

SPARCS

D1.2 Roadmap for Urban Transformation

30/09/2023

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 864242

Topic: LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities

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Deliverable administration				
No & name	D1.2 Roadmap for Urban Transformation			
Status	Released	Due	M48	Date
				2023-09-30
Author(s)	SPI, ESP, LPZ, CMM, KFS, KLD, LVIV, RVK, FHG, VTT			
Description of the related task and the deliverable. Extract from DoA	<p>T1.2 Urban Transformation (SPI) M12 – M60</p> <p>The objective of this task is to initiate the design process of the urban transformation that will be taking place in SPARCS cities, building upon the detailed diagnosis developed in the first task of WP1 (Task 1.1) and systematized in the Characterization Report (D1.1), as well as following the guidelines set in the City Vision aiming at reaching the envisioned city scenario (Task 1.7). The personalized approach undertaken will allow developing a city-tailored strategy to promote a structural transformation directing the city's urban development towards sustainability. To be effective and manageable, it is important that this process starts at a smaller yet representative scale - Positive Energy Districts/Blocks - ensuring a proper scaling up and replication at a later stage. This will lead to the development of a Roadmap for Urban Transformation (D1.2), a strategic document that will demonstrate how the Replication & Scale-up Plans in LHCs (Task 5.5) and the Implementation Plans in FCs (Task 5.4) contribute to achieving the final City Vision 2050 (Task 1.7), underpinned data gathered from the City Diagnosis (Task 1.1) where intermediate milestones for 2030 and 2040 will also be set in order to monitor city's pathway to the desired future scenarios (2050). Furthermore, a relevant set of outputs both informing and supporting a wider urban transformation process in cities will be developed. Among these instruments are: i) a Standardized Implementation Strategy of Energy Solutions on Positive Energy Districts/Blocks (D1.3), building upon information and data gathered from Task 5.1.2; ii) an Energy Solutions Catalogue for Positive Energy Blocks/Districts (D1.4), focusing on specific and integrated sets of solutions leading to the creation of Positive Energy Blocks/Districts in urban ecosystems, relying on information and data gathered from Task 5.1.3; and iii) Recommendations for integrating Positive Energy Blocks in strategic and political city instruments (policies & regulations, masterplans, infrastructure plans, city budget) including recommendations for the national and supranational legislation (D1.5).</p>			
Participants	SPI, VTT, ESP, LPZ, CMM, RVK, KLD, KFS, LVIV, ADV, FHG, BABLE, LSW, ULEI, NEW, CVUT, SUITE5, VERD, NECU, LCE, GOPA			
Comments				
V	Date	Autho rs	Description	
0.1	22/08/2023	SPI	Draft outline, including draft of partner cities' reports	



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0.2	04/09/2023	SPI	Full draft version for peer review
0.3	13/09/2023	VTT	Reviewer comments, inputs and suggestions
0.4	15/09/2023	FHG	Reviewer comments, inputs and suggestions
0.5	27/09/2023	SPI	Deliverable checked by WP leader and released to the Coordinator and the Quality Manager for quality check and subsequent submission to the EC.
1.0	29/09/2023	VTT	Coordinator submits the deliverable to the EC
Dissemination level			
PU	Public		X
CO	Confidential, only for members of the consortium (including the Commission Services)		



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About SPARCS

Sustainable energy Positive & zero cARbon Communities demonstrates and validates technically and socioeconomically viable and replicable, innovative solutions for rolling out smart, integrated positive energy systems for the transition to a citizen-centred zero carbon & resource efficient economy. SPARCS facilitates the participation of buildings to the energy market enabling new services and a virtual power plant concept, creating VirtualPositiveEnergy communities as energy democratic playgrounds (positive energy districts can exchange energy with energy entities located outside the district). Seven cities will demonstrate more than 100 actions turning buildings, blocks, and districts into energy prosumers. Impacts span economic growth, improved quality of life, and environmental benefits towards the EC policy framework for climate and energy, the SET plan and UN Sustainable Development goals. SPARCS co-creation brings together citizens, companies, research organizations, city planning and decision-making entities, transforming cities to carbon-free inclusive communities. Lighthouse cities Espoo (FI) and Leipzig (DE) implement large demonstrations. Fellow cities Reykjavik (IS), Maia (PT), Lviv (UA), Kifissia (EL) and Kladno (CZ) prepare replication with hands-on feasibility studies. SPARCS identifies bankable actions to accelerate market uptake, pioneers innovative, exploitable governance and business models boosting the transformation processes, joint procurement procedures and citizen engaging mechanisms in an overarching city planning instrument toward the bold City Vision 2050. SPARCS engages 30 partners from 8 EU Member States (FI, DE, PT, CY, EL, BE, CZ, IT) and 2 non-EU countries (UA, IS), representing key stakeholders within the value chain of urban challenges and smart, sustainable cities bringing together three distinct but

Partners



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EXECUTIVE SUMMARY

Sustainable energy Positive & zero cARbon CommunitieS (SPARCS) demonstrates and validates technically and socioeconomically viable and replicable, innovative solutions for rolling out smart, integrated positive energy systems for the transition to a citizen-centred zero carbon and resource efficient economy.

In this context, Work Package 1 (WP1) “Urban Transformation Strategy”, and specifically Task 1.2. “Urban Transformation”, aim at defining a multi-layered strategy promoting structural transformation directing the partner cities’ urban development towards sustainability.

Building up on the work developed by the 7 partner cities for the City Vision 2050, the “Roadmap for urban transformation” seeks to identify the pathway that will bridge the gap between the present and the envisioned future. For this the roadmapping process takes into consideration the Key Strategic Areas (KSA) for urban transformation identified by each city as a framework onto which the existing city development strategies, processes and initiatives are organized, as well as the activities being developed under SPARCS project [Replication & Scale-up Plans in the 2 Lighthouse cities (LHCs) and the Implementation Plans in the 5 Fellow Cities (FCs)]. Based on this framework, a participatory process, involving a vast array of stakeholders and experts relevant for the KSA, was developed, resulting in the identification and discussion of the main outcomes (projects, measures, technological developments) that need to be delivered in 2030 and 2040 in order to achieve the desired sustainable future identified for 2050 in the City Vision process.

This deliverable presents the whole process of methodological development and implementation of the roadmap in each partner city. The methodology was tested in two pilot roadmapping workshops held in the city of Kladno and was used by the task forces of the 7 partner cities to develop a tailored approach and implement the roadmapping workshops adapted to their context. As a result, each city developed a roadmap consisting in the graphic representation of their pathway towards sustainability, with specific milestones for each KSA, and the description of the main measures and relevant inputs that contribute to those milestones. Considering that each territory has its specificities, the results also include the description of the roadmapping process and lessons learned, serving as an example for other cities who are following similar paths and wish to implement their own roadmaps towards sustainability.

