring retention to achieve “greenfield” runoff rates from new developments sites and systematic planning for retention of flows within catchments (ideally by creating green spaces which act as flood storage areas as well as for recreation or biodiversity purposes). Additional guidance and design standards would be provided to developers to assist them in achieving compliance which would encourage the use of water permeable materials and retention technologies (from storage tanks in space constrained sites, to features such as swales and reedbeds in sites where there are interstitial spaces or landscaped areas0. These SUDS principals should be integrated into the new GUP as requirements for permission to develop areas.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.W2. Protect more of the city from the risk of flooding;
- S.O.CCA1. The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning);

Key indicators & targets:

28. Percentage of dwellings damaged by the most intense flooding in last 10 years

Inclusion of clear SUDS related policies in the General Urban Plan and subsequent planning decision making.



Current Context

Development of new urban drainage infrastructure could substantially improve localised flooding risk, since there are not any at the moment. Localised flooding is a common event in Belgrade and specific to certain locations. Belgrade is currently in the stage of rapid urbanisation, hence the number of localised floods can only increase, as well as their volume. Introducing SUDS infrastructure be the most efficient and economical solution, the kind of which will be necessary to tackle this problem.

Investment Costs

CAPEX: 250,000 (study only)

OPEX: no direct OPEX but potentially costs associated with enforcement

Fit with Funding sources

City Budgets, Donors

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q2 2022

Implementing bodies:

City of Belgrade, **Secretariat for Urban Planning and Construction**

Key stakeholders:

Secretariat for Environmental Protection, Ministry for Environmental Protection, private companies

Urban Planning Institute of Belgrade

Delivery risks:

There are limited risks associated with the development of a policy document, however careful engagement will be required with developers to ensure that the correct balance is struck between commercial considerations for additional space/infrastructure requirements on their sites and managing drainage in the wider network.

Smart City Potential - Potential to Benefit

A city wide drainage model could be used to understand where the risks of localised flooding exist and to vary the application of suds policies based on risk. In the longer term there are also potentially opportunities for monitoring of flow levels to dynamically manage runoff in the city.

Synergy with Other Actions

WW4 - Development of flood protection measures

WW 4: Development of flood protection measures

Purpose – Strengthening flood defence systems along major rivers and creating additional flood storage capacity

Benefits – Reduced current and climate induced risk of flooding which has previously caused significant disruption

Costs – CAPEX: € 18M; OPEX: € 500K



2021			2022			2023			2024			By 2025	
			Planning			Implementation							

Description

Flood protection involving a combination of measures, including reconstruction of existing embankments, reconstruction of existing overtopping walls at the quays; reconstruction and construction of river dikes and quays; construction of storage small reservoirs, retention basins and the regulation of riverbeds on smaller internal watercourses (see WW1). Implementation of an Operational plan for defence from floods on category II waters in the city of Belgrade for 2020 year.

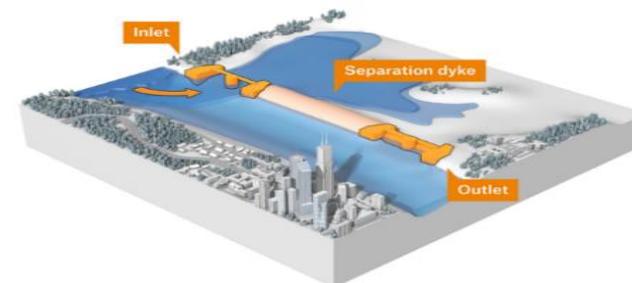
There are existing schemes in place to address capacity problems in combined sewer systems, however the City would benefit from the expansion of that programme reducing flood risk in other areas of the city and improving resilience to climate change. Currently planned activities include: Embankment in Novi Beograd and Zemun (reconstruction); Embankment from the delta of the Sava river to Block 70a on the left bank of the Sava (reconstruction); Parts of the embankment on the right bank of the Sava, from its delta to the upstream barrier at Ada Ciganlija, including embankments near Ostružnica and Umka (reconstruction); Embankment of the lower course of the Topčider river (reconstruction); Velikoselski Rit, Ada Huja, upstream from the “Šaran” restaurant (reconstruction and construction of river bank revetments and quays); Smaller internal watercourses (construction of small reservoirs, retentions and regulation of riverbeds).

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

S.O.W2. Protect more of the city from the risk of flooding; S.O.CCA1. The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning); S.O.W3. Achieve at least a 40% connection rate for residential and commercial properties connected to a sewage network with treatment



Key indicators & targets:

28. Percentage of dwellings damaged by the most intense flooding in last 10 years

Current Context

The most vulnerable parts of Belgrade are the flood prone areas near the Sava river (embankments of the Sava River in the Belgrade inner city, particularly the lower plateaus in the Stari Grad municipality from Sajam to the Sava-Danube estuary and Ada Ciganlija), the Danube (Zemun, Pančevacki Rit and Veliko Selo) and lower areas of the municipalities of Savski Venac and Čukarica. These areas are below the maximum elevation of the Sava and Danube and are at risk of flooding. They are protected by embankments, but in some places, these are old and not sufficiently high.

Investment Costs

CAPEX: € 18 million

OPEX: € 500,000/ year – € 4 million over 8 years

Fit with Funding sources

Local/State Budget, IFI and Donors

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation*Timescale:*

Q3 2021 – Q4 2024

Implementing bodies:

Serbian Water Company, Belgrade Water Company

Key stakeholders:

City of Belgrade - Secretariat for Environmental Protection, Secretariat for the Defence, Emergency Situations, Communications and Coordination of Public Relations

Delivery risks:

No significant risk is envisaged

Smart City Potential - Potential to Benefit

Opportunities for real time monitoring of flood levels as well as early warning systems for areas prone to flooding but not economic to defend.

Synergy with Other Actions

Strong overlap with the development of a Rainwater storage and retention (WW6), climate resilience planning (CCA1) and Green Infrastructure (L4)

WW 5: Wastewater Treatment Programme

Purpose – Establishment of a wastewater treatment plant and associated conveyance which is currently absent in the city

Benefits – Improved water quality in the Danube, Sava and local groundwater with associated biodiversity and amenity benefit

Costs – CAPEX: € 771M; OPEX: n/a



2021		2022			2023			2024			By 2030		
		Planning			Implementation							Implementation	

Description

A programme of improvements to the Wastewater treatment system which is envisioned to be delivered in two phases:

Phase I: Development of a hydraulic model and quality monitoring system for the Sava and Danube rivers which would be carefully calibrated through extensive measurements in order to give trustworthy data to determine the scope of Phase II and in particular the extent to which tertiary treatment is necessary or if there is opportunity to rely on the natural capacity of the Danube and Sava rivers to process nutrients as there is limited remaining heavy industrial activity in the city ;

In addition to the design of the wastewater infrastructure more consideration is necessary to determine the final disposal route for Sludge generated at the new wastewater treatment plant as it is unclear that the new landfill site at Vinca will provide appropriate disposal options. This should include consideration of landfilling (including alternative sites to Vinca), incineration, disposal to land.

Phase II: Elaboration of the planning and technical documentation for the wastewater treatment plant for the city's communal wastewater and construction of interceptors and other missing infrastructure for conveyance and a new wastewater treatment plant.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.W3. Achieve at least a 40% connection rate for residential and commercial properties connected to a sewage network with treatment;
- S.O.W2. Protect more of the city from the risk of flooding;

- S.O.CCA1. The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning);



Key indicators & targets:

27. Percentage of residential and commercial wastewater that is treated according to applicable national standards

Current Context

Belgrade is the only capital city in Europe that does not have a wastewater treatment system. One third of the city does not have a sewage system (and is reliant on septic tanks), and areas covered by the sewage system, ultimately lead to direct untreated discharges into the Sava and the Danube.

There is a significant opportunity to improve environmental performance within the city and potentially downstream to receptors such as the Black Sea¹⁷ and create a better quality of life for citizens.

There are already ongoing programmes to expand and improve wastewater collector networks which are well developed and have funding. Therefore, the collector network was scoped out of this action.

Investment Costs

CAPEX: € 771 million (period 2021-2026, € **385.50 M**)

OPEX: N/A – to be covered by fees

Fit with Funding sources

City Budget (with possible State support) IFI and Donors, potentially private sector financing (via PPP)

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Phase 1 (studies and scoping): Q3 2021 – Q1 2022

Phase 2 (design and delivery): Q2 2022 - Q4 2029 -

Implementing bodies:

Ministry of Construction, Transport and Infrastructure

Key stakeholders:

¹⁷ The case is often made that due to the large receiving capacity of Sava/Danube and its wide, slow flowing hydrology mean that natural processes remove much of the significant contamination locally. This has not been investigated by the consultants and would need robust examination in the proposed study.

City of Belgrade – Secretariat for Environmental Protection, Secretariat for Utilities and Housing Services, Secretariat for Investments, Belgrade Land Development Public Agency, PUC Water Supply and Sewage of Belgrade

Delivery risks:

Huge projects are always followed with risks. Strong coordination between all stakeholders is significant challenge

Smart City Potential - Potential to Benefit

Significant potential in both network monitoring and therefore dynamic response to incidents and proactive asset management. This could include, for example:

- (a) Intelligent process optimisation for water and wastewater treatment: includes supervisory control and data acquisition (SCADA) enabled smart management of treatment plants.
- (b) Leakage detection, location and control: Monitor with sensors and control pump pressure to reduce leakage
- (c) Low GHG wastewater treatment technology
- (d) Outflow quality and pollution monitoring: Real time data to instantly detect pollution incidences and post warnings in storm water and industrial use outflow water

Synergy with Other Actions - Will strengthen resilience to manage with heavy rainfall (where wastewater overflow can have serious implications for clean water supply and spread of disease).

WW 6: Rainwater storage and retention

Purpose – Creation of physical storage basins in network to retain runoff and reduce downstream flooding risks

Benefits – Reduced risk of flooding from urban drainage which could be exacerbated by climate change

Costs – CAPEX: € 6 M; OPEX: 50,000.00/ year



2021		2022		2023		2024		By 2025	
		Planning		Implementation					

Description

Retention basins would be designed and built as local storm water control facilities, i.e. basins that temporarily store excess storm runoff and then discharge it at a rate not to exceed the downstream channel capacity. The retention basins should provide the 100-year event runoff storage volume at the outfall point of the developed watershed.

The design of these basins provides substantial opportunity for Blue-Green infrastructure which creates both natural and engineered protection natural and social services for the city. In addition to flood storage, such areas can provide significant biodiversity and recreational benefits.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.W2. Protect more of the city from the risk of flooding;
- S.O.CCA1. The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning).

Key indicators & targets:

28. 1. Annual number of storm water or sewerage overflows per 100km of network length (no data)

Current Context

Increasing coverage of impermeable surfaces associated with urbanisation, has led to an increase in peak runoff flows from precipitation which can lead to flooding where downstream channels do not have appropriate capacity. Also, such rapid runoff is often of poor quality containing:

- Soil, i.e. material on the surface of the terrain
- From liquid and solid substances that have been poured or applied to the surface of the terrain
- Air pollution which has deposited out onto the surface of the terrain.

As Belgrade is in the process of intensive urbanization, it is necessary to create retention capacity to store water as close as possible to the place of their origin, but also to establish water quality monitoring of runoff to understand the impact of its release into the natural environment.

Investment Costs

CAPEX: € 6,000,000

OPEX: € 50,000/ year – or € 400,000 over 8 years

Fit with Funding sources

State Finance, City Budget, IFI and Donors

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q1 2025

Implementing bodies:

Belgrade Water Company

Key stakeholders:

City of Belgrade – Secretariat for Investments, PUC Water Supply and Sewage of Belgrade, Secretariat for Environmental Protection, Belgrade Land Development Public Agency

Delivery risks:

No significant risks envisaged.

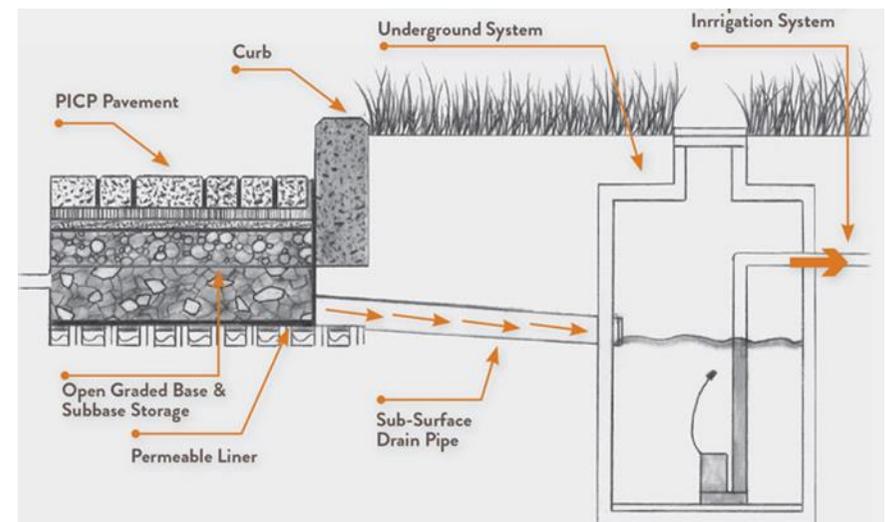
Smart City Potential - Potential to Benefit

Installation of sensors for identifying the need for emptying a container could improve time and hygiene management. There is a possibility to automate parts of the waste collection process, too.

