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Circular Prague 2030

Prague Strategy for Transition to a Circular Economy

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PRA GUE
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Contents

Frequently Used Abbreviations

CO_2	Carbon dioxide
CTU	Czech Technical University
EPD PCH	Environmental Protection Department PCH
IPR	Prague Institute of Planning and Development (IPR Prague)
MMW	Mixed municipal waste
OICT	Operátor ICT, a.s.
PCD	Prague City District
PCH	Prague City Hall
PDS	Pražská developerská společnost
BICP	Business and Innovation Centre of Prague
PPD PCH	Public Procurement Department PCH
CWTP	Central Wastewater Treatment Plant

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Prague innovation institute

CIRCLE ECONOMY

The strategy was approved by resolution of the PCH Assembly No. 33/17 on 27.1.2022.

Summary

Circular Prague 2030 – Prague Strategy for Transition to a Circular Economy (referred to in this document as the 'Strategy') presents a framework for initiatives which the city can use to support its further development in such a direction. By adopting the Strategy, Prague commits to continuously reducing its environmental and carbon footprint (resource intensity of consumption), and to moving towards carbon neutrality, which it aims to achieve by 2050. To accomplish this vision, Prague is motivating the city's stakeholders, including the private sector and the general public, to manage resources and consume responsibly. By implementing cost-saving measures and preventing waste, Prague is contributing to savings in raw materials and reducing the city's overall CO_2 emissions.

A circular economy can make an important contribution to meeting climate goals. It is estimated that 45% of global CO_2 emissions are linked to the production and consumption of food, materials, and products we use every day.[1]

Following the example of other European cities (Amsterdam, London, Paris, Copenhagen, Glasgow, and many others), Prague aspires to become a circular innovation hub where the city promotes digitalisation, development, and use of new technologies through strategic and pilot projects.

The Strategy is based on the approved Prague 2030 Climate Plan[2] and its objectives. It was developed following a resolution of the Prague City Council and is based on the recommendations of the Working Group on the Circular Economy within the PCH Council Commission for Sustainable Energy and Climate.

With the involvement of the commercial sector, research, and development, the circular economy presents an opportunity for new types of products and services, as well as new jobs. By supporting a shared economy, community activities, and the involvement of social enterprises, the circular economy also contributes to the city's social cohesion.

Last but not least, the circular economy is a way to meet ambitious waste legislation targets. Sorting 70% of municipal waste cannot be realistically achieved without halting (or at least slowing down) the growth of municipal waste production. The circular economy is thus a necessary prerequisite for meeting mandatory waste management targets, as the failure to meet these could result in penalties and a halt in the flow of EU funds.

Prague's strategy for the transitioning to a circular economy focuses on objectives and measures in sectors with the greatest potential for material and emission savings. These are: 1) construction, 2) water, 3) agriculture and food, and 4) waste. There are also three cross-cutting areas focusing on tools which the city can use to support the implementation of measures proposed in the four sectors. These are public procurement, i.e. what products and services the city demands. Next are incentive tools in the form of subsidies, vouchers, as well as targeted education and communication support or outreach campaigns. The third area is the management and implementation of the Strategy, i.e. coordination within the city, development of action plans, and their evaluation based on collected data.

The Prague 2030 Strategy for the Transition to a Circular Economy was developed by the Prague Innovation Institute, z.ú. (PII) in close collaboration with Environmental Protection Department of Prague City Hall (EPD PCH), the companies Pražské služby, a.s. and Pražská vodohospodářská společnost, a.s., CTU UCEEB, CTU FCE, Crea-Tura, and a many other experts drawn from among representatives of the city and city organisations and companies, private businesses, and representatives of universities, as well as NGOs who participated in individual or group consultations. The expertise of the Dutch company Circle Economy, which had already participated in material flow analysis – Circular Scan of the City of Prague (INCIEN, 2019), was also a highly valuable contribution.

The proposed strategy includes 7 strategic objectives which are elaborated into 27 specific objectives and which then translate into 76 measures and 37 project cards that form the basis of the action plan. See Table 1 on page 6.

In many cases, inspiration for the proposed solutions came from examples of good practice abroad, which are presented here in the form of examples or references.

Generally speaking, waste and water are the thematic areas that to date have been developed the furthest – up to the level of project cards – as the city and its companies have been systematically working on these over the long term. Urban agriculture has also been receiving support from the city, with a number of new activities identified within this area during the preparation process of the Strategy. There is great potential for further development in urban agriculture, not least in view of the unquestionable demand from the public. The areas of construction and responsible public procurement are still inadequately covered in terms of both capacity and expertise. The private sector in Prague is developing new circular solutions in the construction sector. The city still lacks a Sustainable Construction Code

1 https://emf.thirdlight.com/link/rl0yth77pffc-jqkp5d/@/preview/1?o

2 https://klima.praha.eu

incorporating circular principles, as well as a methodological coordination unit to systematically promote new circular approaches in the construction sector. A completely new agenda is the city's food policy and measures to prevent food waste.

The 34 projects listed in the project cards include infrastructure projects prepared by Pražské služby, a.s. (PSAS) and Pražská vodohospodářská společnost, a.s. (PVS), as well as projects focused on establishing new regulations, education, communication, and other softer types of activities. Most of the projects range in the order of hundreds of thousands to tens of millions of CZK, with higher overall investment intensity for infrastructure projects. Financing will be provided by a combination of resources from Prague City Hall (PCH) and European funds and programmes. Examples of projects being developed are given in Appendix of the present document.

The largest upcoming infrastructure project is the biogas plant planned by Pražské služby, a.s. (PSAS), which is to serve as the end technology for using biodegradable municipal waste (BMW) unsuitable for composting, with an expected annual capacity of 50,000 tonnes. PSAS also intends to build capacity for the treatment of slag, so that the 60,000 tonnes of this material currently taken to landfill can be used in the construction industry.

Pilot projects of Pražská vodohospodářská společnost, a. s. (PVS) are in the process of verifying the possibility of processing biogas from sewage sludge into BioCNG, which will be subsequently introduced into the gas pipeline network, as well as a solution for sewage sludge treatment, with the possibility of energy recovery.

The introduction of the city-wide collection of biodegradable municipal waste and, e.g., the expansion of multicommodity collection (i.e. the joint collection of plastics, beverage cartons and metal packaging) are examples of PCH EPD projects that require the cooperation of the public and must be accompanied by education and awareness-raising communication campaigns. These are also projects that promote the reduction of bulky waste by encouraging sharing, repair, and reuse. These include the development of reuse centres, the expansion of reuse points, community events such as 'Iron Sundays', and others.

Another category of projects is represented by those which support initiatives originating from the city districts or the public. For example, community gardens or community composting and, more generally, the development of urban agriculture and sustainable food management, including food waste prevention.

From the city's point of view, one of the most important measures is to take into account circular principles in the purchase of products and services, as well as in construction, and thus introduce criteria for responsible public procurement, training city staff and city organisations, creating an environment for sharing knowledge, and for testing these new approaches on specific contracts.

Promoting the involvement of companies (SMEs, start-ups) and their closer collaboration with the city and with research institutions when focusing on waste and pollution prevention represents another type of project. One such example is the Circular Prague platform, intended to engage businesses or test new practices in the city in the form of so-called urban labs.

In order to be able to implement the range of measures in its entirety, it will be necessary to set up project management for this Strategy and establish a coordinator for the circular economy at PCH. The Strategy for Transition to a Circular Economy foresees close coordination with other strategic documents (see the map of strategies on page 11), especially in the areas of data sharing and setting indicators.

Table 1: Overview of the strategic and specific objectives of the Prague Strategy for Transition to a Circular Economy

Theme	Strategic objectives	Specific objectives	Number of measures	Project cards
Thematic strategic objectives				
1 Construction	S01 Reduce the consumption of primary raw materials and increase the efficiency of material flows in the construction industry	SO1/I: The city as a bank of materials, building materials are recorded and recycled to the maximum extent SO1/II: Reduction of construction waste by implementing demolition practices that allow for the reuse of materials SO1/III: New construction and renovation in line with the requirements of resource circularity and the sustainable use of materials SO1/IV: Sustainable operations, prioritising renovation over new construction	11	4
2 Water	S02 Reduce rainwater runoff through sewers, increase water and nutrient recycling and reuse, including for energy purposes	SO2/I: Water savings and leak detection SO2/II: Promoting the use of rainwater, grey water and wastewater and other resources in the territory SO2/III: Use of wastewater heat and water energy SO2/IV: Use of waste sludge in alliance with CE principles SO2/V: Ensuring a comprehensive approach to water management	15	5
3 Agriculture and food	S03 Reduce food waste, increase the local production and consumption of healthy food sourced from urban and peri-urban agricultural production	SO3/I: Increase the city's demand for organic products (gastro pubs, canteens), promotion of urban and peri-urban organic farming SO3/II: Promoting urban agriculture and subsistence farming (community gardens, management of surplus from allotments, rooftop farms, urban farms etc.) SO3/III: Circular management of organic/gastro waste through returning nutrients to the soil SO3/IV: Reduction of food waste by introducing prevention and distribution of surpluses SO3/V: Promoting innovation in food production (vertical farms, hydroponics, aquaponics, more environmentally friendly food processing; offering space, logistics)	16	5
4 Waste	S04 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce by 50% the production of mixed municipal waste before 2030	SO4/I: Minimising production of and increasing the recovery rate of the city's bulky waste to 50% by 2030 SO4/II: Sorting and treatment of biodegradable municipal waste with 60% efficiency by 2026 SO4/III: Increase the sorting rate of municipal waste to 60% in 2025 and to 65% by 2030, as well as ensuring the highest possible rate of feasible recycling SO4/IV: Continuous and systematic communication and outreach across the city's inhabitants, businesses, as well as at the national legislative level	12	14
Cross-cutting strategic objectives				
5 Public procurement	S05 Increase demand for circular solutions by incorporating such practices into the city's own projects, guidelines, and public procurement	SO5/I: Integrating circular economy principles into public procurement SO5/II: Integrating circular economy principles into the operation of the city and its organisations SO5/III: CE principles and conserving primary resources as a foundation for city projects	10	3
6 Support for entrepreneurship, innovation, and outreach	S06 Promote innovation in the business and civil sectors leading to a circular economy	SO6/I: Supporting the shared economy, citizen initiatives and businesses in the CE SO6/II: Support for pilot projects and innovation, involvement in science and research SO6/III: Communication, education, and outreach for the CE	5	4
7 Management and implementation	S07 Manage, coordinate, and evaluate the implementation of the CE Strategy	SO7/I: Establishing project management for the implementation and development of action plans SO7/II: Setting indicators for the circular economy (CE) SO7/III: Communicating of the objectives of the Strategy and their implementation	7	2

I — Introduction

Why a Circular Economy?

The circular economy represents a new approach to managing raw materials, resources, and products. Instead of a linear system where raw materials are extracted, processed, used, and then discarded, it emphasises the elimination of waste and maintaining the circulation of raw materials and products at their highest possible value and for as long as possible over extended cycles. This saves primary resources, reduces the amount of waste produced, and creates added economic value. The circular economy is therefore a route to more responsible patterns of production and consumption, which in their current form are unsustainable in the long term, as far as material and energy intensity are concerned. Over 90% of the world's mined raw materials become waste and are not returned back into circulation, while resource consumption and resource intensity are globally increasing. As illustrated by the Ecological Footprint indicator, the limits of available material resources in industrialised countries are continuously being exceeded. If we were to continue to consume the same amount of resources in the Czech Republic as we do now, we would require an area equivalent to 2.5 planet Earths.[3] The so-called Circular Material Use Rate (CRM) indicates the proportion of material that is entered back into circulation within national economies. Based on Eurostat data, this rate in the Czech Republic was 8.3% in 2019, while the EU average was almost 12%; the top countries, the Netherlands and Belgium, achieved around 30%.[4]

Lower material consumption also means lower energy consumption and less pollution. Based on available data, a fully circular economy would reduce global CO_2 emissions by up to 49%.[5] Utilising resource efficiency and reusing of materials and products contributes to the long-term resilience of economies. Particularly when total resource consumption at current levels is expected to double by 2050 [6] and access (not only) to critical raw materials (including those used in modern technologies) outside Europe may be at risk.

Last but not least, the circular economy reduces waste. The European Waste Framework Directive [7] and other European regulations have set very ambitious targets for sorting and recycling municipal waste, and Czech legislation has subsequently adopted them.[8] For example, meeting the legislative target of sorting 70% of the recyclable components of municipal waste by 2035 cannot be realistically achieved without stopping (or at least slowing down) the increase in municipal waste production.

The transition to a circular economy foresees changes in many sectors and their entire production chains, on the part of both the producer and consumer (see the eight key elements of a circular economy). At the same time, it creates opportunities for innovation, new types of business, and the development of new jobs.[9] An integral part of the circular economy is the development of digitalisation, monitoring, and data collection. A new trend is the development of the bioeconomy, i.e. care for natural ecosystems and the intensified use of natural materials and processes for economic purposes.

European and National Policies

The circular economy is a relatively new phenomenon and has only begun to be systematically addressed by European and national policies in recent years. The Paris Agreement adopted in 2015 and the publication of the 2030 Sustainable Development Goals[10] triggered new initiatives. Between 2018 and 2020, the European Commission issued a total of six strategies and frameworks which are directly related to the transition to a circular economy. The European Green Deal[11] from 2019 then aims for a climate-neutral Europe in 2050, when economic growth will be disentangled from the consumption of primary natural resources. Four intermediate objectives are directly related to the circular economy: (1) Mobilising industry for a clean circular economy; (2) Building and renovating in an energy and resource efficient way; (3) Designing a fair, healthy, and environmentally friendly food

3 Open Data Platform (footprintnetwork.org)

4 https://ec.europa.eu/eurostat/databrowser/view/sdg_12_41/default/table?lang=en

5 https://emf.thirdlight.com/link/rl0yth77pffc-jqkp5d/@/preview/1?o

6 https://www.oecd-ilibrary.org/docserver/af983f9a-en.pdf?expires=1633522008&id=id&accname=guest&checksum=4BD807CB1C1A391479DEC6B5808BC74F

7 Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (europa.eu)

8 Waste Act, Act No. 541/2020 Coll. (zakonyprolidi.cz)

9 Strategic framework of the Circular Economy of the Czech Republic 2040: the goal of creating at least 50,000 new jobs by 2040 through the transition to the circular economy

10 17 UN Sustainable Development Goals. Two of them are directly related to the development of a circular economy in cities: Goal 11 Sustainable cities and communities, and Goal 12 Responsible consumption and production.

11 https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22- 11ea-8c1f-01aa75ed71a1.0010.02/ DOC_1&format=PDF

Fig. 1: Circular Economy

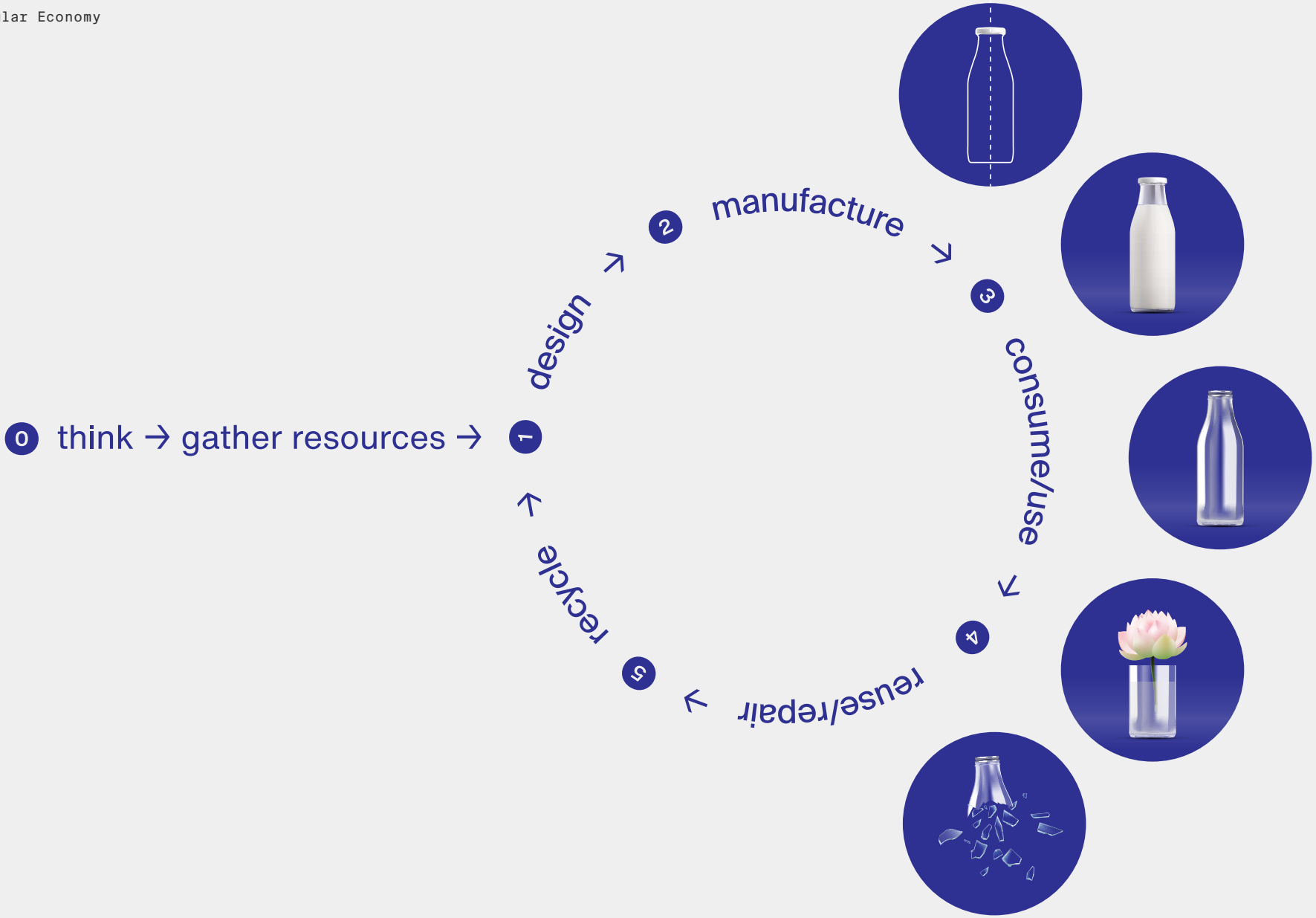


Table 2: Strategic and conceptual documents related to the Prague Strategy for Transition to a Circular Economy

Document	Year	Contracting entity
Sustainable Development Goals	2015	UN
Green Deal for Europe	2019	European Commission
Circular Economy Action Plan	2020	European Commission
European Industrial Strategy	2020	European Commission
European Strategy for Plastics in a Circular Economy	2018	European Commission
Farm to Fork Strategy	2020	European Commission
Circular Economy – Principles for Building Design	2020	European Commission
State Environmental Policy of the Czech Republic 2030 with a view to 2050	2021	MoE
Waste Management Plan of the Czech Republic for the period 2015-2024	2014	MoE
Circular Czech Republic 2040	2021	MoE
Strategic Framework Czech Republic 2030	2017	MoE
EU Action Plan – Towards Zero Pollution in Air, Water and Soil	2021	European Commission

system; and (4) A zero pollution ambition for a toxic-free environment.

The Circular Economy Action Plan from 2020 defines close to 30 measures for priority material chains that the European Union should implement. It focuses on electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water, and nutrients.

At the national level, the State Environmental Policy of the Czech Republic 2030, updated in 2021, determines priorities and actions in areas related to environmental sustainability. In the same year, the Ministry of the Environment of the Czech Republic (MoE CR) published the Circular Czech Republic 2040 strategic framework, where one of the ten priority areas concerns circular cities and infrastructure. The Strategic Framework emphasises the introduction of circular production methods and sustainable products in the private sector to the greatest possible extent; savings in primary raw materials and the use of secondary raw

Fig. 2: Areas of the Circular Economy

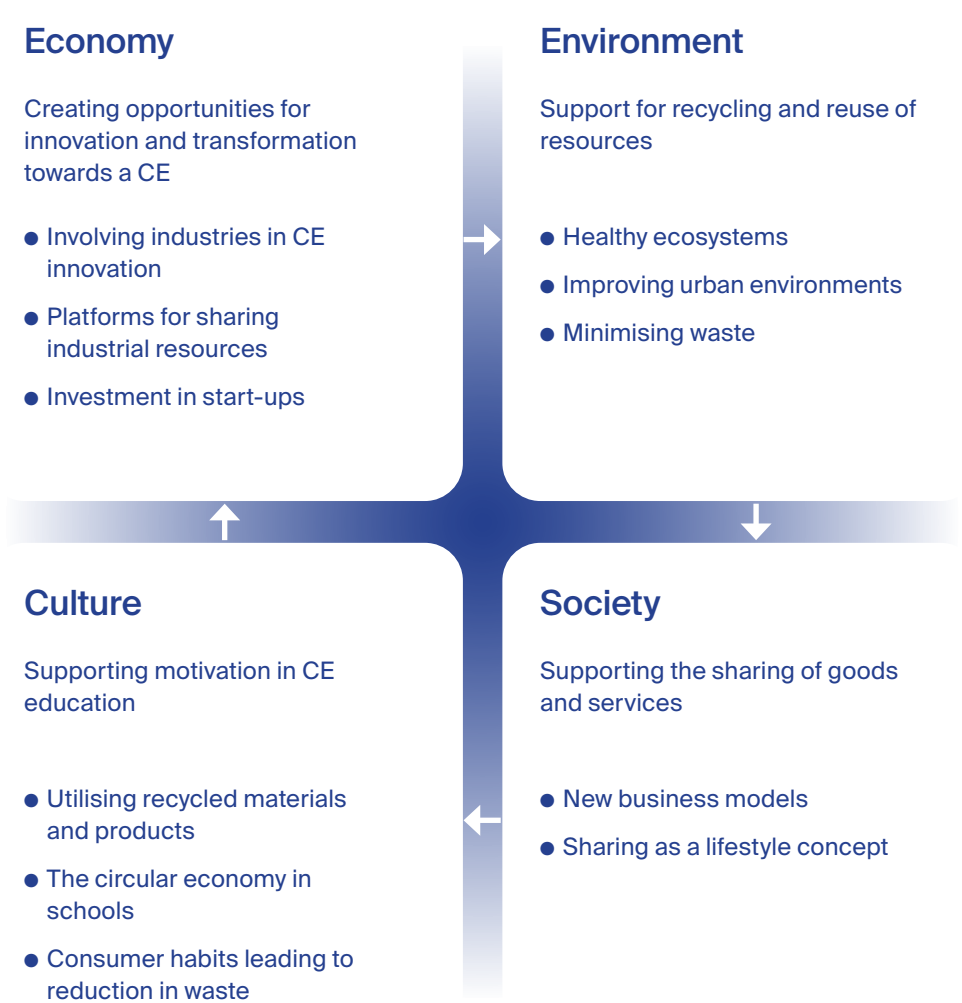
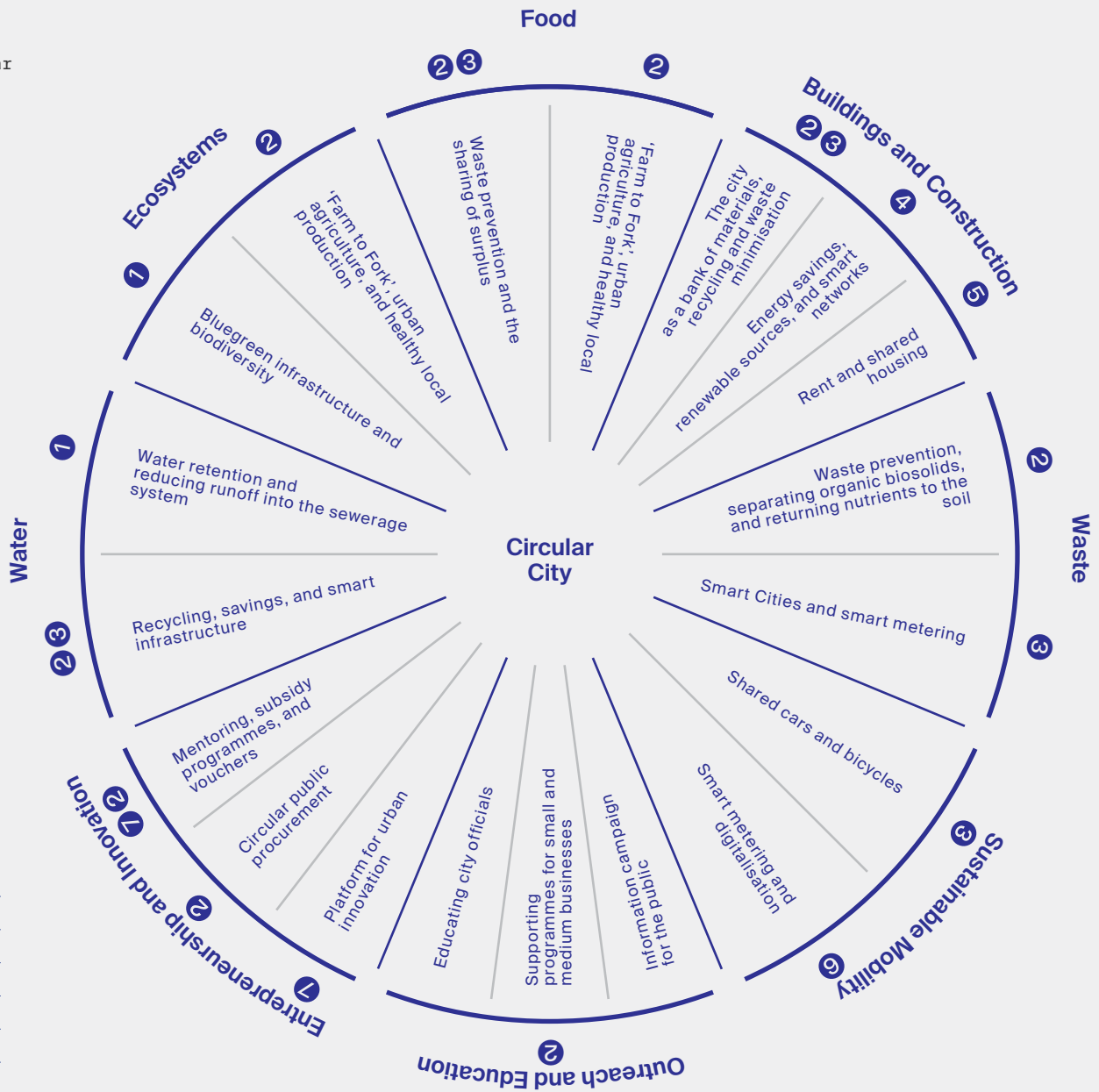


Fig. 3: Strategic and conceptual documents related to the Prague Strategy for Transition to a Circular Economy



1	Climate Change Adaptation Strategy
2	Circular Prague 2030
3	Smart Prague 2030
4	Prague 2030 Climate Plan
5	Housing Development Strategy
6	Sustainable Mobility Plan
7	RIS3 Strategy

materials as standard; the exploitation of the potential of the bioeconomy; reduction of food waste; and last but not least, the introduction of circular business models.