Complementarily, with the culmination of the roadmapping process, the conditions are set for the development of the final/updated version of the City Vision 2050 (D1.12), which should include the updates and adjustments done by the cities to their KSA and Vision Statements (VS), in the context of the roadmap.

The main chapters that comprise this deliverable are summarised below.

Chapter 1 explains the purpose of the Roadmap in the SPARCS project context, as well as the expected results for the partner cities, focusing on the upstream and downstream relationships with other Tasks and Work Packages. It also identifies the contributions of the consortium partners for the development of the deliverable.



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Chapter 2 focuses on the methodological framework of the roadmapping process, explaining the adaptation of the traditional concept of roadmapping for the SPARCS reality, detailing the development stages of the methodology, as well as the interactions and fine-tuning of the approach to each city's ecosystem. The chapter also explains the local engagement process adopted by each city, and reflects on the lessons learned from the whole process, pointing out the main results achieved.

Chapter 3 comprises the description of the roadmapping process by each partner city, including the preparation, workshops, results (Graphic Roadmap and Key Outcomes, defining the milestones for 2030 and 2040 on each city's pathway towards the desired City Vision 2050), and also the lessons learned and next expected steps on the process.

In turn, **Chapter 4** sums up the main achievements and impacts of the roadmapping process both in terms of the cities' sustainable development process as in terms of the effects on other tasks in SPARCS project. The chapter includes also other relevant reflections and conclusions, highlighting the importance of the roadmapping process for promoting the ownership of both the City Vision and the Roadmap by the cities and contributing to the urban transformation towards a climate neutral future.



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1. INTRODUCTION

1.1 Purpose and target group

The aim of this deliverable is to develop a city-tailored strategy to promote structural transformation that guides the urban development of SPARCS Lighthouse (LHCs) and Fellow (FCs) Cities' urban development towards sustainability. Within WP1, the roadmapping process is closely intertwined with the City Diagnosis (T1.1) and City Vision 2050 (T1.7), acting as a bridging element between these two tasks.

Building upon the data gathered for the City Diagnosis (Task 1.1) and by setting intermediate milestones for 2030 and 2040 for the purpose of monitoring the cities' pathways to the desired future scenario (City Vision, Task 1.7), the Roadmap for urban transformation will also help demonstrate how the relevant activities concerning upscaling and replication in LHCs (Tasks 3.9, 4.7, and 5.5) and the Implementation Plans in FCs (Task 5.4) contribute to achieving this ultimate objective.

Thus, the outcome of the roadmapping process is the development of a Roadmap for Urban Transformation (D1.2), a strategic document, supported by a visual diagram, that will constitute a guiding strategic tool for the cities and a bridging element, allowing the identification and visualization of the key outcomes that must be delivered in each city between the current day and 2050, in order to achieve the Bold City Vision 2050.

1.2 Contributions of partners

The methodology supporting and guiding the Roadmapping process was defined by SPI in close collaboration with KLD and CVUT, who provided essential contribution in the development of the supporting document "Guidelines for the Roadmapping process & Workshop" and also by testing the methodology through the pilot roadmapping workshops and subsequently sharing their experience.

Based on the methodology provided, the local task forces set up in each LHC and FC for this task have executed their respective Roadmapping Workshops by adapting the methodology to the specific context, needs, and challenges of their cities.

The results of the workshops were reported in a "Roadmapping Process and Workshop report", developed by each city and integrated in the present deliverable. In turn, local technical partners have supported partner cities in the preparation and execution of the roadmapping workshops, and in the development of the reports, according to their fields of expertise.

1.3 Baseline

This deliverable is informed essentially across WPs 1, 3, 4, and 5 and makes specific use of baseline information derived from: *T1.1 City diagnosis, data collection & preliminary analysis; T1.7 City Vision 2050; T3.9 Replication and exploitation preparation (Espoo LHC); T4.7 Replication and exploitation preparation (Leipzig LHC); T5.4 Project Development in Fellow City; T5.5 Project Upscaling and replication in LHCs.*



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1.4 Relations to other activities

The table below shows the linkage between the timeline and activities of Task 1.2 with the timeline and activities of other WPs and related Tasks.

WP	Task	Short Description
WP1	T1.1	City Diagnosis provides important info about the current status quo of the LH and FC (M12).
	T1.6	The results of the engagement process developed for the roadmap are summed up in the provided QAT forms will contribute to the D1.10 Social Engagement Tools and Procedures (M60).
	T1.7	Integration with City Vision activities. City Vision – Draft (M20) providing the desired future scenario, Vision Statements (VS) and Key Strategic Areas (KSA) that were used as guidelines for the workshops and Milestones definition in the roadmapping process. From M48, T1.2 will be linked with the Final City Vision providing the necessary updates to the D1.12 (M60).
WP2	All tasks	The Monitoring and Impact assessment tools developed within WP2 could help measure and define expected results from the different key outcomes of the roadmapping process.
WP3	T3.9	Incorporation in the Roadmap for Urban Transformation of preliminary activities concerning replication districts as relevant inputs to achieving the City Vision.
WP4	T4.7	Incorporation in the Roadmap for Urban Transformation of preliminary activities concerning replication districts as relevant inputs to achieving the City Vision.
WP5	T5.3 (Subtask 5.3.1)	Fellow Cities profile providing important info about the current status quo of the FCs / Incorporation of the projects integrating the Implementation Plans (M36) in Fellow Cities as “Key enabling projects/solutions” in the Roadmap for Urban Transformation. Project outlines are helping to achieve the vision.
	T5.4/T5.5	Incorporation of relevant preliminary results of the Project Development (T5.4) in FC and Project Upscaling and Replication (T5.5) in LHCs in the Roadmap for Urban Transformation.



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2. METHODOLOGY FOR THE ROADMAPPING PROCESS

The methodology developed for the roadmapping process sought to provide the necessary framework enabling the LHC and FC to co-create, together with the most relevant stakeholders in the local ecosystem, a strategic tool (Roadmap) that will guide the cities in the pathway to sustainability, between the current day and the Bold City Vision 2050.

This framework builds upon specific features of the participatory process established for the development of the City Vision (Task 1.7), namely the definition of a local task force in each city, the involvement of relevant stakeholders and partners in the context of SPARCS ecosystem, and the development of workshops focused on strategic development areas for the cities (KSA). These elements were combined with complementary inputs deriving from scientific literature and experience in similar processes, resulting in the “Guidelines for the roadmapping process” - a manual with detailed steps, insights, recommendations, and supporting material for the development of the roadmapping activities in each partner city.