Synergy with Other Actions

Will strengthen resilience to manage with heavy rainfall (where wastewater overflow can have serious implications for clean water supply and spread of disease).

Strong overlap with the development of a SUDS policy (WW3) which examines reducing runoff at source for new developments (rather than in catchment), climate resilience planning (CCA1) and Green Infrastructure (L4)



W2/5: Recyclable Waste Collection

Purpose – Distribution of infrastructure (collective and domestic) for collection of recyclable materials

Benefits – Increased recycling rates

Costs – CAPEX: € 9.2M; OPEX: n/a



2021		2022		2023		2024		By 2025	
Implementation								Implementation	

Description

This action refers to the collection of recyclable waste across different types of urban area. These include: 300 underground containers per year for recyclable municipal waste over a three year period planned for central high-density areas; 1,200 above ground recycling banks are planned in the transition zone; and 43,100 blue bins (240 litres capacity) are to be distributed for domestic waste separation in individual housing areas. This will also require an increase in the number of vehicles require to service waste collection of the new bins and containers.

Underground containers are much needed in the central city zones because they significantly contribute to the hygiene of public spaces and the aesthetics of the city streets. This is an ongoing program (since 2009) that is integrated into the business plan and program of PUC “Gradska čistoća”, which has the potential to be scaled up. So far, about 500 underground containers have been installed (which have a 10-year lifespan).

There are currently around 300 above-ground containers for recyclable waste (arranged within approximately 100 “recycling islands”), and there are approximately 100 “recycling bells” (for disposal of glass).

According to the Local Waste Management Plan of the City of Belgrade 2011-2020, one 240l bin per household should be distributed for the

disposal of recyclable waste (including PET, aluminium cans and paper). The lifecycle of these bins is 5 years, meaning an amortisation rate of 20%. The action regarding blue bins is has been justified due to the low-cost and because it has a good impact on kerbside recycling rates.

A plan for the installation of underground waste selection and recycling containers from 2019-2029 is also being elaborated, while the plans for some central city municipalities have been already adopted (Stari Grad and Vračar). According to the plan for the Stari Grad city municipality, in the following ten years installation of 840 underground containers are planned in an area of 538 ha.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted:

- S.O.SW.1. Enhance infrastructure for the separate collection, waste separation, reuse and recycling of municipal waste

Key indicators & targets:

31. Proportion of MSW that is sorted and recycled, total and by type of waste e.g. paper, glass, PVC bottles, metals, currently 2%, target 20% (by 2025 as interim and 65% by 2035 (as per EU target)).

31.1. Percentage of MSW which is disposed of in open dumps, controlled dumps or bodies of water or is burnt, currently 98%, target 20%.

31.2. Percentage of MSW landfilled disposed of in EU compliant sanitary landfills, currently 0%, target 100%.



Current Context

The measure is in line with the intentions and aims of the Local Waste Management Plan of the City of Belgrade 2011-2020 and with the Plans for Installation of Underground Containers for Waste Selection and Recycling 2019-2029, adopted by some city municipalities. The Environmental Protection Programme of the City of Belgrade (2015) pointed out the need for the Plans for Installation of Underground Containers for Waste Selection and Recycling 2019-2029 at the city level, as well as the role of the bins in the collection of mixed and recyclable waste.

Investment Costs

CAPEX: € 9.166 million as follows: € 8,000 underground container per piece¹⁸ (€ 7,200,000 total); € 130¹⁹ per above-ground container (€ 156,000 total); € 42 blue bin²⁰ (€ 1,810,200 total).

¹⁸ See www.gradskacistoca.rs/wp-content/uploads/2019/02/Sedma-izmena-Plana-JN-16.12.2019.-za-Portal.pdf (p. 8).

OPEX: N/A – covered with user fees

Fit with Funding sources

City, State, IFI and Donors, and general public for bins

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale: Q3 2021 – Q4 2025

Implementing bodies:

Secretariat for Environmental Protection, PUC “Gradska čistoća”, Ministry for Environmental Protection – Environmental Protection Agency

Key stakeholders: Private companies as distributors of new technologies in underground container production, private companies as producers of blue recycling bins.

Delivery risks: Attainment of a large number of locations for the installation of the underground containers and sufficient space to locate blue recycling bins by collection (most of the city sidewalks are turned to parking lots).

Smart City Potential - Potential to Benefit

Installation of sensors for identifying the need for emptying a container could improve time and hygiene management. There is a possibility to automate parts of the waste collection process as well.

Synergy with Other Actions

W9/11 – Green Energy from Waste; W12 – Recycling Collection Centres.

¹⁹ www.alibaba.com/product-detail/Cheap-price-big-volume-800-liter-60758314718.html?spm=a2700.drainage_lp_1.0.0.1b221af0F3Lsxf&s=p&fullFirstScreen=true

²⁰ See www.fontana.rs/vodovod-i-kupatilo/vodovod/ostalo-za-vodovod/kanta-za-smece-240-l?sku=UKS240

W6: Household Hazardous Waste

Purpose – Improve collection and disposal of Household Hazardous waste

Benefits – Reduced pollution of the natural environment by channelling hazardous materials into appropriate treatment and disposal.

Costs – CAPEX: € 4.25M; OPEX: € 1.5M/year



2021				2022				2023				2024				By 2030			
				Planning				Implementation				Implementation							

Description

Following one of the basic principles of waste management, household hazardous waste cannot be disposed of together with non-hazardous waste.

The action creates space within four proposed transfer stations and two centres for waste collection (see W12) to provide citizens with the ability to appropriately dispose of hazardous waste.

There is also a measure in the Local Waste Management Plan of the City of Belgrade (2009), which requires PUC “Gradska čistoća” to collect hazardous waste from the population twice a year under existing service charges, using a special vehicle. The mobile collection system consists of a specially equipped truck that stops at a series of the pre-determined locations where citizens can deposit their hazardous waste. People who have a permit for the collection and transport of certain streams of hazardous waste will also continuously collect waste in accordance with recently adopted regulations.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

S.O.SW.1 – Enhance infrastructure for the separate collection, waste separation, reuse and recycling of municipal waste

Key indicators & targets:

31.2. Percentage of MSW landfilled disposed of in EU compliant sanitary landfills, currently 0%, target 100%.

Current Context

It is estimated that in Belgrade there are about 15,000 tonnes of hazardous waste generated annually. Hazardous waste is often stored and disposed improperly, without prior treatment. Currently, there are no registered hazardous waste treatment plants in Serbia, although there are several plants that are in the process of obtaining the necessary waste management permits.

Investment Costs

CAPEX: € 4.25 million based on:

- 5 vehicles at € 250,000 each
- € 3 million for the development of specific landfill site

OPEX: € 1.5 million per year – assuming approximately € 100 per tonne – € 10.5 million over 8 years



Fit with Funding sources

City, State, IFI and Donors

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q4 2023

Implementing bodies:

Secretariat for Environmental Protection, **PUC “Gradska čistoća”**.

Key stakeholders:

Ministry for Environmental Protection, Secretariat for Utilities and Housing Services, private companies with the license to collect hazardous waste.

Delivery risks:

Smart City Potential - Potential to Benefit

So far, the stress is on arranging space for disposal of household hazardous waste and establishing a system for its regular collection. The use of smart technologies is not currently intended by the implementation of this measure. However, an additional component could be added involving digital tracking and payment for waste disposal with feedback delivered to users to increase awareness and reduce waste.

Synergy with Other Actions

W12 – Recycling Collection Centres.

WW5 – There is a need to find a solution to sludge disposal from proposed wastewater treatment projects. However, we consider that a specific strategy for wastewater sludge is necessary and therefore have not incorporated this into this measure.

W9-11: Green Energy from Waste

Purpose – Investment in biofuels and cogeneration based on organic waste

Benefits – Scope for substantial carbon and energy benefits along with a potential reduction in waste volume to landfill

Costs – CAPEX: € 12.8M; OPEX: n/a



2021		2022		2023		2024		By 2025	
		Planning		Implementation		Implementation		Implementation	

Description

This action involves investment in facilities to use organic waste to produce biogas and energy (electricity and heating) and compost. Construction of a facility for biogas production out of manure and biomass in the proximity of the “PKB” site (a major agribusiness centre) could create benefits in terms of reductions in GHG emissions. It is likely to be a substantial investment with reasonable profitability.

The territory of the city of Belgrade includes large scale industrial crop production over an area of about 6,780 ha. Currently, soybean and oilseed rape production could yield about 3,500 tonnes of biodiesel per year. By using uncultivated or repurposing part of the cultivated land (in the municipalities of Surčin, Sopot, Obrenovac and Palilula), raw materials could be provided for a biodiesel factory with a capacity of 10,000 tonnes per year.

The Environmental Protection Programme (2009) and Local Waste Management Plan of the City of Belgrade 2011-2020 define construction and equipping of plants for the composting of green waste as one of the necessary measures, however within this 3-5 year GCAP cycle, stakeholders suggested this was not included in the scope of this action and that the focus was placed on activities other than domestic composting.

The Development Strategy for the City of Belgrade (2017) lists the following relevant projects: (1) Construction of a landfill gas power plant (after the closure of the Vinča landfill) with a maximum capacity of 4 MW (estimated total cost: € 8,000,000), (2) Construction of a cogeneration plant (2.4 MW of heat and 300 kW of electricity) in Padinska Skela fuelled by biomass (estimated total cost: € 4,800,000). Construction is already underway on an additional cogeneration plant (80 to 90 MW of heat and 10 MW of electricity) at the Waste Management Centre in Vinča (estimated total cost: € 90,000,000 – noting that this is already financed)

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

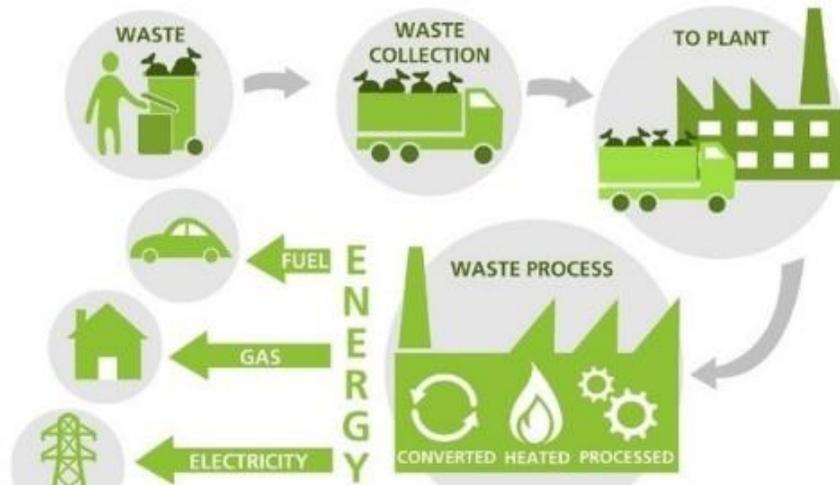
Strategic objectives targeted

- S.O.SW.1. Enhance infrastructure for the separate collection, waste separation, reuse and recycling of municipal waste

Key indicators & targets:

31.1. Percentage of MSW which is disposed of in open dumps, controlled dumps or bodies of water or is burnt, currently 98%, target 20%.

31.2. Percentage of MSW landfilled disposed of in EU compliant sanitary landfills, currently 0%, target 100%.



Current Context

Biogas is recognized as one of the proposed RES measures in the territory of Belgrade in the Environmental Protection Programme (2009), also supported by the Local Waste Management Plan of the City of Belgrade 2011-2020. In addition, the Development Strategy of the City of Belgrade (2017) describes the project in Padinska Skela. The Development Strategy also defines the construction of cogenerated energy production facilities.

Investment Costs

CAPEX: € 12.8 million for biogas power plant and one cogeneration plant²¹;

OPEX: N/A - Operating expenses will be covered by income received for energy generation.

²¹ Development Strategy of the City of Belgrade – Action Plan (2017)

Fit with Funding sources

City, IFI and Donors, planned at least partially via PPP

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q3 2025 *Implementing bodies:*

Secretariat for Energy, PUC “**Beogradske elektrane**”, Agricultural Combine Belgrade (PKB), PUC “Zelenilo Beograd”

Key stakeholders:

Ministry for Mining and Energy, Secretariat for Environmental Protection.

Delivery risks:

Acquisition of land for the construction of plants and land ownership issues might postpone delivery, as it has already been the case with construction of a cogeneration plant in Padinska Skela. Reaching suitable agreement between PPP parties might also postpone delivery.

Smart City Potential - Potential to Benefit

Automation of some processes such as biowaste collection and energy production represent a possibility

Synergy with Other Actions

W2-5 – (Recyclable) Waste Collection; W12 – Recycling Collection Centres; E1 – Connecting to the natural gas distribution network with a gradual increase in the share of gas from renewable energy sources

W12: Recycling Collection Centres

Purpose – Creating locations where people can deliver recyclable waste to increase recycling rates

Benefits – Better access to recycling facilities for citizens and therefore improved rates of recycling.