Circular Economy in Cities

Cities produce over 75% of the world's CO_2 emissions, consume 75% of natural resources, and produce 50% of waste. On the other hand, they generate 80% of GDP and can therefore be major drivers of system change. Cities have a key role to play in the transition to a circular economy. Among European cities, Amsterdam adopted the first Circular Economy Strategy in 2015. London, Copenhagen, Paris, Brussels, Glasgow, and many others have followed, and the list is rapidly growing. Among cities in Central and Eastern Europe, Prague is the first metropolis with the ambition to formulate and implement a comprehensive strategy for transition to a circular economy.

OECD Work on Cities

According to a 2020 OECD analysis conducted across 51 cities around the world, the main reasons why cities are integrating circular economy principles into their policies include: climate change and global trends in the decreasing availability of natural resources (90% of which become non-recycled waste after use), economic change, job creation, pressure from grassroots initiatives and private sector activity, the emergence of new business models and technological developments, and obligations and targets arising from inter/national legislation. Responses showed that climate change is the main driver (more than 70% of respondents). Global trends in the availability of raw materials and economic change were cited as relevant reasons in more than 50% of responses, and almost 50% of respondents cited job creation.[12]

And what do cities expect from a circular economy? According to the OECD (2020), the main assumptions involve rethinking production and consumption patterns; improving environmental quality; new business models; and encouraging behavioural change and stimulating innovation.

How to achieve the vision of a circular city? The Ellen MacArthur Foundation lays out 5 steps[13]:

- Stimulate design for the circular economy,
- Promote the development of business models and resource management systems that keep products and materials in the economy at their highest possible value,
- Target achieving a functioning economy through incentives and regulatory requirements that enable circular solutions,
- Invest public funds in innovation, infrastructure, and in skills which create circular opportunities,
- Promote public-private collaboration for sustained and durable system change.

The development of a shared economy at the city level is also important, and is emphasised in a number of CE Strategies for world cities (Glasgow, Paris, Brussels, and others). Sharing goods and services creates new business opportunities and jobs. The sharing culture is also reflected in the sharing of data, experiences, and resources, and represents an important principle in the management of circular cities.

Despite being most often linked to environmental issues, the circular economy is a cross-sectoral theme. The implementation of circular economy principles has a direct and positive impact on many areas of urban life and is far from being limited to environmental objectives.

12 The Circular Economy in Cities and Regions OECD

13 https://policy.ellenmacarthurfoundation.org/universal-policy-goals

Table 3: Strategic and conceptual documents related to the Prague Strategy for Transition to a Circular Economy

Document	Year	Contracting authority
Prague Strategic Plan	2016	IPR Prague
Prague Climate Pledge	2019	Prague City Hall
Prague 2030 Climate Plan	2021	Prague City Hall
Integrated Strategy for ITI (integrated territorial investment) for the Prague Metropolitan Area	2021	Proces – Centre for Municipal and Regional Development
Waste Management Plan of the Capital City of Prague	2016	Prague City Hall
Regional Waste Management Plan of the Capital City of Prague	2016	Prague City Hall
Territorial Energy Concept of the City of Prague	2013	Sev.en Energy
Sustainable Mobility Plan for Prague and its Suburbs	2019	Prague City Hall
Prague 2030 Alternative Fuels Strategy	2020	Prague City Hall
Prague Regional Innovation Strategy (RIS3)	2019	IPR Prague
Smart Prague 2030 concept	2017	ICT Operator
Capital City of Prague Climate Change Adaptation Strategy	2017	Prague City Hall

Where Does Prague Stand?

The Prague Strategy for Transition to a Circular Economy is being developed in relation to the adopted Prague 2030 Climate Plan (2021) and the recommendations of the Working Group on the Circular Economy within the PCH Committee on Sustainable Energy and Climate. Its author is the Prague Innovation Institute, z.ú. (PII, z.ú.), an organisation established by Prague City Council to support the development of the innovation ecosystem, especially in the areas of education, entrepreneurship, and urban development.[14] The implementation of the Climate Plan over the next ten years envisages a 45% reduction in CO_2 emissions compared to their 2010 levels. This target will be delivered in four areas: sustainable energy and buildings, sustainable mobility, the circular economy, and adaptation measures.

For two years, the City of Prague has been systematically approaching the topic of the circular economy, thanks to its establishment of the Working Group for the Circular Economy, which is tasked with recommending systematic measures to the City Council on an ongoing basis. Thanks to its activities, a number of projects, initiatives, and plans to develop this Strategy have been launched across Prague. Apart from the Circular Scan of 2019 and the Prague 2030 Climate Plan, no other strategic document of the City of Prague has explicitly addressed the circular economy as such, although a number of existing strategic documents already work with the principles of the circular economy and contain measures that aim towards it. These include, e.g., the vision of a city of short distances in the Prague Strategic Plan, shared mobility in the Sustainable Mobility Plan, and the goal of a waste-free city in the Smart Prague 2030 concept. Another document that lies close to the topic of circular economy is the Strategy for the Adaptation of the City of Prague to Climate Change, which overlaps with the Strategy for Transition to a Circular Economy, especially in the area of rainwater management. The circular economy topic is also connected with innovation, similarly with the use of data and new technologies. For this reason, the Prague Regional Innovation Strategy (RIS3) and the Smart Prague 2030 concept (see Table 3) are also relevant.

The present Strategy focuses on those areas which have not yet been covered by other strategic documents, but at the same time it assumes close coordination with all relevant strategies of the City of Prague.

The analytical part is based on the analyses of material flows carried out as part of the Prague Circular Scan, which was undertaken in 2019 by the Institute for Circular Economy (INCIEN) and Circle Economy[15], a Dutch company. The latter has also been involved in consultations on drafting the present Strategy. The scan focused on mapping and analysing the main material flows in the city with the greatest potential for savings and circular solutions, while also considering economic and social aspects. The recommendation of the Circular Scan is to focus action plans on construction, water, and the management of municipal waste and its recoverable components, together with bulky waste and household consumer products. A separate theme concerns public procurement and how to set its guidelines to promote circular principles and practices.

Another input comprised the conclusions of the Prague 2030 Climate Plan and the Working Group on the Circular Economy within the PCH Committee on Sustainable Energy and Climate. Last but not least, more than 20 individual interviews with experts in the respective fields were held in connection with the preparation of the Strategy, and discussions with about 60 experts and city representatives took place through interactive webinars and workshops.

Drafting Process and Methodology

Participatory approach to the drafting of the Prague Strategy for Transition to a Circular Economy

Transition to a circular economy requires the creation of new collaborative relationships plus better coordination and involvement of stakeholders within local government (city hall and its departments, city organisations) and those without (private sector, academia, NGOs, households). In a city with 57 municipal districts, this is not an easy task, as many of the activities and changes related to the circular economy take place at the level of city districts and neighbourhoods. Coordination between the city and its districts is therefore essential. Digitalisation and the potential of online platforms provide opportunities for new forms of cooperation in this regard.

Following the Circular Scan, the City of Prague identified 4 thematic areas: 1) construction, 2) water, 3) agriculture and food, and 4) waste. Workshops were held in May, specifically focusing on each individual area. Workshops were organised by the Prague Innovation Institute (PII, z.ú.) in cooperation with experts from the PCH EPD, academia (CTU UCEEB, FSV CTU), Prague organisations (IPR), Prague

14 https://www.prazskyinovacniinstitut.cz

15 https://incien.org/cirkularni-sken-prahy-prinasi-vizi-mesta-pro-udrzitelne-nakladani-s-vodou-a-odpady/

Fig. 4: Map of stakeholders

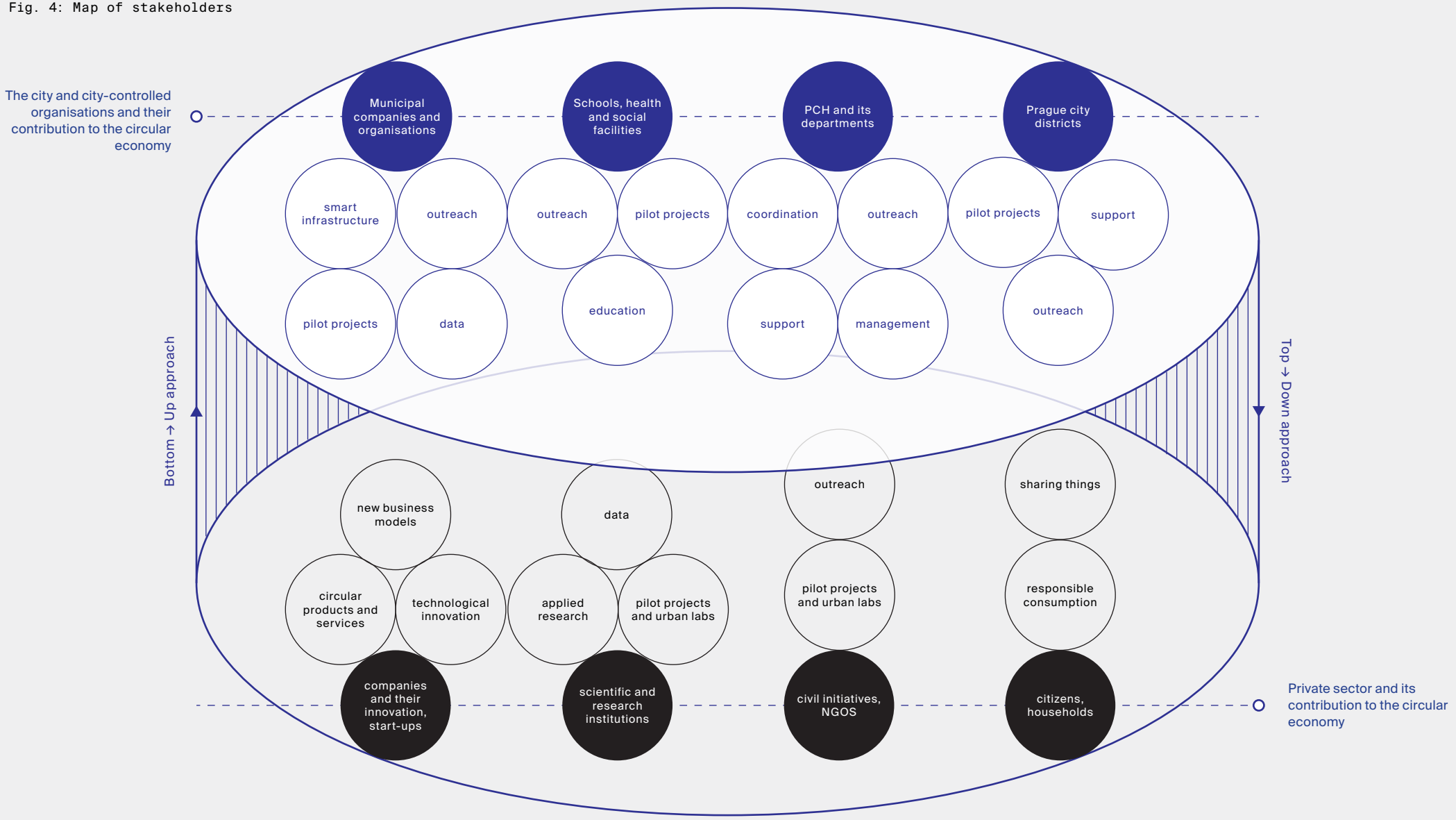


Fig. 5: Methodology

Strategic objectives

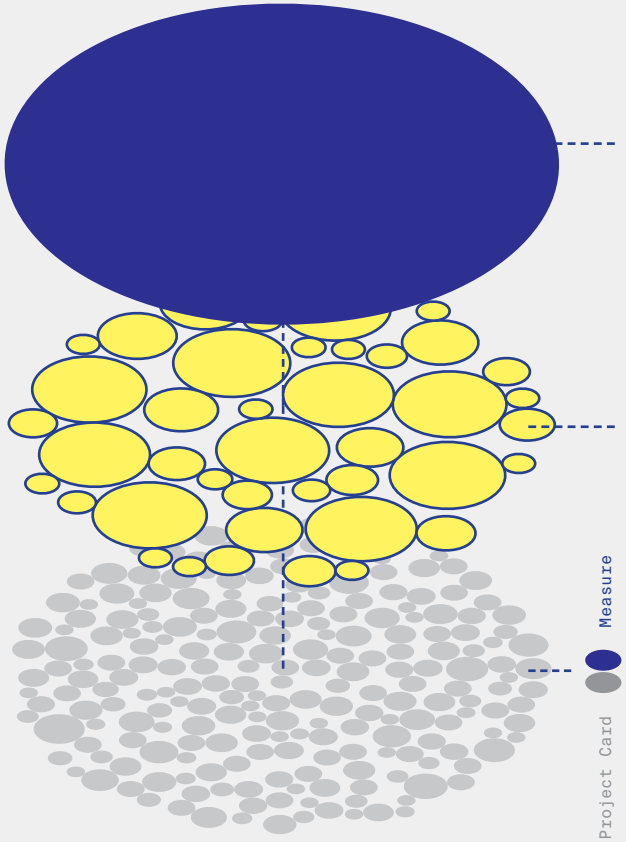
Represent the main circular objective for each sector/ theme

Specific objectives

A set of practical objectives which lead towards the fulfilment of the strategic objective

Measures

Particular projects that operationalise specific objectives at the city level



Examples:

SO1 Construction: Reduce consumption of primary raw materials and increase the efficiency of material flows in the construction industry

SO1/I Specific objective: The city as a bank of materials, building materials are recorded and recycled to the maximum extent

Measure SO1/I/a: utilising digitalisation and BIM to record materials and so enable their further use

A Strategic Objective is proposed for each of the 7 areas (chapters), which is then further broken down into Specific Objectives and realised through proposed measures:

Measures are evaluated based on three categories which may influence their feasibility and overall potential.

- **Circular Impact**: What is the environmental, social, and economic impact of the measure? To what extent does it promote circularity within Prague?
- **Technical feasibility**: Is there adequate technology to implement the measure? Are the technical staff and knowledge available?
- **Economic viability**: How costly will it be to implement the measure on a large scale? Are there examples of functional projects with the same intention?

These three categories are scored for each measure on a scale of 1 to 3:

Low ●○○
Medium ●●○
High ●●●

Project cards set out specific project aims which are being developed by Prague or its organisations. They form the basis for the Strategy's action plans.

Projects included in action plans must still undergo approval at PCH, or at the level of individual organisations. Their inclusion in an action plan therefore does not automatically mean that they will be realised.

companies (PSAS, PVS), as well as the business (Crea-Tura) and civil sectors (reuse federation). Workshops were preceded by and based on many individual interviews and analyses. In total, over 60 people were involved in this phase. At these workshops, the proposed strategic objectives, specific objectives, and types of proposed measures were discussed. Based on such feedback, draft chapters were prepared by the experts and circulated by the Prague Innovation Institute to the workshop participants for comments and additions in September 2021. The proposed objectives and measures were also reviewed by experts from Circle Economy. They evaluated the individual measures in terms of economic and technical feasibility, as well as their environmental impact, i.e. what savings they could bring in terms of primary resource consumption and whether they would contribute to waste reduction.

What can be done to save resources in a given area is the core question of the four thematic chapters. What the city can do to put the proposed measures into action is the central question for the three cross-cutting areas, i.e. what opportunities and tools does the city have to realistically start moving towards a circular economy? First and foremost is public procurement, and therefore what products and services the city is seeking. Then there are motivational tools, not just in the form of subsidies, and vouchers, but also consisting of targeted education and communication support, information campaigns, etc. Finally, the third area is setting up a management system to implement the Strategy, i.e. preparing action plans and evaluating them based on impact indicators.

II — Proposal Section

Vision: Circular Prague 2030

Prague is continuously working on reducing its enviromental and carbon footprint (resource intensity of consumption) and is moving towards carbon neutrality by 2050. This motivates Prague's stakeholders, including the private and public sectors, to manage resources responsibly and contribute to reducing the city's overall CO_2 emissions by implementing cost-saving measures and preventing waste generation.

Greenhouse gas emissions are closely linked to the consumption and use of material resources. If we were able to approximately double the global circularity of material flows by 2032, this would result in the global reduction in greenhouse gas emissions of up to 39%, enough to keep global temperature increase below 2 degrees.[16]

By adopting the Strategy for Transition to a Circular Economy, Prague has declared its ambition to become a circular innovation hub, where through the implementation of strategic and pilot projects, the city supports digitalisation and the development and use of new technologies, materials, and processes and can serve as an inspiration for other cities in the region.

The City of Prague's strategy for the transition to a circular economy focuses on measures in sectors with considerable potential for material and emission savings. These are:

Construction – reducing greenhouse gas emissions reduction can be achieved by increasing the reuse and recycling of materials, increasing the lifespan of buildings, or by choosing materials with a low carbon footprint. It has been reported that the thoughtful and properly executed renovations of old buildings can reduce CO_2 emissions by up to 60%.[17]

Water – promoting grey water consumption reduces the demand for drinking water and the overall volume of wastewater. Both the extraction of drinking water and the treatment of wastewater are energy intensive. The use of energy and nutrients from wastewater or nature-based solutions for rainwater management also reduce CO_2 emissions, as well as enhance CO_2 capture through urban greenery.

Agriculture and food – introducing regenerative and circular principles into food production and consumption can bring about global greenhouse gas savings of up to 49% by 2050 (equivalent to 5.6 billion tonnes of CO_2).[18] Promoting a circular and sustainable food system in Prague, i.e. local and environmentally friendly production, carries with it CO_2 savings in the transport sector. And not just in terms of distance, but also in fuel consumption by redirecting organic waste from incinerators to biogas plants for biomethane production. Or, in terms of the consumption of energy-intensive artificial fertilisers, which can be replaced by organic fertilisers generated by converting organic waste into certified compost in composting plants in the city's built-up area.

Waste – CO_2 savings can be achieved by promoting the recycling and reuse of materials, reducing the amount of waste, and also by the material and energy recovery of organic waste (including sewage sludge), whereby biomethane replaces the consumption of fossil fuels. However, most emission savings are achieved if no waste is generated at all. Therefore, measures and activities especially related to the prevention of waste generation must be promoted in the circular economy.

The three proposed cross-cutting areas contribute to material and energy savings somewhat indirectly, by creating the conditions necessary for the implementation of measures with concrete and quantifiable CO_2 savings impacts in the four thematic areas. These cross-cutting areas are: (a) public procurement, (b) business support, innovation and outreach, and (c) management and implementation.

16 Circle Economy (2021). The Circularity Gap Report. Retrieved from: Circle Economy

17 Heritage Counts (2020). Buildings Must Be Recycled and Reused to Help Tackle Climate Change. Retrieved from: Historic England website

18 [3] Ellen MacArthur Foundation (2021). Five benefits of a circular economy for food. Retrieved from: Ellen MacArthur Foundation website

Table 1: Overview of the strategic and specific objectives of the Prague Strategy for Transition to a Circular Economy

Theme	Strategic objectives	Specific objectives	Number of measures	Project cards
Thematic strategic objectives				
1 Construction	S01 Reduce the consumption of primary raw materials and increase the efficiency of material flows in the construction industry	SO1/I: The city as a bank of materials, building materials are recorded and recycled to the maximum extent SO1/II: Reduction of construction waste by implementing demolition practices that allow for the reuse of materials SO1/III: New construction and renovation in line with the requirements of resource circularity and the sustainable use of materials SO1/IV: Sustainable operations, prioritising renovation over new construction	11	4
2 Water	S02 Reduce rainwater runoff through sewers, increase water and nutrient recycling and reuse, including for energy purposes	SO2/I: Water savings and leak detection SO2/II: Promoting the use of rainwater, grey water and wastewater and other resources in the territory SO2/III: Use of wastewater heat and water energy SO2/IV: Use of waste sludge in alliance with CE principles SO2/V: Ensuring a comprehensive approach to water management	15	5
3 Agriculture and food	S03 Reduce food waste, increase the local production and consumption of healthy food sourced from urban and peri-urban agricultural production	SO3/I: Increase the city's demand for organic products (gastro pubs, canteens), promotion of urban and peri-urban organic farming SO3/II: Promoting urban agriculture and subsistence farming (community gardens, management of surplus from allotments, rooftop farms, urban farms etc.) SO3/III: Circular management of organic/gastro waste through returning nutrients to the soil SO3/IV: Reduction of food waste by introducing prevention and distribution of surpluses SO3/V: Promoting innovation in food production (vertical farms, hydroponics, aquaponics, more environmentally friendly food processing; offering space, logistics)	16	5
4 Waste	S04 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce by 50% the production of mixed municipal waste before 2030	SO4/I: Minimising production of and increasing the recovery rate of the city's bulky waste to 50% by 2030 SO4/II: Sorting and treatment of biodegradable municipal waste with 60% efficiency by 2026 SO4/III: Increase the sorting rate of municipal waste to 60% in 2025 and to 65% by 2030, as well as ensuring the highest possible rate of feasible recycling SO4/IV: Continuous and systematic communication and outreach across the city's inhabitants, businesses, as well as at the national legislative level	12	14
Cross-cutting strategic objectives				
5 Public procurement	S05 Increase demand for circular solutions by incorporating such practices into the city's own projects, guidelines, and public procurement	SO5/I: Integrating circular economy principles into public procurement SO5/II: Integrating circular economy principles into the operation of the city and its organisations SO5/III: CE principles and conserving primary resources as a foundation for city projects	10	3
6 Support for entrepreneurship, innovation, and outreach	S06 Promote innovation in the business and civil sectors leading to a circular economy	SO6/I: Supporting the shared economy, citizen initiatives and businesses in the CE SO6/II: Support for pilot projects and innovation, involvement in science and research SO6/III: Communication, education, and outreach for the CE	5	4
7 Management and implementation	S07 Manage, coordinate, and evaluate the implementation of the CE Strategy	SO7/I: Establishing project management for the implementation and development of action plans SO7/II: Setting indicators for the circular economy (CE) SO7/III: Communicating of the objectives of the Strategy and their implementation	7	2

1 — Construction

Strategic Objective SO1 ● Reduce the consumption of primary raw materials and increase the efficiency of material flows in the construction industry

The largest material flows within Prague occur in the construction sector. As a city, Prague consumes 13.5 million tonnes of construction materials per year (see the Circular Scan), which represents 74% of all waste based on data from 2019 (evaluation of the regional WMP)[19]. 95% of materials used in the construction sector originate from primary sources, i.e. nearly 13 million tonnes per year (12.8 t).

Construction and demolition activities generate construction and demolition waste. Prague accounts for 1.3 million tonnes of construction and demolition waste, 41.7 % of which (i.e. 550,000 t) is further used within its territory. The target of the Waste Management Plan (WMP) is 70 %. A significant part of construction and demolition waste is transported outside the city's territory: according to the evaluation of the regional WMP from 2019, this makes up about 58% of all construction waste (excluding soil and stone) and no further record is available beyond this. It can be assumed that a portion of this waste has been utilised further.

Of the areas analysed, the greatest potential impact of circular measures therefore lies in the construction sector. A focus on construction and public procurement is also recommended in the 2019 document Circular Scan.

19 http://portalzp.praha.eu/file/3254634/Vyhodnoceni_POH_kraje_HMP_za_rok_2019.pdf

● Examples of Good Practice

London

As a city, London has the ambition to become a centre for circular design and construction. It has identified 38 major opportunities for building/reconstruction/deconstruction and repurposing where it wants to promote (achieve) circularity by a) using design to make both operations and 'after life' more efficient, b) focusing on reconstruction rather than demolition, c) achieving material savings using secondary materials, and d) implementing optimised deconstruction for the reuse of building materials. As a result, London expects not only an increase in GDP (up to GBP 3 billion/year) in a context of steeply rising prices globally for primary construction materials, but also an increase in jobs in this segment. It will favour construction in layers that are affordable, easily disassembled, flexible in purpose, and made of recyclable materials that allow subsequent reuse.

Communication with the private sector and sharing of good practice takes place within a circular construction platform. London motivates and supports stakeholders who want to contribute to fulfilling its objectives.

● Examples of Good Practice

Amsterdam

Amsterdam aims to be a fully circular city by 2050. One of the main goals of its Circular Strategy is to cut the cit''s consumption of primary raw materials by 50% before 2030. To achieve this, a transformation of approaches and implementation of measures in the building sector is essential. From 2022, all urban development and public space design will be subject to circularity criteria. Circular public procurement targets not only the planning and construction phase, but also sets requirements for the maintenance and operation of buildings in the long term, including the end of their life cycle. All of this would be impossible without the joint efforts of stakeholders, whom the city connects and supports, e.g. by providing financial support or by advantaging projects when they apply circular criteria. An integral part of the approach is the encouragement from the city towards the sharing of information and data on materials and material flows.

Amsterdam is also an example of a city that has defined specific circular criteria for public procurement in the construction sector (Amsterdam Circular Housing Standards) and applies them, for instance, when evaluating bids for the construction of residential housing.

According to the current Housing Development Strategy published in April 2021, 9,000 new flats should be built in Prague every year (approximately 5,500 flats are annually completed as of now), of which 500 should be council flats. Prague wants to build 5,000 council flats by 2030, bringing the total to 35,000. There are also plans to build and renovate many schools and kindergartens, as well as other civic amenities. Expansion of the Prague metro, tram lines, and roads is also planned. In all these public projects, it is already possible to incorporate circular principles of construction/reconstruction, while validating and evaluating their impacts.

Examples of good practice and inspiration can be found in Amsterdam, London, and other cities.