As stated before, the methodological framework was developed by SPI in collaboration with KLD and CVUT and was used as a baseline for the pilot roadmapping workshops undertaken in KLD between April and May 2022. After the pilot workshops, the Guidelines document was updated, allowing the transfer of learnings to the other 6 partner cities. Cities received sustained support to implement the methodology through multilateral knowledge sharing calls with the support of KLD and CVUT and bilateral calls conducted by SPI (see section 2.5 The process towards a tailored approach and lessons learned).

2.1 Approach

2.1.1 Conceptual framework

The Roadmap for urban transformation, as part of Task 1.2, shares the objective of contributing to the design process of the urban transformation that will be taking place in each partner city of the SPARCS project. In this sense, the roadmapping process cannot be dissociated from the detailed diagnosis developed under the first task of WP1 (Task 1.1) and systematised in the City Characterization Report (D1.1), on which it builds upon, neither from the City Vision 2050 (D1.11 & D1.12, Task 1.7), which it ultimately aims to fulfil (Figure 1).



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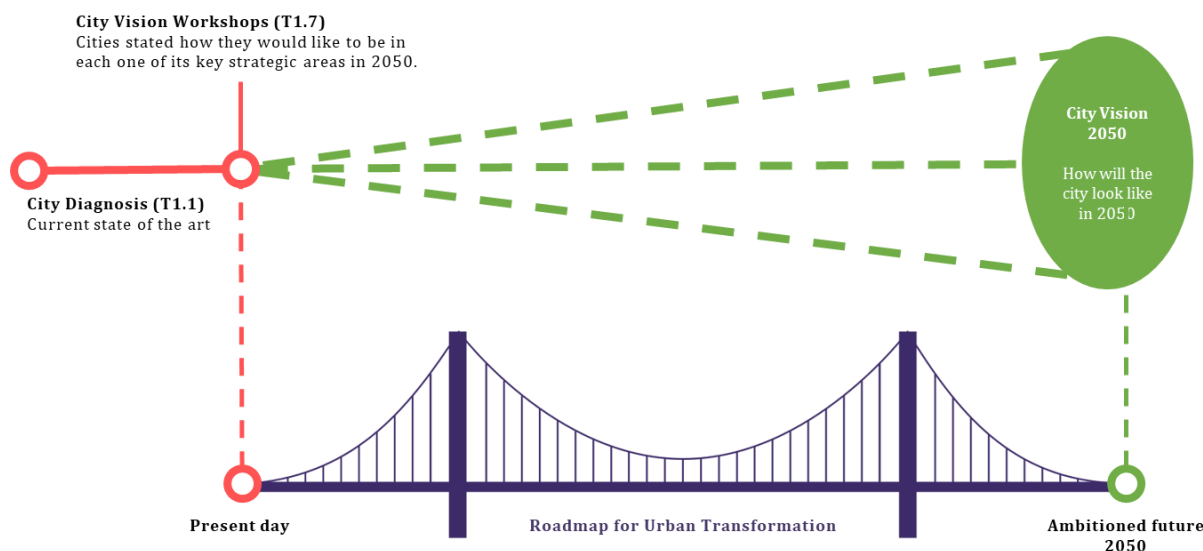


Figure 1. Illustrative diagram representing the roadmapping process

The concept of roadmapping has been “used for strategic planning and technology management” in order to “enable organizations to graphically represent the pathways that are required to achieve goals (...) and realize a vision in a temporal context, (...) bridging the gap between the present and the vision” (Okada et al. p. 168).

In this respect, a roadmap may be developed through workshops and joint activities involving stakeholders and experts, resulting in a graph structure with an enclosed timeline including multiple layers (e.g., market, product, technology, etc.) showing events, actions and linkages between these and across layers. In particular, the design of a roadmap is an “iterative process involving development, analysis, evaluation, and revision, through which the scope and details of the roadmap increase with each interaction” (ibid. p. 168). Therefore, “the most important benefit of roadmapping is considered to be the discussions and exchanges that take place when generating and sharing knowledge at these workshops” (ibid. p. 169). In this sense, the roadmapping process should be understood as a long-term systematic one that should engage ecosystem players over time. These players’ knowledge and available data will help update the medium- and long-term steps (milestones and VS) accompanying the sustainable development of the cities towards the Bold City Vision.

2.1.2 The Roadmap for urban transformation in SPARCS

The approach undertaken in SPARCS frames the roadmap as a high-level strategic document that will illustrate the key outcomes that must be delivered between the current day and 2050 in order to achieve the ambitioned future scenario for each city. Furthermore, it can also be understood as a set of strategic and methodological guidelines informing how to go from a smaller yet representative scale – the district scale (e.g., Positive Energy District) – towards a broader and more structural transformation in the



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urban ecosystem, ultimately directing cities' urban development towards carbon neutrality.

The scales in which the roadmap operates are diverse in their nature and range. In this respect, the roadmap includes inputs that influence urban transformation both at a smaller yet representative scale (e.g., district scale), as well as at the level of city-wide ecosystems, taking into consideration scaling up and replication processes. Besides the territorial scale, time scale and level of concreteness of the interventions and processes are also taken into consideration, varying between relevant projects whose implementation is already on the way, to medium and long-term structural processes, strategical guidelines and visioning.

As stated before, both the City Vision and the Roadmap for urban transformation processes aim at promoting a broad and structural metamorphosis at the city-scale. In this effort, Positive Energy Districts can play a relevant role. On the assumption that PED can be understood as models for a sustainable urban ecosystem at a micro scale, in the context of the SPARCS roadmapping process PED also function as a testbed for specific solutions that have the potential to be implemented at a city-wide scale, through replication and upscaling.

However, in order to foster such a radical change at a wider territorial level, a mere replication and upscaling of the solutions being implemented at PED level is clearly insufficient. The required transformation relies on the development of a more comprehensive and open process that ponders different variables, data, mechanisms and contexts, resulting in the strategic route towards a zero-carbon ecosystem that encompasses the city in its multiple layers.

In this sense, as urban transformation is bound to result from developments occurring in different strategic domains, both the City Vision and the Roadmap for urban transformation are structured by a set of Key Strategic Areas (KSA), which were initially tailored for each Lighthouse and Fellow City in the context of the City Vision process and partly updated by the cities during the Roadmapping process¹. These KSA act as a framework onto which, the results of the roadmap can be displayed and summarised in relevant milestones that need to happen, in 2030 and 2040, for the cities to achieve their 2050 City Vision.

Through an integrated methodology, the Roadmap for urban transformation also takes into consideration the existing city development processes (e.g., city's or region's strategic documents and projects concerning mobility, energy, governance) that will, to a certain level, guide the investments and synergies in the aforementioned strategic subjects for the short-medium term. This exercise has a twofold purpose, on the one hand it contributes to grounding and providing a solid structure for the roadmap, on the other it provides a framework in which the relevant relationships and possible synergies between these strategic documents become evident, as well as their contribution to achieving the milestones within the relevant KSA and vision statements.