Costs – CAPEX: € 20M; OPEX: € 840K/year



2021		2022		2023		2024		By 2026	
		Implementation						Implementation	

Description

This action refers to the construction and equipping of 4 transfer stations with the collection of recyclable waste and 2 centres for the collection of recyclable waste alone. Both transfer stations and recycle centres will have a facility for the separation of recyclables. Technical documentation is in preparation and three recycling centres have been equipped: within the PUC “Gradska čistoća” facility – Novi Beograd; at Milan Toplice Street 1 Voždovac; and within the PUC “Gradska čistoća” Višnjička 55 b (new hall within the “Waste” facility). An additional recycling centre funded by the Kingdom of Norway and is located at Django Reinhart bb – Mirijevo settlement, Zvezdara City Municipality. Technical documentation for other recycling centres is also under development.

An additional challenge is that the collection fleet is constrained by the number of available operating trucks and also by a challenge that trucks do not allow for segregated waste collection and therefore residents see segregated waste streams being mixed when collected which disincentivises people from segregating waste. Therefore, it is proposed that an additional number of specialised collection trucks are purchased. No study to accurately determine the number of trucks has been done and the consultant has nominally estimated 85 trucks over 5 years based on an average of 5 trucks in each of the 17 municipalities.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

S.O.SW.1. Enhance infrastructure for the separate collection, waste separation, reuse and recycling of municipal waste

Key indicators & targets:

31. Proportion of MSW that is sorted and recycled, total and by type of waste e.g. paper, glass, PVC, bottles, metals, currently 2%, target 20%.

31.2. Percentage of MSW landfilled disposed of in EU compliant sanitary landfills, currently 0%, target 100%.



per city municipality, while the other document requires smaller number of the centres.

Investment Costs

CAPEX: € 20,000,000 € – including € 12,000,000 for recycling centres & € 8,000,000 for collection trucks

OPEX: € 840,000 / year (€ 60,000 per year per centre for 14 centres²²) – or € 6.72 million over 8 years.

Current Context

Recycling rates in Belgrade are low with most of the waste going direct to landfill and in future, to an Energy-from-Waste Plant. However, it would be desirable to divert recyclables to ensure that they are recovered, and these are important facilities to enable that.

The action is in line with the intentions and aims of the new Local Waste Management Plan of the City of Belgrade 2021-2030 but with the difference that GCAP action, as well as the Environmental Protection Programme of the City of Belgrade (2009), requires one recycle centre

Fit with Funding sources

City, IFI and Donors

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

Q3 2021 – Q4 2026

Implementing bodies: Secretariat for Environmental Protection, PUC “Gradska čistoća”.

Key stakeholders: Ministry for Environmental Protection, Secretariat for Utilities and Housing Services

Delivery risks:

The attainment of locations for the recycling centres might be time-consuming and might require alternative solutions. By the construction of the new sanitary landfill with cogeneration facilities in Vinča the City will be obliged to secure minimal amount of waste; therefore, it might be challenging to secure both needs for the cogeneration and recycling/reuse.

Smart City Potential - No Foreseeable Opportunity

So far, the stress is on establishing new recycling centres. The use of smart technologies is not intended by the implementation of this measure.

Synergy with Other Actions

W2/5: Recyclable Waste Collection

²² Estimate based on 2 to 3 staff per centre plus office expenses.

3.6 Greening and Resilience



3.6.1 Current framework

Greening

“Zelenilo-Beograd” is the public utility company that is in charge of green spaces in the City. Besides maintenance, creation of new green spaces and recreation zones, this company is also responsible for the creation of plans, investment and technical documentation for the reconstruction of existing areas and the planning of new areas such as parks, road greenery, squares, etc. The company operates within the territory of the 10 central municipalities in Belgrade, while the other municipalities have their own public utility companies, or delegate these activities to a private company (in the case of the Mladenovac municipality).

Maintenance and development of green spaces in the City is led according to a Business Program, which focuses on quality, preservation, improvement, expansion of green spaces and adoption of new technological processes that mitigate the negative impacts of urban lifestyles on the environment and population health. Different procedures are assigned to different green spaces that are categorised by type: parks, squares, street lawns, road and residential greenery belong to I to V category, areas that are not used for planned purposes belong to category VI, and vertical greenery (i.e. green walls) is assigned category VII.

While creating the Belgrade Master Plan 2021, it has become clear that the City does not have a clear strategy on green spaces, nor a financing policy. In response to this, the Urban Planning Institute of Belgrade has created the “Green Regulatory of Belgrade” project which was executed in the following four phases and adopted in August 2019:

- Phase I: analysis of best practice and creation of a draft “Resolution on Protection and Improvement of Green Spaces of Belgrade”;
- Phase II: preparation of a program for the creation of a GIS system for green spaces;
- Phase III: population of the GIS with relevant habitat data;
- Phase IV: creation of the General Regional Plan for the System of Green Spaces in Belgrade.

Running parallel to this project is the creation of a green areas cadastre (also using GIS) which is now fully operational. The main goal of this initiative was to secure an integrated database on green spaces for further processing of planning, use, maintenance and protection, whilst simultaneously enabling open access to the data.

Resilience

In its 2017 **Second National Communication** (2NC) to the United Nations Convention on Climate Change (UNFCCC) the Republic of Serbia highlights that the sectors at the national level highly vulnerable to climate change include:

- Hydrology and water resources
- Forestry
- Agriculture
- Health care

The 2NC recommends a series of adaptation measures for each of the sectoral vulnerability assessments completed, covering the following strategic areas of **risk reduction, policy, monitoring and research, capacity building and public awareness**. There is acknowledgment in the report that there is a need for further and more detailed analysis in all sectors. In its 2017 Second national communication to the United Nations Convention on Climate Change (UNFCCC) the Republic of Serbia highlights that the sectors highly vulnerable to climate change include:

In terms of adaptation measures, specific recommendations have been made for each of the five sectors analysed in more detail in the 2012 Climate Change Vulnerability Assessment (CVA) of Serbia (a slightly different sector list than set out in the more recent Second National Communication: **water management, public health, agriculture, energy and biodiversity**). In accordance with the identified pervasive problems, main recommendations include: elaboration of strategic adaptation papers, establishing of coordination bodies for planning and implementation of adaptation measures, systemic development of intersectoral cooperation, strengthening of scientific capacities and development of cooperation

between the scientific sector and decision-makers, and inclusion of the civil society in the adaptation planning process.

All of these recommendations are likely to be transferrable to the City level, and most are aligned with the city specific climate vulnerabilities and measures set out in the City's climate change adaptation action plan and vulnerability assessment.

In 2015, the City of Belgrade (led by the Secretariat for Environmental Protection) developed a specific **climate change adaptation action plan and vulnerability assessment** (CCAAP) supported by the German Gesellschaft für Internationale Zusammenarbeit (GIZ) through the project Climate Change Adaptation in Western Balkans (CCAWB).

This specific city of Belgrade assessment highlights that the following sectors are particularly vulnerable to climate change in Belgrade:

- Population
- Infrastructure
- Built environment
- Economy
- Natural resources

The actions cover urban green structures, water systems, urban planning, building design and non-structural measures, and include details of the implementing agencies, a priority ranking (high, medium or low) as agreed with the working group set up and a timeframe classified as short term (with an implementation period of up to two years), medium term (with an implementation period of 2 to 5 years), long term (with an implementation period of over 10 years) and continual. According to the applied multi-criteria analysis, the green infrastructure development and the flood protection are the highest priority measures.

Accompanying the adaptation activities is a plan for the monitoring of their implementation requiring achievement criteria to be established by the working group. There is, however, no mention of how these adaptation activities (nor their monitoring) will be funded, or what development finance

or university research funding could be accessed to assist the implementation.

In 2018, Belgrade joined the EU Covenant of Mayors for Climate and Energy in 2018. This commits the City of a reduction of at least 40% in GHG emissions by 2030 alongside adopting a joint approach to tackle climate change mitigation and adaptation. As part of the commitments, the City is also required to submit a Sustainable Energy and Climate Change Action Plan ("SECAP") to outline the key actions they plan to undertake and will include mainstreaming of adaptation (and mitigation) measures into relevant plans within 2 years (alongside include a Baseline Emission Inventory to track mitigation).

3.6.2 Key Challenges

The key perceived challenges for green space are as follows:

- Uncontrolled urban sprawl often happens at the expense of green spaces.
- The database on green areas (GIS) still needs to be opened to the public and updated regularly. Even then there is a risk of misinformation due to illegal activities (such building) that changes the situation notification to the responsible authorities.
- Establishing the Directorate for Public Green Space Management
- Adoption of the Law on Green Infrastructure, which would ensure compliance with the rules during implementation of projects, and more importantly the quality control of the works in accordance with the Terms and Conditions that exists, but there is no control body
- Linking green spaces so that they are seen as a single system to maximize their functionality.
- The park and recreation zone network outside of the inner-city requires improvements. The few large recreation zones that exist are not enough for many residents for daily use. Access to these spaces has become more important to citizens during the ongoing COVID 19 pandemic where people need access to local greenspace for both exercise and mental wellbeing.

- Certain green spaces could be less accessible by public transport, which may discourage citizens from using them or increase the requirements for using a car and subsequently the provision of parking lots.

A thorough analysis of the **city's vulnerability and resilience/ adaptation potential** has been carried out as a part of the Sustainable Energy and Climate Action which accompanies this document. This was largely based on work that had already been carried out for the Belgrade Climate Change Adaptation Action Plan which was developed in 2015 and looked comprehensively at vulnerabilities across the City.

A range of climate hazards were identified including, heatwaves, extreme cold and flooding present the highest risks to Belgrade. While extreme cold has historically had severe impacts, the projected climate scenarios indicate that overall temperature increases should have a balancing effect, reducing the likelihood of extreme cold in the future. Flooding is likely to remain a significant hazard.

The main risks to the city's economy concern tourism and industry. Tourism is vulnerable to extreme heat and drought in the summer months and the expected impact on water quality and supply. The main industries identified as vulnerable in Belgrade include the energy and mining sectors. This is because of their dependency on the city's infrastructures (including transport, energy and water supply) and the anticipated disruptions to these services due to occurrences of extreme temperatures, heavy precipitation and flooding.

Future risks to the economy were also assessed with respect to retail. Overall, the risks were assessed as low / medium. Extreme heat was identified as posing a high risk to retail due to potential disruptions to the transportation of goods and changes in buying behaviour.

Building stock and materials probably face more damage due to high and very high risk of heat waves, droughts, and storms in summer and floods in summer and winter. The built environment relates to existing buildings, urban infrastructure (such as pavements etc.). In Belgrade, the built environment is highly exposed to climate hazards rendering it highly vulnerable, especially in densely built-up areas.

The vulnerability of natural resources is very high. Open green spaces demonstrate a high level of vulnerability to almost all of the potential effects of climate change. It is estimated that the Belgrade water resources, and their quality are highly vulnerable to the effect of heatwaves and droughts. It is estimated that heat waves, extreme cold and heavy precipitations / floods, as effects of climate change, will significantly affect the deterioration of air quality in Belgrade.

The vulnerability of agricultural and forestry is estimated as high to all the effects of climate change. The vulnerability of biodiversity and ecosystems in Belgrade to heatwaves and droughts is estimated to be high, due to their high exposure and low adaptive capacity. The vulnerability of biodiversity and ecosystems to the effects of extreme cold is estimated as medium.

In terms of adaptive capacity, two types of vulnerabilities can be distinguished: vulnerability stemming from the socio-economic context, and vulnerability stemming from the physical and environmental situation.

Adaptive capacities to socio-economic vulnerability in Belgrade include the following:

- The population has a low adaptive capacity and high sensitivity to climate (in particular the elderly, infants and children, people with mobility impairments, chronic illnesses, etc.). There is no pronounced spatial distribution of poverty; and
- Industry (namely mining and energy) has a low adaptive capacity, due to its dependency on transport infrastructure.

Adaptive capacities to physical and environmental vulnerability in Belgrade include the following:

- Infrastructure: City infrastructures flagged as having low adaptive capacity due to their high exposure include: road transport (with the busy routes and streets the most vulnerable), electricity and district heating systems, and water supply and sewerage;
- Natural resources: the adaptation plan observed low adaptive capacity for open green spaces, water resources, agricultural and forestry, biodiversity and ecosystems;

- Built environment: limited adaptive capacity due to high exposure to extreme weather conditions of building stock and materials.

Perhaps the greatest challenge is in the implementation of the existing CCAPP document and this could be further strengthened by:

- Improved collection of monitoring data for resilience metrics to ensure that accurate information is used in decision making

- Improved economic analysis of the impact of vulnerabilities to ensure that the economic consequences of mal-adaptation or inaction are given due consideration in decision making processes
- Alignment of city and government objectives to ensure that national objectives and municipal objectives are aligned to meet ratified international commitments.

3.6.3 Objectives and Actions

ID	Strategic Objective	Action	Key action components	Indicative		Timeline
				Estimated CAPEX (Total & 2021-2026)	Annual OPEX (€)	
Climate Adaption						
CCA1	S.O. CCA1 – The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning)	Integrating climate adaptation into Belgrade's decision-making processes, including policy developments and project investments (then paired up with public awareness raising)	Institutional measure, Study, Monitoring framework	0.25 M <i>0.25 M</i>	0.05 M	Q3 2021 – Q3 2025
Green space						
GS1	S.O.GS1 – Substantially increase the "tree cover" territory and level of porosity of Belgrade's territory	Afforestation and Greening programmes	Investment, Policy	100 M <i>55.56 M</i>	N/A	Q3 2021 – Q2 2029
TOTAL				100.25 M <i>55.81 M</i>	0.05 M	

3.6.4 Actions

CCA 1: Integrating climate adaptation into Belgrade's decision-making processes, including policy developments and project investments (then paired up with public awareness raising)

Purpose – Implement institution measures to ensure that climate is integrated into decision making

Benefits – Improved resilience to climate change and associated social, economic, and environmental benefits

Costs – CAPEX: € 250K; OPEX: €50K/year



2021		2022		2023		2024		By 2025
		Implementation						Implementation

Description

The purpose of integrating climate adaptation into Belgrade's decision-making processes will be twofold: (1) Reducing climate sensitivities and increasing adaptive capacities and (2) Enhancing the sustainability and impact of action taken by the City by taking into account potential climate change impacts during the planning phase.