To fulfil the strategic objective, the following 4 specific objectives have been identified:

- SO1/I: The city as a bank of materials, building materials are recorded and recycled to the maximum extent
- SO1/II: Reduction of construction waste by implementing demolition practices that allow for the reuse of materials
- SO1/III: New construction and renovation in line with the requirements of resource circularity and the sustainable use of materials
- SO1/IV: Sustainable operations, prioritising renovation over new construction

Specific objective SO1/I	The city as a bank of materials, building materials are recorded and recycled to the maximum extent

The long-term objective is to gain an overview of materials in the city and their possible reuse (the city as a material bank concept), and to radically reduce the consumption of primary resources and materials with a high carbon footprint. Among other measures, the introduction of a carbon footprint assessment for new developments will be necessary. This will be a gradual process, with pilot projects and the testing of new practices and innovations, including digital platforms, etc. The private sector has already begun to play an important role and will continue to do so. The city's task is to create an encouraging environment for the development new approaches, which also includes drawing on international experience.[20]

We propose the following 2 measures to meet the specific objective:

Measure **Objective SO1/I/a**	Utilising digitalisation for material records with the aim of their further application

Having knowledge about the nature and quantity of materials and, where appropriate, their availability is a necessary prerequisite for using them more sustainably. Material passports are already being used in renovation projects. In the future, the aim is to compile a publicly accessible online material bank of the city. This can be created by utilising data from the individual digital models of buildings and urban infrastructure which are already being used for the purposes of design, construction, as well as the recording and categorising of buildings. A Smart City concept, where material flows are monitored in real time, can be achieved by utilising e.g. the Golemio system for collecting data on material flows and using the city as a material bank/urban mine. Architects, investors, the city, and contractors could thus share information and use materials that would otherwise become waste. The draft of the

20 Madaster, an example of a digital material bank, https://madaster.com/

BIM Act foresees the use of BIM in the context of above-the-line construction contracts. Prague has been taking all steps to comply with the Act since 2018, and pilot projects are already underway to verify the set rules defined by the Prague BIM Standard. Therefore, it is desirable to start verifying this approach on pilot projects in coordination with the private sector.

Measure **objective SO/I/b**	Support for material-sharing platforms and reuse infrastructure

Reuse centres can promote the reuse of building materials in the case of secondary materials which have reached the end of their moral lifespan but are still in good enough condition to be used by someone else without problems occurring.[21] Reuse centres should also serve end-customers and encourage builders to use these facilities, e.g. by providing the free disposal of used building products and materials. The proposal is to create a physical place (reuse centre) for the temporary storage and sale of secondary materials, ideally in combination with a digital platform that will allow the registration of available materials, the linking of supply and demand, and the sale itself. Today, there is no record of available materials and elements in Prague. Inspiration can be drawn from the Czech Cyrkl (B2B) and Rotor Deconstruction Brussels, a reuse centre for building materials supported by the city. In addition to consulting on environmentally friendly demolition, it also connects stakeholders and experts in construction and demolition to help sell materials.

Given the rising cost of building materials, the use of secondary materials may soon be a cost-effective alternative. In addition, reuse centres, or repositories, can be a suitable environment for social economy stakeholders or an opportunity to involve people who experience difficulties in accessing the labour market.

Specific objective SO/II	Reduction of construction waste by implementing demolition practices that allow for the reuse of materials

This objective is in line with the European strategies on circular economy and sustainable construction (explicitly listed at www.recyklujmestavby.cz/legislativa).

Based on a preliminary critical analysis, waste sorting should take place during demolitions, in accordance with the Methodological Guidance of the Waste Department of the Ministry of the Environment on the Management and Treatment of Construction and Demolition Waste. A standard requiring pre-demolition audits is also currently awaiting approval. If the different types of demolition waste are separated, they can then be effectively used for construction either on or near the demolition site. A critical evaluation should always be made as to whether the use of construction materials and products is efficient, from environmental, economic, social, and other perspectives.

We propose the following three measures to meet the specific objective:

Measure **Objective SO1/II/a**	Require controlled deconstruction of buildings and preparation for the recycling of materials at the demolition site (pre-sorting, shredding, etc.) in public procurement

As the contracting authority, the city should require bidders to critically evaluate the recoverability of generated demolition waste, if available locally. Alternatively, nearby demolition, construction, or reconstruction projects that also generate construction and demolition waste should be mapped. The aim is to achieve a situation where the tender documentation includes a requirement for the processing of construction waste (usually clean materials, offcuts generated during construction or reconstruction – thermal and acoustic insulation, plasterboard, ceramic blocks, etc.), which can be sold on the construction market (to private persons) or collected by the manufacturer, who is usually able to process unpolluted construction waste as a raw material for a new product.

> An example of good practice is Oslo, where demolition is managed in a way that allows maximum recovery of the demolition material. The municipal administration maintains a database of demolition projects and therefore has access to an up-to-date overview of potential material sources. Many other examples of good practice can be found in a comprehensive summary publication published by ICLEI in 2020.[22]

21 Example 1 – A school or local authority performs a window replacement and receives a subsidy for a new building in 2 years. The 2-year-old windows can continue to be used without any issues. With good quality dismantling, they can be offered for further use.
Example 2 – A warehouse with steel elements, concrete ceiling components that are still structurally sound is being demolished – someone could further use it for e.g. a shed or maybe a garage.
Example 3 – Sewer trusses, kerbstones, etc., someone will make further use of them.

22 https://circulars.iclei.org/wp-content/uploads/2020/09/BBI-CCM-lessons-learned.pdf

Measure **Objective SO1/II/b**	Increase demand for recyclables by incorporating a requirement for their use in public procurement where appropriate

Public procurement may require an economic evaluation of the options for the use of primary and secondary raw materials. This would take into account all possible aspects, including transport, as a source of noise and pollution involving sanitation in the construction area. In addition, a pre-demolition audit (for some types of construction) and the preparation of a Construction and Demolition Waste Management Protocol may be required. In addition, preference may be given to products made from renewable or environmentally friendly materials, products with a higher content of recycled materials, where appropriate, with reference to the normative and legal documents that the product is to comply with. [23]

23 https://www.sovz.cz/wp-content/uploads/2021/06/sovz_kontrolni-list_stavebnictvi_s-komentarem_210614.pdf

Measure **Objective SCO/II/c**	Education of and outreach to the city's employees, city organisations, and PCDs about the possibilities of using recyclables (concrete, reinforced concrete, glass, plasterboard, etc.) and other environmental criteria in public procurement

Contracting authorities should be continuously trained in the potential use of recycled (secondary) materials and their supply on the market [24], as well as in other possible requirements (e.g. Environmental Product Declaration / EPD / eco-friendly products). They should be aware of relevant sources of information concerning standards or good practice.

- see Appendices, List of Project Cards, Strategic Objective 5 Public Procurement: **Training module on circular procurement for city employees, city organisations, and city districts**

24 For example, Kronospan ČR, spol. s r.o. produces particleboard using 50% recycled material obtained from municipal collection yards.

Specific objective SO1/III	New construction and renovation in line with the requirements of resource circularity and the sustainable use of materials.

Circular requirements in construction can best be met in new buildings. This applies to new neighbourhoods and the concept of a city of short distances, as well as to individual houses, where it is possible to work with circular principles already at the stage of their design – selecting the appropriate choice of materials and considering their entire life cycle, including possible later modifications, and the final deconstruction and reuse of materials. Some circular principles are already included in the 2021 Guidelines for the Development of Investor Specifications for Urban Housing Construction in the City of Prague[25]. Prague now faces the challenge of implementing pilot projects in cooperation with the private sector and introducing best practices into mainstream urban building practices.

We propose the following three measures to meet the specific objective:

25 Zadání-investora-pro-městskou-bytovou-výstavbu.pdf (pdspraha.eu)

Measure **Objective SO1/III/a**	Incorporate the demands of circular principles into Prague's Sustainable Building Code

A brief for the investor incorporating circular principles is the first step towards more sustainable construction development. At the same time, the durability of the materials used should be the subject of a critical study. Emphasis should be placed on the use of high-quality materials with a long use-life, a low carbon footprint (with respect to durability), and the potential for subsequent reuse or easy recyclability. This can be evaluated using already established methods such as LCA[26] or LCC[27], for example.

At the same time, buildings should be designed with a long lifespan, and therefore in the knowledge that the purpose of the building may change over time, the requirement to change the appearance may change, but that the supporting structure and other features may be retained (e.g. give

26 LCA (Life Cycle Assessment – assessing the environmental impact of a building's life cycle)

27 LCC (Life Cycle Costs – the operating and maintenance costs of the building over its life cycle)

preference to a load-bearing frame over a wall system).

For the city to gain insight into the prevalent use of materials, it will be necessary to identify and monitor relevant impact indicators on adaptability, dismantling, reuse, and recycling that can be incorporated into the city's construction policies.

Considering this, it is desirable to focus more on building reuse and renovation, promoting the multifunctionality of buildings over time, which represents the most material-efficient approach.

- See Appendices, List of Project Cards, Strategic Objective 1 Construction: **TSK Circular guidelines for sustainable construction**

Measure **Objective SO1/III/b**	Support for pilot projects implemented by the city which incorporate circular principles (construction of public amenities, construction of urban housing, etc.)

Municipal pilot projects are a way to start implementing the objectives of the Strategy for Transition to a Circular Economy in the construction sector. Inspiration comes from foreign and domestic projects, such as the construction of a sustainable kindergarten in the Prague 19 PCD, which is being implemented by SKANSKA in the Albatros Kbely project. Exchange of knowledge, expert consultations, as well as cooperation with specialised institutions and the private sector are encouraged.

- See Appendices, List of Project Cards, Strategic Objective 1 Construction: **Pilot testing of circular principles for public amenities**

An inspiring circular construction project that received support from local government is the Circle House in Denmark. A concept and solution for fully circular housing was developed with the involvement of all stakeholders across the sector https://gxn.3xn.com/project/circle-house

Innovative pilot projects could benefit from the involvement of the New European Bauhaus initiative (European Commission Communication COM(2021) 573 final), which aims to provide access to circular products and materials with lower carbon emissions while preserving the cultural and creative dimensions of the building ecosystem.

Measure **Objective SO1/III/c**	Infrastructure for education, outreach and sharing good practice

The key to Prague's successful transition to a circular economy in the construction sector is the involvement of stakeholders across the city and across industries – from both the public and private sectors. It is desirable to educate not only professionals, but also lay people – those involved in the commissioning of new construction and demolition, and building operators (green operation and the 'circular office'). A suitable method is 'learning by doing' – trying out new practices on pilot projects and creating an online platform or physical space for outreach and sharing experiences. This function is often fulfilled by reuse centres for construction materials. Such a space is still missing in Prague.

> An example of a physical space promoting collaboration is Rotterdam's BlueCity https://www.bluecity.nl, where a circular hub has been created on the site of a former swimming pool complex, open to innovative companies, the public, and anyone interested in creating and implementing circular projects. A proven good practice is the establishment of a reuse centre for construction materials where education and outreach can take place. An example of an online platform is Amsterdam Smartcity https://amsterdamsmartcity.com/.

Specific Objective SO1/IV	Sustainable operations, prioritising renovation over new construction

Construction activities are always material and energy intensive. The most effective way to reduce the consumption of material resources and emissions is to extend the lifespan of buildings and to find new functions for those buildings which are currently unused or are proposed for demolition due to moral obsolescence.

We propose the following three measures to meet the specific objective:

Measure **Objective SO1/IV/a**	Life span and variability of possible use (after-life) should be considered when developing projects

Cities and buildings are undergoing increasingly rapid changes. It is therefore necessary to consider buildings throughout their lifecycle, as well as their 'after life' phase. It is also necessary to take into

account that the function of buildings may change over time. Principles such as the flexibility and modularity of buildings serve this purpose.

An example of a flexible solution is the so-called modular building, which can be adapted to the highest demands of circular construction, e.g. by using secondary materials or returning dismantled parts back into circulation. The capacity of modular buildings can be easily changed based on current needs (advantageous for nurseries, hospitals, etc.), but also the layout, and purpose of the building, and its location.[28] Also in the context of the housing crisis, in recent years modular buildings have been used for housing. The costs are cheaper than in conventional construction. This model has been tried and tested in Scandinavia and the United Kingdom.[29]

> The City Hall in Brummen (The Netherlands) has built a new part of the city hall, which is connected to the historic part that is a symbol of the city, with modular blocks (https://www.rau.eu/portfolio/gemeentehuis-brummen/). More examples of good practice can be found at https://jansnel.co.uk/.

28 https://www.sovz.cz/praxe/pristavba-materske-skolky-z-mobilnich-kontejnerovych-bunek-mc-praha-12/

29 More at boblock.com

- see Appendices, List of Project Cards, Strategic Objective 1 Construction: **PDS pilot circular projects**

Measure **Objective S01/IV/b**	Consider the characteristics of the materials used in terms of their sustainability

Potential hierarchy of material use:

1 – Existing materials

2 – Circular materials

3 – Local materials

4 – Recycled materials

5 – Recyclable materials

6 – Renewable materials

Measure **Objective SO1/IV/c**	Promote new functions for long-term unused buildings in the city

Prague accounts for countless unused buildings, including those owned by the city. Prioritising reconstruction over new construction implies compiling an inventory/auditing of unused buildings owned by the city and developing proposals for their reuse. In preparing this strategy, several potential uses were identified – both as storage space for urban agricultural production and any accompanying processing, as well as for the aforementioned reuse centres intended for construction materials. There are many other meaningful uses to be found. At the conceptual level, there is still the possibility for an online catalogue/app for unused buildings in the city with suggestions for their potential use.

2 – Water

Strategic Objective SO2 ● Reduce rainwater runoff through sewers, increase water and nutrient recycling and reuse, including for energy purposes

In principle, the circular economy for the water sector especially includes water reuse, water energy recovery, and the material and energy recovery of sewage sludge.

We can expect that demands on the functionality of water supply and drainage systems will only keep increasing. These systems need to be adapted to the extreme drought and flood events which are expected to occur with greater frequency than previously. At the same time, the scarcity of water resources may become a critical factor in meeting our needs, and especially the needs of our future generations.

From this point of view, water resource management is one of the greatest current challenges and it is essential to search for, adopt, and implement measures that will optimise water management, harness its potential, and utilise the products of wastewater treatment themselves, i.e. sewage sludges. The measures here therefore aim not only to minimise the consumption of water at the consumer level and during distribution, but also seek to replace drinking water with utility water, rainwater, or water which has already been used and has been made sanitary through treatment. The energy potential of water, i.e. thermal energy for heating and cooling buildings or kinetic energy for electricity generation, has also remained under-utilised until now. Sewage sludges can be used as a source of energy, organic matter, and nutrients, especially phosphorus.

After a detailed assessment of the relevant measeures, e.g. through life cycle cost analysis (LCC) or life cycle assessment (LCA), their implementation can offset the carbon footprint of water management systems and actively contribute to reducing negative environmental impacts. Carbon in wastewater is biogenic and therefore CO_2 emissions from the removal (oxidation) of organic matter are considered carbon neutral.

The drinking water supply system of the City of Prague uses three water sources – Želivka (Švihov), Jizera (Káraný) and Vltava (Podolí). From the individual water treatment plants at the water sources, water is transported through supply lines not only to Prague but also to some of the municipalities of the Central Bohemian Region; in total, about 1.53 million inhabitants are supplied. The drinking water distribution system within Prague's territory comprises 51 pumping stations, 67 reservoirs with a total volume of 753,000 m^3, 3,549 km of water supply lines and 876 km of water supply connections. In 2020, approximately 79,469 million m^3 of drinking water was supplied to end customers, with low losses in the water supply network of approximately 12.9%. There are also a number of private wells that Prague residents use as a supplementary

source of water (e.g. for watering their gardens), especially in the city's outskirts.

Drainage of the Prague city area is mostly ensured by a unified sewer system, while only peripheral areas are drained by separate sewers. The sewerage system for public use includes not only 3,730 km of sewers and 1,007 km of sewerage connections, but also 347 sewage pumping stations. Wastewater is treated in the Central Wastewater Treatment Plant (CWTP) on Císařský ostrov, about 39% in the old water line and 54% in the new water line. A total of about 7% of the wastewater produced within the city's territory is treated in 20 branch treatment plants. In 2020, a total of 110.529 million m^3 of treated wastewater was discharged into watercourses. To date, there are still sites in the territory of Prague where wastewater is treated individually. However, their volume is negligible, as it accounts for about 0.3 % of the total volume of wastewater produced.

The total value of Prague's water management infrastructure assets managed by the Pražská vodohospodářská společnost, a.s. exceeded CZK 147 billion as of 31 December 2020.

In September 2018, implementation of the New Water Line of the Water Treatment Plant was completed, and its trial operation began. This represents one of the largest water infrastructure investments in the Czech Republic within the last decade. The modernisation of the existing water line and comprehensive sewage sludge management is currently underway. Upon completion, which is expected in 2030, the CWTP will meet the required parameters for wastewater treatment and sewage sludge management. At the same time, the principles of the circular economy, such as the injection of biomethane biogas into the pipeline network or the energy recovery of sewage sludges, will be being taken into account or will have beein given greater emphasis.

The development in the catchment area of secondary wastewater treatment plants, as well as the stricter legislative requirements for the quality of treated wastewater, are triggering a need for the intensification or complete reconstruction of these plants. Due to the size of the investment budget needed for modernisation, some of the secondary treatment plants will be closed and the wastewater will be discharged to the CWTP after the necessary extension of the sewerage network.

From the perspective of circular principles, it is always advisable to rigorously assess the benefits of treating wastewater at the point of source, e.g. on the site of secondary treatment plants, or in smaller areas or facilities where justified, and to encourage decentralised solutions. This will be key if the necessary legislative changes are to be made in the near future to allow for wider opportunities to use grey as well as pre-treated and treated wastewater. In general, the cost-effective distance for transporting utility water between the water source and the consumer is limited to a maximum of 5 km. However, this will always depend on the characteristics of the source and consumption needs.

Specific requirements aimed at a circular economy in the sector of water management are also defined in the document Investor's Assignment for Urban Housing Construction in the City of Prague document, which is binding for all city organisations. The requirements for technical facilities include not only preferential solutions for rainwater and on-site accumulation, but also for the use of grey water for flushing or its treatment within the set block or neighbourhood, as well as water infiltration.

The following five specific objectives are proposed to meet this strategic objective:

- SO2/I: Water savings and leakage detection
- SO2/II: Promoting the use of rainwater, grey water and wastewater and other resources in the territory
- SO2/III: Use of wastewater heat and water energy
- SO2/IV: Use of waste sludge in alliance with CE principles
- SO2/V: Ensuring a comprehensive approach to water management

Specific Objective SO2/I	Water savings and leakage detection

Although saving water and detecting leaks are not directly related to circular economy measures in the 'reuse' sense, it is necessary to consider them as one of the basic principles in water management for reducing the demands placed on water resources and the associated lower production of wastewater. Water losses in Prague's water supply network have been consistently low in recent years. In 2020, they amounted to about 12.9%, compared to 46% in 1996. This is the result of a combination of long-term measures, such as the division of the water supply network into sub-monitored (metered) zones, continuous monitoring of the water supply network, continuous and periodic evaluation of losses in the supply zones, and regular diagnostics of the water supply network. The rehabilitation of the aged water supply network based on a technical assessment of the condition of the water supply lines (replacing only the necessary sections) has also been initiated. The introduction of the remote readings of water consumption within the Prague area is being carried out

in accordance with the Prague 2019–2025 Smart Metering Strategy.

The following two measures are proposed to meet this specific objective:

Measures **Objective SO2/I/a**	Saving drinking water through the use of efficient appliances or by utilising rainwater and grey water

Examples of energy-saving devices and appliances include energy-saving taps, possibly supplemented with aerators, energy-saving shower heads, dishwashers, and washing machines. Another option for saving drinking water is the use of rainwater and grey water for flushing sanitation facilities, as well as other uses such as utility water, e.g. for cleaning and sanitation around buildings. In buildings or parts of buildings where higher traffic is expected, such as administrative buildings, restaurants, or other amenities, the use of waterless urinals is recommended if technically feasible.

In conjunction with energy-saving devices, it is necessary to ensure optimal water pressure in domestic distribution systems, this being the case for all individual devices, even those located on the highest floors of buildings, where this cannot be ensured in all cases by the public water supply network. As the volume of discharged wastewater decreases, the concentration of pollution is likely to increase. In sewer network profiles with insufficient transport velocity, suspended solids may subsequently settle and require regular cleaning.

A number of projects have already been implemented in the Prague area that respect the requirements for rainwater management.

> In terms of residential development, this is the case for the residential area of SUOMI Hloubětín, where effective rainwater management is in place. Rainwater is harvested from the roofs of the buildings and used for watering grassy areas. Excess rainfall is drained into bioswales terminating in a central infiltration basin with a safety overflow into the revitalised section of the Rokytka River. Roads, pavements, and other public areas are drained into tree-planted bioswales, which are connected by underground gravel beds, pipes, or troughs with outlets to the central catchment tank, depending on the morphology of the terrain. As far as possible, permeable surfaces are used in the area to allow rainwater to infiltrate, e.g. for parking spaces.

● Examples of Good Practice

Use of structural substrates in blue-green infrastructure elements

In order to manage rainwater and provide suitable conditions for tree growth in public spaces, blue-green infrastructure elements using structural substrate are used, especially in the Nordic countries. The purpose of structural substrates is not only to retain and gradually release rainwater, but also to provide a porous environment in the root zone of trees to allow soil gas exchange and also high permeability for water preventing the risk of over-saturation. Thanks to its specific properties, structural substrates include so-called biochar, which is produced by the thermal decomposition of biomass and is therefore a good example of the circular economy in practice. Another benefit of using biochar in structural substrates, or as a soil additive in general, is the capture (sequestration) of CO_2.

Measures **Objective SO2/I/b**	Detecting drinking water leakage

The detection of drinking water leakages is carried out throughout the entire water supply system through a combination of operational interventions from on-line monitoring data (early response to a leak or accident) and the balance evaluation of the supply zones, identifying leakages even below the detection limit of on-line monitoring. The water supply operator already uses a combination of advanced methods, which should be further developed, e.g. by linking dispatch data and smart metering.

> A promising technology for locating leaks in larger water supply systems is the use of satellite technology.

> In the City of Prague, the water supply operator uses technology based on the Synthetic Aperture Radar satellite of the Japanese Space Agency JAXA. The sensor on the satellite processes the transmitted radar pulses in order to potentially distinguish the type of water, surface, waste, or drinking water. The radar reflections penetrate to depths of up to 3 meters, depending on the type of surface. In the pilot testing, the area from Nové Město (New Town) to Pankrác was imaged, which represents about 500 km of the water supply network. The system identified 45 areas with potential drinking water leaks. Subsequent surveys using standard technologies found 26 hidden water leaks. Detection for the

whole of Prague is planned in phases for 2021–2023.[30]

Specific Objective SO2/II	Promoting the use of rainwater, grey water, and wastewater, and other resources in the territory

From a circular economy perspective, municipal water management can make use of the water generated on municipal territory, i.e. it is possible to make use of rainwater and recycle grey water or wastewater. An alternative source can also be infiltrated water, drainage water associated with utility and traffic structures, or water from natural water sources which is in many cases discharged into sewer systems.

The key indicator for the utilisation of these resources is their quantity and availability throughout the year together with the quality that corresponds to their intended use. Although rainwater may reach significant volumes, it is a highly spatially and temporally variable resource with a risk its stored volume being depleted during prolonged periods of drought. In contrast, greywater is a stable, decentralised resource. Clearly the most stable and high yielding source is wastewater discharge, which is concentrated at the point of outflow from wastewater treatment plants.

The approximate available volume of annual precipitation falling in the Prague area is approximately 292.64 million m^3/year, considering the area of 496 km^2, average annual precipitation of 590 mm/year and the estimated average runoff coefficient of 0.4. This volume approximately corresponds to the volume of the Orlík reservoir, or 223 times that of the Hostivař reservoir.

The total amount of grey water produced within Prague's territory can be tentatively derived in the amount of approximately 16.0 million m^3/year from the volume of supplied water – the volume of which was 80.0 million m^3/year in 2020, and from the estimated ratio of grey water to 20% of all distributed water. This volume corresponds to the volume of the Fláje reservoir, or 12 times that of the Hostivař reservoir.

The amount of treated wastewater discharged into surface waters from wastewater treatment plants on Prague's territory was approximately 110.53 m^3 in 2020. This volume corresponds to the volume of the Dalešice reservoir, or 84 times the volume of the Hostivař reservoir.

In terms of circular water management, the following four measures are relevant for new construction projects:

Measure **Objective SO2/II/a**	Efficient rainwater management

A fundamental requirement for the proper implementation of rainwater management is the enforcement of legislative requirements not only in new construction projects, but also when changes are made to existing ones. Section 5(3) of Act No. 254/2001 Coll. is crucial. As amended on 1 January 2021, it introduces the obligation that when carrying out construction work, changes to buildings, or changes to their use, a supply of water must be provided, as must the disposal of wastewater through sewers designated for that purpose. The runoff of surface water resulting from the impact of atmospheric precipitation on such buildings (hereinafter referred to as rainwater) should be limited through accumulation and subsequent use, or, where appropriate, by land infiltration or evaporation, or, if none of these methods of limiting the runoff of rainwater are possible or sufficient, by its retention and controlled disposal, or by a combination of these methods.[31]

Another area involves promoting the retention and use of rainwater on the city's land and on land entrusted to city districts.

Prague is guided by the Urban Drainage Master Plan of the City of Prague, which is regularly updated, refined, and developed. The basic investment measures in the field of wastewater and rainwater management are based on this Master Plan. A number of stormwater retention basins are proposed on the sewer network and are gradually being implemented, e.g. the large stormwater tank in Karlín.

In order to establish clear rules for rainwater management in buildings within Prague, Standards for Rainwater Management in the City of Prague have been drawn up and are expected to be approved by the end of 2021.

- see Appendices, List of Project Cards, Strategic Objective 2 Water: **Biochar TSK**

Measure **Objective SO/II/b**	Use of grey water

Grey water, i.e. water from showers, wash basins, washing machines, and technological processes, which does not contain faeces or urine, or only in negligible amounts, can be used as utility water after appropriate pre-treatment. As a rule, it is

30 https://www.pvk.cz/aktuality/satelit-odhalil-pres-dve-ste-potencialnich-uniku-pitne-vody-patraci-potvrdili-padesat-lokalit/, accessed 17. 8. 2021.

31 For more, see the Climate Change Adaptation Strategy (https://adaptacepraha.cz)

used for flushing sanitary facilities, as water for cleaning in and around buildings, or for irrigation. The system can be supplemented with heat recovery from grey water waste. The advantage of grey water is its continuous availability throughout the year.

It is necessary to implement separate pipelines in a building for the collection of grey water and its subsequent distribution. Both mechanical and biological treatment is used for the pre-treatment of grey water, where the water is then usually filtered and purified, e.g. by using membrane technology with subsequent sanitary protection. These facilities are usually located on basement floors and are scaled in proportion to the amount of grey water produced.

The issue of grey water has not yet been addressed in current legislation, although national strategic documents do address this type of water source.[32]

> Only a small number of grey water recycling systems have been implemented in the Czech Republic[33] for apartment buildings (Skanska Botanica, Asio New internals), hotels (Mosaic House Prague, Hotel Galant Mikulov), shopping centres (Centrum Černý most), and administrative buildings.

Measure **Objective SCO/II/c**	Wastewater management and reuse

Treated wastewater from CWTPs is discharged into surface waters. Subject to compliance with statutory conditions for small sources, discharges to groundwater are also permitted in exceptional cases. As with grey water, the advantage of wastewater is its continuous availability throughout the year.