¹ The KSA encompass subjects such as sustainable urban development, energy, mobility, Smart City and digitalization, and governance, and comprise a set of Vision Statements (VS) for the carbon neutral future of the cities.



Furthermore, it also takes into account data and inputs coming from other SPARCS WPs and Tasks (see section 1.3) which are particularly relevant as they aim directly at the “transition to a citizen-centred zero carbon & resource efficient economy” and can create important synergies with other initiatives and processes included in the roadmap.

Building upon these premises, the development of the Roadmap follows a co-creation approach, co-defining in specific roadmapping workshops, alongside with the local stakeholders, the key outcomes (e.g., intermediate milestones, solutions, projects, innovations, research projects) needed to reach the envisioned future. In this sense, while the City Vision stands for the aspired reality that each city wants to achieve by 2050, the roadmap shows what needs to be delivered to make that envisioned future happen.

By defining the correlations and connections with the cities’ strategic instruments and also with the SPARCS ongoing processes (replication, upscaling, implementation plans, and vision statements defined within the City Vision process), and through the involvement of stakeholders from different sectors in each city, the roadmapping process has a decisive role in promoting the ownership of the SPARCS Urban Transformation Strategy by the partner cities.

2.2 Breakdown structure of the roadmapping process

The roadmapping process is anchored to the following methodological milestones:

- **City diagnosis/city vision** (see Section 1.4);
- **Pilot roadmapping workshops in Kladno (M31, M32);**
- **Adaptation of the methodology in all partner cities, including activities under WP3, WP4 and WP5** (see Section 1.4);
- **Development of the roadmapping workshops in LH/FC (M40-M44)**

As stated before, the methodology for the roadmapping process is indissociable from the City Vision process as it sets its basic premises in the conclusions and outputs derived from the visioning process and focuses in defining the intermediate steps / milestones to achieve the envisioned future.

In this sense, the first steps towards the development of the roadmapping methodology were taken shortly after the City Vision 2050 – Draft was completed, in June 2021. This inception phase consisted in defining an initial high-level approach to a tailored methodology and concept as a result of bilateral calls with the partner cities and WP leaders, and defining a preliminary internal version of the methodological approach.

The subsequent stage consisted in the definition of the first version of the methodological guidelines and supporting materials, which were co-designed by SPI and KLD/CVUT and were tested in the partner city’s preparation process for the pilot workshops.

Simultaneously, high-level alignment of the process with WP3, WP4, and WP5 was held, in order to establish the necessary connections between the roadmapping process and the replication and upscaling activities in LHCs and the Implementation Plans in FCs. At this point it was understood that the timing defined for the Replication & Scale up Plans



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in the LHCs (T5.5 started in M24 and finishes in M60) was not entirely aligned with the Roadmapping process (due in M48). Consequently, the relevant preliminary activities and information concerning Task 5.5 and Tasks 3.9 and 4.7 (Replication and exploitation preparation) were to be approached in the roadmapping process of the LHCs according to their relevance and state of development.

In February 2022, the city of Kladno shared their experience concerning the preparation of the pilot workshops through a collective call where common concerns and expectations were identified, together with possible approaches to solutions.

In April and May 2022, the pilot roadmapping workshops were held in Kladno on the KSA of Energy and Mobility. The results and lessons learned from the workshops were introduced in the final version of the Guidelines, which were made available in June 2022.

In November 2022, an 'urban transformation workshop' with the consortium partners was held during the Consortium meeting in Kifissia, where the main concerns and difficulties faced by each city were discussed and addressed, taking into consideration the proposed methodology as well as the lessons learned from Kladno's Pilot workshops. As a result from this workshop, a 'questions & suggestions' table that was developed and shared with the cities.

Throughout the whole process, multiple bilateral calls were held between SPI and the partner cities paving the way to a local tailored approach to the roadmapping process and workshops. Figure 2 sums up the stages for the development of the methodology.

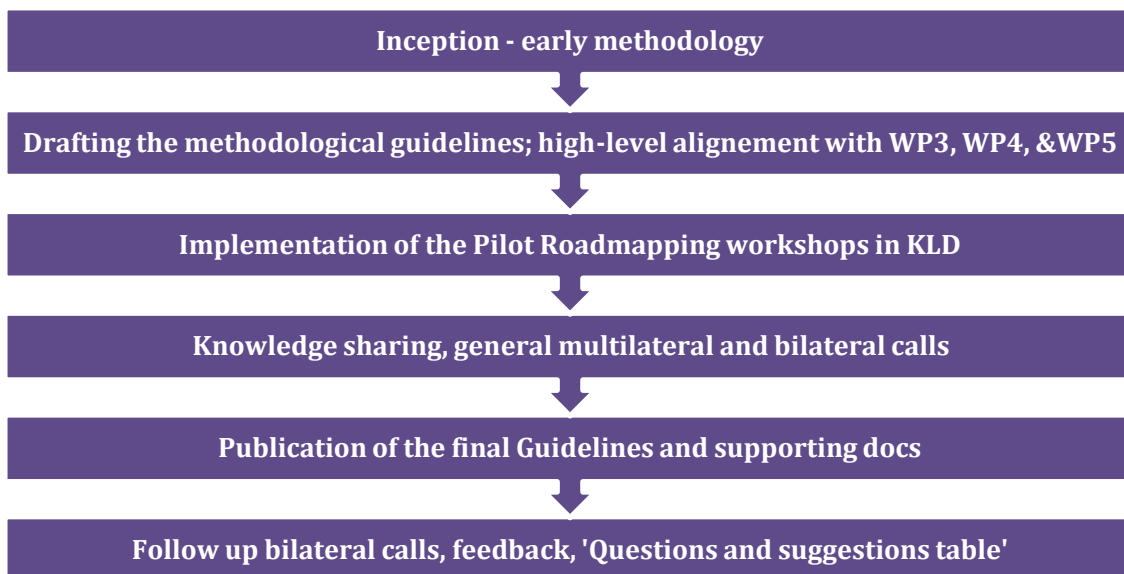


Figure 2. Development of the Roadmapping methodology

Using as a reference the aforementioned Guidelines document and the suggested methodological structure, the cities prepared their roadmapping processes between March and December 2022 (M30 to M39) – Table 1.