The following actions have been identified to facilitate the integration of climate adaptation into Belgrade's decision-making processes:

- Establish a working group on climate change adaptation that will coordinate responses between the City's administrations and public utilities and facilitate horizontal integration across sectors. The working group shall also facilitate a close relationship between policy makers, climate scientists, researchers and adaptation specialists. In order to ensure that actions that are agreed in the working group are implemented a regulation should mandate the Secretariats to do so.
- Operationalise a monitoring framework to track the City's progress on the integration of adaptation policy into Belgrade's decision making and to continue to monitor the City's climate change vulnerabilities and adaptation needs as.

- Reflect climate change adaptation needs across all relevant aspects of the City's spending – a mandatory screening process should be established for checking whether adaptation has been considered in project investment proposals (by building on criteria such as the EU taxonomy on sustainable investment).

Establish an information and awareness campaign on climate change adaptation in a continuous effort to improve available information and ensure policy relevance of this information.

Key Action component(s)

Investment	Institutional measure
Capacity Building	Technical assistance
Data Management	Monitoring framework

Strategic objectives targeted

The key strategic objective is S.O.CCA1 - The city is aware of its vulnerabilities to climate change and actively planning to adapt (disaster risk informed urban planning). Other Strategic Objectives that are relevant for adaptation include: S.O.B2 - Using existing buildings to create elements of green infrastructure, S.O.W2 - Protect more of the city from the risk of

flooding, S.O.GS1 – Substantially increase the "tree cover" territory and level of porosity of Belgrade's territory

Key indicators & targets:

Key indicators to monitor progress include:

- Establishment and operationalisation of a working group
- Operationalisation of a monitoring framework to track adaptation actions in the City
- Proportion of climate change adaptation related spending (mainstreaming) in the City's budget
- Share of policy options contributing to improving governance, dissemination of information and awareness of climate change adaptation aspects

The mid-term target for this policy option will be to ensure the consideration of adaptation, resilience and disaster risk is clearly mainstreamed into all of the city's major decision-making processes

Current Context

A Climate Change Adaptation Action Plan for Belgrade was adopted in 2015 which included a detailed vulnerability and risk assessment and identified and prioritised 23 adaptation measures. However, the action plan does not appear to have gained wide exposure amongst City authorities and horizontal and vertical coordination mechanisms to systematically implement the action plan have not yet been established. In particular, mainstreaming of adaptation measures into sectoral policies have not been fully materialised. The Action Plan also suggested the establishment of a working group and the development of a monitoring framework however, the working group does not appear to be in place and monitoring has not been fully operationalised.

Investment Costs

CAPEX: € 250,000 for technical assistance

OPEX: 2 FTE staff within the City administration - € 50,000 / year – € 450,000 over 9 years

Fit with Funding sources

City funds with support available from donors (including TA from IFIs but not as reimbursable loans)

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale:

The screening of investments and communication with the public should be on a continuous basis, while the establishment of relevant governance and monitoring structures should take place in the short-term

Implementing bodies:



The City Administration comprises 25 secretariats that perform administrative affairs in the scope of rights and responsibilities of the City of Belgrade. The most relevant is the **Secretariat for Environmental Protection** (five departments: (1) Department for Monitoring and Environmental Protection, (2) Department for Strategic Planning and Resource Management, (3) Department for Environmental Protection Management, (4) Department for Legal and Economic Issues, and (5) Department for Waste Management). Others that

could be involved in the implementation of this option include the

Secretariats for Finance, Urban Planning and Construction, Legislation of Buildings, Economy and Investments.

Key stakeholders:

In addition to the City administration key public utility companies and public organisations to provide a range of public services will play an important role. These include:

- PUC Water Supply and Sewage of Belgrade (JKP “Beogradski vodovod i kanalizacija”) – produces and treats water, supplies hygienically and bacteriologically safe drinking water, collects and distributes waste water and atmospheric water;
- PUC Greenery Belgrade (JKP “Beogradsko zelenilo”) – designs public green areas, orders and maintains public green areas and river banks, maintains public sanitary facilities, produces and maintains equipment for parks, sport areas and other recreation areas, produces flowers and decorative flora and plants it in public areas;
- PUC City Sanitation (JKP “Gradska čistoća”) – maintains hygiene of public areas by dry and wet cleaning procedures, collects and maintains communal waste from public areas, manages communal waste from its collection, transport, treatment to safe disposal, maintains public landfills and recycling materials, empties, transport and treat waste from cesspits;
- Belgrade Urban Planning Bureau (JP “Zavod za urbanizam Beograda”) – creates all types of planning documents that contribute to development, construction and urbanisation of the City;
- Belgrade Land Development Public Agency (JP “Direkcija za građevinsko zemljište i izgradnju Beograda”) – manages, orders and equips city building-land and buildings of the relevance for the city;
- Public Company „Ada Ciganlija“(JP “Ada Ciganlija”) – maintains parks, water and recreation areas, takes care of public beach, and maintains services on the lake, and organizes culture, sport, art activities and manifestations;
- Public Water-Management Company “Beogradvode” – protects Belgrade area from negative impacts of water, maintains built and

non-built riverbanks (except the harbour zone at the Danube river), maintains winter quarters for ships and the Sava ship terminal (except devices within the terminal).

The awareness raising campaign would target the entire population of Belgrade.

Delivery risks:

The main challenge is likely to be maintaining political priority for adaptation issues to ensure that necessary interventions are supported. This is likely to apply across organisations.

Smart City Potential - Potential to Benefit

Potential to use smart ways to communicate the City’s key vulnerabilities and to inform the public about the importance of climate adaptation.

Synergy with Other Actions

Adaptation actions are mainstreamed into the following GECAP sectoral measures: L2 - Brownfield Development Programme; L5 – Study on Urban Land Management Policies and Instruments; L1 - Linear Park Project; L4 - City wide programme for urban green infrastructure (GI) development; E4 - Afforestation and Greening Programmes; B2 - Greening city buildings; WW2 - Water saving and Loss reduction; WW1 - Small watercourse and drainage channel rehabilitation; WW3 - Water drainage; WW4 - Development of flood protection measures; WW6 - Rainwater storage and retention; WW5 - Wastewater Treatment Programme

GS1: Afforestation and Greening Programs

Purpose – Implementation of an extensive programme of afforestation, park expansion and erection of green walls/roofs

Benefits – Improved greenspace, biodiversity benefits, other ecosystem services such as pollution regulation and drainage retention

Costs – CAPEX: € 100M; OPEX: n/a



2021		2022		2023		2024		By 2029	
		Implementation						Implementation	

Description

Afforestation and Greening Programs aim to protect vulnerable resources such as forests and public greenery which support resilience against climate change impacts, maintain environmental quality (especially air quality) and provide space for biodiversity. PUC “Zelenilo Beograd” has planned to plant a total of 50,000 seedlings, particularly targeting areas that are under the management system of PUC “Beogradvode” and corridors managed by PUC “Zelenilo Beograd”. The process of finding new areas for afforestation is ongoing. City municipalities have submitted their proposed coverage and are looking for afforestation areas in accordance with the Plan of General Regulation of Green Area System of Belgrade (2019). The Programs are intended to increase green space through afforestation, greening, green roofs, green walls and creation of green corridors. Targets include:

- increase the forest area by 20% of City’s territory through the implementation of the Belgrade Afforestation Strategy.
- other park greenery on a total area of 178,827 m², including decorative bush, hedges, roses and other floral material, and
- Erection of 10,000 m² of green walls.

50 locations have already been identified for vertical greening of pillars and retaining walls, and as many for reclamation of degraded and

neglected spaces. The total planned area of roof gardens and green facades is 1,000 m². Based on the Feasibility study findings, a financial instrument at preferential conditions, will be established blending IFI, pre-accession EU funds and city budget.

The activity will contribute to the evaluation and improvement of the regulatory function of urban greenery, which will affect the mitigation of air pollution by suspended particles PM₁₀ and PM_{2.5}.

Key Action component(s)

Investment	Policy or Regulation
Capacity Building	Stakeholder Engagement
Data Management	Study

Strategic objectives targeted

- S.O.GS.1. – Substantially increase the “tree cover” of Belgrade territory’s territory
- S.O.L.3. – Substantially increasing the role that Green Infrastructure and open space play in provide in the operation of the city
- S.O.B2 – Using existing buildings to create elements of green infrastructure

Key indicators & targets:

6. Open green space area ratio per 100,000 inhabitants (forests, forest land and public green spaces), currently 6.9 km²/100,000 inh, target 12.5 km²/100,000 inh.

6.1. Share of green space areas within urban limits, currently 12.4%, target 22.7% (30%)

Current Context

The Programs are in line with the Belgrade Afforestation Strategy (2009), Belgrade Master Plan (2010), Environmental Protection Programme of the City of Belgrade (2015) and Plan of General Regulation of Green Area System of Belgrade (2019). In addition, it is fully in line with the provisions of Spatial Plan for the Republic of Serbia Act (2010) and Belgrade Climate Change Adaptation Action Plan (2015) where afforestation and greening are recognized as relevant elements in climate change mitigation and adaptation.



Investment Costs

CAPEX: € 100 million²³ - Afforestation: 2,000 €/ ha²⁴ & Green roofs/green walls: 150 €/ m² (period 2021-2026, € 55.56 M)

OPEX: N/A – part of routine operations

Fit with Funding sources

City, IFI, IPA pre-accession EU fund

City funding	National or regional funds	IFIs - reimbursable
Donors	Private sector / PPPs	General public / other

Good fit | Possible fit | Poor fit

Implementation

Timescale: Q3 2021 – Q2 2029

Implementing bodies: **Secretariat for Environmental Protection**, Belgrade Urban Planning, State Enterprise for Forest Management “Srbijašume”, PUC “Zelenilo Beograd”, PUC “Beogradvode”, PUC “Ada Ciganlija”.

Key stakeholders: Ministry of Agriculture, Forestry and Water Management, University of Belgrade – Faculty of Forestry, University of Belgrade – Faculty of Biology

Delivery risks: The proposed programme of planting is ambitious and will require a substantial amount of labour to ensure deliver.

Constraint on availability of land to undertake further planting as much of the existing public land holding available for planting has been planted. As such there are challenges in procuring the land as the city is unable to invest in private land and therefore needs to purchase the land. This is not currently costed.

Smart City Potential - Potential to Benefit

Asset management services of green spaces treating green and blue assets as economic assets and proactively managing them. Potential for improving quality and costs of maintenance in the case of green walls, a system that contains self-watering option might be installed.

Additionally, intra-city green cover pattern analysis / green space assessment could be a potential Smart application within this action.

Synergy with Other Actions

L1 – Linear Park Project; L4 – City wide programme for urban green infrastructure development; L5 – Study on Urban Land Management Policies and Instruments; WW4 – Development of flood protection measures.

²³ Belgrade Afforestation Strategy (2009)

²⁴ Ibid.

4 Financing Options

A nighttime photograph of a cityscape. In the foreground, a modern waterfront promenade with a paved walkway, young trees, and streetlights is visible. To the left, there are modern buildings with large windows. In the background, a dense urban area with various buildings and construction cranes is illuminated against a dark sky. A body of water is visible on the right side of the image.

What does this chapter tell me?

- A summary of the City's financial status
- What are the potential Sources of finance which could be applied to each GCAP action?

4.1 Summary of City's Financial Status

Table 4.1 shows data on the economic context for Belgrade. As can be seen, Belgrade accounts for 40% of GDP and has a per-capita GDP which is higher than the rest of the country – in 2015, it was equivalent to approximately € 8,000 per capita versus a national average of approximately € 5,1000 in Serbia that year. It is noteworthy that the population spends a relatively small amount on housing, water, electricity, gas, and other fuels - 17.1% in 2017 in Belgrade versus 24.2% in the EU in 2017²⁵. This is likely due to the prevalence of outright ownership (without mortgages) in the city and low prices for energy.

Table 4.1 Economic context data²⁶

Item	2014	2015	2016	2017
GDP total Republic of Serbia (in mil. RSD)	3,876,403	4,312,038	4,521,265	4,754,368
GDP of Belgrade region as % of the total GDP	39.9%	39.3%	40.0%	40.0%
Per capita GDP, Republic of Serbia (in mil. RSD)	0.58	0.61	0.64	0.68
GDP per capita, Belgrade region (in mil. RSD)	0.92	0.95	n/a	n/a
Unemployment rate, Belgrade region ²⁷	17.9%	13.9%	13.5%	11.9%
Average number of household members, Belgrade region	2.61	2.64	2.54	2.51
Average monthly available budget per household member, Belgrade region	25,173	26,327	27,332	29,011
Average monthly expenses per household member (RSD)	23,335	24,621	26,000	27,561

²⁵ See https://ec.europa.eu/eurostat/statistics-explained/index.php/Household_consumption_by_purpose

²⁶ <http://www.stat.gov.rs/sr-latn/publikacije/> Statistical Office of the Republic of Serbia, Statistical Yearbooks 2014 -2018

Food and non-alcoholic beverages	36.6%	32.0%	32.3%	34.5%
Housing, water, electricity, gas and other fuels	16.4%	16.8%	17.0%	17.1%
Transport	9.1%	10.6%	9.7%	8.4%

Table 4.2 describes the cities sources of budget revenue in recent years. As can be seen, out of total revenue of approximately 91.5 billion RSD (€ 770 million), income taxes account for over 50% of the tax revenue and over 30% of total revenue. Property taxes are second highest in the structure of revenue. The level of grants and other voluntary transfers for the city are quite low – at only approximately € 10,000 in 2018.