However, in less prominent watercourses, especially during episodes of prolonged droughts, discharged pre-treated wastewater may be the dominant source of water downstream of the treatment plant outfall on the watercourse.

EU legislation on this issue accepts the requirements of the circular economy. The Water Framework Directive 200/60/EC mentions water reuse as one of a range of possible complementary measures. Article 12 of the Urban Waste Water Treatment Directive 91/271/EEC stipulates as part of the discharge conditions that treated wastewater should be reused whenever appropriate. From 26 June 2023, Regulation (EU) 2020/741 of the European Parliament and of the EU Council on minimum requirements for water reuse, which regulates the use of recycled water, particularly in agriculture, will enter into force.

Although pursuant to Section 38(11)(b) of Act No.254/2001 Coll., the water management authority is supposed to assess the possibility of wastewater reuse when permitting the discharge of wastewater into surface waters or groundwater, this possibility is generally not thoroughly examined due to the lack of methodological support.

The Horizon 2020 Wider Uptake project is currently underway to assess the safe use of recycled water for watering greenery.

- see Appendices, List of Project Cards, Strategic Objective 2 Water: **Horizon 2020 Wider Uptake**

Measure **Objective SO2/II/d**	Use of leachate, drainage, and other waters

Leachate and drainage waters are related to linear utility and transportation structures, such as collectors and subways, or else are waters from natural unused water sources, such as historic public wells, and springs, etc. These water sources are generally discharged to sewers. When separate storm sewers are used, they are discharged without use into a watercourse; integrated sewer systems are discharged and treated at wastewater treatment plants, which cover the associated operating costs.

Depending on the water quality, water from these sources can be used for watering greenery, cleaning, and cooling public spaces. It can be used as utility water, or even as drinking water for the population in emergency situations.

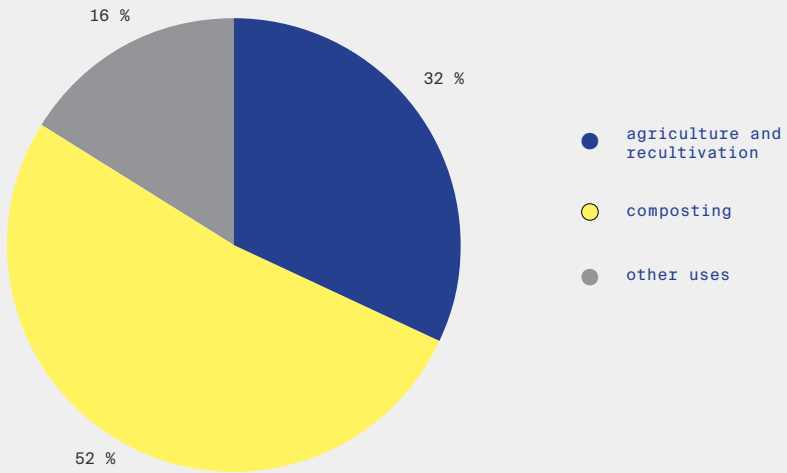
Limits to the use of such sources may be the constant fluctuations in yield and quality throughout the year, or the spatial limits for locating new facilities, such as storage and pumping stations, and their associated equipment in urbanised areas with a high density of utilities.

> A good example is the sprinkling of streets with leachate from collectors. Leachate water from collectors has been used for street sprinkling and air humidification in the City of Prague since 2020. The pumping station with a collection point is located at Uhelný trh in Prague 1. Based on laboratory tests, the quality of the water passes health standards. A similar water collection point is also planned for Havlíčkovo náměstí in Prague 3.

32 Strategy on Adaptation to Climate Change in the Czech Republic (MoE, 2015), National Action Plan on Adaptation to Climate Change (MoE, 2017) or State Environmental Policy of the Czech Republic 2030 with a view to 2050 (MoE, 2021).

33 https://www.mzp.cz/C1257458002F0DC7/cz/prioritni_osa_6_seznam_projektu/$FILE/ofeu-studie_sede_vody-20210517.pdf

Fig. 6: Use of sewage sludge in the Czech Republic



An important source of water in the area is the leachate water of the metro system due to the extensiveness of its surface location within the territory of the City of Prague.

Specific Objective SO2/III	Use of wastewater heat and water energy

Drinking water, as well as utility and wastewater offer some alternative ways of utilising secondary energy sources, whether it be energy from heat for heating and cooling buildings, or potential and kinetic energy for electricity generation. We can already find examples of heat and water energy being used in Prague, and the adoption of this Strategy is an effort to motivate not only private stakeholders but also the public sector to use such resources more intensively.

We propose the following two measures for this specific objective:

Measure **Objective SO2/III/a**	Water heat recovery

By using heat exchangers and heat pumps, the heat energy of water can be used to heat buildings or to combine heating in the winter and cooling in the summer. Water is an ideal medium given the generally relatively small fluctuations in temperature throughout the year. However, the heat generated and released into the environment can also be used in water management facilities. This includes, e.g., cooling the air behind blowers in wastewater treatment plants to temper buildings, etc.

> Several projects realised in Prague's territory use heat recovered from drinking water or wastewater. One of the first such implementations was heat recovery for hot water heating in a grey water recycling system at the Mosaic House Hotel in 2010. Three heat pumps have been installed in the Kbely wastewater treatment plant. Two of the heat exchangers use wastewater as a source, one system uses waste heat from the blower room. The Main Point Karlín office building, on the other hand, uses water from the Vltava River for its cooling system, where plate heat exchangers are located in a channel drain that runs under the building.[34]

Measure **Objective SO2/III/b**	Utilising the potential and kinetic energy of water

The use of potential and kinetic energy of water, the so-called hydraulic potential, includes mainly small hydropower plants (SHPPs) and microturbines corresponding to the size of the flow and its gradient. Hydropower plants in wastewater treatment plants are usually small sources on the outfall, i.e. mini and micro turbines, considering the limited flow and notably small gradients.

The installation of hydropower plants and micro-turbines can be implemented in water supply facilities such as water treatment plants, water supply lines, inflows to reservoirs and pumping stations, and also within the water distribution network. For sewerage facilities, microturbines are usually installed at the outflow of wastewater treatment plants if local conditions, e.g.

34 https://www.asb-portal.cz/stavebnictvi/technicka-zarizeni-budov/energie/administrativni-budova-main-point-karlin, accessed 1 June 2021

sufficient gradient and flow, as well as flood protection facilities, allow it.

> As part of the system supplying Prague and parts of the Central Bohemia Region with drinking water, a hydropower plant is being implemented at the end of the water supply tunnel in Jesenice. This HPP on the drinking water intake from the Želivka water treatment plant with an average flow rate of 2.5 m^3/s will have an output of approximately 1 MW. Another example of an SHPP implemented on Prague's territory is the Mazanka pumping station, where a water turbine is installed at the inflow to the building.

Specific Objective SO2/IV	Use of waste sludge in accordance with CE principles

Sludge forms an integral part of wastewater treatment technology and cannot be simply subjected to preventive measures which limit its formation. Prevention can be defined as the reduction of pollution in discharged municipal wastewater, e.g. by banning kitchen waste disposal units connected to the sewerage system, or by adjusting and tightening the effluent quality criteria for major wastewater producers connected to the sewerage system.

In terms of sludge management, the use of sewage sludge as a source of energy, organic matter, and phosphorus, or its use as an alternative to industrial fertilisers in agriculture when applied under precisely defined conditions, is essential in the context of the circular economy.

For the economic management of sewage sludge, which includes primary, biological, and (for larger plants) chemical sludge, dewatering and drying may be necessary to reduce its volume. So far, treated sludge in the Czech Republic is mostly applied directly to agricultural land or for reclamation, about 32% of total sludge production, or composted, about 52%.

Some risks associated with sludge use are well documented (heavy metals), others are less defined (pharmaceuticals, microplastics) but new findings can be expected to lead to stricter legislation in this area. For these reasons, alternative ways of dealing with sewage sludge are also being sought, e.g. its energy recovery involving the production of biomethane as well as thermal and electrical energy, or its composting. Energy recovery from sludges can offset the carbon footprint of the wastewater treatment plant, as the biogenic carbon present in sludge is considered carbon neutral.

In addition to the energy and material use of sludge, the potential for phosphorus recovery by direct separation from sludge water in wastewater treatment plants, and – in the case of sludge mono-combustion – from its ash under the condition of metal separation by thermo-metallurgical technologies is also significant. However, these technologies are at the pilot project stage and Prague is not yet considering their realisation.

The chosen method of sludge recovery depends, among other things, on the size of the wastewater treatment plant. In Prague's territory it is necessary to apply one set of technologies at the CWTP and a different set at branch wastewater treatment plants. The transport requirements of treated sludge should also be factored into the decision.

The following five model measures are proposed for sludge management, with respect to CE principles:

Measure **Objective SO/IV/a**	Biomethane recovery

Sewage sludge (i.e. biodegradable waste) produces biogas, which can be used to produce biomethane. This can then be used to power vehicles, injected back into the gas network, or used to generate electricity and heat. A 'mix' of these possible uses is ideal, with a preference for a use based on the current commodity price or needs.

A project for the use of sewage sludge gas at CWTP, in the sense of biomethane production, is currently being developed for use in the Prague city area. The resulting biomethane gas will be converted to CNG quality natural gas, which will then be utilised to power approximately 16 vehicles owned by the managing and operating company of the water-related infrastructure system, while it may also be injected into the gas pipeline network.

- see Appendices, List of Project Cards, Strategic Objective 2 Water: **Biomethane, use of sewage sludge gas in the CWTP, Prague**

Measure **Objective SO/IV/b**	Incineration and co-incineration

Thermal methods for the energy recovery of sewage sludge include incineration, co-incineration, and carbonisation. Another thermal method, pyrolysis, is a separate technological process. At temperatures above 300 °C, complete breakdown of pharmaceutical residues and other contaminants in the sewage sludge is achieved. The preferred method for treating sewage sludge is mono-combustion where

the end product is an undegraded ash containing nutrients, which also includes phosphorus (up to 18% P_2O_5), in addition to the production of heat and electricity. This may become an attractive alternative to the current diminishing sources of phosphorus in the future.[35] Sewage sludge can also be co-incinerated in power plants, waste incineration plants or cement plants, and used e.g. as a building material.

Considering the precautionary principle and existing available infrastructure, Prague will follow the route of co-incineration. Based on the feasibility study Sludge Management of the CWTP, modernising the treatment of sewage sludge in the form of anaerobic stabilisation with/without hydrolysis is recommended, with the thickened dewatered sludge subsequently transported for energy recovery at the incineration plant ZEVO Malešice or to the ČEZ Horní Počaply site.

- see Appendices, List of Project Cards, Strategic Objective 2 Water: **Sewage sludge treatment**

35 https://www.sovak.cz/sites/default/files/2019-11/SOVAK%20%C4%8CR%20Studie%20nakl%C3%A1d%C3%A1n%C3%AD%20s%20%C4%8Dist%C3%ADrensk%C3%BDmi%20kaly%20v%20%C4%8CR%20FINAL.pdf, accessed 17 August 2021.

Measure **Objective SO2/IV/c**	Pyrolysis

This is a relatively new method, already being used abroad in certain large wastewater treatment plants. In the Czech Republic, it has only been applied in the Trutnov-Bohuslavice plant. It may also represent a possible solution for Prague in the future. The pyrolysis process involves the thermochemical decomposition of organic substances but unlike incineration, this is done in anaerobic conditions. The resulting product is not ash, but a product generally known as biochar, containing highly porous organic carbon or phosphorus, as well as a liquid component and pyrolysis gas. Based on the results of the pyrolysis test run at the Trutnov plant, it is expected that the biochar produced will be registered as a soil adjuvant or fertiliser.

Measure **Objective SO2/IV/d**	Use on agricultural land

The application of treated sewage sludge to agricultural land meets the requirements of current legislation and the principles of the circular economy (returning nutrients to the soil). In light of new findings and knowledge concerning all pollutants and their environmental impacts, as well as possible health risks, it can be assumed that legislation is likely to be become stricter and the use of this method will no longer be possible in the future. The thermophilic digestion technology currently in operation at the Prague CWTP ensures the hygienisation of sewage sludge and at the same time the production of biogas, which is used to generate electricity to power pumps, blowers, and other electrical equipment. The production of electricity also generates waste heat, used to heat the sewage sludge to temperatures of 55–56°C, which ensures its safety. The thermophilic digestion technology at the Prague CWTP has successfully passed independent verification of the efficiency of its sludge hygienisation in accordance with current legislation, but it is necessary to prepare for stricter legal requirements.

Measure **Objective SO2/IV/e**	Composting processes

Provided that all the principles and requirements of the applicable legislation are met, composting is another option for material recovery of sewage sludge when it enters the composting process as part of the mix of raw materials.

During the composting process, all input materials, including sewage sludge, are hygienised, but some pollutants are not removed (e.g. pharmaceutical residues, microplastics, and heavy metals). For this reason, it can be expected that even this method of sewage sludge management will not meet the tightening legislative requirements in the future, and Prague should be prepared for stricter legislation.

This technology is used for sludge that does not meet the conditions for direct application to agricultural land after leaving the wastewater treatment plant. The properties of the resulting product must meet the legislative requirements and be duly registered as a fertiliser.[36]

Specific Objective SO2/V	Ensuring a comprehensive approach to water management

A complex approach to water management, i.e. the analysis of flows from sources to discharges, both existing and prospective, not only allows for a more economical use of water and water resources, but also serves as a basis for optimising investments in the renewal and reconstruction of water

36 In cases where the resulting compost is not sold by the composting facility operator and is used for other activities (e.g. establishing/maintaining of public greenery), it does not need to be registered.

infrastructure, and is also used for crisis management.

For this specific objective, we propose the following 2 model measures:

Measure **Objective SO2/V/a**	Water audit

The municipality's water audit includes a comprehensive water management analysis. It is a fundamental prerequisite for conscious water management and serves as a basis for a comprehensive carbon footprint analysis.

In general, the different steps of a water audit can be divided into three main sections:

- analysis of the current state of water management in the municipality,
- identification of potential drinking water savings, potential sources of utility water, and reduction of the risk of water scarcity impacts,
- design of decentralised and centralised measures, including their prioritisation for sustainable water management.

As Prague does not have a completed water audit, it is proposed to develop it in the form of a project card.

- see Appendices, List of Project Cards, Strategic Objective 2 Water: **Water audit**

Measure **Objective SO2/V/a**	Real time control of the urban drainage system to reduce stormwater runoff into the sewerage network

Real-Time Control (or RTC) is the name given to a system of measures that allow the function of a sewer system to be optimised by appropriate manipulation of the network based on predictions of future system behaviour. Among other things, the number and volume of overflows from relief chambers can be reduced by the optimised filling of retention basins or retention areas. Such systems are already in use in Germany, Austria, and Sweden.

3 — Agriculture and Food

Strategic objective SO3 ● Reduce food waste, increase local production and consumption of healthy food sourced from urban and peri-urban agricultural production

Europe is on track to reach the 2030 target to achieve 25% of agricultural land farmed using organic farming methods. Prague should also aim to expand the areas being cultivated organically, in particular by supporting and encouraging farmers on private land, and proportionally increasing the production and consumption of organic food from urban and peri-urban agriculture.

There are over 20,000 ha of cultivated agricultural land in Prague, mostly privately owned and divided into numerous smaller plots. Of these, only about 1,300 ha are owned by the city and these are not always plots on which agricultural operations can be carried out. Prague also has a considerable area of urban orchards on its territory and, as part of the maintenance of its land, it looks after 10,000 fruit trees growing in established tree rows, avenues, and orchards. There are also orchards in Prague which are privately owned or managed by PCDs. Agriculture is mainly conventional, with a focus on cereals, rapeseed, permanent grassland, etc.

New land lease agreements from 2020 set a requirement for 450 ha of urban land to be farmed in an organic farming regime, i.e. without the use of chemicals. The main aim was to reduce health risks and promote biodiversity. From the circular economy point of view, it is also desirable to reduce the energy intensity of agricultural production, to support local producers and to contribute to reducing distances between producer and consumer. Shortening supply chains reduces packaging, processing, refrigeration, and transport requirements. Food waste is a problem that has not yet been addressed, and this affects not only Prague but the whole of Europe. In response to this, is the EU's 2020 Farm to Fork Strategy, which not only seeks to address climate obligations, but also health – minimising the use of chemicals and changing eating habits, given that over 50% of Europe's adult population is overweight.

Even more relevant for the circular economy is the fact that around 30% of food produced in Europe ends up as waste. In response to this, a number of European cities, including signatories to the so-called Milan Food Policy Convention[37], such as Birmingham, Barcelona, and other cities like London and Paris, are adopting food policies and testing solutions to prevent food waste. The city of Vienna has set a procurement target of 50% of food purchases to be organic by 2030 and up to 70% by 2050. With the adoption of this Strategy, Prague is also embarking on a journey to reduce food waste and strengthen local and organic food production.

The following five specific objectives are proposed to meet this strategic objective:

- SO3/I: Increase the city's demand for organic products (gastro pubs,

37 The Milan Pact – Milan Urban Food Policy Pact

canteens), promotion of urban and peri-urban organic farming

- SO3/II: Promoting urban agriculture and subsistence farming (community gardens, management of surplus from allotments, rooftop farms, urban farms, etc.)
- SO3/III: Circular management of organic/gastro waste through returning nutrients to the soil
- SO3/IV: Reduction of food waste by introducing prevention and the distribution of surpluses
- SO3/V: Promoting innovation in food production (vertical farms, hydroponics, aquaponics, more environmentally friendly food processing; offering space, logistics)

Specific Objective SO3/I	Increase in the city's demand for organic products (gastro pubs, canteens), promotion of urban and suburban organic farming

Prague already has examples of good practice that can be built upon. These include the municipal field in Horní Počernice, where the production of courgettes was distributed to Prague school canteens, the cultivated land of the Prague 12 PCD, the experimental field of the ČZU in Uhříněves, where 'organic potatoes' are grown, as well as the municipal orchards and web application 'Na ovoce' run by the same association. The demand for organic and local products is high, as shown by public interest in the Prague 'farmers' markets and use of the Community Supported Agriculture (CSA) model. Community or cooperative shops (e.g. Obživa) are also emerging, building new business models on a community basis. There is also a demonstrated interest in healthy local food on the part of school canteens. A pilot project for school canteens is also underway, and the city administration is committed to promoting organic production in schools.

> The Good Food Strategy of the City of Brussels may be an inspiration here. The aim is that by 2035, 30% of the fresh fruit and vegetables consumed by Brussels residents should come from urban and peri-urban areas where they are produced using regenerative practices (e.g. benefits for public health, soil health, cleaner air and groundwater, financial savings in fertiliser consumption, and reduced soil degradation). Between 2014 and 2016, direct farmer-to-consumer supply increased by 76% and short supply chains are still on the rise.
>
> https://environnement.brussels/news/mieux-produire-bien-manger-cest-la-strategie-good-food-de-la-region

The following two measures are proposed for this specific objective:

Measure **Objective SO3/I/a**	Preparation of a cooperative model between farmers, the city, and municipal organisations (schools, social facilities, etc.)

Setting up managed communication with the private sector will allow reconciliation between the needs of the city and individual stakeholders within the city (schools, social and health facilities) and the private sector. This can result in the guaranteed procurement of production (negotiated product and commodity prices) or the setting of mutually acceptable conditions in tenders. Cooperation can also start with the launch of an on-line platform (on-line marketplace) where producers and consumers, operators of school canteens, or kindergartens and others can meet to offer their products.

- see Appendices, List of Project Cards, Strategic Objective 3: Agriculture and Food: **On-line market for school canteens**

Measure **Objective SO3/I/b**	Motivate farmers to produce food by providing storage space, compost, or certified digestate

The advantageous provision of space or facilities for processing locally grown produce (vegetables, fruit) or the advantageous purchase of compost/certified digestate can be an incentive to switch to growing food for direct consumption on land where cereals, rapeseed, etc. are currently being grown conventionally. Providing favourable conditions for storing seasonal produce will make it possible to extend the period over which it can be consumed (vegetables, potatoes, fruit), making the cultivation of these crops significantly more attractive to farmers.

Specific Objective SO3/II	Promoting urban agriculture and subsistence farming (community gardens, management of surplus from allotments, rooftop farms, urban farms, etc.)

Prague has been experiencing a community garden boom in recent years which has yet

to subside. There are already 58[38] such spaces to date. The main limiting factor for establishing more is the lack of suitable areas. There are several organisations working in Prague to support and operate community gardens (Kokoza, Ekodomov), and community gardens are also part of certain development projects (e.g. the Skanska Modřany project). Production gardens within the CSA model (Kuchyňka, KomPot, Pastvina, and Prokopská zahrada) are also being established, and continue to bring together several thousand Prague residents. But there are also other forms of food provision still less developed, such as roof gardens or the disposal of surplus material from vegetable gardens, or the establishment of urban farms. Making the most of the city's potential for urban agriculture and subsistence farming is the aim of the measures outlined below.

Four measures are proposed for specific objective 2:

38 See mapko.cz

Measure **Objective SO3/II/a**	Assessing the production function of urban and subsistence projects with the aim of their possible involvement in the city's regular supply chain

It is desirable to extend the current pilot evaluation of the production function of community gardens (research project led by Kokoza and ÚJEP[39]) to other possible forms of farming (urban orchards, rooftop farms, and agricultural land owned by the city). The aim is to get a more specific overview of the city's potential for food production in this way, and ensure available consumer capacities (primarily city organisations – schools, social and health facilities), with significant involvement of the PCDs. In 2019, with the support of PCH, a master plan/proposal for community gardens was prepared by the Kokoza organisation. Thanks to the momentum this area has been gaining, it is advisable that data is updated every two years, and at the same time the scope is extended to cover additional areas of urban agriculture, including allotment gardens.

39 Project titled: Zvýšením potravinové soběstačnosti k odolnosti společnosti vůči dopadům krize, realizace 2021–2023 [Increasing food self-sufficiency to improve society's resilience to the impacts of crisis, implementation 2021–2023], supported by TAČR

- see Appendices, List of Project Cards, Strategic Objective 3 Agriculture and Food: **Urban agriculture master plan**

Measure **Objective SO3/II/b**	Methodological and mentoring support from the city for the establishment and maintenance of community gardens

The establishment and operation of community gardens, including examples of good practice, is described in the city's Community Gardens Methodology from 2020.[40] Community gardens are established on land owned by the city and the PCDs (e.g. Prague 3, Prague 7, Prague 10 and 11), as well as on private land (Kaufland in Prague 6 Podbaba or Bílá Hora). There are currently 58 community gardens in Prague. In addition to the potential for producing herbs and vegetables, community composting is a standard part of community gardens. They also serve as outreach centres in matters such as healthy lifestyle, waste prevention, and responsible waste management. They have a social importance for strengthening social relations in their neighbourhoods, serving also as informal community and cultural centres (examples of community gardens in Prazelenina, Kotlaska, and others). Support for the development of community gardens by the city can take several forms, and financial and expert support from the city is already ongoing. The different forms of support are:

40 5546_KOKOZA_Metodika_zakladani_KZ-WEB.pdf

- Economic (subsidy programmes of the city and PCDs for operational costs, or for community garden coordinators)
- Property (including the temporary provision of currently unused land, e.g. brownfields, and land with building restrictions)
- Knowledge-based (mentoring in setting up community gardens, support for sharing good practice, expert consultations)
- Social (support for integrating of disadvantaged groups and involving social enterprises as suppliers)

Measure **Objective SO3/II/c**	Establishment a pilot productive urban farm project

Urban farms are already a relatively common part of life in big cities. However, Prague lacks an urban productive farm, where setting up such a farm could encourage the establishment of others, ensuring ther availability to residents across the city. In addition to their production function, they

also act as natural community centres, engage in environmental education, and create jobs suitable for those disadvantaged in the labour market.[41] Productive farms provide educational programmes for schools, the public, and farmers. They support adaptive stormwater management measures, participate in CO_2 capture and storage, community composting, and planting and maintaining green spaces.

- see Appendices, List of Project Cards, Strategic Objective 3 Agriculture and Food: **Urban production farm**

Measure **Objective SO3/II/d**	Identifying and offering suitable land for urban agriculture, with the possibility of producing an app

Not only land allocated for urban farming, but also land that is temporarily unused (brownfields, land subject to building restrictions, underused land for schools or other social and health facilities, etc.) is suitable for urban agriculture. The purpose of this measure is to create an online tool for searching and marking suitable land, as well for its owners to offer it up for such use. Extending the existing map (www.mapko.cz) to include these new features is also a possibility.

Specific Objective SO3/III	Circular management of organic waste and returning nutrients to the soil

Prague produces more than 100,000 tonnes of biodegradable waste per year from its residents, much of which ends up in mixed municipal waste. The aim of the waste policy is to separate at least 60% of bio-waste from MMW by 2030 (i.e. 50,272 tonnes) and process it in biogas plants or composting facilities. In addition to the centralised collection provided by the Prague Waste Consortium 2016–2025, there is also the possibility of decentralised collection and processing in community composting facilities and composters with subsequent use of the compost on site – in the maintenance of green areas, local gardens, school grounds, etc. Motivation and support from PCDs and private entities (homeowners, canteen operators, etc.) is a prerequisite.

The following four measures are proposed for this specific objective:

Measure **Objective SO3/III/a**	Mapping the potential of decentralised biodegradable waste collection

With reference to the measure SO3/II/a — Assessing the production function of urban and subsistence projects — it is also desirable to determine the potential for the decentralised collection of organic/gastro waste, taking into account different types of development. The ideal solution is the subsequent use of compost or certified digestate on soil near its place of origin.

Measure **Objective SO3/III/b**	Coordination with PCDs in promoting community composting and community compost bins

Establishing a coordination platform with representation of the city/EPD PCH, PCDs and other relevant stakeholders (e.g. Lesy hl. m. Prahy (Prague Forests), Kokoza, Ekodomov, Technická správa komunikací (Technical Administration in Communications) for sharing experience, and methodological guidance in the introduction and implementation of community composting, but also e.g. in the establishment and operation of community gardens.

> An example of this is the Prague 3 PCD, which has installed 5 community composting bins in cooperation with the organisation Kokoza and local communities. One composting bin serves 50 households, is locked with a code lock and can only be accessed by the community. In just 3 months of the project, 2 tons of biodegradable waste were sorted.[42] Prague 10 together with Ekodomov distributes the community composting bins and invites their managers to information meetings.