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Table 1. Proposed methodological steps for the roadmapping process

Methodological steps	Description / Outputs	Timeframe
Step 1 Forming a Task Force in each partner city	The underlying engagement concept of the roadmap derives from the one developed for the City Vision 2050, thus it should involve the same/similar task force which was involved in the development of the City Vision workshop in each of the partner cities.	M30-M31
Step 2 Framing the roadmapping process in the Bold City Vision 2050, in the cities' relevant strategic documents, and with the outcomes from WP5	A preliminary reassessment of the KSA and vision statements defined for the City Vision process should be performed; measurable categories within the vision statements should be identified; relevant ongoing measures/ processes, within the city's strategic documents, should be identified; relevant information derived from the Implementations Plans/ Replication Plans (WP5) should be assessed; trends and wild cards identified/ revisited.	M30-M34
Step 3 Stakeholder Involvement & Efforts Expected from the Partners	Identification of relevant stakeholders from the local community and ecosystems as well as clarification of the technical partners' role in the preparation and development of the roadmapping process, in particular for the roadmapping workshop.	M31-M35
Step 4 Resources for the Roadmapping Workshop	Assessment of the supporting material needed for the workshop. Using the list and templates provided with the Guidelines as a reference the cities should define the supporting materials needed for the development of their roadmapping workshop(s).	M31-M35
Step 5 Design the Roadmapping Workshop at the city level	Clarification of the objectives for the roadmap; clarification of the boundaries; designing the adapted roadmapping workshop format, based on the "Indicative Roadmapping Workshop Methodology Outline" displayed in the Guidelines; evaluating and adapting the suggested exercises and tools (e.g. backcasting, forecasting, wild cards); revisiting the status quo posters and trend galleries used for the City Vision workshops; identifying the participants that will take part in each session; defining the date(s) for the workshop(s).	M31-M35

The roadmapping workshops were developed between January and May 2023 (M40 to M44)² as presented in Table 2. The cities chose different formats and scopes, according to their specific contexts, including online and face-to-face sessions; general workshops encompassing all the KSA at once and separate workshops focusing on specific KSA (or

² With the exception of Kladno which held the first two (pilot) workshops in April and May 2022 (M31 & M32).



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combining them according to their affinities or to the changes introduced in the City Vision). Furthermore, most of the cities held separate meetings with key partners and experts, before and after the workshops, which served to stabilise and complement the information and key outcomes.

Table 2. Dates of the Roadmapping Workshops in partner cities

City	Roadmapping workshops' themes/KSA	Dates
Espoo	WS1. Urban Energy	18/01/2023
	WS2. Urban Mobility	25/01/2023
Kifissia	WS1: Group 1: Energy Consumption of buildings; Group 2: Green Energy; Group 3: Mobility.	13/03/2023
	WS2: Group 1: Citizen engagement; Group 2: Digital City; Group 3: Urban Planning.	14/03/2023
Kladno	WS1. Energy.	07/04/2022
	WS2. Mobility.	25/05/2022
	WS3. Smart City.	07/06/2023
Leipzig	WS1. General Roadmap for urban transformation.	08/02/2023
Lviv	WS1. Development of Mobility and Transport; Infrastructure Spatial Development.	31/01/2023
	WS2. Energy Development; Climate; Housing and Infrastructure.	15/02/2023
Maia	WS1. Energy (Internal ecosystem: City + Key stakeholders).	02/03/2023
	WS2. (External ecosystem: City + All relevant stakeholders): Group 1: Sustainable Urban Development; Group 2: Energy Transition; Group 3: Mobility; Group 4: Smart City; Group 5: Inclusive & Integrated City.	12/04/2023
Reykjavik	WS1. General Roadmap for urban transformation.	26/05/2023

Following the completion of the Roadmapping workshops in all partner cities, bilateral calls between SPI and the cities were made in order to help fine tune and align the results and the report structure, whenever needed.



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The final results of the roadmapping process were included in the roadmapping reports developed by each participating city. These reports, presented in chapter 3, cover the key outcomes of the process, including the graphic overall roadmap with the milestones for 2030 and 2040, and also an overview of the roadmapping process, from its inception to the workshop(s).

After finalizing the roadmapping process, including the identification of the milestones and relevant inputs needed to achieve the vision statements for 2050, the cities will revisit their City Vision reports, contributing to the final version of the City Vision 2050 (D1.12), due in M60.

2.3 Local Engagement Concept

The development of a Roadmap in each partner city, focused in promoting urban transformation and, ultimately, leading to the desired future framed within the City Vision 2050, requires an effective ownership of the process by the cities and local ecosystem partners.

In this sense, the suggested approach was built upon the engagement process designed for the City Vision workshops, fine-tuning it according to the lessons learned from the aforementioned process and also from the results of the pilot roadmapping workshops held in Kladno. On the one hand, involving the same stakeholders that participated in the City Vision workshop had the advantage of drawing upon the experience and knowledge on the project and visioning exercises. On the other hand, taking into consideration the more operative nature of the expected inputs for the roadmap, namely the relevant solutions/projects/innovations for achieving the Visions Statements in each KSA, the list of stakeholders required, in some cases, a more relevant involvement of the cities' technical departments and of experts in specific fields.

In general, it was considered appropriate to involve stakeholders with complementary roles and interests, including decision-makers, participants who were available to discuss medium or long-term strategical issues, as well as ones committed and focused on the short, medium-term issues. In this sense, besides the members of the local consortia, the cities reported the involvement of representatives from: *city council; government; partner organizations outside of the SPARCS project; research and university; associations; engineering organizations; private companies; and civil society.*

The participatory process had, in most cases, a twofold approach, consisting in the co-creation of the milestones and relevant inputs during the workshop(s), and also on the involvement of specific partners/experts in 1-to-1 or smaller group discussions outside the workshop(s). These focused interactions were useful to help mature the baseline information that was presented at the workshops and also to fine-tune the results after the workshops.



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2.4 Workshop process

Approach

As a main vehicle for the development of the roadmap, the envisaged workshop(s) were to involve the most relevant stakeholders for the Key Strategic Areas of development defined in the City Vision process.

The format of the workshops was designed by the cities, based on the suggested approaches stated in the Guidelines document and adjusted to the local ecosystem and conditions. In this respect, two options were suggested. The first option involved the development of a single workshop covering all the themes/KSA simultaneously, by assigning different groups for each theme, and then having a joint discussion/brainstorming phase over the primary results. This option would allow the experts/stakeholders from different areas to give their inputs across all the relevant themes, assessing the relevance and establishing the connections, hierarchy, and level of dependence between the main measures and milestones across themes/KSA. The second option involved the development of separate sessions for each theme / KSA, and subsequently the realization of a general workshop to discuss and assemble the partial results into the overall roadmap.

Roadmap template

A graphic roadmap template was made available for the cities as part of the methodological Guidelines (Figure 3). It consisted of a table with the KSA or themes organized in horizontal pathways that led from the status quo (identified on the left side of the table) to the City Vision (displayed on the right), where the milestones and other results from the workshops should be displayed. These pathways were framed by a timescale referencing the milestones that each KSA should encompass for 2030 and 2040.