Table 4.2 Belgrade City budget revenue and expenses 2014-2018²⁸

Item	2014	2015	2016	2017	2018
Total Revenues ('000 RSD)	70,002,792	74,986,103	89,017,016	90,983,925	91,502,625
Total Revenues ('000 EUR)	€ 595,336	€ 637,717	€ 757,042	€ 773,770	€ 778,181
Total Expenditures ('000 RSD)	66,576,912	72,878,387	87,611,117	89,969,922	103,287,680
Total Expenditures ('000 EUR)	€ 566,201	€ 619,792	€ 745,086	€ 765,146	€ 878,406

Note: Exchange rate used is 117.5853 RSD / EUR according to the National Bank of Serbia's exchange rate for 25/8/2020

Based on an analysis of debt levels from Belgrade (see Table 4.2), the general level of debt service is relatively manageable in relation to the total revenues of the city – with a ratio of debt service to revenue under 0.10 in 2017 and expected to be under 0.05 in 2017. At the same time, Moody's

²⁷ <https://zis.beograd.gov.rs/index.php/2013-12-09-10-22-54.html> Statistical Yearbook of the City of Belgrade

²⁸ Official Gazzete of the City of Belgrade No. 29/2015, 62/2016, 42/2017, 62/2018, 64/2018

rating of Ba3 implies that the city's debt should be evaluated as "not prime" and have some speculative elements (see Table 4.4 for the credit rating history of Belgrade)²⁹. This debt rating could mean that it would be relatively difficult for the city to issue long-term low-cost debt in order to cover the costs of investment without IFI involvement (such as EBRD). It may also necessitate the involvement of the central government for large infrastructure investments.

Table 4.3: Financial summary, City of Belgrade in the period 2014 - 2018 (mil. EUR)

Financial Summary (mil. EUR)	2014	2015	2016	2017	2018
Debt Repayments	28.2	37.0	52.2	52.5	29.5
Net Debt Increase (Decrease)	10.0	-21.7	-28.9	-31.8	-25.0
Debt Stock (€ million)					
Total Short-Term Debt	0.0	0.0	0.0	0.0	0.0
Total Long-Term Debt	412.3	404.8	362.9	328.1	303.1
Total Debt	412.3	404.8	362.9	328.1	303.1
Key ratios					
Current Surplus / Debt Service (min 1.0x/2016, 1.5x a/f)	2.4	2.4	2.18	2.20	1.77
Outstanding Debt / Total Revenues (0.7x/2016, 0.6x a/f)	0.8	0.7	0.53	0.44	0.37
Outstanding Debt / Current Surplus	3.7	3.2	2.49	2.29	4.34
Debt Service / Total Revenues	0.1	0.1	0.10	0.09	0.05

Table 4.4: City of Belgrade rating history

Ratings History	2014	2015	2016	2017	2018 Plan

²⁹ See https://www.moodys.com/sites/products/ProductAttachments/AP075378_1_1408_KI.pdf for more on Moody's rating system.

S&P	N/A	N/A	N/A	N/A	N/A
Moody's	N/A	N/A	B1	Ba3	Ba3
Fitch	N/A	N/A	N/A	N/A	N/A

4.2 Sources of Potential Finances

There are a number of potential sources for financing of GCAP Actions which are included in the table below. Within the process of development of the GCAP, each action was evaluated for the likelihood of being able to attract appropriate finance from either the city or other sources.

Financing mechanism	Description
City funding	This would be direct funding via mechanisms such as municipal budgets (including future capital project budgets, and in-kind contributions of items such as land or time of existing staff). Additional city funding availability could be made available from sources such as bond issuances – though this may be difficult in Belgrade's circumstances. This would also include municipally-owned companies.
National or regional funds	This would include finance (typically non-reimbursable) in the form of direct fiscal transfers. It could also be a mechanism for distribution of other financing mechanisms (such as those below).
International Financial Institutions (IFIs) –reimbursable	This would include, for example EBRD, EIB, etc. Funding via this mechanism is most typically via debt instruments wherein the banks provide finance to cities either via national governments with sovereign loans or by lending directly to the city. Different development banks have different policies on lending practices. In some cases, equity finance is also possible. In this sort of mechanism, there is an expectation / requirement to repay the investment. It could also include, for example, guarantee mechanisms set up.
Donor funds – non-reimbursable	This would include, for example, the EU IPA funds and other donor sources which are non-reimbursable (typically grants). Funding via these sources is often used as a means to close funding gaps to enable loans

Financing mechanism	Description
	and other investments to be viable. It could also include technical assistance. It could also include donor funds mobilized by IFIs.
Private sector finance / Public-Private Partnerships (PPPs)	<p>Some actions will involve city policies or investments which trigger private sector finance (such as encouraging new forms of energy production) while others could be linked to a joint venture or public-private partnership with private sector investors or other third parties – such as in the case of waste management, district heating, and even energy efficiency in publicly-owned buildings. Involving private sector investment can reduce the financial liabilities for the City and allow for shared risk burden between City and the private investor, while still allowing the City to retain a degree of control and influence over investment activities.</p> <p>Some capital projects may be financed, built, controlled and operated by private organisations. This could include private companies working under services contracts with the city, such as a utility concession operating for a defined time period (e.g. 25 years).</p>
General public and other sources	This would include financing from the general public (for example in renovations of the residential sector) or other decentralised models of fundraising, including payment by service users and crowd-funding.

As has been used in other GCAPs, a scoring system based on colours was used (Red, Amber, Green) to assess the appropriateness of financing mechanisms and sources for each action as follows:

- **Green - Good fit:** to be prioritised in further investigation. This may be because the finance source is well matched to the scale of the intervention and / or this type of activity is common for this type of mechanism / source. For all measures, it is assumed that the city itself could finance the action (either through the budget or through a municipally-owned company).
- **Amber - Possible fit:** to be explored, but not necessarily the right fit. This rating indicates that the scale of financing required is inappropriate for this financing mechanism (to some extent either too large or too small), or that this action is not typically financed via the mechanism – with some exceptions.

- **Red - Poor fit:** This may be because the scale of the project is well outside the boundary in terms of scale for a type of financing or is inapplicable (e.g. the funding is for a study and therefore bank lending / equity investments are unlikely).

4.3 Assessment of Actions against Financing Options

The total investment required over the coming 10-year period (through 2030) to implement the GCAP is almost € 5.2 billion. There may also be further opportunities for PPPs / private sector involvement – which is shown in the table below. This would be a sizable amount of investment in comparison to city revenues.

Increased OPEX from the GCAP is estimated to be around € 10 million – most of which is due to ongoing costs for the Tram / Train system. Many of the larger investments in the city (such as LE2, PL1, PL2, and B1) would result in significant decreases in Operational Expenditures (OPEX) while improving the environment. While a full cost-benefit analysis has not been carried out for the GCAP, we expect many of these investments will actually be financially profitable enough to justify investment.

Overall, the assessment shows that all interventions have at least one potential alternative method of financing. It can be expected that many of the actions would involve at least one additional finance source (in addition to the city). Investment by the Central Government, donor involvement, IFI investment, and the involvement of the private sector will be critical to the full implementation of the GCAP actions – in particular for the larger investments. Continued donor support for policy development and studies to fully scope investments will also be critically important.

Table 4.5: Financing requirements of actions (in millions of euros) and potential financing options

Action	Total investment (capital expenditure or for studies)	Implementation timescale	Additional annual OPEX for the city (MEUR)	National or regional funds	IFIs – re-imbursable	Donors	Private sector / PPPs	General public / other
T1 - Extension and development of Belgrade Metro and train	€ 200.00	Q4 2021 – Q4 2030	€ 1.50					
T3 - Purchase of electric buses and busses that use RES	€ 950.00	Q3 2021 – Q4 2030	€ 2.00					
T4 - Public cycling system	€ 6.45	Q3 2021 – Q2 2027	€ 0.20					
T5 - Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycleways	€ 33.00	Q3 2021 – Q4 2030	€ 0.25					
T6 - Commercial transport policy	€ 0.50	Q3 2021 – Q3 2022	N/A					
T7 - Plan for a network of public chargers for electric vehicles	€ 10.00	Q3 2021 – Q3 2026	€ 0.20					
T8 - Incentives and financing of e-vehicles for public and private commercial vehicles (range 200km/day)	€ 5.00	Q3 2021 – Q3 2026	N/A - covered by vehicle owners					
L1 - Linear Park Project	€ 50.00	Q3 2021 – Q3 2023	€ 0.05					
L2 - Brownfield Development Programme	€ 0.50	Q3 2021 – Q3 2024	N/A					
L4 - Study for a City-wide programme for urban green infrastructure development	€ 0.50	Q3 2021 – Q3 2023	N/A					
L5 - Study on Urban Land Management Policies and Instruments	€ 0.10	Q3 2021 – Q1 2022	N/A at this stage - but maybe after study					
L6 - Donji Dorcol Superblock project	€ 15.00	Q3 2021 – Q3 2024	€ 0.20					

Action	Total investment (capital expenditure or for studies)	Implementation timescale	Additional annual OPEX for the city (MEUR)	National or regional funds	IFIs – re-imbursable	Donors	Private sector / PPPs	General public / other
L7: Green Market Kalenic	€ 12.00	Q3 2021 – Q3 2024	To be determined by feasibility study					
B1 - Renovation / Energy efficiency and use of RES in municipal buildings	€ 300.00	Q3 2021– Q4 2030	N/A - negative ongoing costs					
B2 - Greening city buildings	€ 0.15	Q3 2021 – Q1 2022	TBD					
B3 - Energy efficiency and use of RES in residential buildings	€ 930.00	Q3 2021– Q4 2030	€ 0.08					
B4 - Regulations and incentive measures in residential buildings	€ 540.00	Q3 2021– Q4 2030	€ 0.04					
E1 - Connecting to the natural gas distribution network with a gradual increase in the share of gas from renewable energy sources	€ 300.00	Q3 2021– Q4 2030	N/A - covered by customer payments					
E2 - Air Quality Data system	€ 0.20	Q3 2021– Q2 2022	€ 0.05					
LE1 - Development and improvement of the district heating distribution network	€ 400.00	Q3 2021– Q4 2030	N/A - covered by customer payments					
LE2 - Improvement energy efficiency district heating heat sources	€ 400.00	Q3 2021– Q3 2025	N/A - negative ongoing costs					
PL1 - Energy efficiency in public lighting	€ 15.2	Q3 2021– Q1 2025	N/A - negative ongoing costs					
PL2 - Smart lighting switches	€ 35.63	Q3 2021– Q4 2030	N/A - negative ongoing costs					
WW1 - Small watercourse and drainage channel rehabilitation	€ 25.00	Q3 2021 – Q4 2030	€ 2.00					
WW2 - Water saving and loss reduction	€ 40.00	Q3 2021 – Q1 2025	N/A - negative ongoing costs					

Action	Total investment (capital expenditure or for studies)	Implementation timescale	Additional annual OPEX for the city (MEUR)	National or regional funds	IFIs – re-imbursable	Donors	Private sector / PPPs	General public / other
WW3 - Sustainable Urban Drainage Policy	€ 0.25	Q3 2021 – Q2 2022	N/A - though potentially for enforcement					
WW4 - Development of flood protection measures	€ 18.00	Q3 2021 – Q4 2024	€ 0.50					
WW5 - Wastewater Treatment Programme	€ 771.00	Q3 2021 – Q4 2029	N/A - covered with user fees					
WW6 - Rainwater storage and retention	€ 6.00	Q3 2021 – Q1 2025	€ 0.05					
W2/5 - Recyclable Waste Collection	€ 9.20	Q3 2021 – Q4 2025	N/A - covered with user fees					
W6 - Household Hazardous Waste	€ 4.25	Q3 2021 – Q4 2023	€ 1.50					
W9-11: Green Energy from Waste	€ 12.80	Q1 2022 – Q1 2026	N/A - Operating expenses covered by income from energy.					
W12: Recycling Collection Centres	€ 20.00	Q3 2021 – Q4 2026	€ 0.84					
CCA1 – Integrating climate adaptation into Belgrade's decision-making processes, including policy developments and project investments	€ 0.25	Q3 2021 – Q2 2025	€ 0.05					
GS1 - Afforestation and Greening Programmes	€ 100.00	Q3 2021 – Q2 2029	N/A - part of routine operations					
Total	€ 5,210.98		€ 9.51					

5 Implementation

What does this chapter tell me?

- What institutional arrangements are necessary to implement the GCAP?
- How will the implementation of the GCAP be monitored?
- How will the impact of the GCAP be monitored?

The purpose of the Monitoring and Evaluation Plan (**Plan**) is to provide a mechanism for understanding if the GCAP has been successful in meeting the objectives that have been set out during its development.