Measure **Objective SO3/III/c**	The use of urban/community compost in the maintenance of urban green spaces and agricultural land

The circular economy also aims to return as much of the organic nutrients from biodegradable waste back to the soil in the maintenance of public green spaces as it does to agriculturally managed land. The maintenance of public green spaces in Prague is carried out by companies on the basis of public tenders. Biodegradable

41 An example of a social urban farm is Social Farms & Gardens in the United Kingdom: www.farmgarden.org.uk

42 Source: Kokoza.

waste is taken to municipal composting facilities, but it is not always common for the resulting compost to be returned for use in public green spaces. This can be ensured by setting a condition in the tender documentation, as already practiced by the EPD PCH. It is desirable to extend this practice to public procurement by PCDs or city organisations. Agreements within the framework of cooperative models between the city and farmers can be used to return nutrients to agricultural land (see specific objective 1, measure 1). New forms of distributing urban compost (involving PCDs, community gardens, etc.) can be developed so that use of urban compost by municipal or city-run organisations, as well as households, develops beyond its level by being brought closer to the end user.

Measure **Objective SO3/III/d**	Education, outreach, pilot projects in schools (zero-waste), and utilising school grounds

Schools can act as catalysts for change in their local areas, and in addition to education and outreach, they are able to implement projects aimed at minimising waste, including food waste. In addition to composting, there is also the possibility of using school grounds to set up school kitchen gardens or community gardens (with an opportunity for parents to get involved). For school canteens, it is important to ensure the exchange of expertise, provide training for staff, reward them appropriately, and to involve experienced chefs from the private sector in order to make more use of healthy, local products. Experience from abroad shows that not only the quality and taste of the food served, but also the environment of school canteens, influences the way food is treated, which is why the concept of school restaurants that are more environmentally and culturally sensitive is becoming much more common. Another possibility is to foster links between schools and the specific farms that supply their produce to schools, which may also be used in the classroom.

> An example of good practice is a student project at the Smíchov Secondary Technical School and Gymnasium, which became the basis for a hydroponic productive farm on the roof of the Nový Smíchov Shopping Centre (Pražskej salát farm).

Specific Objective SO3/IV	Reduction of food waste by introducing surplus prevention and distribution

Food waste accounts for over 30% of mixed household waste and is currently being dealt with primarily through its separation from general waste and further treatment (composting, biogas plants). However, the prevention of food waste is not yet systematically addressed at PCH, and it will also need to be anchored within the authority. The EC's Farm to Fork Strategy[43], which provides a framework for a common European policy for sustainable food production and marketing, sets a target to halve the per capita production of food waste by 2030.

> The city of Milan e.g, has taken a comprehensive approach to the problem of food waste. To prevent it, it reduces taxes for supermarkets and restaurants which donate food they would otherwise discard. A hub was set up where the city collects food from retail, the HoReCa sector, school canteens, and other places, and this is further distributed to those in need. Milan educates and motivates its residents, with schools and children and their parents as the priority target group, because targeting them means a future return on investment. An important milestone in this context is the Milan Cities Food Pact, which has been signed by more than 180 cities around the world and involves 450 million people.
>
> https://www.milanurbanfoodpolicypact.org/

43 Source: https://ec.europa.eu/food/system/files/2020-05/f2f_action-plan_2020_strategy-info_en.pdf

The following two measures are proposed for specific objective 4:

Measure **Objective SO3/IV/a**	Food waste origin analysis

The aim of this measure is to map where food waste occurs in Prague and in what quantities, and to propose steps — based on this data — to prevent food waste. The analysis will focus on food flows in organisations established by the city – schools, social and health care institutions, and others, as well as in the private sector. The proposed measures should primarily promote the prevention and reduction of food waste (targeted outreach campaigns, sharing any surplus, food donations, reuse of surplus food for commercial sale, etc.) and only then tackle recycling. Once the city has more accurate data on food surplus and food waste streams, it can set short- and long-term targets and evaluate progress in reducing waste.

- see Appendices, List of Project Cards, Strategic Objective 4: **Food waste analysis**

Measure **Objective SO3/IV/b**	Promoting food banks and digital platforms for sharing surpluses

The online platforms Na ovoce, Nesnězeno, and Jídlov operate in the Czech Republic, all of which are designed for end customers (individuals who want to buy surplus food at a reduced price). The customers pick the food up themselves, with Nesnězeno focusing on food from restaurants and Jídlov on unsold food from shops and bakeries.

An online platform for donating food from canteens and catering is currently in the planning phase, and aims at connecting catering businesses, distribution companies, and recipients (charities/food banks).

- see Appendices, List of Project Cards, Strategic Objective 4: **Online platform for sharing ready-made food**

> Lisbon has launched a pilot project to develop a web-based application, LISBOA ZERO, to reduce organic waste at its source. The aim was to identify the quantity and diversity of food and food waste sources, and to assess the number of meals, costs, and CO_2 emissions saved. Of the 76 food donors who signed up to the app, 1.6 million meals were saved, representing approximately 800 tonnes of food waste, and the equivalent of 3,400 tonnes of CO_2 emissions.
>
> https://www.lisboazero.app/en/

Specific Objective SO3/V	Promoting innovation in food production (vertical farms, hydroponics, aquaponics, more environmentally friendly food processing; offering space, logistics)

This specific objective primarily focuses on supporting pilot projects in the field of urban innovation implemented mainly in the private sector, as well as their evaluation and creating conditions for the dissemination of successful solutions. Model measures indicate areas where innovations can be implemented and those, where private sector activity can be expected, including with support from the city (innovation subsidy programme, training and mentoring of companies, etc.) – see SO6.

> Inspiration can be found in already implemented projects in the Czech Republic and abroad. These are, for example, the Association of Aquaponic Farms in Přáslavice, the longest operating aquaponic farm, which combines not only production but also aquaponic research (https://www.aquaponickafarma.cz/), and RotterZwam in Rotterdam, a circular use of used coffee grounds to grow mushrooms at home (https://www.rotterzwam.nl/).

The following four model measures are proposed for this specific objective:

Measure **Objective SO3/V/a**	Review the availability of suitable urban spaces/ rooftops for hydroponic and other forms of urban agriculture

A limiting factor for the development of urban agriculture is the lack of available space, which need not necessarily be land. Brownfields or rooftops with certain parameters may also be suitable. One example is the hydroponic productive farm on the roof of OC Nový Smíchov (prazskejsalat.cz).

Measure **Objective SO3/V/b**	Incorporate green productive roofs into the Sustainable Building Code (as an indicator to be considered during project preparation)

The structural properties of roofs are another factor limiting their use for food production purposes. Incorporation of this requirement into the Prague Sustainable Building Code will ensure that this requirement is considered when developing the specification and design of new buildings.

Measure **Objective SO3/V/c**	Implement pilot projects of vertical or rooftop productive farms on new buildings belonging to the city or city organisations (schools, social facilities, etc.)

Pilot projects in city-owned buildings can contribute to the further dissemination of this practice. It is therefore desirable to determine the parameters of feasibility for vertical or productive rooftop farms in the audit of city buildings.

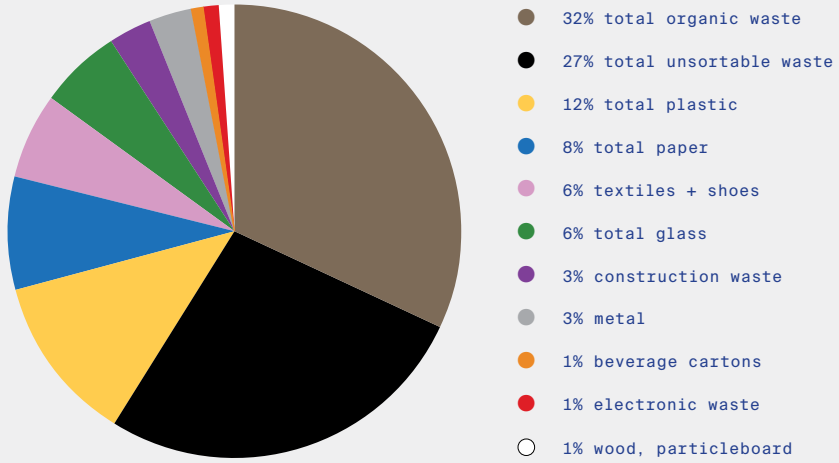
Measure **Objective SO3/V/d**	Education, outreach and sharing good practice, with the involvement of PCDs and city organisations

Although examples from abroad show that urban agriculture in its various new forms is a common feature in cities, there is still a lack of broader awareness of these possibilities in Prague, and therefore a lack of coordinated support for its development. Education, outreach and sharing good practice have the potential to remedy this situation.

4 — Waste

Specific Objective SO4 ● Prevent waste; sort, recycle, and reuse as much waste as possible; reduce by 50% the production of mixed municipal waste before 2030

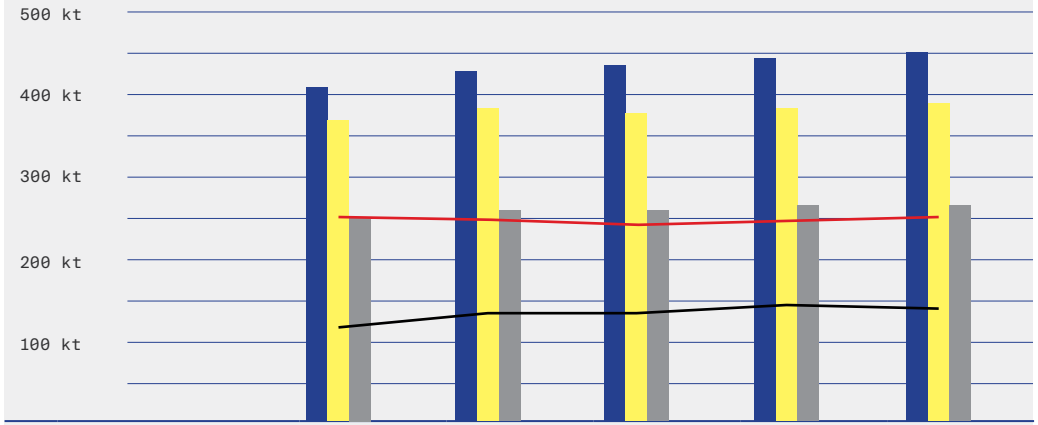
Fig. 7: Composition of MMW in the Czech Republic and Prague



More than 5 million tonnes of waste are generated in the territory of the City of Prague every year. Of this, 78% is construction and demolition waste. Due to its importance, this material flow is dealt within a separate chapter. Municipal solid waste (MW), which is the focus of this chapter, accounted for 14% of the city's total waste generation in 2019, equivalent to 722,000 tonnes. This quantity includes both municipal waste deposited by residents and waste produced by companies operating within Prague. Citizens deposited in total of 448,370 tonnes of municipal solid waste in 2019, of which approximately 31% was recyclable waste. The largest article of municipal waste (MW) is mixed municipal waste (MMW), which accounted for approximately 58% of the total municipal solid waste (MSW) production of Prague in 2019, i.e. 261,300 tonnes.

The strategic objective is to reduce MMW by 50% by 2030 compared to 2020 levels. The current rate of compliance with this target is 0%. The production of MSW in 2019 was 261,300 tonnes. If we calculate the increasing production of SW and MSW in Prague as has been the case in recent years and we do not assume any significant

Fig. 8: Use of MMW in Prague. Source: PCH (2019)



	2015	2016	2017	2018	2019
Total amount of MW (kt)	404,27	425,36	430,88	444,20	448,37
Total use (kt)	366,85	376,68	373,53	382,28	388,01
Amount of MMW in thousands t	252,85	255,78	258,09	261,82	261,30
Energy use (kt) A00	251,7	245,9	241,3	245,3	249,1
Material use (kt) A00 + BN3D	115,15	130,78	132,23	136,98	138,91

intervention, PCH will have to reduce MMW production by 50% by 2030 in comparison to 2020, or 154,843 tonnes. To meet the MMW sorting target, PCH should ensure an increase in sorting to 65% of total MMW production by 2030, which would signify an increase in sorted municipal waste components of 190,000 tonnes per year.

Under the forthcoming OPE 2021–2027, investment in the prevention, collection, sorting and re-sorting of waste, and its material recovery as well as selected forms of energy recovery will be significantly supported under Specific Objective 1.5 Support for Transition to a Resource-Efficient Circular Economy.

To achieve the strategic objective (as well as the objectives of the Waste and Packaging Act and the internal objectives of PCH), four specific objectives are proposed:

- SO4/I: Minimising production of and increasing the recovery rate of the city's bulky waste to 50% by 2030
- SO4/II: Sorting and treatment of biodegradable municipal waste with 60% efficiency by 2026
- SO4/III: Increase the sorting rate of municipal waste to 60% in 2025 and to 65% by 2030, as well as ensure the highest possible rate of feasible recycling
- SO4/IV: Continuous and systematic communication and outreach across the city's inhabitants, businesses, as well as at the national legislative level

Specific Objective SO4/I	Minimising the production and increasing the recovery rate of the city's bulky waste to 50% by 2030

Every year, Prague residents dispose of more than 40,000 tonnes of bulky waste (BW) through the city's collection yards or large-volume skips. Another 7,000 tonnes of BW are generated by dumping unnecessary items next to municipal waste bins. Such waste mainly consists of furniture, household appliances, and common household equipment. To date, all BW is landfilled, and the production of BW is increasing every year with the purchasing power of Prague's inhabitants.

However, BW has great potential to remain in circulation. Furniture, e.g., can be passed on, repaired, and individual components recycled and/or reused for energy purposes. In a recent development, collection yard operators are now required to recover 40% of the BW from collection yards for further energy or material use. For a successful transition to the circular economy in this sector, it is desirable to first focus on offering innovative and more sustainable services to Prague's residents at the same cost, reducing the production of BW, and increase the services and possibilities of repair, replacement, and reuse of existing furniture and appliances, thus minimising the negative impacts on the environment, waste management logistics, and related costs.

Three model measures are proposed for the purpose of this specific objective:

Measure **Objective SO4/I/a**	Create an accessible network for reuse services (both physical and online)

Reuse activities can be divided into several groups: a) brick-and-mortar centres/shops accepting unwanted goods (reuse centres, charities), b) reuse workshops and repair shops putting products back into circulation (furniture, household equipment, sports equipment, etc.), c) internet and mobile apps – selling or exchanging (for collection), and d) non-monetary exchange events (swaps). The aim is both to encourage the further development of these services in all their diversity, to motivate the public towards their use, and to link them logistically with the support of online applications.

Examples of Prague's range of services include reuse points (Pod Šancemi or Zakrytá), reuse workshops (Kampus Hybernská), as well as furniture banks, charity shops, and charities (Koloběh, Sue Ryder, Cesta domů). Reuse services can also function as social enterprises.

Development in this area is fairly dynamic, although there is still lacking a comprehensive range of services available in Prague. The upcoming online signpost 'Circular Map of Prague' is intended for this purpose. Examples of other upcoming activities are the expansion of the network of reuse points and the Fashion Hub in Štěrboholy.

- see Appendices, List of Project Cards, Strategic Objective 4 Waste:
  Circular Map of Prague
  Expanding the network of reuse points
  Fashion Hub

Measure **Objective SO4/I/b**	Build a reuse centre on the territory of the City of Prague

A reuse centre can be defined as a physical and freely accessible space where citizens can be inspired by concepts of sustainability and everyday household tools. Reuse centres of the 'Viennese type' are created at collection centres, where they use the capacity of the centre and divert suitable products by offering them back for resale within a sales area. They also deal with repairing items and returning them back to working order. They tend to be either located within the collection yard itself or linked to it logistically.

> Examples are the reuse centres OZO Ostrava and Tandler Vienna. In Eskilstuna, Sweden, next to a waste collection point has been set up the Retuna shopping centre, where only second-hand products can be bought for reuse. The Retuna centre is owned by the city and is economically self-sufficient – in 2018 it sold goods worth CZK 30 million and it employs dozens of people. Retuna generates public interest in the culture of reuse, repair, and the circular lifestyle.
>
> Link: https://www.retuna.se/english/photos-for-download/

- see Appendices, List of Project Cards, Strategic Objective 4 Waste: **Reuse Centre**

Measure **Objective SO4/I/c**	Promote community and business activities that meet the characteristics of reuse, reduce, and repair activities

Trending these days are non-monetary swaps, which work by exchanging things that one person does not need but someone else finds useful. These meetings are organised by a local organisation or group (typically parent centres, parent groups) or by a professional organisation like SWAP Prague (www.swapprague.cz). There are also public wardrobes or libraries of things. The first city-organised Iron Sundays (October 2021, Prague-Slivenec city district) are also successful.

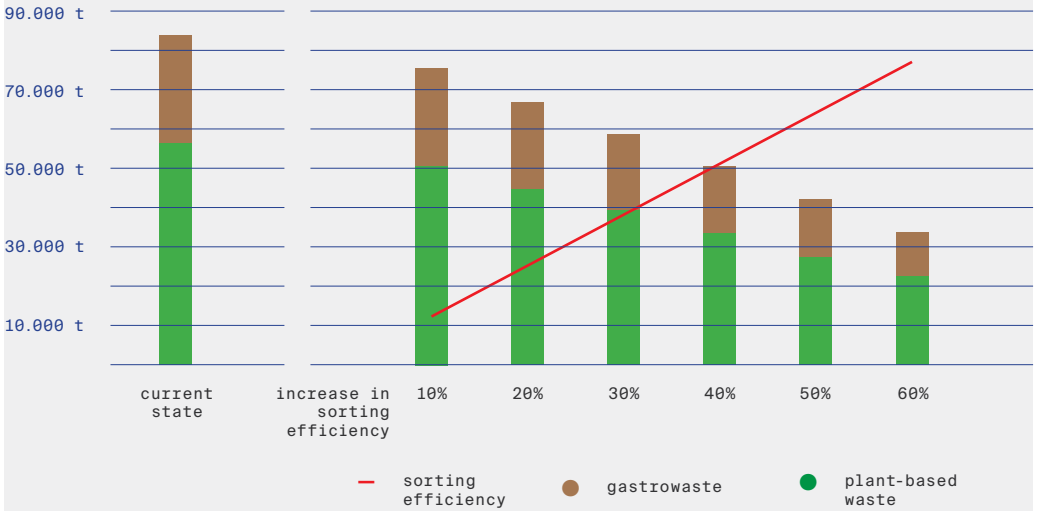
- see Appendices, List of Project Cards, Strategic Objective 4 Waste: **Iron Sunday**

Specific objective SO4/II	Sort and process biodegradable municipal waste with 60% efficiency by 2026

On average, 32% of the content by weight in mixed municipal waste (MMW) bins consists of biodegradable components. There are subsequently used for energy recovery at the incineration plant ZEVO Malešice together with other components of MMW. Based on analyses, approximately 84,000 tonnes of bio-waste can be found in the MMW on Prague's territory. With an efficiency of 60%, it would be possible to sort about 50,000 tonnes of biodegradable waste from MSW and use it with a higher added value for the production of BioCNG and digestate.

In 2019, approximately 14,000 tonnes of plant-based biodegradable waste were collected from citizens through the sites provided by the city – collection centres, skips, composting facilities, stable collection points, and home collection (brown bins). Other waste production recorded by the company Pražské služby is catering waste from traders. In 2019, 7,000 tonnes of gastrowaste were transported to the biogas plant.

Fig. 9: Potential to reduce the weight of biodegradable waste in MMW.
Source: PSAS prediction (2021)



From 2022, PCH will begin offering the collection of plant-based biodegradable is waste free of charge to all residents of the city. At the same time, it is expanding the capacity of its composting facilities (Slivenec and Ctěnice). A fundamental change will be brought about by the expansion of the collection of kitchen waste of plant and animal origin from households, schools, and restaurants, and its use for biogas production. A pilot project for the collection of food waste from households in the city districts of Prague 5, 6, and 7 is underway until the end of 2021. The aim is to expand throughout the whole city.

The treatment of sorted biodegradable waste and food waste will be carried out in a biogas plant which are currently under development (one of the options is to locate it on the premises of Pražské služby, a.s., in Malešice, or in another location). The prevention of food waste itself will be a key tool for meeting the objective.

Three model measures are proposed for this specific objective:

Measure **Objective SO4/II/a**	Introduce large-scale collection of biodegradable waste (kitchen and plant-based components) from residents by 2026

The aim is to involve all Prague residents and to promote the highest possible sorting and cleaning rate of sorted biodegradable municipal waste (BMW) from the waste management system according to the type of residential development. This will result in the sorting of at least 50,000 tonnes of BMW per year from 2026.

- see Appendices, List of Project Cards, Strategic Objective 4 Waste:
  Collection and further management of organic/food waste
  Bio-waste information campaign
  Collection of food waste from school canteens

Measure **Objective SO4/II/b**	Secure recycling capacity for converting biodegradable waste into high added value resources

To effectively meet the SO4 target, it is necessary to provide recycling capacity as a disposal facility for 50,000 tonnes of collected biodegradable municipal waste (BMW). This is handled for the city by the municipal company Pražské služby, a.s., which is currently developing a project for the future construction of a biogas plant in Prague.

> In Berlin, 150 vehicles are used to collect bioCNG waste, which is produced from more than 60,000 tonnes of collected BMW waste. These vehicles quite literally function thanks to the waste of Berlin's residents. Not only do they emit less pollution, as they produce two-thirds less CO_2, but they also make half the noise[44] of the previous buses.

- see Appendices, List of Project Cards, Strategic Objective 4 Waste: **Biogas station**

44 https://www.berlin.de/senuvk/umwelt/abfallwirtschaft/downloads/siedlungsabfall/Abfall_Broschuere_engl.pdf

Measure **Objective SO4/II/c**	Supporting at-home and community composting

The average production of kitchen waste ranges between 40 and 75 kg per person per year, while the production of garden waste ranges between 4 and 15 tonnes per hectare of land. Biodegradable waste is an ideal material for composting. A household living in a family house with a garden can expect to produce between 140 and 200 kg of biodegradable waste per person per year. The organisation Kokoza, which promotes home and community composting in Prague, works with the data of 100 kg of biodegradable waste/person/year. It is already clear from these figures that there is also considerable potential for reducing MMW through the promotion of home and community composting, including professional support, consultation, and the exchange of experience.

- see Appendices, List of Project Cards, Strategic Objective 4 Waste: **Composting facilities and bins for PCDs**

Specific objective SO4/III	Increasing the sorting rate of municipal waste to 60% in 2025 and to 65% by 2030, as well as ensuring the highest possible rate of feasible recycling.

As of 2021, following the amendment to the Waste Act, municipalities are obliged to ensure that separately collected recyclable components account for at least 65% of municipal solid waste in the calendar year 2030 and subsequent years. The separately sorted recyclable components of municipal waste generated on the territory of the municipality by the activities of non-business natural persons and not transferred to the municipal system may also be included in the calculation of the share. Prague currently sorts about 31% of its municipal waste. As a result, it needs to more than double its sorting rate within 9 years.

The greatest potential for increasing the sorting rate of the MMW is found in organic waste, which accounts for at least 32% of the volume of MMW, followed by plastics at 12%, paper at 8%, textiles and shoes at 6% and glass at 6%. Analyses show that there are 83,798 tonnes of organic waste, 31,270 tonnes of plastics, 15,740 tonnes of glass and 20,746 tonnes of paper in total in the MSW in Prague. The desirable situation is to prevent the generation of MMW in the first place, and then to maximise the rate and quality of sorting the individual components of MMW at source through innovations in waste management and collection. The previously listed SO1 and SO2 also ensure the fulfilment of this objective. All these activities aim to maximise sorting and recycling rates and are therefore complementary.

The following three measures are proposed to meet this specific objective:

Measure **Objective SO4/III/a**	Intensify the collection of packaging waste in the form of household and multi-commodity collection depending on the type of residential development

The joint collection of plastics, metals, and beverage cartons in one collection bin will increase the quantity and cleanliness of the sorted components, reduce collection costs, and free up street space by removing a portion of collection bins. In order to increase the level of participation of residents in the sorting system, a so-called door to door system for the collection of specific materials – e.g. plastics, which residents sort directly at their homes – can also be introduced.

- see Appendices, List of Project Cards, Strategic Objective 4 Waste: **Multicommodity collections**
- see Appendices, List of Project Cards, Strategic Objective 4 Waste: **Door-to-door system of waste collections**

Table 4: Production of MW 2019 PCH. Source: PCH (2021)

	Unit	2015	2016	2017	2018	2019
Total production of municipal waste (A00 + BN30)	t/year	404,268	425,360	430,882	444,200	448,370
Total production of materially recoverable municipal waste (A00 + BN30)	t/year	115,152	130,775	132,233	136,975	138,914
Sorting rate of MW (A00 + BN30)	%	28,48%	30,74%	30,69%	30,84%	30,98%
Mixed municipal waste A00	t/year	252,848	255,779	258,087	261,816	261,299

Measure **Objective SO4/III/b**	Construction and commissioning of a materials reclamation facility for plastic and metal packaging and beverage cartons

The materials reclamation facility in Chrášťany will be completed in 2022. It will enable Prague to provide high-quality final sorting of household and multi-commodity collection (SO3a), and ensure control over the recycling of problematic materials, especially plastics.

> As of 2015, Ljubljana has been collecting used beverage cartons and turning them into a source of cellulose for recycled paper for the city and city organisations. 15,117,815 used beverage cartons (529 tonnes) were recycled, 6,887 trees and 430,268 tonnes of CO_2 were saved. Based on data from March 2021, 41.5% of the paper used for hygiene purposes in Ljubljana comes from recycled beverage cartons.[45]

- see Appendices, List of Project Cards, Strategic Objective 4 Waste: **Materials reclamation facility**

Measure **Objective SO4/III/c**	Promoting recycling capacities and closing the flow of materials for other components of municipal waste

Together with PSAS, Prague will systematically proceed in closing material flows, thus ensuring effective recycling of other components of Prague's MMW and waste management, such as organic waste, plastics, slag, or glass.

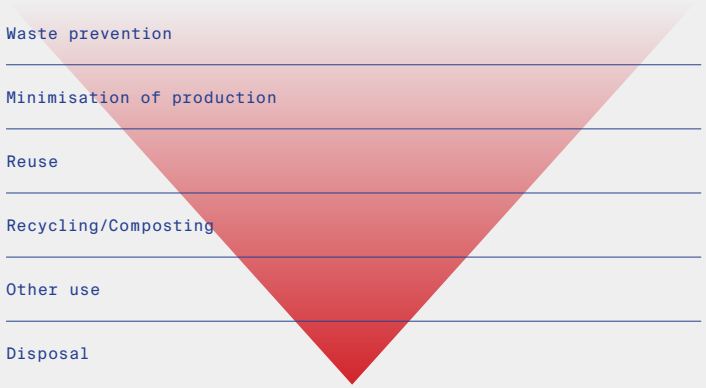
- see Appendices, List of Project Cards, Strategic Objective 4 Waste: **Slag management**

Specific objective SO4/IV	Continuous and systematic communication and education across the city's inhabitants, businesses, as well as at the national legislative level

According to the waste management hierarchy and the main principles of the circular economy, the key step is to prevent the production of waste. Prague needs to approach this theme systematically and ambitiously, across all SOs and their measures. Furthermore, the prevention of waste, whether it is food, furniture, or packaging, is seen as a key tool for meeting all the specific objectives mentioned above.