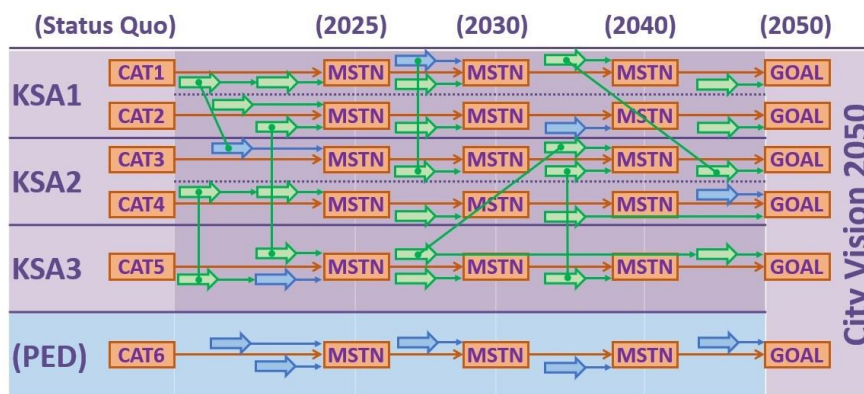


Figure 3. Schematic diagram for the roadmapping template

Suggested exercises and methodologies

A specific set of tools and methodologies, considered adequate for the roadmapping process and workshops, were suggested to the cities. Some of these tools, namely the Trend Gallery and Status Quo Posters, derive from the City Vision process and were expected to be updated and used as supporting material for the workshops.

The suggested exercises and methodologies are listed below:



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- **Forecasting.** Forecasting approaches are effective for “setting realistic and short-term goals based on analysis of past and present performance”. Since predicting future events, such as market trends and emerging technologies, are complicated by limited data availability, existing tools in the field of foresight research (e.g., Delphi and scenario planning) are often used to support roadmapping” (Okada et al., 2020)
- **Backcasting.** Backcasting is a process in which “the future desired conditions are envisioned and steps are then defined to attain those conditions. ... Backcasting is about analysing possible ways of attaining certain futures as well as their feasibility and potential. ... backcasting involves finding ways of linking goals that may lie far ahead in the future to a set of steps to be taken now and designed to achieve that end.” (Bibri et al., 2019)
- **Wild Cards.** ‘Wild cards’ correspond to events of low probability that in case of taking place would have a profound effect on whether or not we will be able to achieve our targets. Taking into consideration the impact of a technological breakthrough scenario or a crisis scenario might prove to be relevant for the discussion or to open new pathways of discussion. The city’s partners/experts can provide a set of wild cards, that can also be based on the trends mentioned in the visioning workshop.
- **Framing questions.** A set of ‘framing questions’, previously developed by the task force, supported by experts, can help project the workshops participants into the future; deal with most relevant themes; consider a wide range of uncertainty (e.g., What needs to be done in order to achieve this specific milestone by 2040? What would be the intermediate milestones for 2025 and 2030? What are the main barriers that need to be overcome? In which ways could the PED contribute this goal?).
- **“Master” spreadsheet.** This exercise, used by KLD for their pilot WS, aimed at providing a clearer view of the ongoing processes and synergies that could be helpful as a starting point for the roadmapping process. The local task force was to compile all the relevant information concerning the city’s main strategic documents (goals, projects, timeframes) in a single spreadsheet/document, sorting out the connections between these and the KSA, and framing them within the roadmap context.

Expected outputs

As a result of the roadmapping workshop, the cities were expected to develop a graphical visualization (see 'Roadmap template' subsection above) of the most relevant intermediate milestones, solutions, projects, innovations, and research projects in the timeline, corresponding to a strategic tool that should support the partner cities on their pathway towards achieving the City Vision. Depending on their level of maturity, the most relevant features of the key outcomes and milestones contained in the graphic roadmap should be described, creating a reference for possible future stages of implementation.



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However, the process should not end with the formalization of the roadmap, therefore partner cities should manage and monitor the evolution of the process and promote/facilitate discussions and reflections on the elements of the roadmap further down the road, whenever new relevant data arises or whenever the intermediate goals are achieved or become obsolete.

Guidelines and supporting documents

For the development of the roadmapping process and workshop, a methodological document (Guidelines for the roadmapping process) containing the conceptual approach; detailed methodology, including milestones, timeframe, operational steps; and supporting material was prepared by SPI in collaboration with KLD and CVUT.

The supporting material provided is listed below:

- Annex 1 – Checklist for the Roadmapping Process;
- Annex 2 – Forming a Task Force;
- Annex 3 - “Master” spreadsheet (analysis and description of measures included in strategic documents and identification of their relevance and connection to measurable categories within the vision statements/KSA);
- Annex 3A - “Master” spreadsheet (KLD example - partially translated);
- Annex 4 – “Action Table” (list and description of the ‘starting point’ measures for the Roadmap);
- Annex 5 – Stakeholder involvement and efforts expected;
- Annex 6 - Workshop Agenda;
- Annex 7 – Attendance List;
- Annex 8 – Poster - Roadmap Template (Template supporting the roadmapping process);
- Annex 8A - Roadmap Template (KLD example - 'Miro' - partially translated);
- Annex 9 - Wild Cards Template;
- Annex 10 - Key Outcomes Cards Template;
- Annex 11 - Status Quo Cards Template;
- Annex 12 - Trend Gallery Posters (City Vision);
- Annex 13 – Roadmapping Process and Workshop Report.

2.5 The process towards a tailored approach and lessons learned

Developing a flexible methodology suited for diverse geographical contexts, ecosystems and organizational cultures requires a dedicated collaboration from all parties involved. In this case, the task forces created for each city played a decisive role in “translating” and adapting the useful parts defined for the methodology into the city’s organizational culture, as well as filtering out unnecessary or non-applicable aspects.

Involving local stakeholders and city administration in the roadmapping process.

The part of the process concerning the involvement of stakeholders and preparation of the participatory process had the advantage of having as a reference the City Vision process. This allowed the local task forces to choose if they wanted to replicate the same



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structure in terms of type of actors and general procedures or if they wanted to develop a different approach that would produce complementary results. Kladno's experience in the pilot roadmapping workshops, translated in the 'difficulties and suggestions table', also points out the involvement of the city's administration as helpful to reinforce the credibility of the process; to clarify the relevance and contributions of the roadmap to other ongoing processes at the city level; and to prompt the involvement of other departments/services in the process. As a result of the roadmapping process in (e.g.) Espoo, Kladno and Reykjavík, the cities reflect on the fact that the discussions and results can be, in some situations, more dependent on the participants involved rather than on the theme that was designated for the group.

Focusing the discussion on the short-, medium-, and long term. In this respect, the experience from the pilot workshops in Kladno, also played an important role, by pointing out, for example, the difficulties encountered in discussing medium- and long-term solutions during the workshop, as a consequence of participants being focused in more concrete and short-term subjects. This situation manifested in most of the cities' workshops, with Espoo pointing out the subsequent need to further develop the topics in order to "expand the roadmap beyond 2030 in more detail".