To do this, the GCAP needs to be measured in two ways:

- Have the Actions that have been identified in the GCAP for the first cycle from 2021-2026 been carried out (**Implementation Monitoring**); and
- Have the Actions that have been implemented had any impact on the indicators pursuant to the EBRD GCAP Methodology that we considered when understanding what the “Green City” challenges of were at the start of the GCAP development process (**Impact Monitoring**).

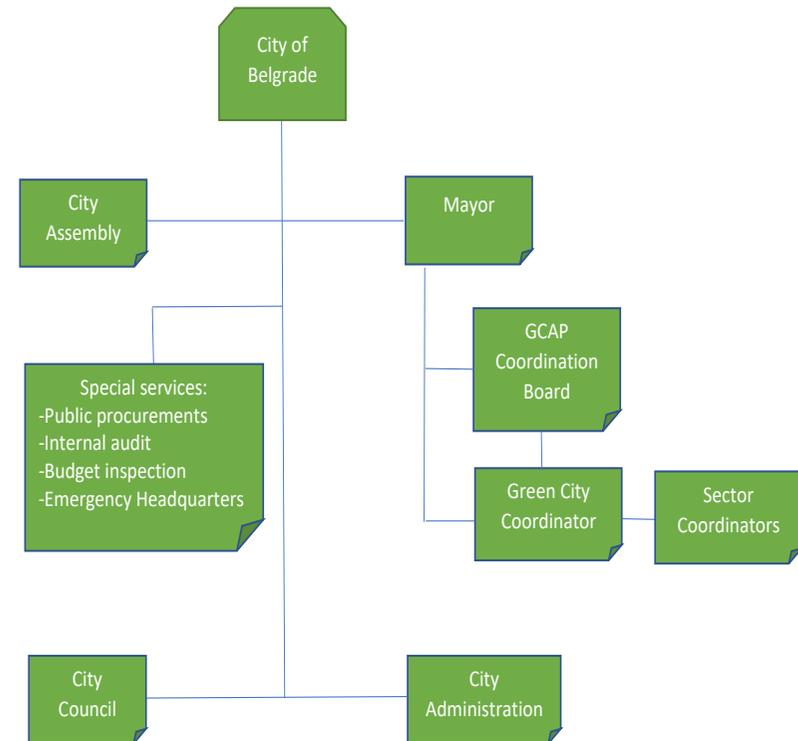
Ultimately, this monitoring information will be critical for the future cycles of the GCAP process in Belgrade, providing intelligence on the state of the environment against the indicators used to establish the Green City Baseline and inform future discussions on the next set of priorities to be addressed at the end of this GCAP cycle.

5.1 Institutional Arrangements

An overview is presented below of the proposed institutional arrangements to ensure that projects are progressed. This includes internal coordination between the Mayor’s Office, Political Champions and technical champions in the various directorates and operating companies.

It also highlights how the GCAP interacts with other key plans including the SECAP which is expected to share administrative coordination. Other plans and processes will include the General Urban Plan, Departmental Budgeting, Operational Delivery Plans, other strategic plans.

This clearly identifies responsibilities and accountability for delivering GCAP Actions. The main organogram is presented in the figure below.



5.1.1 GCAP Coordination Board and Sector Champions

The implementation of the Plan is going to require the cooperation of multiple departments and entities within and outside the direct authority of the City. A central Belgrade GCAP coordination unit will be established within the Secretariat for Environmental Protection (SEP). This will be referred to as the “GCAP Coordination Board“, and will be composed inter alia of representatives from various Secretariats, Public Companies and Public Utility Companies that represent the GCAP Sectors (Sector

Champions) and supplemented by a select representatives of other Belgrade Administration for horizontal issues, such as Budget and Finances and Public Relations. These will be senior figures and will act as leaders for the GCAP sectors to provide leadership and ensure progress.

5.1.2 Green City Coordinator

A single, designated coordinator for the GCAP (Green City Coordinator) will be appointed from within the SEP to ensure management, coordination, monitoring and other activities on the GCAP at an operational level. The Green City Coordinator will aim to align the monitoring and evaluation process with other City processes and other strategic objectives of the City.

5.1.3 Sector Coordinators

Each Sector Champions will appoint its coordinator (Sector Coordinator) at an operational level to coordinate with the Green City Coordinator and form the operational coordination unit for the GCAP (GCAP Coordination Team). The Green City Coordinator will collate information provided by each Sector Coordinator to ensure that the monitoring processes (for both Implementation and Impact) are executed efficiently. The Green City Coordinator will work directly with the “Sector Coordinator” to prepare the data and resulting reports. Therefore, the work of the Green City Coordinator will be supported by Sector Coordinators in other departments. However, as scale and diversity of activities increase, we will review workload and consider whether additional support will be needed to fulfil the role of the Green City Coordinator and successfully implement the GCAP.

Many of the Indicators related to the state of the environment are published annually by Secretariat for administration – Sector for statistics. Several of the other GCAP Sectors are represented by arms-length institutions (for example the Water Sector is represented by PUC “Water Supply and Sewage of Belgrade”). As a result, the role of the Green City Coordinator in coordinating information will be critical.

Individual Actions may be implemented by any entity that is agreed with the GCAP Coordination Board which could be a City department, enterprise or an external party (such as a state entity or a private sector entity). The agency implementing an Action (Implementing Body or IB) will be required to coordinate with the GCAP Coordination Team as a condition of its engagement in delivering an Action under the GCAP. The Sector Champions might come from the same organisation/department which will be also an Implementing Body for certain Action but both roles might be also split into two units.

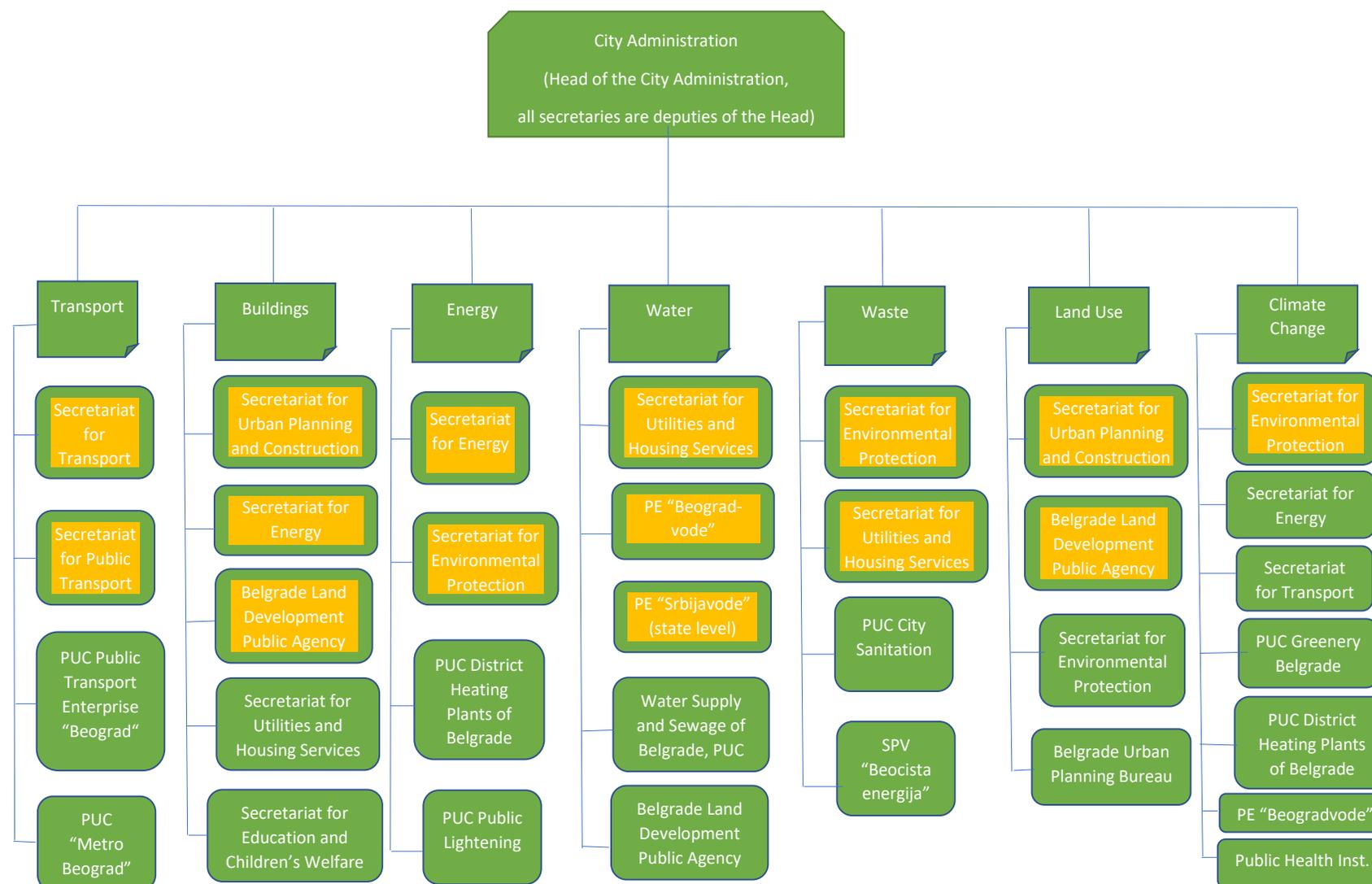
Table 5.1: Sector Champions

Sector	City Department / Entity
Transport	Secretariat for Transport Secretariat for Public Transport
Buildings	Secretariat for Urban Planning and Construction Secretariat for Energy Belgrade Land Development Public Agency
Industries	Ministry of Economy
Energy	Secretariat for Energy Secretariat for Environmental Protection
Water	Secretariat for Utilities and Housing Services PUC Water Supply and Sewage of Belgrade PE Beograd Vode, PE Srbija Vode
Waste	Secretariat for Environmental Protection Secretariat for Utilities and Housing Services
Land Use	Secretariat for Urban Planning and Construction Belgrade Land Development Public Agency
Climate Change	Secretariat for Environmental Protection

Their roles are reflected in Figure 3 below

Figure 5-1: Organisational structure for implementation of the GCAP within structure of the Belgrade City Administration

5.2 Monitoring Framework



As a summary of the above process, the following key measures should be undertaken to mobilise a successful monitoring and evaluation framework for the GCAP.

5.2.1 Institutional Measures

There are several measures needed to ensure that a robust monitoring framework is in place:

- Measure 1.1: Develop and appoint - by a decision of the MCEC - the GCAP Coordination Board, comprising senior staff from the identified departments of the City (Sector Champions supplemented by a select representatives of other Belgrade Administration responsible for horizontal issues, such as Budget and Finances and Public Relations), and establish its procedural and reporting rules to the City Assembly, frequency of meetings etc.
- Measure 1.2: Identify the GCAP Coordination Team - i.e. a wider operational coordination and monitoring group for the Belgrade GCAP - and appoint by a decision of the City Assembly the Green City Coordinator from the Secretariat for Environmental protection, including allocation of respective responsibilities and rules for the GCAP Coordination Team, inter alia for Belgrade GCAP operational coordination, data collection, monitoring and evaluation, GCAP promotion, stakeholder engagement and liaising with financial institutions and authorities.
- Measure 1.3: Appoint Sector Coordinators, as the remaining members of the GCAP Coordination Team, to support the Green City Coordinator at an operational level with respect to the Sector Champions' remit, i.e. relevant GCAP Sector.

5.2.2 Target-setting and Data Quality Improvement Measures

- Measure 2.1: Confirm the Indicators Database as the agreed baseline data
- Measure 2.2: Review the Indicators Database in detail and work together to define the agreed metrics for measuring Impact on each Action.

- Measure 2.3: Annual Update of the Indicators Database and methods of data collection used for its development with recent and validated data and updated EBRD GCAP Methodology.
- Measure 2.4: Liaise with relevant agencies to close the gaps in quality of Core Indicator data which are relevant for the GCAP.
- Measure 2.5: Collaborate with other agencies in Belgrade to ensure that Indicator data is collected across multiple sectors and there is a cross-departmental collaboration in place within the City to align the Actions with other planned activities of the City outside the Belgrade GCAP.

5.2.3 Tool-developing Measures

- Measure 3.1: Prepare quality management procedures to record and store data centrally and in a consistent manner with responsibility for validation and robustness of monitoring data with the Sector Coordinators.
- Measure 3.2: Prepare an Annual Monitoring Report template, including clear, concise and user-friendly checklists.
- Measure 3.3: Decide on the Annual Monitoring Report template prepared pursuant to Measure 3.2.

5.2.4 Monitoring, Preventive and Corrective Measures

- Measure 4.1: Implementation Monitoring - Prepare regular reports (based on inputs from the Implementing Bodies).
- Measure 4.2: Implementation Monitoring - Discuss progress, approve reports and take preventive and/or corrective measures, if necessary.
- Measure 4.3: Impact Monitoring - Prepare Annual Monitoring Report (based on inputs from the Implementing Bodies).
- Measure 4.4: Impact Monitoring - Discuss results, approve the Annual Monitoring Report and identify preventive and/or corrective measures, if necessary.
- Measure 4.5: Implement preventive and/or corrective measures identified by the GCAP Coordination Board and approved by the City

Assembly, which may require additional investments, adjustments to the current investments, an extension of the timeline or an adjustment of ambition for the specific Action.