Therefore, new services for waste prevention must be accompanied by a communication campaign and outreach focused on the importance and possibilities of waste prevention among Prague's residents and business entities. Similarly, the PCH must create an economic incentive

Fig. 10: Hierarchy of waste management



45 https://municipal-material-cycle.org/en/home/

system for greater and better involvement of residents and trades in waste management.

In order to maximise the impact of the strategy, it is necessary to involve city companies and other relevant stakeholders in the implementation process. One of the key tools is the systematic support and mandatory inclusion of the private sector in the waste management of PCH, which is not allowed by current national legislation.

Three types of measures are proposed to meet specific objective 4:

Measure **Objective SO4/IV/a**	Outreach campaign focused on waste prevention

A professional, continuous, and well-coordinated outreach campaign that will focus primarily on the prevention of food waste, the 3Rs, the promotion of implemented measures associated with reducing the production of bulky waste and the decrease in packaging waste.

For 2022, the main themes of the outreach campaign are the promotion of bio-waste separation, Iron Sundays, reuse points, and the launch of the Circular Prague Map portal. The communication campaign will also focus on promoting multi-commodity waste collection and on information about the operations of the materials reclamation facility (see measure SO4/III/b). Outreach campaigns will be thematically coordinated with the relevant city companies, i.e. with Pražské služby a.s., the contributory organisation Lesy hl. m. Prahy, PVS, and other companies ensuring the operation of municipal infrastructure. In order to increase the efficiency of information support for individual projects, information channels set up within the EE system will also be used.

Melbourne has chosen an interesting way of campaigning. During the filming of the new three-part ABC series 'War on Waste', Melbourne filled a tram with 50,000 disposable cups. The tram travelled around the city as a reminder to people of the impact their love for coffee can have.[46]

Measure **Objective SO4/IV/b**	Pay As You Throw (PAYT) economic incentive system for residents

The general binding regulation based on the new waste legislation establishes a new method of calculating the municipal waste fee in the form of a rate per 1 litre of a collection bin for MMW. From 1 January 2022, the City of Prague will levy a fee for the disposal of municipal waste from immovable property based on the capacity of the means of collection. The structure of the fee will 'reward' those who separate waste, thereby reducing the production of MMW. The new legislation calls for a uniform rate of charge per litre of MMW collection container. Until now, the rate of the municipal solid waste fee was set at a monthly amount based on the number, volume, and frequency of servicing of the collection services. Now, if the property owner makes a greater effort to consistently separate the recoverable components of municipal waste, it will always be possible to reduce the volume or frequency of the bin collection depending on the amount of mixed waste actually produced, and thus reduce the fee amount. An important incentive from 1 January 2022 also involves supporting property owners in the collection and sorting of plant-based and, eventually, kitchen biodegradable waste, by providing free collection containers for sorting these commodities as a means to actually reduce the production of MMW.

Measure **Objective SOC4/IV/c**	Involve the business sector in the municipal waste management system

Involving the business sector and entrepreneurs in the municipal waste management system makes sense both from the environmental and economic point of view. However, current legislation does not impose any obligation on entrepreneurs to participate in the municipal waste management system. It is therefore desirable to make efforts to motivate their involvement in the municipal collection system before initiating changes to national and local legislation.

46 https://www.globalcitizen.org/en/content/a-tram-filled-with-50000-takeaway-coffee-cups-spot/

5 — Public Procurement

Specific Objective SO5 ● Increase the demand for circular solutions by incorporating such practices into the city's own projects, guidelines, and public procurement

According to the European Commission, public procurement accounts for 14% of the EU's GDP. In the Czech Republic, roughly CZK 600 billion a year is invested from public funds. The City of Prague is a major contracting authority and investor. In 2020 alone, the total size of public procurement for supplies, services, and construction works amounted to over CZK 2.5 billion, and if we include Prague organisations – over CZK 3.2 billion. If the city demands circular solutions, it will significantly support the development of circular practices in the private sector. Thischange can occur in the construction sector, services, with the purchasing of consumer goods, office equipment, or healthy food from local producers. In all these areas, new practices that save resources and minimise waste can be encouraged.

Responsible procurement is one of the measures of the EU Circular Economy Action Plan, a tool for cities to create demand for circular solutions. With reference to Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement, responsible procurement is a binding principle in the Public Procurement Act as of 1 January 2021 (§6/4), which states: "The contracting authority is obliged to comply with the principles of socially responsible contracting, environmentally responsible contracting, and innovation within the meaning of this Act when establishing the terms and conditions of the contract, evaluating tenders, and selecting the supplier, provided this is possible given the nature and purpose of the contract. The contracting authority shall duly justify its action."

Socially and environmentally responsible public procurement does not mean competing on the lowest bid price but, requires working with qualitative evaluation criteria and setting new requirements in the tender documentation where possible, that take into account social and environmental aspects, including the requirement for circular solutions. On the one hand, responsible procurement is more demanding in terms of planning and administration; on the other, the city obtains better quality supplies and services and meets its strategic objectives through public procurement. A streamlined and transparent approach, good coordination within the city in developing projects and particular procurements, and providing methodological support and sharing good practice across the city and its organisations, including PCDs, are essential to maximise the simplicity and security of responsible procurement (see the recommendations of the Institute for Responsible Public Procurement).

Three specific objectives are proposed to meet strategic objective 5:

- SO5/I: Integrating circular economy principles into public procurement

- SO5/II: Integrating circular economy principles into the operation of the city and its organisations
- SO5/III: CE principles and conserving primary resources as a foundation for city projects

Specific objective SO5/I	Integrating circular economy principles into public procurement

Circular procurement can be applied in all thematic areas covering strategic objectives 1–4. This can include the use of recycled materials in construction, water recycling requirements, the purchase of healthy local produce for school canteens and other organisations established by the city, and the purchase of second-hand furniture, etc. There are countless such possibilities, and the city should create a catalogue of tendering procedures where such criteria will be applied, as well as make procedural arrangements to ensure that tenders are assessed for their suitability and contain parameters for circular solutions.

Five model measures are proposed to meet the specific objective:

Measure **Objective SO5/I/a**	Preparation and approval of the Responsible Procurement Strategy of the City of Prague with a list of specific opportunities where circular solutions may be required

The Responsible Procurement Strategy sets out the basic principles to which the city subscribes vis-à-vis responsible public procurement and describes how and in which areas it will apply the principles of responsible procurement, including a monitoring and evaluation system.

- see Appendices, List of Project Cards, Strategic Objective 5 Public Procurement: **Responsible Procurement Strategy**

Measure **Objective SO5/I/b**	Preparation and approval of a methodology for responsible procurement within the city

The methodology will regulate the procedural management of public procurement procedures within PCH, with an emphasis on transparency, and the coordination between the Public Procurement Department and the relevant departments in incorporating the required principles/conditions of responsible procurement into individual procurement documents.

Measure **Objective SO5/I/c**	Catalogue of model public procurement contracts with the implementation of responsible procurement

Based on an analysis of the city's public procurement and previously implemented examples of good practice, recurring contracts in which responsible procurement criteria can be applied when purchasing services, products, or construction work will be identified. Checklists of possible criteria and requirements, or model tender documents, will be developed for these selected contracts.

Measure **Objective SO5/I/d**	Strengthening the capacity of the Public Procurement Department to provide methodological support to other relevant departments

Methodological support is a prerequisite for the relevant departments to engage in innovative public procurement practices, including circular procurement. Consultation and expert support in the implementation of responsible public procurement will be provided by the Public Procurement Department of PCH, and will require the strengthening of its staff capacity to cover this new agenda.

Measure **Objective SO5/I/e**	Sharing good practice and training in responsible procurement and circular procurement

The purpose of the measure is to train employees of the city, PCDs, and city organisations who draft public procurement contracts, and who can apply within them the principles of circular economy, and to gradually build a coordinated platform of experts who deal with responsible and circular procurement within the city and share their experience.

> An inspiration here could be the Cooper8 Circular Procurement Academy for public administration organisations. Participants in the academy are introduced not just to the general principles of circular procurement, but also to specific steps that they can apply to procurement documentation within their agenda and their organisations.[47]

- see Appendices, List of Project Cards, Strategic Objective 5 Public Procurement: **Training module on circular procurement for city employees, city organisations, and PCDs**

Specific objective SO5/II	Integrating circular economy principles into the operation of the city and its organisations

The operations of PCH, the PCD administrations, and Prague organisations, if set up correctly, create many opportunities for introducing circular approaches, not only in the search for savings (energy and materials), but also in the purchase of products with a long lifespan, or made of recycled material, etc. Opportunities include, e.g., the sustainable management of computer technology, both within Prague's schools, but also within the city, PCDs, and their organisations. Current subsidies for schools are usually only intended for the purchase of new technology and investment in maintenance, and they do not allow for possible upcycling. If this were to change, it would be possible to continue to use upcycled technology in schools, as well as to distribute it to e.g. pupils from socially disadvantaged families. Upcycling procedures have been successfully tested e.g. in the EDUBO project.

For the city to truly take advantage of these opportunities, coordination and methodological support within the authority or within individual city organisations is needed.

The following three measures are proposed for this specific objective:

Measure **Objective SO5/II/a**	Preparation and adoption of rules for responsible resource management and waste minimisation in the city's operations

Prague should adopt the city's 'green governance' rules, aiming to keep energy consumption as low as possible, minimise waste and pollutants in the operation of individual institutions, and to promote centralised collective purchasing where appropriate.

> The circular procurement of furniture for Wageningen City Hall can be taken as an example: the City Hall has committed to circular procurement for all its contracts. It has chosen circularity requirements such as decomposability, repairability, absence of toxic chemicals, and other criteria for its furniture purchases. Prices have been no higher than for conventional furniture and the city has achieved CO_2 savings.[48]

Measure **Objective SO5/II/b**	Establishment of an organisational unit that will provide methodological support and coordinate cost-saving operations of PCH and city organisations

This involves establishing an executive unit for the implementation of the principles for the cost-effective operation of the city's institutions. The prerequisite is, e.g., monitoring trends in this area, coordinating the exchange of good practice, supervising the training of officials, providing methodological support, and preparing pilot projects and their verification.

Measure **Objective SO5/II/c**	Establish a system for sharing information on responsible procurement across the city

Adopt a Prague City Council resolution to secure annual reports from the directors of departments for city-established contributory organisations on responsible public procurement, incorporating the principles of circular economy.

Specific objective SO5/III	CE principles and conserving primary resources as a foundation for city projects

The City of Prague, its organisations, and PCDs execute, purchase, and prepare assignments for various projects, for which it is desirable to take into account the circularity of material flows, waste prevention, and primary resource savings. This is a new and rapidly evolving cross-cutting issue that involves new products, technologies, and services. This pushes the city towards implementing innovations in their processes, as well as in thinking about how projects are decided on and developed.

47 https://www.copper8.com/en/projects/circulair-inkopen-academy/

48 https://ec.europa.eu/environment/gpp/pdf/news_alert/Issue69_Case_Study_138_Wageningen.pdf

Measure **Objective SO5/III/a**	Developing and testing circular procurement procedures for pilot projects

The purpose of the measure is to broaden the experience baseline on circular procurement based on the implementation of pilot projects (by PCH departments, city organisations, or PCDs), and to share experience, keep records of tested solutions, and incorporate good practice into manuals (at what stage and by whom should circular requirements be formulated). Incorporate the theme of responsible public procurement into the promotion of urban innovation.

- see Appendices, List of Project Cards, Strategic Objective 5 Public Procurement: **Public contract for the maintenance of greenery**

Measure **Objective SO5/III/b**	Sharing and supporting the replication of good practice and innovation across the city

This measure consists in preparing and ensuring the operation and updateing of a data communication platform intended for disseminating good practice. This platform will contain a database of implemented projects which have successfully applied the principles of the circular economy, with additional opportunities for discussion and the sharing of knowledge and experience. The provision of accompanying training events and workshops is also an essential part of this measure.

6 — Support for Entrepreneurship, Innovation, and Outreach

Strategic objective SO6 ● The city supports innovation of the business and civic sectors towards a circular economy

Achieving the goals of the circular economy, i.e. minimising waste and maximising the reuse and recycling of materials in closed cycles, requires new and innovative business and production practices, technologies, materials, but also social innovations, such as in the area of sharing things.

To meet strategic objective 6, we propose focusing on the following three specific objectives:

- SO6/I: Supporting the shared economy, citizen initiatives and businesses in the CE
- SO6/II: Support for pilot projects and innovation, involvement in science and research
- SO6/III: Communication, education, and outreach for the CE

Specific objective SO6/I	Supporting the shared economy, citizen initiatives and businesses in the CE

A number of business and non-profit activities aimed at waste reduction, waste prevention, consumption, and reuse are spontaneously emerging in Prague. There is a general lack of awareness of these activities, their benefits in terms of circular economy objectives, and a lack of tools to promote them, link them, and to enable greater interaction and opportunities for cooperation.

There are two model measures proposed for the specific objective:

Measure Objective SO6/I/a	Platform for sharing, promoting, and coordinating CE activities

Mapping business and non-business activities and the possibility to register/engage through a single digital platform offering targeted education and networking, coupled with support for joint circular projects are all opportunities that the upcoming Circular Prague platform plans to cover. Similar platforms are being created in other cities to support the cooperation of stakeholders in the circular economy.

> An example of this is Circular Glasgow. This is a platform for the city and other public organisations that supports the business sector through education/outreach and networking in the CE sector. It stimulates innovative CE projects using circular business models, 'design thinking' methods, and innovative approaches. It connects different actors/sectors and stimulates their mutual cooperation to increase competitiveness in the application of CE principles.

- see Appendices, List of Project Cards, Strategic Objective 6 Support for Entrepreneurship, Innovation, and Outreach: **Circular Prague platform**

Measure **Objective SO6/I/b**	Education and support programmes for SMEs, and start-up entrepreneurs, outreach for the CE

Offering training and mentoring programmes for companies/start-ups in cooperation with the Business and Innovation Centre of Prague (BICP) and the Circular Prague platform. In addition, the involvement of social enterprises in mentoring programmes in the CE area.

> The Brussels Be Circular programme is an integrated regional support and multidisciplinary programme implemented across government departments and administrations. It aims to support businesses and increase the competitiveness of economic activities in the region. In collaboration with companies and academia, 111 specific actions have been developed over the last four years to support the integration of CE principles, as well as the associated job creation and reduction in CO_2 emissions.

- see Appendices, List of Project Cards, Strategic Objective 6 Support for Entrepreneurship, Innovation, and Outreach: **Education in the circular economy for companies and social enterprises**

Specific objective SO6/II	Support for pilot projects and innovation, involvement in science and research

Prague is still not making sufficient use of the capacities of the private sector or academia, schools, and universities for fostering innovation. Collaboration across sectors and industries is one of the objectives of the Prague Regional Innovation Strategy (RIS3), it is also envisioned in the strategic objectives adopted by the city. The establishment of a collaborative innovation ecosystem facilitates the formation of new start-ups, the development of entrepreneurial activities in the international sphere, and international projects that will strengthen Prague's position in the innovation ecosystem.

Two model measures are proposed for this specific objective:

Measure **Objective SO6/II/a**	Innovation Support Subsidy Programme

Support for innovation is covered by the Innovation Strategy of the Capital City of Prague, which sets out priority areas, so-called domains of regional specialisation, where the city sees resources/potential, or, conversely, the need for innovation. This new grant scheme will support specific projects in Prague's priority areas. A new theme is urban innovation in response to societal challenges. This also includes the circular economy and projects supporting partnerships between the city, academia, and businesses in this area.

- see Appendices, List of Project Cards, Strategic Objective 6 Support for Entrepreneurship, Innovation, and Outreach: **Subsidies for innovation in the circular economy**

Measure **Objective SO6/II/b**	Support for urban labs (pilot and experimental) with a focus on the CE

Implementation of pilot testing for new approaches, exchange of knowledge with other cities and city districts, with the involvement of Prague organisations and the private and academic sector. Taking advantage of opportunities for international cooperation and for the involvement of city organisations in international projects led by the city (programme Horizon Europe and others). Inspiration can be found on the website of the European Network of Living Labs (enoll.org).

> The Copenhagen Solution Lab was established to develop innovative solutions for urban issues such as flooding, traffic congestion, pollution, etc. It is the city's gateway for companies and academia to directly develop and test prototype solutions in an urban lab environment.[49]

> The Circular City + Living Systems Lab (CCLS) at the University of Washington in Seattle is a cross-faculty and interdisciplinary international research collaboration between universities in the US and Europe for solutions in regenerative and resilient cities – climate change adaptation, the application of CE principles in food production, and more.[50]

49 https://cphsolutionslab.dk/en

50 https://knowledge-hub.circle-lab.com/article/8694?n=Circular-City-%2B-Living-Systems-Lab---University-of-Washington-Seattle

Specific objective SO6/III	Communication, education, and awareness raising for CE

Public information and outreach campaigns are already underway at various levels. The aim is to better coordinate them, to make them more coherent and to target specific groups that can be agents of change (e.g. housing cooperatives and housing associations). Closer cooperation with municipal companies and municipalities is a prerequisite. A separate area is urban education, teacher training and the incorporation of circular economy education into school curricula. There is also the possibility of implementing zero-waste school demonstration projects and their subsequent replication.

Subsidy programmes for supporting citizen initiatives and non-governmental non-profit organisations (NGOs) announced by the City of Prague are already contributing to the fulfilment of this specific objective, as are PCDs and ongoing programmes and projects within the system of Environmental Education and Outreach (EEO). However, it is desirable to further strengthen the emphasis on the circular economy in these activities.

One measure is currently proposed for specific objective 3:

Measure Objective SO6/III/a	Development and implementation of a communication strategy for various target groups

The purpose of this measure is to better coordinate and target the city's informational and outreach campaigns. This means preparing an overview of ongoing activities related to outreach and education in the field of circular economy (at the level of the city, PCD or private entities), naming the main target groups that can be agents of change, and preparing or supplementing existing tools and methods with those that can contribute to more effective outreach to selected groups of the public and their involvement in CE activities.

- see Appendices, List of Project Cards, Strategic Objective 6 Support for Entrepreneurship, Innovation, and Outreach: **Communication strategies in the circular economy**

7 — Management and Implementation

Strategic objective SO7 ● Manage, coordinate, and evaluate the implementation of the CE Strategy

This Strategy presents a framework for the city's activities aimed at transitioning Prague to a circular economy. It proposes 73 model measures and establishes a set of concrete projects in the form of 37 project cards, which are the first step towards implementing the Strategy and are the foundation of its action plan.

The Strategy for Transition to a Circular Economy is part of the city's 'climate package' and assumes close coordination with other strategic documents (see the map of strategies on page 11).

If the approval of this Strategy by the city authorities is to be the starting point of the process to transition to a circular economy, then project management with a project team, an action plan, and indicators to monitor status and development in each area are needed. Prague does not yet have unified data or a set of baseline indicators to form a basis for informed decision-making.

The success of the strategy in terms of concrete results and the implementation of projects with a real impact on the consumption of resources depends to a large extent on coordination within PCH, cooperation with city organisations, Prague's companies, and the private and civil sectors. Bridging sectors, communication platforms, outreach campaigns, and education are essential in order to create an ecosystem that can generate new practices, products, and services, both within and outside the city and city organisations. PCDs have an important role to play in the coordination and management of activities aimed at achieving a circular economy, where their involvement is expected in the form of intermediate projects, as well as in their participation through platforms for sharing good practice, education, and outreach activities in the field of circular economy.

The clear communication of circular economy themes, the goals and measures of the 2030 Strategy for Transition to a Circular Economy, and reports on their implementation, can be considered a separate area.

To achieve strategic objective 7, we propose focusing on the following three specific objectives:

- SO7/I: Establishing project management for the implementation and development of action plans
- SO7/II: Setting indicators for the circular economy (CE)
- SO7/III: Communicating the objectives of the Strategy and their implementation

Specific objective SO7/I	Establishing project management for the implementation and development of action plans

Measure **Objective SO7/I/a**	Establishing a project committee and the position of coordinator

This measure is an essential step in setting up project management. A steering committee with a cross-sectional representation of the individual themes of the Strategy (at the level of relevant councillors or heads of departments), and an executive unit in the form of the newly established position of Circular Economy Coordinator within the EPD PCH.

Cities such as Amsterdam, Brussels, Ljubljana, London, Paris, Rotterdam, and others have already established the position of a Circular Manager.[51]

51 Cities and regions going circular: Circular economy vision, policies and tools | The Circular Economy in Cities and Regions : Synthesis Report | OECD iLibrary (oecd-ilibrary.org)

Mesure **Objective SO7/I/b**	Preparation of action plans at biannual intervals

The list of project cards serves as the basis for the first action plan of the Strategy. It is desirable to keep these cards and project plans up to date and to monitor whether or not they are moving towards implementation. They should be submitted to the Prague City Council on an annual basis. A report on the implementation of the action plan for the Strategy should be submitted to the Prague City Council annually and the action plan should be updated at two-year intervals by resolution of the City Council.

Specific objective SO7/II	Setting indicators for the circular economy (CE)

Measure **Objective SO7/II/a**	Data availability analysis for necessary data

The main objective of the Strategy for Transition to a Circular Economy is to reduce CO_2 emissions and the carbon footprint of the city. However, the city does not have (or does not collect or monitor in a coordinated way) the necessary data to make such calculation. Analysing the availability of the data needed to evaluate trends in the city's carbon intensity is the first proposed step, in cooperation with those departments and organisations which are already involved in data tracking (IPR, OICT, Pražské služby, a.s., and others), and including the involvement of academic departments or private entities.

> An example of good practice is the pilot project named Carbon Footprint Savings, run by Prague Public Transit Company in its Transport Connection Finder. The CO_2 savings for a given connection are based on the difference in carbon dioxide emissions between a public transport journey and an average car taking the same or a similar route from a given starting point to a given destination. In the case of comparable journeys, indirect emissions (related to vehicle operation and fuel production) are also included in these calculations.

Link: www.dpp.cz/spolecnost/aktuality/detail/66_1489-uspora-uhlikove-stopy-ve-vyhledavaci-spojeni

Measure **Objective SO7/II/b**	Proposing a set of indicators to measure the transition to the circular economy

The core of this measure is to prepare a set of indicators that will be communicable and informative on emission and material savings in the individual monitored areas. The premise is to use data already monitored by the city and to work in coordination with other city strategies on a uniform set of indicators and their regular evaluation.

- see Appendices, List of Project Cards, Strategic Objective 7 Management and Implementation: **Developing a set of indicators for the circular economy**

Specific objective SO7/III	Communication of the objectives of the Strategy and their implementation

Measure **Objective SO7/III/a**	Establishing a website for the CE transition Strategy

The website will provide information on the strategic and specific objectives adopted, and on model measures, background

analyses, and good practices at home and abroad. It will also provide information, in layman's terms, on developments in the implementation of the Strategy, on monitored indicators and implemented projects, and will publish action plans and subsequent reports on their implementation.

Measure **Objective SO7/III/b**	Setting up the communication of monitored indicators and their use in city management

This measure is based on the experience of cities that are already working on similar strategies, have set indicators, and use them for outreach and city management.

> The City of Amsterdam[52] has initiated the development of an online platform to communicate directly with all stakeholders in the city (residents, companies, institutions) to inform them in real time, and in an interactive way, about what is happening in the city and about important stakeholders in the fields of sustainability and CE.

> Glasgow is working with the University of Strathclyde to set up a set of indicators to measure the impact of the Circular Glasgow platform. It focuses primarily on key indicators: business engagement, potential carbon savings, and potential job creation.[53]

Measure **Objective SO7/III/c**	Networking and coordination with PCDs

Closer cooperation and coordination between PCH and PCDs will be needed to achieve the set objectives in individual areas. This is the case in the waste sector, where the proposed changes will require cooperation and support from the public, and therefore the help of PCDs with education and outreach. Another area is responsible public procurement, which can be supported by sharing experiences and providing methodological support across the city. An additional example is the introduction of circular practices into schools that have been founded by PCDs.

- see Appendices, List of Project Cards, Strategic Objective 7 Management and Implementation: **Networking and workshops for city districts**

52 https://amsterdamsmartcity.com/about

53 https://www.c40.org/researches/municipality-led-circular-economy

III — Appendices

Evaluation of the Measures Proposed in the Thematic Chapters 1–4

The proposed measures are evaluated by qualified estimations (with the support of the consultants Circle Economy) based on three categories that may affect the resulting feasibility and potential impact of each measure:

Circular Impact: What is the environmental, social, and economic impact of the measure? To what extent does it promote circularity within Prague?

Technical feasibility: Is there adequate technology to implement the measure? Are the technical staff and knowledge available?

Economic viability: How costly will it be to implement the measure on a large scale? Are there examples of functional projects with the same intention?