Framing the roadmapping process in the cities' relevant strategic documents. This exercise, which was considered crucial for the purpose of giving context to the roadmap and strengthen its function of articulating the cities' existing synergies towards sustainability with the actions developed in the context of SPARCS project, raised significant and diverse questions in the cities, and was reported as one of the most time-consuming tasks, in some cases.

According to the provided "Guidelines," the mentioned exercise was "aimed at establishing the connection between the relevant strategic documents for the city and the City Vision, by identifying the most relevant measures (solutions, projects, innovations, and research projects) and categorizing them within the Vision Statements / Key Strategic Areas". As a result, the cities analysed the relevant documents and catalogued the existing measures, resulting, in some cases, in an extensive list which raised the problem of sorting out which measures should be considered relevant and included in the roadmap and which ones should be left out.

A suggested solution for this difficulty was, in a first stage, to rate the measures' priority and, in a subsequent stage, to "break-down" some vision statements into simpler categories. The creation of these categories would serve a twofold purpose, on the one hand, it should help clarify if the measures in question were related to the existing categories/VS, in turn, in case they were not related, this would lead to the elimination of the measure, or to the creation of a new category and VS, in case the team decided that the measure was relevant for the city's pathway towards sustainability.

Overall, the roadmapping process was a learning opportunity for all the participants, and as a result, the cities developed an important reflection on their short, medium, and long-term goals regarding climate neutrality, resulting in the co-creation of a strategic tool that will assist them in their journey towards sustainability.



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The heterogeneity of the results achieved, the specificities of the adopted and adjusted methodologies presented, as well as the testimony of each partner in terms of lessons learned sum up a variety of approaches and outcomes that can help other cities and entities in their own effort towards climate neutrality.

2.6 Summary of the Results

The main results of the Roadmap for urban transformation task consist in the development of a roadmapping report by the SPARCS partner cities, including:

- a **graphic/visual roadmap, with milestones for each of the relevant KSA**, and most relevant connections between ongoing and proposed measures/ projects/ actions;
- a **description of the key outcomes that need to be delivered** in order to achieve those milestones;
- a **reflection on the methodological process and workshops**, as well as on the overall **lessons learned and future steps**.

Complementarily, a **methodology for the Roadmapping process was developed** by SPI, in collaboration with KLD and CVUT, consisting of the **methodological Guidelines** and **supporting material**, which provide guidance and support for the cities in the implementation of their Roadmap for urban transformation (see list of supporting materials in section 2.4, subsection “Guidelines and supporting documents”, and in Appendix 1).



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3. ROADMAPPING REPORTS

This chapter integrates the roadmapping reports developed by each partner city, based on a specific template provided by SPI, integrating the main tangible outcomes of the roadmapping process and workshop(s). These reports were developed mainly between M39 (December 2022) and M46 (July 2023) and delivered, in a draft version, to SPI for internal review. During the review process, and in the final stage of development of the reports, bilateral calls were organized between SPI and each partner city, resulting in the fine tuning of the reports. Each report is structured as follows: *Introduction; Overall roadmap results, including the graphical roadmap and key outcomes per KSA; Adopted methodology and procedures, including the methodology for the roadmapping process and the workshop agenda; Lessons learned and next steps.*

As most of the reports have a strong component of key outcomes that connects the roadmap to other strategic documents, a detailed description of the Milestones for each cities' roadmap is presented in the Appendices section.

3.1 Espoo Roadmap

3.1.1 Introduction: Pathways for positive energy district (PED) development within the strategic areas of urban energy and urban mobility

City of Espoo is a frontrunner on sustainable development on multiple fronts. The city's strategy, the *Espoo Story*³, states that the city aims to be carbon neutral by 2030 and that it aims to reach the Agenda 2030 UN Sustainable Development Goals (SDGs) by 2025. Espoo has also been selected as one of the cities for the EU Mission for Climate-Neutral and Smart Cities by 2030⁴, acting as a frontrunner in urban transformation towards sustainability on the European level. To reach these targets, carbon neutral urban solutions, based on the principles of circular economy, in energy, mobility, urban development, and other fields related to sustainable development, need to be developed, planned and implemented. The Sustainable Espoo development programme⁵ (2021-2025, third four-year term, running since 2013) focuses on developing new solutions and practices in close collaboration with local organization and business stakeholders, city departments, and residents. Sustainable development here includes the ecological, social, economic and cultural dimensions of sustainability. Espoo also aims to increase its carbon-handprint, which means that the carbon neutral solutions developed in Espoo can act as concrete examples and scalable references for other cities across the globe.

In the EU Horizon2020 funded research and innovation project SPARCS (*Sustainable energy positive & zero-carbon communities, 2019-2024*), Espoo acts as a Lighthouse city,

³ <https://www.espoo.fi/en/city-espoo/espoo-story>

⁴ <https://www.espoo.fi/en/news/2022/04/espoo-selected-implement-eu-mission-on-climate-neutral-and-smart-cities-together-other-pioneers>

⁵ <https://www.espoo.fi/en/city-and-decision-making/espoo-story/sustainable-espoo-development-programme>



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where new smart city solutions are studied, demonstrated and examined. The project focuses on the development of positive energy district (PED) solutions from technical, citizen engagement and urban planning perspectives. In short, positive energy districts are areas that produce more energy than consume it. The project is a collaboration of over thirty partners across Europe.

This report covers the roadmapping workshop process, which focused on exploring possible futures of the built environment in the topic of smart cities, new energy and mobility solutions, sustainable lifestyles, and PED development. The workshop process aimed to identify what could the future pathways for sustainable development in these topic areas be, including future PED development, which covers especially questions related to the development of zero-carbon and human centric urban energy and mobility solutions. Focus on positive energy district development can provide new insight, capacities, and practical solutions for local sustainable energy and mobility development. As the city pushes sustainable development work forward on multiple fronts, PED development provides a unique district level approach for zero-carbon solutions that can support the development of sustainable, carbon free communities within the city through new technologies, processes and concepts.

The road-mapping workshops presented here aimed to map and identify possible future pathways on how energy and mobility related technologies, solutions, practices, policies and related user behaviours develop in the future, providing the basis for future PED area development. The horizon was set all the way up until year 2050 and the intermediate time periods of 2030 and 2040. Rather than focusing on singular solutions or pathways, the workshops, organized by the city of Espoo SPARCS project team for the local Espoo SPARCS project consortium member partners, aimed to map the variety of different possible pathways for these topics. We can see from future(s) research tradition that future visioning always deals with *multiple* possible futures rather than a *singular* future. The process of thinking of the possible futures can help identify especially different possibilities, drivers, barriers, and (unexpected) disruptions – such as the recent energy crisis in Europe and the COVID-19 pandemic – related to the development and evolution of the topics in question. Future(s) research approach is especially relevant in terms of sustainable development, as it aims for long-term targets and processes on local and global issues. Possible future scenarios can help us understand where we are at currently, what has happened before, and what are the desirable and probable next steps in the process. Are we on the right path to achieve desirable futures, or do we need to do something more/less, or do something differently?