- Measure 4.6: Upon request and subject to subsequent approval by the Green City Coordinator, make the Annual Monitoring Report available to appropriate external parties, including the EBRD, SIDA and other stakeholders.

5.2.5 Monitoring Investment Measures

- Measure 5.1: Propose specific investment measures for each GCAP Sector to improve the quality or availability of data, e.g. specify and procure any missing pollution monitoring equipment and/or technology with relevance for the GCAP.
- Measure 5.2: Decide on the proposal for specific investment measures for each GCAP Sector to improve the quality or availability of data pursuant to Measure 5.1.

6 Summary of Benefits

What does this chapter tell me?

- What are the Key Environmental Benefits of the GCAP?
- How much GHG emission benefit with the GCAP create?
- What other Social and Gender benefits will the GCAP create?

6.1 Introduction

This Green City Action Plan is aiming to drive improvement in the environmental performance of our city. The benefits of each of the Actions were assessed against a range of typical benefits defined in the EBRD Green Cities Methodology. These reflect not just Environmental benefits but also social and economic co-benefits which should be achieved with the implementation of the action plan.

Each action has potential to benefit multiple areas identified within this framework and a matrix approach has been used to identify which actions will support which areas of benefit. Benefit has been categorised into three levels:

3 Significant Benefit: There is substantial potential benefit which is core to the selection of the option for the GCAP

2 Secondary Benefit: There is likely to be some benefit which is material to the selection of the option, but not the primary driver

1 Marginal Benefit: There may be marginal benefits, but these are not factors which were material to the selection of the option

The analysis of benefit for each project is presented in Table 6.1 below.

Due to the strategic nature of this plan, these benefits have been assessed largely qualitatively and should be considered indicative. They do however provide guidance to implementing agencies on the range of benefits likely to be derived by each action.

A short narrative Summary of Benefits has been provided within each of the detailed descriptions of Actions in the main body of this report.

Table 6.1 Assessment of Benefits

Action	Environmental Benefits										Economic Co-Benefits				Social Co-Benefits					
	Air Quality	Water quality	Soil quality	Biodiversity	Water use	Energy use	Land use	Material use	Climate change mitigation	Climate change adaptation	Financial returns for investor	Non-financial Economic Benefits	Employment	Economic inclusion	Public health	Access to basic services	Safety	Gender equality	Green behaviour and awareness	Community involvement
T1 - Extension and development of Belgrade Metro and train	3					3	1		3	1	2	3	2	2		3	1	1	1	2
T3 - Purchase of electric buses and busses that use RES	3					2			2			2		2		3	1	2	2	
T4 - Public cycling system	3					2			2	1	2	1	1	1	3	1	2		2	
T5 - Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycleways	3					2			2	1		1			3	2	2	2	2	1
T6 - Commercial transport policy	2					2	2				1	2			2		2		1	
T7 - Plan for a network of public chargers for electric vehicles	3					1			2		2		1		2				2	
T8 - Incentives and financing of e-vehicles for public and private commercial vehicles (range 200km/day)	3					1			2					2	2		1			
L1 - Linear Park Project	2			2		1	3		1	2		1		2	2	1	2	1	2	3
L2 - Brownfield Development programme	2	2	2	2			3		1	2	3	2		2	1	1	1	1	1	2
L4 - Study for a City-wide programme for urban green infrastructure development	2	2	2	3			2		1	3		2		1	2			2	3	3
L5 - Study on Urban Land Management Policies and Instruments	2	2	2	2			3		1	2	2	2		2	2				2	3

Action	Environmental Benefits										Economic Co-Benefits				Social Co-Benefits					
	Air Quality	Water quality	Soil quality	Biodiversity	Water use	Energy use	Land use	Material use	Climate change mitigation	Climate change adaptation	Financial returns for investor	Non-financial Economic Benefits	Employment	Economic inclusion	Public health	Access to basic services	Safety	Gender equality	Green behaviour and awareness	Community involvement
L6 - Donji Dorcol Superblock project	2			2			3				2			2	1	3	1	2	3	
L7: Green Market Kalenic	1			2		2			1	1		2	2	2	1	2	1	1	2	3
B1 - Renovation / Energy efficiency and use of RES in municipal buildings	2					3			3	2	2	2	2	1		1			2	
B2 - Greening city buildings	1	2		2		2			2	3		2	2	1					1	1
B3 - Energy efficiency and use of RES in residential buildings	2					3			3	2	2	2	2	1		1		2	2	2
B4 - Regulations and incentive measures in residential buildings	2					3			3	2		2	1	2	2			1	1	
E1 - Connecting to the natural gas distribution network with a gradual increase in the share of gas from renewable energy sources	2					1			3		2	1	1	2	2	2				
E2 - Air Quality Data system	3	1	1	1					2	2		1	1	2	3			2	2	2
LE1 - Development and improvement of the district heating distribution network	3				2	3			3	1	2	2		1	2	2			1	
LE2 - Improvement energy efficiency district heating heat sources	2					3			3		2	1		2	1					
PL1 - Energy efficiency in public lighting						3			3						1	1				
PL2 - Smart lighting switches						3			3						1	1				
WW1 - Small watercourse and drainage channel rehabilitation		3		2						3		1	1	1		2				
WW2 - Water saving and loss reduction					3					2	2								2	
WW3 - Sustainable Urban Drainage Policy		2		2			2			3		2		1		2			1	
WW4 - Development of flood protection measures				1						3		3				2				
WW5 - Wastewater Treatment Programme		3		3	2					2	1	2	1	2		2			1	
WW6 - Rainwater storage and retention		2								3		2					1			
W2/5 - Recyclable Waste Collection								3						1	2					2
W6 - Household Hazardous Waste		2	2					2						2		2				2
W9-11: Green Energy from Waste			1	1		3		2	3											
W12: Recycling Collection Centres								3	2			2	1		2				2	2
CCA1 – Integrating climate adaptation into Belgrade’s decision-making processes, including policy developments and project investments	1	1	1	2	2	1	1	1	1	3	1	2	1	2	2	2	1	2	2	2
GS1 - Afforestation and Greening Programmes	2	1	1	3	1	3	2		2	2		1	1		1				1	2

6.2 Key Environmental Benefits

The following section provides a summary of the key environmental benefits which are likely to be achieved through the implementation of the Belgrade GCAP.

6.2.1 Air Quality

Air Quality in Belgrade has been a continuously rising problem. We have developed an Air Quality Plan which identifies key sources of pollution are wide use of solid fuel boilers, traffic and energy generation and sets out measures to achieve the following goals:

- Reduce emissions of harmful substances to the air from heating plants
- Reduce emissions of the thermo-energetic complex to a level that is below emission limit values
- Reduce emissions from traffic
- Establish an efficient system of monitoring and reporting on air quality in the Belgrade Agglomeration
- Establish an efficient system of respect for the principles of environmental protection on the territory of the Belgrade agglomerations
- Reduce the impact of suspended particulate emissions on air pollution

Some progress has been made in developing projects in this area, but overall tangible implementation of projects has been limited.

Even though Air Quality Monitoring is performed annually to a high standard and methodology, the overall management of data must be improved to achieve an overarching objective to cut various gas emissions.

Air quality in the city was identified as being an area which requires improvement in Air Quality Management followed by implementation of numerous actions presented in this action plan.

There are several key areas of intervention that are likely to result in improvements to air quality which can be broadly separated into the following key groups:

Improvements to point emissions sources such as district heating plans and solid fuel/oil fired boilers around the city

- LE1 - Development and improvement of the district heating distribution network
- LE2 - Improvement energy efficiency district heating heat sources
- B1 - Renovation / Energy efficiency and use of RES in municipal buildings
- B3 - Energy efficiency and use of RES in residential buildings
- E1 - Connecting to the natural gas distribution network with a gradual increase in the share of gas from renewable energy sources

Reduction in emissions from traffic

- T1 - Extension and development of Belgrade Metro and train
- T3 - Purchase of electric buses/trams and busses that use RES with infrastructure development
- T4 - Bicycle-Sharing System
- T5 - Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycle ways
- T6 - Commercial transport policy – City logistics
- T7 - Plan for a network of public chargers for electric vehicles
- T8 - Incentives and financing of e-vehicles for public and private commercial vehicles (range 200km/day)

Natural air quality mitigation

- B2 - Greening city buildings
- L4 - Study for a City-wide programme for urban green infrastructure development
- E 2 - Air Quality Data system
- GS1 - Afforestation and Greening Programmes

6.2.2 Biodiversity

The city is home to a variety of ecosystems some of which are natural, and others are modified by anthropological activities. Within the wider territory there are various types of ecosystems including forests on the hills, inundation zone forests, swamp ecosystems, artificial water ecosystems, plantation forests, river ecosystems, abandoned agricultural lands and ruderal ecosystems.

The plan aims to use green infrastructure to provide natural services to the city which creates a significant opportunity for enhancing biodiversity, particularly outside areas which already enjoy protection and particular in the water environment. Key terrestrial opportunities include:

- L1 – Linear Park Project
- L2 - Brownfield Redevelopment Programme
- L4 – Study for a city wide programme for urban green infrastructure development
- B2 – Greening of City Buildings
- GS1 – Greening an Afforestation programmes

Opportunities for the aquatic environment include:

- WW1 – Small watercourse and drainage channel rehabilitation
- WW3 – Sustainable urban drainage policy
- WW5 – Wastewater Treatment Programme
- WW6 – Rainwater Storage and Retention

6.2.3 Water Use

While the city has a plentiful supply of water from the Sava river, which is heavily regulated and considered reliable with a water exploitation index of 11% (well inside the Green benchmark), however abstraction at existing wells often exceeds capacity and concerns have been raised in the city's existing Climate Change Adaptation Plan over the impact of climate change. There are also efficiency benefits in terms of pumping costs and energy use from reducing per-capita consumption and several measures have been identified which can relieve pressure on demand:

- LE1 – Development and Improvement of the District Heating Network
- WW2 – Water Saving and Loss Reduction

There is also an opportunity to reduce pressure on downstream abstractions by improving the quality of wastewater discharges to the Danube and Sava through improved wastewater treatment, namely:

- WW5 – Wastewater Treatment Programme

6.2.4 Land Use

Belgrade faces challenges from an expanding population and is under pressure to grow. There has also been a significant amount of development outside the constraints of the formal planning process in the last 30 years and current planning frameworks are working to correct this by servicing areas that have developed outside the urban plan. There are also issues of "Land Banking" in more central areas which are exacerbating the pressure to sprawl. There is a new General Urban Plan in development which creates a strong opportunity to apply principals defined in this Green City Action Plan.

Key benefits that can be derived from the actions defined in this plan in terms of land use planning can be divided into two key areas:

1) The use of green infrastructure to make better use of land to deliver necessary environmental services for people. Key measures include:

- L1 – Linear Park Project
- L4 – Study for a city wide programme for urban green infrastructure development

2) Encouraging high density sustainable development in central areas of the city including:

- L2 – Brownfield development programme
- L5 – Study on urban land management policies and instruments
- L6 – Donji Dorcol super block

6.2.5 Material Use

There is a significant amount of investment ongoing in the replacement of the old Vinca landfill site which no longer has capacity to service Belgrade and comprehensive facilities for treatment and disposal are currently being delivered under a Public Private Partnership model. However significant opportunity was identified to support appropriate segregated waste collection and the following measures have been included in the plan to support the objective of increasing recycling rates with a mid term target of enabling at least 15% municipal solid waste recycling. These measures include:

- W2/5 – Recyclable Waste Collection
- W6 – Household Hazardous Waste Collection
- W12 – Recycling Collection Centres

Opportunity was also identified to harness energy from waste agricultural material, reducing this waste stream and generating renewable energy:

- W9-11 – Green Energy from Waste

6.2.6 Energy Use & Climate Change Mitigation

The GCAP was developed in parallel with a Sustainable Energy and Climate Action Plan (SECAP) produced using the tools developed by the EU's Covenant of Mayors. As a part of this process a Baseline Emissions Inventory was taken against a baseline year (2015) and then emissions within the most relevant sectors (residential buildings, municipal buildings, public lighting and transportation) were projected to 2030 to create a future baseline which considered factors such as socio-economic parameters (e.g. population growth and GDP) and the introduction of nationwide measures that are outside of the city's influence (such as appliance standards, the biofuel target for the transport sector and changes in the energy production / transformation mix). A second analysis was then undertaken projecting emissions to 2030 but this time considering the impact of climate change mitigation measures proposed in the GCAP and SECAP (noting that the actions included in the two plans have been harmonised).

6.2.6.1 Baseline Scenario to 2030

According to the baseline scenario, the energy consumption in 2030 will grow by 16.6% compared to 2015, with energy use in the transport sector growing by 76.3% and energy use in the buildings sector decreasing by 16.6%. CO₂ emissions in 2030 will be reduced by 7.2% compared to 2015, which will mostly be the result of improvements in energy efficiency in buildings (resulting in 27.7% reductions) and the growth of transport emissions by 59.0%. The larger influence of the buildings sector, as a percentage of energy / BEI emissions, results in the lower percentage savings having a higher absolute impact than the increase in emissions from transport. Figure 6-1 shows the growth of energy consumption in BEI sectors and Figure 6-2 shows the projections of CO₂ emissions of the sectors covered in the BEI in the baseline scenario.