These three categories are scored for each measure on a scale of 1 to 3:

Low ●○○
Medium ●●○
High ●●●

SO1 **Reduce the consumption of primary raw materials and increase the efficiency of material flows in the construction**	Circular impact	Technical feasibility	Economic viability
Utilising digitalisation for material records with the aim of their further application	●●●	●●●	●●●
Support for material sharing platforms and reuse infrastructure	●●●	●●○	●●○
Require controlled deconstruction of buildings and preparation for the recycling of materials at the demolition site (pre-sorting, shredding, etc.) in public procurement	●●●	●●○	●●●
Increase demand for recyclables by incorporating a requirement for their use in public procurement where appropriate	●●○	●●●	●●●
Education of and outreach to the city's employees, city organisations, and PCDs about the possibilities of using recyclables (concrete, reinforced concrete, glass, plasterboard, etc.) and other environmental criteria in public procurement	●●●	●●●	●●●
Incorporate the demands of circular principles into Prague's Sustainable Building Code	●●●	●●●	●●●
Support for pilot projects implemented by the city which incorporate circular principles (construction of public amenities, construction of urban housing, etc.)	●●●	●●●	●●●
Infrastructure for education, outreach, and sharing good practice	●●●	●●●	●●●
Lifespan and the variability of possible use (after-life) should be considered when developing projects	●●●	●●○	●●○
Consider the characteristics of the materials used in terms of their sustainability	●●●	●○○	●○○
	●●●	●●●	●●●

SO2 **Reduce rainwater runoff through sewers, increase water and nutrient recycling and reuse, including for energy purposes**	Circular impact	Technical feasibility	Economic viability
Saving drinking water through the use of efficient appliances or by utilising rainwater and grey water	●●●	●●●	●●○
Detecting drinking water leakage	●●●	●●○	●●○
Efficient rainwater management	●●●	●●○	●●○
Use of grey water	●●●	●●●	●●●
Wastewater management and reuse	●●●	●○○	●○○
Use of leachate, drainage, and other waters	●●●	●●●	●●●
Water heat recovery	●●●	●●●	●●●
Utilising the potential and kinetic energy of water	●●●	●●●	●●●
Biomethane recovery	●●●	●○○	●●○
Incineration and co-incineration	●●●	●●○	●○○
Pyrolysis	●●●	●●○	●●○
Use on agricultural land	●●●	●○○	●○○
Composting processes			
Water audit			

SO3 **Reduce food waste, increase local production and consumption of healthy food sourced from urban and peri-urban agricultural production**	Circular impact	Technical feasibility	Economic viability
Preparation of a cooperative model between farmers, the city, and municipal organisations (schools, social facilities, etc.)	●●●	●●●	●●●
Motivate farmers to produce food by providing storage space, compost, or certified digestate	●●●	●●○	●●○
Assessing the production function of urban and subsistence projects with the aim of their possible involvement in the city's regular supply chain	●●●	●●○	●●○
Methodological and mentoring support from the city for the establishment and maintenance of community gardens	●●○	●●○	●●○
Establishing pilot production of an urban farm project	●●●	●●○	●●●
Mapping the potential of decentralised biodegradable waste collection	●●○	●●○	●●●
Coordination with PCDs in promoting community composting and community compost bins	●●○	●●○	●●○
The use of urban/community compost in the maintenance of urban green spaces and agricultural land	●●○	●●●	●●●
Education, outreach, pilot projects in schools (zero-waste), and utilising school grounds	●●○	●●●	●●●
Food waste origin analysis	●●●	●●●	●●●
Promoting food banks and digital platforms for sharing surpluses	●●●	●●●	●●●
Review the availability of suitable urban spaces/rooftops for hydroponic and other forms of urban agriculture	●●●	●●○	●●○
Incorporate green production roofs into sustainable building regulations (as an indicator to be considered during project preparation)	●●○	●●●	●●●
Implement pilot projects of vertical or rooftop productive farms on new buildings belonging to the city or city organisations (schools, social facilities, etc.)	●●○	●●●	●●●
Education, outreach and sharing of good practice, with the involvement of city districts and city organisations	●●●	●●●	●●●

SO4 **Prevent waste; sort, recycle, and reuse as much waste as possible; reduce by 50% the production of mixed municipal waste before 2030**	Circular impact	Technical feasibility	Economic viability
Create an accessible network for reuse services (both physical and online)	●●●	●●●	●●●
Build a reuse centre on the territory of the City of Prague	●●●	●●○	●●○
Promote community and business activities that meet the characteristics of reuse, reduce, and repair activities	●●●	●●○	●●○
Introduce large-scale collection of biodegradable waste (kitchen and plant-based components) from residents by 2026	●●○	●●○	●●○
Secure recycling capacity for converting biodegradable waste into high added-value resources	●●○	●●●	●●●
Supporting at home and community composting	●●○	●●●	●●●
Intensify the collection of packaging waste in the form of household and multi-commodity collection, depending on the type of residential development	●●●	●●●	●●○
Construction and commissioning of a materials reclamation facility for plastic and metal packaging, and beverage cartons	●●●	●●○	●●○
Promoting recycling capacities and closing the flow of materials for other components of municipal waste	●●●	●●○	●●○
Outreach campaign focused on waste prevention	●●●	●●●	●●●
Pay As You Throw (PAYT) economic incentive system for residents	●●●	●●○	●●○
Involve the business sector in the municipal waste management system	●●●	●●●	●●●

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SO1 Construction

Strategic Objective SO1 ● Reduce the consumption of primary raw materials and increase the efficiency of material flows in the construction industry

PC1	**Circular guidelines for sustainable construction**
Strategic objective	SO1 Reduce the consumption of a primary raw material flows in the construction industry
Project description	Incorporating circular principles into the Sustainable Building Code will promote their use in practice. The Code is a methodological guide for the preparation of specifications and the setting of quality parameters for tendering procedures for renovation or new construction. The Code includes a list of requirements, with the proviso that their applicability should always be assessed in relation to the specific case. The Code focuses on prioritising the reuse and/or refurbishment of buildings (new use) and setting requirements for circular construction and subsequent green/zero-waste operation. It encourages the multi-functionality of buildings over time as well as plans to encourage the on-site separation and recycling of municipal waste. The Code should include reversibility, resource recovery, and recycling as part of mainstream requirements which today would include energy efficiency or the carbon neutrality of buildings across their life cycle. For this, there are already a number of methods and indicators that can be applied (LCC, LCA, material passports), EN and ISO standards for building construction, Level(s): the European Framework for Sustainable Construction, the Removable Building Design (RBD) protocol/tool, the use of materials with an Environmental Product Declaration, ISO standards for DfD/A (ISO 20887), and others.
Project goal	Incorporate circular principles into the Rules for Sustainable Construction of the City of Prague and promote their use in new construction and reconstruction projects by providing methodological guidance on what can be applied and under what circumstances.
Responsibility for preparation/ implementation	IPR
Project partners	INV PCH, EPD PCH, PDS
Implementation timetable (quarter)	Completion of the implementation within the TAČR research project
Estimated budget and source of funding	
Indicators – outputs, impacts (CO_2, material savings, etc.)	Number of projects implemented using circular principles/year. Savings in building materials (t/year) Savings in CO_2 (t/year)

PC2	TSK circular guidelines for sustainable construction
Strategic objective	SO1 Reduce the consumption of primary raw materials and streamline material flows in the construction industry
Project description	The project will contribute to the increased recycling and management of R-material and material surpluses. In the first step, TSK in cooperation with CTU (Faculty of Civil Engineering) is preparing a technical regulation: 'Use of R-material in asphalt mixtures in road structures under the administration of the City of Prague'. The aim of the regulation is to streamline the management of R-material generated during the milling process in the repair of asphalt pavements. Another objective is to apply the principles of circular economy, i.e. to increase the amount of R-material added to asphalt mixtures well beyond what is allowed by the existing outdated technical regulations. TSK will thus significantly support a reduction in the consumption of non-renewable resources, i.e. asphalt binder and aggregates. The newly introduced R-material management policy will reduce the amount of landfilled material and the costs associated with landfilling. In the second step of the process, after the implementation of the above-mentioned regulation and its initial verification in practice, TSK will focus on the transport mechanism of the recycled material, where the aim is to minimise the total transport paths and therefore emissions. In the preparation of construction (reconstruction, repair, and maintenance), TSK will focus on finding a suitable location for the storage of R-material and will give priority to its use in the nearest given location, always maintaining the appropriate quality parameters. The aim is to ensure that the management of R-materials and surplus materials in general is such that their use in the immediate vicinity is maximised, and surplus materials are transported over minimum distances.
Project goal	Incorporate principles for the recycling and circular use of R-material into the implementation of reconstruction, repair, and maintenance of TSK Praha a.s., (or provision of methodologies, documents and infrastructure to other HMP units by TSK).
Responsibility for preparation/ implementation	TSK
Project partners	CTU Prague (Faculty of Civil Engineering), PII, z.ú
Implementation timetable (quarter)	Start of work on the recycling regulation 10/2021, pilot projects underway from 5/2022. Followed by the implementation and management phase of R-material in the second half of 2022, possibly involving otherPCH units.
Estimated budget and source of funding	5 mil. CZK TSK, grant support
Indicators – outputs, impacts (CO_2, material savings, etc.)	Number of projects implemented using circular principles/year Savings in building materials (t/year) Savings CO_2 (t/year)

PC3	Pilot testing of circular principles for public amenities
Strategic objective	SO1 Reduce the consumption of primary raw materials and streamline material flows in the construction industry
Project description	In preparation for the construction of new civic amenities (schools, kindergartens, playgrounds, etc.), procedures for possible circular solutions will be gradually piloted throughout the entire life cycle of the building (construction, operation, subsequent modifications, and deconstruction). Once all options have been evaluated (in the form of a checklist), the solutions selected as feasible will be incorporated into the projects. As part of pilot testing, the Investment Department will be provided with expert support in the preparation and evaluation of the checklists and subsequently in the preparation of the circular procurement documents. Furthermore, a procedural approach to preparing such complex projects will be analysed and proposed, so that all necessary entities can be involved in their preparation, and comments related to the legislation, as well as to the objectives and other strategic documents of the City of Prague, can be expressed. The result will be compiled into an implementation manual.
Project goal	With expert external support, to pilot the implementation of circular solutions in the construction of school buildings (school facilities) and to prepare recommendations/ manuals for the procedural preparation of such projects.
Responsibility for preparation/ implementation	INV PCH, EPD PCH, SD operators
Project partners	UCEEB CTU, selected law firm experienced in circular procurement, PII, z.ú
Implementation timetable (quarter)	Start Q2/Q3 2022 End 2023
Estimated budget and source of funding	1 200 000 CZK PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Number of circular solutions applied in pilot verifications Estimated material savings of circular solutions CO_2 savings over the whole life cycle of the building Manual and checklists for the preparation of amenity projects / technical seminar

PC4	**Pilot circular projects in urban housing construction**
Strategic objective	SO1 Reduce the consumption of primary raw materials and streamline material flows in the construction industry
Project description	PDS has been entrusted with 500,000 m2 of land for the preparation of residential construction in Prague. Among other factors, the methodology of the Investor's Assignment for Urban Rental Housing (Assignment-investor-for-urban-housing- development.pdf (pdspraha.eu)) also considers selected principles related to saving resources and recycling. An example of such a solution in the context of the housing crisis of recent years is so-called modular construction, i.e. the serial production of prefabricated modules, with quality control in production and their assembly on site. The advantage of this solution is its respect for the environment and the surrounding buildings, speed of construction, and quality. By taking into account the entire life cycle of the structure, including its disposal at the end of its useful life, this method of construction also minimises the carbon footprint and reduces costs. The total investment cost of the project is 20–30% lower if implemented by a public entity (e.g. PDS). This model has been tested in developed markets in Scandinavia and the UK. Currently, a pilot implementation of a modular building for municipal rental housing (construction of approx. 30 rental flats) is being prepared in the vicinity of the Ládví metro station, with the assumption that this solution will allow the preservation of existing parking spaces, which are scarce at this location. This approach can be used in other locations as well.
Project goal	Pilot testing the possibility of using modular buildings for municipal rental housing, incorporating sustainable construction requirements, including circular principles.
Responsibility for preparation/ implementation	Pražská developerská společnost (PDS)
Project partners	IPR
Implementation timetable (quarter)	
Estimated budget and source of funding	
Indicators – outputs, impacts (CO_2, material savings, etc.)	material savings

SO2 Water

Strategic Objective SO2 ● Reduce rainwater runoff through sewers, increase water and nutrient recycling and reuse, including for energy purposes

PC5	**Biochar TSK**
Strategic objective	SO2 Reduce stormwater runoff through sewers, increase water recycling and reuse, including energy
Project description	TSK actively promotes the standards of blue-green infrastructure (BGI) and Pražské stromořadí. In order to manage rainwater and provide suitable conditions for tree growth in public spaces, BGI elements using structural substrate are applied, especially in the Nordic countries. The purpose of structural substrates is not only to retain and gradually release rainwater, but also to provide a porous environment in the root zone of trees to allow soil gas exchange and high water permeability so that there is no risk of over-saturation. Due to its specific properties, the structural substrates include so-called biochar, which is produced by the thermal decomposition of biomass during pyrolysis, and is therefore a good example of circular economy in practice. Another benefit of using biochar in structural substrates, or as a soil additive in general, is the capture (sequestration) of CO_2. Another positive impact is the ecological incineration of bio-waste.
Project goal	To reduce the consumption of primary raw materials and to make material flows more efficient through the production of biochar by pyrolysis. Biochar production, combustion of bio-waste by pyrolysis.
Responsibility for preparation/ implementation	TSK
Project partners	Lesy hl. m. Prahy, IPR PCH
Implementation timetable (quarter)	Start 2022 End ongoing
Estimated budget and source of funding	100 mil. CZK TSK, subsidy opportunities
Indicators – outputs, impacts (CO_2, material savings, etc.)	Number of projects implemented using circular principles/year Weight of treated bio-waste

PC6	Horizon 2020 Wider uptake
Strategic objective	SO2 Reduce stormwater runoff through sewers, increase water recycling and reuse, including energy
Project description	The Horizon 2020 Wider Uptake project is currently underway to assess the safe use of recycled water for green watering and industrial or agricultural use. The project at CWTP Praha is monitoring the content of pollutants, including residues of pharmaceuticals and hormonal preparations, in plant biomass after passing through a soil filter with vegetation using different sources of irrigation water – raw river water from the Vltava River, pre-treated wastewater at the outflow from the CWTP and water at the outflow treated by membrane filtration and UV radiation. The output of the project will be, among other things, an economic assessment of recycling, including distribution to the nearest potential points of use where drinking water is still being used for irrigation, i.e. Stromovka Park, ZOO and Botanical Garden.
Project goal	To verify the effect of selected final treatment methods for treated wastewater discharged from NVL CWTP on selected species of urban greenery.
Responsibility for preparation/ implementation	University of Chemistry and Technology, CTU, PVS a.s.
Project partners	PVK a.s.
Implementation timetable (quarter)	Start 2020 End 2023
Estimated budget and source of funding	2.135,225 EUR EU Funds, SME Executive Agency (EASME)
Indicators – outputs, impacts (CO_2, material savings, etc.)	Economic assessment of water recycling from the CWTP, including distribution to the nearest potential points of use

PC7	Biomethane, use of sewage sludge gas in the CWTP, Prague
Strategic objective	SO2 Reduce stormwater runoff through sewers, increase water recycling and reuse, including energy
Project description	The pilot project seeks to verify technology for treating biogas obtained in the sludge management of the central wastewater treatment plant (CWTP) during the treatment of Prague sewage sludge by anaerobic stabilisation, including the injection of the resultant BioCNG into the medium pressure gas pipeline network.
Project goal	To verify the transformation of biogas into BioCNG and its injection into the Prague medium pressure gas network.
Responsibility for preparation/ implementation	Pražská vodohospodářská společnost a.s.
Project partners	Pražské vodovody a kanalizace a.s..
Implementation timetable (quarter)	Start Q3 2019 End Q1 2024
Estimated budget and source of funding	66,365,000 CZK, excluding VAT PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Amount of BioCNG (m^3/year) Savings CO_2(t/year)

PC8	**Sewage sludge treatment**
Strategic objective	SO2 Reduce stormwater runoff through sewers, increase water recycling and reuse, including energy
Project description	The sludge management of the central wastewater treatment plant (CWTP) in Prague, designed and implemented according to a basic concept in the 1960s, requires modernisation. The project is currently working on a modernisation concept that aims to maximise biogas production, ensure its optimal energy use, and provide further efficient energy processing of the anaerobically stabilised dewatered sewage sludge.
Project goal	To propose a target solution for the modernisation of sludge management at the CWTP, including optimal energy utilisation.
Responsibility for preparation/ implementation	Pražská vodohospodářská společnost a.s.
Project partners	Pražské vodovody a kanalizace a.s..
Implementation timetable (quarter)	Start Q4 2020 End Q4 2022
Estimated budget and source of funding	20 mil. CZK, excluding VAT PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Amount of BioCNG (m^3/year) Savings of CO_2(t/year)

PC9	**Water audit**
Strategic objective	SO2 Reduce stormwater runoff through sewers, increase water recycling and reuse, including energy
Project description	A water audit is one of the basic pillars of integrated water management in municipalities. It consists of a comprehensive analysis of water management. It covers water resources, water demand and use, as well as the subsequent treatment of wastewater or seepage, and the regulated discharge of rainwater. The audit establishes objectives, principles, priorities, recommended or binding parameters, and design procedures for conceptual and development measures to support the sustainable management of water and related energy. The water audit also predicts abstractions and the variability of water demand in the foreseeable future, for adaptation to climate change according to an area's expected development. Due to the comprehensiveness of a water audit, the outputs are useful not only vis-à-vis water management issues and for spatial planning purposes, but also for other government authorities, e.g. water authorities, crisis management departments, and regional sanitation stations during emergencies. The audit will be prepared in stages – first, the methodology will be prepared in different versions according to level of detail and the involvement of other organisations and municipalities, and it will then be piloted in the selected area. After evaluation, it will be possible to extend it to the territory of the Capital City of Prague.
Project goal	To prepare a comprehensive analysis of water flows, from sources to discharges – existing and future – in the territory of the capital city Prague, not only for implementing the principles of the circular economy in water management, and implementing adaptation and mitigation measures to climate change, but also for the purpose of dealing with emergencies.
Responsibility for preparation/ implementation	EPD PCH
Project partners	PVS, a.s., CTU, Faculty of Civil Engineering
Implementation timetable (quarter)	
Estimated budget and source of funding	2 mil. CZK (1st stage) PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	variable according to the type of measure/object

SO3 Agriculture and food

Strategic Objective SO3 ● Reduce food waste, increase local production and consumption of healthy food sourced from urban and peri-urban agricultural production

PC10	**On-line market for school canteen**
Strategic objective	SO3 Agriculture and food – reduce food waste, increase local production and consumption of healthy food sourced from urban and peri-urban agriculture
Project description	An online marketplace, where the supply of agricultural products and the demand of school canteens can meet, is a way to increase the consumption of organic products on the part of the city (gastro, canteens) and thus support urban and peri-urban organic farming. There is clearly an interest from school canteens in healthy, local products (especially from smaller school canteens in kindergartens) and some are already trying to link up with specific food producers. The online marketplace, sponsored by the municipality and also supported by market-linked services, e.g. delivery services supplying products to school canteens (ensuring deliveries in smaller packages, cleanliness, etc.) will allow canteen operators to plan menus that include local produce. The online marketplace will also include a discussion forum for the possible sharing of experiences and gathering of suggestions for the gradual improvement of the whole system for ordering and supplying local agricultural products. The basis of the system will be those schools that are already interested in local (organic) products, and who may gradually be joined by other actors, either school canteens or agricultural suppliers.
Project goal	To promote the consumption of healthy food from urban and peri-urban agriculture in Prague schools.
Responsibility for preparation/ implementation	PCH/Education Department
Project partners	OICT
Implementation timetable (quarter)	Start 2022/23 End launching 2023
Estimated budget and source of funding	
Indicators – outputs, impacts (CO_2, material savings, etc.)	Number of entities linked to the online marketplace (schools/producers) Quantity of products purchased through online marketplaces (t/year)

PC11	Urban agriculture master plan
Strategic objective	SO3 Agriculture and food – reduce food waste, increase local production and consumption of healthy food sourced from urban and peri-urban agriculture
Project description	The demand for areas with a potential productive function in Prague is growing. At the same time, there is a lack of overview of developments and current needs in this area. The historically prepared master plans for community gardens or garden settlements are outdated as new areas are being created (e.g. productive roof farms, private or municipal plots, newly connected to the city's food supply). Urban agriculture also includes orchards on municipal and private land. In order for the city to effectively support the development of urban agriculture and the demand for urban agriculture products, it needs to know the current status, needs, and trends, which can be ascertained by regularly updating data in two-year cycles by preparing an urban agriculture master plan.
Project goal	Regularly obtain up-to-date data on developments and needs in urban agriculture (acreage, production, ensuring distribution) in two-year cycles
Responsibility for preparation/ implementation	EPD PCH
Project partners	IPR, OICT ?
Implementation timetable (quarter)	Start 2022 End two-year cycles
Estimated budget and source of funding	PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Area of land allocated for productive functions (ha) Quantity of local agricultural products for consumption (t/year) Number and area of community gardens

PC12	Pilot urban productive farm
Strategic objective	SO3 Agriculture and food – reduce food waste, increase local production and consumption of healthy food sourced from urban and peri-urban agriculture
Project description	The urban productive farm is a proven concept in many European cities. This project proposes to pilot its implementation on the territory of the capital city of Prague. If the concept proves successful, it can be an inspiration for the creation of other such farms, which can have a range of different concepts – organic farming, regenerative agriculture, hydroponics, or aquaponics. An essential part of such farms, apart from the food production itself, is also organic education and outreach, new approaches to food production and processing, as well as the inclusion of disadvantaged groups in the labour market. A good example is the network of such farms in the UK (https://www.farmgarden. org.uk).
Project goal	To support urban agriculture and social integration by implementing an innovative project linking local food production with environmental and social aspects.
Responsibility for preparation/ implementation	EPD PCH
Project partners	
Implementation timetable (quarter)	Start 2022/23 End
Estimated budget and source of funding	PCH, EU funds
Indicators – outputs, impacts (CO_2, material savings, etc.)	

PC13	Food waste analysis
Strategic objective	SO3 Agriculture and food – reduce food waste, increase local production and consumption of healthy food sourced from urban and peri-urban agriculture
Project description	Prague does not yet have an overview of where and how food is wasted. The proposed project will focus on food flows in city-established organisations (schools, social and health facilities, etc.) and in the private sector (canteens and restaurants). Based on the findings, measures will be primarily proposed to promote the prevention and reduction of food waste (targeted outreach campaigns, sharing of surpluses, food donation, reuse of surplus food for commercial sale, etc.) and only secondarily to address recycling. Once the city has more accurate data on flows of food surplus and food waste, it can set short- and long-term targets and evaluate success in reducing waste.
Project goal	Obtain data on food waste in city-established organisations and the private sector in order to propose measures to prevent food waste in these facilities
Responsibility for preparation/ implementation	EPD PCH
Project partners	
Implementation timetable (quarter)	
Estimated budget and source of funding	up to 1 mil. CZK, Horizont Evropa programme, PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Quantified potential food waste savings (t/year) Proposal for recommendations for specific actions to prevent food waste

PC14	Online platform for sharing ready-made food
Strategic objective	SO3 Agriculture and food – reduce food waste, increase local production and consumption of healthy food sourced from urban and peri-urban agriculture
Project description	The intention of the online platform project for donating food from canteens and catering, including from city facilities (e.g. schools), is to enable the linking up of catering operations, distribution companies, and beneficiaries (charities/food banks). The ready-to-eat meal sharing platform, based on an opensource solution for IOS and Android operating systems and a web platform, will differ from existing food sharing apps in that it will not focus on food distribution to individuals, but to charities, and will also be usable for city and municipal organisations (e.g. for handling leftovers from catering orders).
Project goal	Food waste prevention
Responsibility for preparation/ implementation	EPD PCH
Project partners	OICT?
Implementation timetable (quarter)	
Estimated budget and source of funding	Horizont Evropa programme, PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Number of meal portions shared Number of active users Attendance

SO4 Waste

Strategic Objective SO4 ● Prevent waste; sort, recycle, and reuse as much waste as possible; reduce by 50% the production of mixed municipal waste before 2030

PC15	**Circular Map of Prague**
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	This concerns the creation of an online portal that will provide citizens of Prague with all available information on the possible ways to dispose primarily of bulky waste, but also other older, but still functional items that owners want to get rid of. This portal will serve as an online signpost. After entering the necessary parameters, it will 'advise' the user on how to dispose of the object in the most efficient way, ideally outside of the waste regime. The portal is therefore seen primarily as a measure to reduce municipal waste production. It is linked to partner repair, donation, and collection services that can subscribe to the platform, and it is anticipated that new services will also be added. An integral part of the portal is displaying the location of individual services on a map of Prague – the so-called Circular Map, where users can find available services and activities in different parts of Prague based on the principles of Reuse or Repair. The first steps have already been taken to prepare the portal. The expected launch date is estimated for the end of 2022.
Project goal	To reduce the amount of bulky waste being produced in the territory of the Capital City of Prague by increasing awareness of the possibilities and services available for its reuse
Responsibility for preparation/ implementation	EPD PCH
Project partners	The technology supplier will be selected on the basis of a tender procedure in accordance with Act No. 134/2016 Coll., on public procurement. Project partners. Prague, Prague Services a.s., organizations that are already cooperating with the city on waste prevention projects in Prague
Implementation timetable (quarter)	Start Q2/Q3 2022 End
Estimated budget and source of funding	4,847,000 CZK, excluding VAT – includes platform implementation, SLA, extended support for one year, PR and Marketing strategy design, PR/marketing implementation for one year, publication plan, editorial PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Total amount of bulky waste (t/year) Number of active portal users Portal traffic

PC16	**Fashion HUB**
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	In cooperation with Pražské službami a.s., discussions are currently underway regarding the realisation of a space suitable for the creation of a circular hub, i.e. a place of education and the synthesis of circular ideas and principles. The space in the Štěrboholská Fashion Arena, with an area of almost 250 m2, is proposed as suitable. In addition to an information booth, educated staff, and facilities, the place should demonstrate 'slow fashion', its benefits, and positive environmental impact. In addition to this function, it is proposed to create a space for swapping textiles, which has recently become increasingly popular among the citizens of Prague. Furthermore, creative workshops could be held here, focusing on sewing, repairing, or improving – so-called 'upcycling'.
Project goal	Education in the field of CE, support for local designers participating in slow fashion, demonstration of the change in society's consumption habits.
Responsibility for preparation/ implementation	EPD PCH, Pražské služby a.s.
Project partners	PCH
Implementation timetable (quarter)	Start Q1 2022 End
Estimated budget and source of funding	PCH, OPE Subsidy titles
Indicators – outputs, impacts (CO_2, material savings, etc.)	Material savings Number of visitors

PC17	**Expanding the network of RE-USE points**
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	The term 'reuse point' refers to a place in a collection yard where Prague citizens can drop off items they no longer need but someone else could still benefit from. It works like a box or a container with an attendant, and the items are offered for free. It is an offer to pre-sort items that would otherwise end up in the collection yard as waste. The reuse point operator uploads the item to the nevyhazujto.cz app. Priority for pickup is given to non-profits, after a 7-day period the item will be displayed for everyone. Currently, there are three reuse points operating in Prague, and plans are underway to expand the network within the context of other collection yards. The ambition would be to cover the territory of the Capital City of Prague evenly, and to ensure the availability of reuse points in all municipalities by 2030.
Project goal	To reduce as efficiently as possible the amount of bulky waste handled annually by the Capital City of Prague and to build a network of reuse points at all the capital's collection yards by 2030.
Responsibility for preparation/ implementation	EPD PCH, operators of waste collection yards
Project partners	collection services
Implementation timetable (quarter)	Start Q3 2022 End
Estimated budget and source of funding	500,000 CZK/1 reuse point/for 1.5 year PCH, subsidy titles of OPE
Indicators – outputs, impacts (CO_2, material savings, etc.)	Total amount of bulky waste (t/year) Amount of material collected at Reuse points (t/year)