Figure 6-1 Baseline projections of final energy consumption (MWh) of BEI sectors

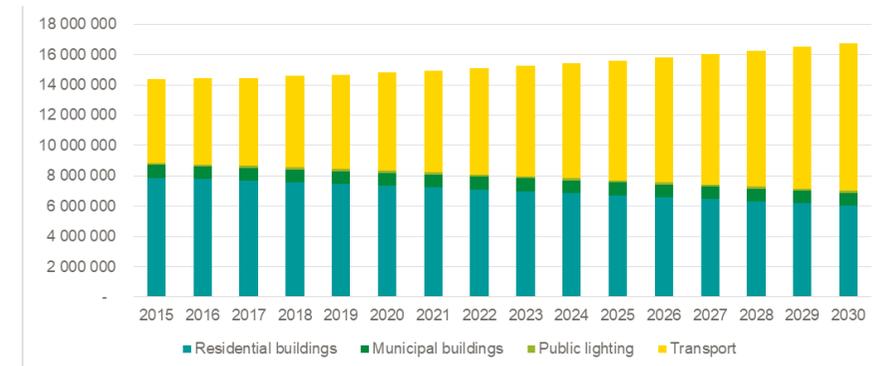
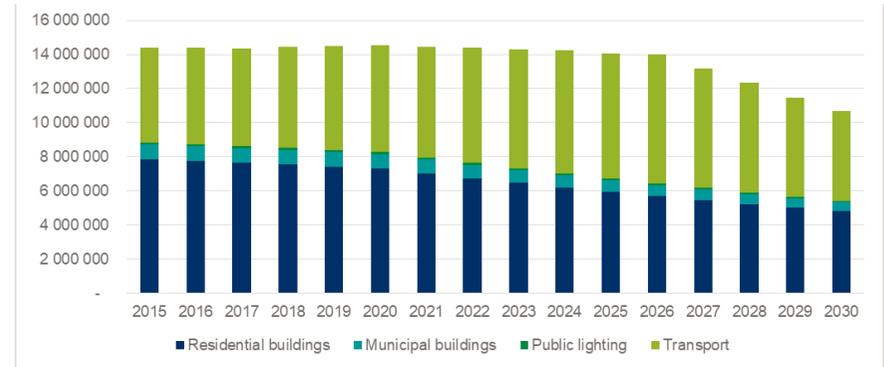


Figure 6-2 Baseline projections of CO₂ emissions (t) from BEI sectors



Figure 6-3 Projections of final energy consumption (MWh) of BEI sectors in mitigation scenario



6.2.6.2 Baseline Scenario to 2030

The climate change mitigation scenario assumes the implementation of mitigation actions described in this document (see Chapter 3). The implementation of these actions results in a projected total emission reduction of 44.0% compared to the BEI and 39.7% compared to the baseline scenario. The largest reductions occur in residential buildings – 51.9% compared to the BEI and 33.5% compared to the baseline scenario. These reductions also incorporate the effects of actions from local energy production, which result in the reduction of the emission factor for district heat.

Figure 6-4 Projections of CO₂ emissions (t) from BEI sectors in mitigation scenario

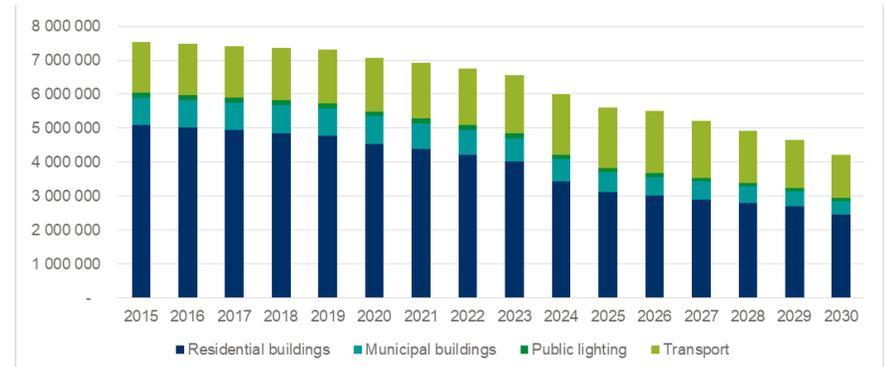


Figure 6-3 shows the growth of energy consumption in BEI sectors and Figure 6-4 shows the projections of CO₂ emissions of BEI sectors in mitigation scenario.

Table 6.2 and Table 6.3 **Error! Reference source not found.** show the savings of final energy, renewable energy production and CO₂ emission reductions for energy efficiency and urban planning and mobility actions respectively, as compared to the baseline scenario in 2030.

Table 6.2 Impacts of energy efficiency actions in 2030, as compared to the baseline scenario

Action	Energy savings	Renewable energy production	CO ₂ reduction
	MWh/a	MWh/a	t CO ₂ /a
E1 - Connecting to the natural gas distribution network with a gradual increase in the share of gas from renewable energy sources	Not estimated, partially included in LE2		
LE1 - Development and improvement of the district heating distribution network	0	0	300,048
LE2 - Improvement energy efficiency district heating heat sources	0	0	535,964
PL1 - Energy efficiency in public lighting	28,529	0	31,382
PL2 - Smart lighting switches	22,123	0	24,335
B1 - Renovation / Energy efficiency and use of RES in municipal buildings	338,487	84,622	407,470
B3 - Energy efficiency and use of RES in residential buildings	1,350,078	34,460	553,033
B4 - Regulations and incentive measures in residential buildings			
Total effect of all actions	1,739,217	119,082	1,852,232

Table 6.3 Impacts of urban planning and mobility actions in 2030, as compared to the baseline scenario

Action	Energy savings	Renewable energy production	CO ₂ reduction
	MWh/a	MWh/a	t CO ₂ /a
T1- Extension and development of the Belgrade Metro and train	3,577,649	0	684,861
T3 - Purchase of electric buses/trams and busses that use RES with infrastructure devt	236,449	55,180	44,265
T4 - Bicycle-Sharing System	676,628	0	158,339
T5 - Encouraging walking and/or cycling within the city through improved pedestrian facilities and cycle ways			
T6 - Commercial transport policy – City logistics	111,469	3,497	67,320
T7 - Plan for a network of public chargers for electric vehicles			
T8 - Incentives and financing of e-vehicles for public and private commercial vehicles			
L1 - Linear Park	Not estimated, supporting measure		
L2 - Brownfield Development Programme	Not estimated, supporting measure		
L4 - Study for a City-wide programme for urban green infrastructure development	Not estimated, supporting measure		

Action	Energy savings	Renewable energy production	CO ₂ reduction
	MWh/a	MWh/a	t CO ₂ /a
L5 – Study on Urban Land Management Policies and Instruments	Not estimated, supporting measure		
L6: Donji Dorcol Superblock project	Not estimated, supporting measure		
L7: Green Market Kalenic	Not estimated, supporting measure		
Total effect of all actions	4,602,195	58,677	954,785

6.2.7 Climate Adaptation

Climate adaptation and resilience has a cross-cutting nature across various environmental sectors and therefore it was important to ensure that adaptation actions are not kept separately but are fully integrated and mainstreamed into the various sectors. As such, adaptation measures can be found not only within the 'Greening and Resilience' chapters but, they also form part of the 'Urban Planning and Mobility', 'Energy Efficiency' and 'Water and Waste' chapters. Notable examples include the greening of the building sector and city-wide greening measures to deal with urban heat effect, measures to improve water efficiency to help coping with droughts or development of flood protection measures.

More specifically, adaptation and resilience actions that are mainstreamed into the GCAP sectoral measures include the following:

- L2 - Brownfield Development Programme
- L5 - Study on Urban Land Management Policies and Instruments
- L1 - Linear Park Project
- L4 - City wide programme for urban green infrastructure (GI) development
- GS4 - Afforestation and Greening Programmes
- B2 - Greening city buildings

- WW2 - Water saving and Loss reduction
- WW1 - Small watercourse and drainage channel rehabilitation
- WW3 - Sustainable urban drainage policy
- WW4 - Development of flood protection measures
- WW6 - Rainwater storage and retention
- WW5 - Wastewater Treatment Programme

As part of the identification of the 'long-list' of measures the team has aspired to identify adaptation benefits that could be achieved by each sectoral measure and to highlight this to stakeholders. Such an approach also helped to capture synergies between climate adaptation and mitigation.

6.3 Key Social and Gender Co-Benefits

Active inclusion of social and gender options addressing inequalities, is integrated in all 35 of the GCAP's proposed actions and is aligned with best practice according to the "Handbook for Gender-Inclusive Urban Planning Design", 2020, World Bank and the "Gender Equality in Transport in Serbia – GETS study" 2019. Social and gender inclusion measures in the GCAP relate to themes of: **access, mobility, safety and freedom from violence, health and hygiene, climate resilience and climate participation**. The measures ensure individuals have agency, and are represented in planning, design and implementation stages, as well as benefitting from economic empowerment and inclusion, while progressing the EU accession requirements through policy implementation.

Vocational training and City-jobs form a large part of the GCAP's measures for social and gender responsiveness. EBRD's Economic Inclusion Strategy (EIS) 2017-2021 sets out an approach that promotes "inclusive market economies where full and fair access to labour markets, finance and entrepreneurship and, more generally, economic opportunity is open to all". Suggestions following a 2017 public consultation on the EIS in the City of Belgrade, have been integrated into the GCAP to promote opportunities for relevant vocational training and apprenticeships linked to City contracts in design, construction, installation, and

operations and maintenance³⁰. City programme synergies with the UN Women Programme Office in Serbia, the Association of Business Women in Serbia, and the International Labour Organisation should be explored to optimise gender and social inclusion.

Other opportunities to leverage these measures are based on collaborations with 100 Resilient Cities, SDGs, Covenant of Mayors, IFC Sustainable Cities Initiative. Examples of specific actions and impacts on social and gender inclusion from the GCAP strategic objectives are:

Access to education, apprenticeships and jobs, especially for the economic inclusion of 15-24 year olds, women, long-term unemployed, PWDs and migrants through: design, construction, installation, operation and maintenance. E.g.: (B1, B2, E1, E2, E4, L1, L7, LE2, W2, W2-5, W5, W12).

Access to finance for building owners and long-term tenants to obtain financial incentives through IFIs, commercial banks and Municipal grants / loans, to install (B3) energy efficient heating/cooling and lighting appliances in residential buildings; subsidies of 10% for customers connecting to natural gas connections (E1); subsidies for e-vehicles (T8).

Access to energy in for form of renewable energy, natural gas and associated connections to buildings, providing residents with more efficient, reliable and cleaner energy options (B1, B3, E1, LE1).

Access to services including conveniently located recycling receptacles or collection services for hazardous material (W5, W6) benefitting the elderly, PWD, persons with chronic diseases, women and children. Modernization of the Kalenić Market (L7) would also provide improved access to important market services in a “greener” environment.

Mobility through provision of cycle lanes and walk ways (L3) replacing car centred infrastructure as cars are reallocated car to underground car parks benefitting individuals who cannot be licenced or drive (medically), or those unable to afford to own and maintain a car e.g. 15-24 year olds,

PWD, low income households, unemployed persons, Roma and migrants.

Safety and freedom from violence, especially for women and girls and LGBTI related to (B1 and B2) improved lighting of renovation / energy efficient and use of RES in municipal and residential buildings; and public street lighting; (L3) multi-modal access to safer car-free sites for walkers, cyclists, elderly and PWD while removing car congestion to underground parking; transit and safety; (PL1, PL2) public street lighting benefitting women and girls, LGBTI, elderly, Roma and migrants.

Health and hygiene, especially for children, elderly, persons with chronic disease, persons living in substandard housing and PWD (B1, B3) due to improved building envelope, thermal regulation and air exchange; improved air quality due to reduced boiler emissions (E1, LE1) and new air quality information systems providing data and forecasts (E2); psychosocial wellbeing from recreational grounds with increased green / cultural spaces (E4, L1); allocated space for pedestrians and cyclists and improved air quality (L3); reduced air pollution, particulate matter and related disease transmission such as COVID-19, and reduced noise pollution from the use of e-vehicles (T12).

Climate resilience through the installation of heating / cooling systems in municipal and residential buildings (B1 and B3) and connections to cleaner heating fuels (LE1), that provide a thermally regulated environment during cold / heat waves mitigating against disease and death, especially for the elderly, children, persons with chronic diseases and PWD; substantial energy efficiency gains and fuel switches (B1, B3, E1, LE2, T12) contributing to low emissions pathways potentially reducing catastrophic climate-related impacts; green roof and wall operations (B3) mitigating the urban heat island effect and providing for slow water retention and filtering during storms, and mitigating against fast onset urban flooding, and (E4) river bank breaking through restored greenspaces and afforestation.

³⁰ An MOU between the Ministry of Education and city contract awarded private sector companies in Turkey, demonstrate replication models for partnerships in education and employment.

Citizen participation in climate solutions, for all Belgrade residents, especially for individuals typically excluded from decision-making such as women and girls, persons living in substandard housing, unemployed, children, youth, PWD and low-income households. Actions include: the installation of smart metres (B3) allowing residents to gain insight on their energy footprints and pay for consumption-based billing; (CCA1) awareness raising about climate change adaptation impacts and actions in the City; (W5, W6) residential understanding and engagement with material and hazardous waste footprints may lead to behaviour and consumption pattern changes.

Appendices



Appendices

Appendices can be found in Vol 2 of GCAP: **GCAP Appendices**