PC18	**Reuse Centre**
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	The Reuse Centre is one of the circular economy's basic tools for waste prevention, although its form and the way it operates may vary. Basically, it is a place where Prague citizens can bring older but functional items that they no longer need, but which would still benefit someone else. Repair/improvement can also take place on site, while educating the citizen about the circular economy. Items will be sold there for symbolic prices, and the assumption is that the proceeds from sales could be used to support a public benefit non-profit project (e.g. public green spaces). Prague will build/operate such a Reuse Centre, available to all citizens, by 2024.
Project goal	To reduce as efficiently as possible the amount of bulky waste annually disposed of by the capital city of Prague. To educate and inform the city's residents about the possibilities of using second-hand, but still functional goods, to 'bust myths' about the quality of second-hand goods, and to promote a responsible approach to individual consumption.
Responsibility for preparation/ implementation	PCH, Pražské služby, PCDs
Project partners	PCD
Implementation timetable (quarter)	Start 2022 End
Estimated budget and source of funding	1,500,000 CZK PCH, subsidy titles of OPE
Indicators – outputs, impacts (CO_2, material savings, etc.)	Total amount of bulky waste (t/year) Quantity of goods offered/transported Number of visitors

PC19	**Iron Sunday**
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	In the context of waste prevention, the creation of community happenings, waste prevention events, known as "Iron Sunday", has been identified as very effective. This name is historically rooted in the community as an opportunity to bring items out into the open, where the material is collected and disposed of. It is a community event where the citizens of Prague have the opportunity to bring their household surplus and in return take away what they need themselves.Along with the exchange of items, education on consumption habits takes place. The event involves organisations that will take care of items that are not collected by citizens at the event venue. Furniture, textiles, crockery, books, houseplants and other household items have great potential for reuse.
Project goal	The aim of the project is to create a schedule of such events in one year on the territory of the capital city of Prague, where, in addition to real waste prevention, sustainable lifestyles and transformation of consumption habits of society are introduced.
Responsibility for preparation/ implementation	PCH
Project partners	PCD, partner organisations involved
Implementation timetable (quarter)	Start 2022 End
Estimated budget and source of funding	400,000 CZK/year – 4 events PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Total amount of bulky waste (t/year) Quantity of goods offered/transported Number of visitors

PC20	Collection and further management of organic/food waste
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	The subject of the project is to continue the coordinated development of and support for the collection of bio-waste of plant origin from the residents of the Capital City of Prague, which is provided for in the city under the contract INO/54/11/010585/2016, concluded between the City of Prague and the Prague Waste Consortium 2016–2025. At the same time, it is necessary to expand and suitably supplement the collection of biological components of plant origin (so-called dry components) with the collection of kitchen residues from the kitchens of Prague households (so-called wet components), which are also significantly represented in mixed municipal waste. A brown collection container for the collection of vegetable bio-waste will be provided free of charge to each building owner from 1 January 2022, if requested. As part of the further necessary intensification of the collection of the organic component in MMW, it is necessary to enable Prague's citizens to sort organic waste within the municipal system. For this reason, in 2021 a pilot test is being carried out to ascertain the interest of citizens, and the appropriate form of collecting kitchen residues from households in different types of buildings. The aim of the test is to ensure their long-term effective collection, either separately (dry and wet components), or together in one collection container. The availability of sufficient and suitable processing capacity of those facilities for recovering the collected commodity, ideally with higher added value (e.g. a biogas plant capacity within a favourable commuting distance), will be essential when deciding which form of collection and further management of collected bio-waste to choose.
Project goal	Gradually reducing the production of mixed municipal waste and increasing the proportion of sorted recoverable components in a way that allows their further use and subsequent application to the soil (certified compost or digestate from a biogas plant).
Responsibility for preparation/ implementation	EPD PCH, Pražské služby a.s.
Project partners	PCD
Implementation timetable (quarter)	Start Q1 2022 End
Estimated budget and source of funding	120 mil. CZK/ year 2022 PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Total amount of sorted bio-waste of plant origin in Prague in t/year) Total amount of sorted bio-waste of animal origin in Prague in t/year) Year-on-year comparison of specific production of mixed municipal waste in t/year

PC21	Bio-waste information campaign
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	The introduction of the citywide collection of organic waste from residents (ensured by the free provision of brown collection bins) will not be possible without the cooperation and active involvement of the public, who must actively participate in the separation of bio-waste in households. The information campaign will be directed **a)** to property owners and residents of the city, so that with the simultaneous operation of the collection of both components of municipal waste, they also know how and where to order specific collection containers and receive basic information support on what belongs or does not belong in each container. They will also receive knowledge on how the collected commodity will be further managed and what its further use will be. Along with the continuous education of property owners and individuals, the campaign will **b)** provide information support to legal entities whose business generates biological waste of animal origin (biological waste from kitchens and canteens), so that they know their legal obligations regarding the management of such waste and actively participate in their implementation.
Project goal	Gradual reduction of the production of mixed municipal waste and increasing the share of sorted recoverable components of municipal waste to increase the sorting rate for municipalities in the Czech Republic as specified in Act No. 541/2020 Coll., on waste.
Responsibility for preparation/ implementation	EPD PCH
Project partners	OMM PCH, PCD
Implementation timetable (quarter)	Start Q1 2022 End
Estimated budget and source of funding	2 mil. CZK/year PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Total amount of sorted bio-waste in Prague in t/year) Year-on-year comparison of specific production of mixed municipal waste in t/year

PC22	Collection of food waste from school canteens
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	The subject of the project is the amassing, collection, and further management of kitchen leftovers from the canteens of school facilities founded by the Capital City of Prague. In the first wave of this project, a total of 28 schools have been brought together and provided with 120 and 30 litre collection containers, free of charge, which are collected from the facilities 2 times a week. Part of the project involves enabling other legal entities (gastro establishments, restaurants) to join this collection system organised by the city. All the collected gastro waste is taken to the biogas plant. Gastro-waste (catalogue number 20 01 08) is listed among those recoverable components of municipal waste that can be included in calculating the sorting rate, as laid down in Act No 541/2020 Coll. on Waste. For this reason, intensifying the collection and further management of gastro-waste, including ensuring that facilities have sufficient capacity for the further management of gastro-waste with higher added value, is one of the main challenges for the future setting of a well-functioning municipal system going forward.
Project goal	Gradual reduction of the production of mixed municipal waste and a proportional increase in the sorted recoverable components of municipal waste, to increase the sorting rate for municipalities in the Czech Republic as specified in Act No. 541/2020 Coll., on Waste.
Responsibility for preparation/ implementation	EPD PCH, Pražské služby a.s.
Project partners	PCD
Implementation timetable (quarter)	Start 2022 End continuous
Estimated budget and source of funding	2 mil. CZK/year PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Total amount of sorted bio-waste of animal origin (i.e. residues from canteens and kitchens; t/year) Year-on-year comparison of the specific production of mixed municipal waste (t/year) Number of establishments involved

PC23	Biogas station
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	The municipal biogas plant represents a final technology for utilising biodegradable waste (with an expected annual capacity of 50 thousand tonnes) that is unsuitable for composting, collected by the company Pražské služby, a.s. from residents and other entities in the territory of the Capital City of Prague. The main output from the operation of the BPS is biomethane (over 4 million m^3 per year), which is mainly intended for injection into the high-pressure gas pipeline and subsequently used in the form of bioCNG as fuel for the collection fleet of PSAS or public transport vehicles.
Project goal	Provide recycling capacity to convert bio-waste into high value-added resources.
Responsibility for preparation/ implementation	Pražské služby a.s.
Project partners	PCH
Implementation timetable (quarter)	Start assumed approx. 2026 End 2028, depending on the implementation method
Estimated budget and source of funding	Approx. 900 mil. CZK, depending on the chosen technology Grant titles, financing through private equity or as a joint venture of PCH/PSAS/other entities
Indicators – outputs, impacts (CO_2, material savings, etc.)	Total amount of MMW treated by BPS (t/year) Total amount of biomethane produced (Nm^3/year) Total amount of digestate or liquor digestate produced (t/year) Fossil fuel savings (l/year)

PC24	Composting facilities and bins for PCDs
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	Horní Počernice has a composting plant operated by the municipal council. Plant bio-waste from the maintenance of local public greenery is collected here, with citizens not being allowed to use the facility. Approximately 1,500 tonnes of bio-waste are brought and processed here annually. The annual production of compost is about 300 tonnes, which is used for maintaining public greenery on the territory of the municipality, but which is also provided free of charge to the municipality's citizens. The limit per property owner with a property number is 0.5 m^3/year. Considering that this example of good practice complies with the principles of circularity, it seems highly desirable to support the development of similar decentralised facilities (e.g. community composters) for the treatment of bio-waste in other districts of the city, either in a mode of operation provided by the municipality or in cooperation with the city, possibly supported by professional non-profit organisations (Kokoza, Ekodomov).
Project goal	Promote the circular management of bio-waste, composting at source and returning nutrients back to the soil.
Responsibility for preparation/ implementation	CD, EPD PCH
Project partners	
Implementation timetable (quarter)	Start continuous End
Estimated budget and source of funding	Example: 8.5 mil CZK are the costs of building a composting plant, the operation of a community composter runs in the thousands of CZK/year
Indicators – outputs, impacts (CO_2, material savings, etc.)	Amount of compost in decentralised facilities per municipality (t/year) Quantity of agricultural products for consumption in Prague (t/year)

PC25	Multicommodity collections
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	The subject of the project is developing and optimising the collection network for usable components of municipal waste, in particular paper, plastics, glass, beverage cartons and metal packaging, and to continuously increase the number of home sites, depending on the financial possibilities of the city, as a means to increase the comfort of sorting for the municipality's citizens. The introduction of the so-called multi-commodity collection of sorted components in one collection container, i.e. the joint collection of plastics, beverage cartons and metal packaging, is perceived primarily as a measure to increase the cleanliness and quality of the collected commodities, and to increase the cleanliness of the surroundings of the collection containers located in public spaces. In the case that the multi-modal collection in public sites is fully implemented, it may also reduce space requirements and improve the public space. The intention behind the multi-modal collection of the usable components of municipal waste is in line with the upcoming project of the company Pražské služby,a.s. for the construction of a sorting line in Chrášt'any for plastics, which will have technology to efficiently sort mixed commodities consisting of plastics, beverage cartons, and metals. Multi-commodity collection is being piloted in the municipality of Štěrboholy, and the town intends to extend this form of collection to all types of buildings.
Project goal	Gradually reducing the production of MMW and increasing the share of sorted usable components of municipal waste and their utilisation, including increasing the efficiency of their collection.
Responsibility for preparation/ implementation	EPD PCH, Prague Waste Consortium 2016–2025
Project partners	PCD
Implementation timetable (quarter)	Start Q2 2022 End continuous
Estimated budget and source of funding	The project does not foresee any burden on the budget of the EPD PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Total amount of sorted recoverable municipal waste in t/year Year-on-year comparison of specific production of mixed municipal waste

PC26	Door-to-door system of waste collections
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	The Capital City of Prague will offer its citizens the possibility to rent separate containers or bags for sorted materials (especially plastic). These are then collected at regular times, according to a schedule, by the collection company. Thanks to the door-to-door sorting system, it will be possible to reduce the amount of waste and increase the volume of recycled material. This system also allows for the greater involvement of residents in the sorting system, and makes it possible to keep records for individual households. Last but not least, it brings greater cleanliness around the container sites. This waste sorting system has been piloted in the municipality of Prague - Štěrboholy and there is potential for its extension to other parts of the capital.
Project goal	By 2030, introduce a door-to-door system in strategically suitable locations within the territory of the Capital City of Prague, with the potential to expand across the entire territory.
Responsibility for preparation/ implementation	EPD PCH, waste collection companies
Project partners	EPD PCH, Pražské služby a.s
Implementation timetable (quarter)	Start 2022 End 2030
Estimated budget and source of funding	EPD PCH OPE
Indicators – outputs, impacts (CO_2, material savings, etc.)	Reducing the amount of MMW Increase in the amount of recycled components CO_2 savings (t/year)

PC27	Materials reclamation facility
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	In 2021, preparations are already underway for the construction of a re-sorting line on the premises of the sorting centre in Chrášt'any; the line will be fully operational in 2022. The new facility will allow for the high-quality re-sorting of packaging components collected at sorted waste sites in the Capital City of Prague within the framework of multicommodity collection. With a capacity of 5t/h and 2 shifts on weekdays, the sorting line will be able to process up to 18,900 tonnes of waste sorted in the Prague city centre, with 90% efficiency separating the individual packaging components, which will enable them to be recycled more easily.
Project goal	To economically, efficiently, and ecologically use the maximum amount of collected packaging materials generated on the territory of the Capital City of Prague.
Responsibility for preparation/ implementation	Pražské služby a.s.
Project partners	M-U-T Maschinen Umwelttechnik Transportanlagen Gesellschaft m.b.H., Austria
Implementation timetable (quarter)	Start Q4 2022 End
Estimated budget and source of funding	Total investment costs 170 million CZK. Pražské služby a.s.
Indicators – outputs, impacts (CO_2, material savings, etc.)	Total amount of plastic packaging sorted (t/year) Total amount of metal packaging sorted (t/year) Total amount of beverage cartons sorted (t/year) Total amount of discards produced (t/year) Total quantity of packaging components entering the sorting line (t/year) Purity of sorted packaging components (% impurities/item) Total quantity of sorted material recovered for recycling (t/year)

PC28	**Slag management**
Strategic objective	SO4 Prevent waste; sort, recycle, and reuse as much waste as possible; reduce the production of mixed municipal waste (MMW) by 50% by 2030
Project description	The incineration plant ZEVO Malešice produces slag at about 25% of the original weight during incineration. Currently, this is about 60,000 tonnes of slag per year, which is taken to the dump. Thanks to a change in legislation, it will be possible to use slag in the construction industry after the necessary treatment. In order to make the construction use of slag possible, it is necessary to build capacities for slag maturation and subsequent metal separation. The technical details of the project are being worked out, but assume the separation of up to 7 kilotonnes of iron and other metals per year. The slag, treated in accordance with the current decree, will be used as one of the layers in road construction.
Project goal	Significantly reduce the amount of material landfilled in the capital. Increase the separation of metals from MWW. Improve the cash flow of PSAS.
Responsibility for preparation/ implementation	Pražské služby a.s.
Project partners	Institute of Chemical Process Fundamentals of the CAS, PCH
Implementation timetable (quarter)	Start Q1 2021 (the preparatory phase is already underway) End Q2 2024 (estimate)
Estimated budget and source of funding	200-300 mil. CZK Pražské služby a.s.
Indicators – outputs, impacts (CO_2, material savings, etc.)	Total quantity of slag deposited in dumps Total amount of metals salvaged Total annual landfill savings Total annual revenue from the sale of sorted metals

SO5 Public procurement

Strategic Objective SO5 ● Increase the demand for circular solutions by incorporating such practices into the city's own projects, guidelines, and public procurement

PC29	**Training module on circular procurement for city employees, city organisations, and PCDs**
Strategic objective	SO5 The city increases the demand for circular solutions by incorporating these practices into its own projects, guidelines, and public procurement
Project description	Preparation of an educational module on responsible procurement focused on circular public procurement within the operations of Prague City Hall, i.e. when purchasing goods and services or procuring construction works. The training module will be prepared by the Prague Innovation Institute (PII) in cooperation with the Public Procurement Department and the EPD, and external lecturers from among experts in circular practices (INCIEN, UCEEB CTU, Institute of Responsible Procurement of the Ministry of Labour and Social Affairs, etc.). The training course will be divided into a general part (on responsible procurement) and thematic parts according to the focus of selected contracts where circular principles can be applied. The thematic part will be conducted in the form of interactive workshops with the involvement of the representatives of potential suppliers (private sector). This includes the preparation of professional methodological documents for city contracting authorities, including a catalogue of standard contracts.
Project goal	To train responsible employees of the city, city organisations, and PCDs on the possibilities of circular responsible procurement, and to create a communication platform for the exchange of experience and further training.
Responsibility for preparation/ implementation	PPD PCH, EPD PCH,
Project partners	PII, z.ú., UCEEB CTU, selected law firm with experience in circular procurements, Ministry of Labour and Social Affairs – Institute for Responsible Procurement, INCIEN
Implementation timetable (quarter)	Start 2022 End 2023
Estimated budget and source of funding	1.8 mil. CZK PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Number of circular solutions applied in city public procurement/year Estimated material savings of circular solutions (t/year) Number of employees of the city, city organisations, and PCDs trained

PC30	Responsible Procurement Strategy
Strategic objective	SO5 The city increases the demand for circular solutions by incorporating these practices into its own projects, guidelines, and public procurement
Project description	The Responsible Procurement Strategy sets out the basic principles to which the city subscribes in the context of responsible public procurement, and describes how and in which areas it will apply them. In addition to environmental considerations (including requirements for circular solutions), responsible procurement also includes socially responsible public procurement, pursuing the involvement of people disadvantaged in the labour market in public procurement. Expert support in the preparation of the Responsible Procurement Strategy can be provided by the Institute for Responsible Procurement at the Ministry of Labour and Social Affairs, which has long been involved in promoting responsible procurement. The Strategy will also include a description of how the city will monitor its implementation and evaluate its benefits. The approval of the Responsible Procurement Strategy by the Prague City Council established an assignment for PCH and specific departments and municipal organisations to apply the principles of responsible procurement in specific areas and for selected types of contracts.
Project goal	Express the political will of the city leadership for the introduction of responsible procurement in specific selected areas, formulate tasks for specific PCH departments and city organisations.
Responsibility for preparation/ implementation	PPD PCH
Project partners	Institute for Responsible Procurement (MoLSA)
Implementation timetable (quarter)	Start Q1 2022 End Q4 2022
Estimated budget and source of funding	PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Responsible procurement strategy adopted by the Prague City Council

PC31	Public contract for the maintenance of greenery
Strategic objective	SO5 The city increases the demand for circular solutions by incorporating these practices into its own projects, guidelines, and public procurement
Project description	The maintenance of public greenery in Prague is provided by companies on the basis of tendered public contracts. Biodegradable waste is taken to municipal composting plants, but it is not always common for the compost produced to be returned to public green spaces. This can be ensured, however, by setting a condition in the tender documentation, as already practiced by the EPD PCH. It is desirable to extend this practice to the public procurement of PCDs and municipal organisations, and to prepare model tender documentation that could be used by PCDs and municipal organisations, and to set up a system to record the use of municipal compost for reuse in the maintenance of green areas.
Project goal	Extend the current practice of PCH/ the EPD PCH in awarding contracts for green maintenance.
Responsibility for preparation/ implementation	EPD PCH
Project partners	CD,city organisations (TSK, Lesy hl.m. Prahy), Pii, z.ú.
Implementation timetable (quarter)	
Estimated budget and source of funding	200,000 CZK PCH, OPE, National Recovery Plan (Component 2.7 Circular Economy)
Indicators – outputs, impacts (CO_2, material savings, etc.)	Seminar: circular principles in green maintenance contracts Sample tender documentation Number of public contracts applying this principle Amount of compost returned to the soil

SO6 Support for entrepreneurship, innovation, and outreach

Strategic Objective SO6 ● The city supports innovation of the business and civic sectors towards a circular economy

PC32	**Circular Prague Platform**
Strategic objective	SO6 The city supports innovation of the business and civic sectors towards a circular economy
Project description	The platform is inspired by similar projects such as Circular London/Amsterdam/Goteborg and is a tool for engaging and connecting companies, and for harnessing their potential to transition Prague over to a circular economy. It will support companies in targeting change, leveraging circular resources, and finding synergies with the city and other companies. The platform establishes a circular ecosystem in the city. It provides inspiration, experience-sharing, education, and professional support to companies and other organisations that are strong players in the local economy and city life, as well as everyday citizens. It has the potential to bring about sustainable ways of operating with high impact and to set up circular flows of large volumes (construction, services, and transport) that do not yet exist. The platform aims to involve dozens of actors from the private, non-profit, and academic sectors, and to work together with the city to find solutions to common problems in the areas of packaging waste, furniture, ICT, and food production.
Project goal	Involving companies in Prague's circular economy and the creation of new projects and initiatives that will bring waste reduction, the efficient use of available resources and materials, as well as new products, services and jobs.
Responsibility for preparation/ implementation	EPD PCH
Project partners	
Implementation timetable (quarter)	Start 2022–2023 End n/a
Estimated budget and source of funding	3 mil CZK/year Horizon, PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Number of companies involved Number of new projects/partnerships/innovations Material savings (t/year) Number of new jobs

PC33	Circular economy education for companies and social enterprises
Strategic objective	SO6 The city supports innovation of the business and civic sectors towards a circular economy
Project description	Education in the application of CE principles in business for SMEs and social enterprises. Preparation of training events and mentoring programmes to provide comprehensive information advice on the circular economy as part of corporate culture, processes, and outputs – products/services. The circular economy as an opportunity for innovation in business, improving competitiveness, engaging social enterprises as one of the target groups, and connecting with companies. This is an extension of the activities of the Business Innovation Centre (BICP) in future cooperation with the Circular Prague platform.
Project goal	Education, mentoring, and the engagement of companies in the circular economy, including social enterprises. Information and mentoring support on waste reduction, efficient use of available resources and materials, as well as innovation for new products, services, and jobs.
Responsibility for preparation/ implementation	PCH
Project partners	PII, z.ú. - PIC, PCH
Implementation timetable (quarter)	Start 2022 Endí 2024
Estimated budget and source of funding	400,000 CZK in 2022 PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Number of companies and social enterprises involved Number of new projects/partnerships/innovations Results in business activity Material/energy savings

PC34	Subsidies for innovation in the circular economy
Strategic objective	SO6 The city supports innovation of the business and civic sectors towards a circular economy
Project description	A new subsidy scheme to support innovation and business development is also an opportunity for projects in the circular economy. The scheme has been created as a tool for implementing the Regional Innovation Strategy of the City of Prague (RIS3) with the aim of supporting the development of the innovation ecosystem in the Capital City of Prague and cooperation between the city, academia, and business. Among the areas of support is also urban innovation – envirotech, climate measures, and the circular economy.
Project goal	To support innovation and the entrepreneurial sector with regard to the city's strategic objectives, to contribute to the development of Prague's innovation ecosystem, its competitiveness, and its internationalisation, especially for SMEs.
Responsibility for preparation/ implementation	PRI PCH
Project partners	
Implementation timetable (quarter)	Start 2022 End 2025
Estimated budget and source of funding	PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Number of supported projects related to the circular economy Results in business activity Material/energy savings

PC35	**Communication strategies in the circular economy**
Strategic objective	SO6 The city supports innovation of the business and civic sectors towards a circular economy
Project description	For the effective implementation of the objectives of the Circular Prague 2030 strategy, it is essential that all actors in the city, especially the inhabitants of Prague, are actively involved. The success of the strategy largely depends on the extent to which the public and various city stakeholders (city and city-managed organisations, PCDs, the private business sector, NGOs, JUAs, and others) can be motivated, within their capabilities, to actively participate in the implementation of the proposed measures. For this purpose, it is necessary to educate and motivate the inhabitants of Prague through targeted information channels, preferably with practical examples of how they can contribute to the circular economy, prevent waste, promote recycling and reduce consumption of primary raw materials. The public should understand what the circular economy is and the concrete benefits of engaging in city projects and applying circular principles to everyday life.
Project goal	Prepare a communication strategy for 2023 and 2024 with the aim to educate in the field of CE and increase the involvement of Prague residents in the city's circular projects, and to influence citizens' conscious behaviour in everyday life.
Responsibility for preparation/ implementation	EPD PCH
Project partners	OMM PCH, PCD
Implementation timetable (quarter)	Start Q1 2022 End 2023–2024
Estimated budget and source of funding	CZK/year Up to 1 mil. CZK PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Developing a communication strategy: Definition of priority themes/communication objectives Definition of target groups Definition of communication strategy tools Definition of impact indicators Definition of the evaluation of the impact of communication campaigns

SO7 Management and implementation

Strategic Objective SO7 ● Manage, coordinate, and evaluate the implementation of the CE Strategy

PC36	**Developing a set of indicators for the circular economy**
Strategic objective	SO7 Manage, coordinate, and evaluate the implementation of the CE Strategy
Project description	The aim is to prepare a set of indicators to measure the shift towards a circular economy (CE) at the level of the Strategy's strategic and specific objectives. The preparation will take place in several steps: 1) analysis of data that the city has available, that it tracks in the implementation of other strategies (e.g. Klimasken, Smart City Index, etc.), and that are applicable for the CE Strategy, 2) identification of data that the city does not yet track and that would be relevant for the CE (e.g. data on food waste), 3) proposal for a procedure to collect the necessary data. Using the research on the most frequently used indicators for CE at city level, and the analysing data of the City of Prague, a set of indicators for the CE will be proposed which will be monitored and presented in the action plans and reports on the implementation of the CE Strategy. The preparation of the dataset will be coordinated with other datasets and coordinators of the city's other relevant strategic documents (Strategic Plan, Climate Plan of the Capital City of Prague, Prague 2030 Climate Plan, PUM, Adaptation Strategy, and Smart Prague), as well as with academic departments and experts specialising in indicators. Coordination will be ensured by the Prague Innovation Institute within the Innovation Platform for Urban Innovation, which is part of the implementation structure of the Prague Innovation Strategy.
Project goal	In coordination with other strategic documents of the city, to prepare a set of indicators at the level of the strategy's strategic and specific objectives, which will be monitored and evaluated in the framework of action plans and reports on the implementation of the Strategy for Transition to a Circular Economy.
Responsibility for preparation/ implementation	EPD PCH
Project partners	PCH, IPR, OICT, PSAS, PII
Implementation timetable (quarter)	Start 2022 End 2022
Estimated budget and source of funding	400,000 CZK PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	Set of indicators for measuring the achievement of the strategic and specific objectives of the strategy

PC37	**Networking and workshops for PCDs**
Strategic objective	SO7 Manage, coordinate, and evaluate the implementation of the CE Strategy
Project description	The creation of a local ecosystem for the circular economy, i.e. a network of collaborating organisations from the public and private sectors that share information, experience and work together on common projects and goals, will be essential for the transition to a circular economy. In addition to PCH, districts representing the public sector are also an important part of this ecosystem. A number of the proposed strategy type actions take place at the municipal level and the support and cooperation of the municipalities with PCH and Prague organisations/companies will be key. The essence of the project is to establish regular meetings between representatives of PCH and the municipalities on specific themes of the Strategy requiring cooperation and coordination. Examples include communication and outreach activities and motivation of the public to engage in waste prevention and separation activities. In addition to sharing experiences, presenting good practices and the possibility of meeting with experts on selected themes, the platform will also be a means of obtaining feedback from the municipalities and better coordination with them in the implementation of new measures. Four meetings per year are foreseen. In addition to up-to-date information, there will be an educational session on new CE themes/projects and an interactive part for sharing experiences and networking.
Project goal	The aim of the project is to ensure better cooperation and coordination in the implementation of the Strategy and its specific measures between PCH and urban districts.
Responsibility for preparation/ implementation	PCH/EPD PCH
Project partners	
Implementation timetable (quarter)	Start 2022 End 2022
Estimated budget and source of funding	400,000 CZK PCH
Indicators – outputs, impacts (CO_2, material savings, etc.)	