The aim of this report is to support the city of Espoo's active and broadscale development work on sustainable development. It presents professional, specialized, insights and knowledge for future prospects that have been gained through a co-creation workshop method from a diverse set of stakeholders, representing different views and knowhow. The focus is set on PED development and the focus areas of sustainable and smart energy and mobility solutions, and their incorporation to the built environment. The insight of the report can support the Espoo Roadmap for Carbon Neutrality by 2030, which is currently in active development. The results of the report can also be used in other development process within the city, such as the Espoo Master Plan 2060 that aims for sustainable growth, by introducing possible pathways for further PED development in the city, covering topics of energy and mobility from technological, practical, and urban



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planning perspectives. As the process emerges from the SPARCS project that focuses on the emergent and actively developing topic of PEDs and new innovative solutions, the insights of the report can support ‘out-of-the-box’ thinking by introducing emergent technologies, concepts and practices for the city development processes.

SPARCS Roadmapping Workshops

This report mainly summarizes the key learnings from two (2) SPARCS Roadmapping 2050 workshops held amongst the SPARCS project’s local Espoo consortium partners in January 2023. The goal in these workshops was to map, identify and examine different possibilities for future sustainable and human-centric smart city development. The perspective towards the future was narrowed down to two *key strategic areas* (KSAs) of the SPARCS project: *urban energy* and *urban mobility* solutions.

The workshops presented here are part of a longer process which began in the early stages of the SPARCS project through the identification of key development trends of future smart city environments. These were collected in the ‘Draft City Vision 2050’ workshop, organized in November 2020 for different Espoo city departments. The desired futures of the built environment in 2050 were envisioned from the perspectives of three KSAs relevant to smart city development and SPARCS project: energy, mobility, and digitalization. The focus was set on the built environment and urban lifestyles, envisioning what Espoo might look like in 2050 through these smart city lenses. The insights were reported in the project deliverable “D1.11 City Vision 2050 – Draft” document in 2020.

For this road-mapping process, the KSAs from the City Vision 2050 Draft report were narrowed down to two, *energy* and *mobility*, leaving the third, *digitalization*, as a separate KSA out. This was done to a) further narrow down the focus to energy and mobility solutions to ensure detailed insight, and b) to prevent overlap between the digitalization and the energy/mobility topics, as digitalization is essential part of the other two from the smart city perspective applied here.

The workshops aimed to answer the following broad questions:

- *What kind of pathways for sustainable urban development and PED development up to 2050 from energy/mobility perspectives can be identified for smart cities in the Espoo context?*
 - *In what ways will the a) urban energy and b) urban mobility thematic areas develop, evolve and transform in the upcoming decades based on expert perspectives of the current situation, identified trends, and possible disruptions and ‘wild cards’?*
 - *What kind of milestones and measures can be identified to reach the desirable future scenarios (considering also the specific geographical, cultural and social contexts)?*
 - *What kind of co-creative measures between different stakeholders could be taken in order to support sustainable development, with a focus on PED perspectives, in 2030, 2040 and 2050?*

The aim was to understand how the built environment could transform in the future through the energy and mobility solutions related to smart city and positive energy district development, both through intended and articulated actions as well as through the indirect effects of technological and behavioural developments, amongst others. The



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topic of PEDs – and what their development means in practice, and what kind of effects they have to both physical and social environment – is still emerging and developing, and no precise indicators exist yet. In this sense, the workshops were charting an unknown but actively developing field. The geographical area of Espoo provides a context for the work, acting as an example of a Northern European geographical and climatical location together with the Nordic cultural, legislative and social context. However, the focus here – smart and sustainable urban energy and mobility solutions – represents a narrow and highly focused approach to the urban phenomena as a whole.

The workshops were arranged for the different SPARCS project's local Espoo consortium partners and their respective experts and specialists in the selected fields of energy and mobility. The SPARCS project team from the Lighthouse City Espoo was responsible for organizing the workshops. The work covered in this report is part of the project's Work Package 1 'Urban Transformation Strategy', Task 1.2 'Urban Transformation'. The insights of this report will be used in a later stage of the SPARCS project to update the Draft City Vision 2050 (see section 3.1.1) report into the project deliverable "D1.12 City Vision – Final" report by the end of the project in 2024.

Focus on PEDs

During the City Visioning process, that begun already in 2020, it became clear that focus on PED solutions would provide new perspectives for local energy and mobility solutions for the city, related to energy efficiency, zero-carbon solutions, integrated systems, and carbon-free mobility from a spatial perspective, including area, district and block level analysis.

A focus on PED approach warrants closer examination, as the emergent framework of positive energy districts can provide new valuable insight for new technological and practical approaches on how to develop sustainable energy and mobility solutions as part of the built environment on the area/district/block level. In terms of energy, Espoo is actively engaged in developing new solutions with local stakeholders, especially with the local energy utility companies, in close strategic collaboration, including on renewable energy solutions; the framework for energy communities; and carbon-free district heating (Espoo Clean Heat programme), supporting the carbon neutral Espoo 2030 target. In terms of mobility, the city, for example, collaborates actively with the regional transportation company HSL, which has already adopted targets for electrifying the local bus traffic in its operational area in Helsinki Metropolitan Area (including major cities Espoo, Helsinki and Vantaa), as well as with new shared mobility service providers.

The PED perspective can add to this ongoing work through the energy positive solutions and can help set the perspective at the block or district levels. As Espoo is actively developed as a network-type city, with five urban centres, the district or block level approach applied in SPARCS can help identify solutions applicable for urban centres. The PED thinking, thus, can add value to the ongoing work on urban energy and urban mobility topics in the city, and also provide insight for future development, also reaching timewise beyond the current carbon neutral Espoo 2030 target. The new innovative solutions from SPARCS on energy management and efficiency, e-mobility development, and stakeholder engagement – including the *Co-creation model for sustainable and smart urban areas*, developed by Espoo in collaboration with the project partners – can provide



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new approaches for the city for future development topics and collaboration with the local stakeholders.

There is no single uniform definition for positive energy districts. The PED Programme implemented by JPI Urban Europe is preparing a ‘common reference framework of Positive Energy Districts and Neighbourhoods’. Based on results from national consultations, the reference framework has defined PEDs as follows:

“Positive Energy Districts are energy-efficient and energy-flexible urban areas or groups of connected buildings which produce net zero greenhouse gas emissions and actively manage an annual local or regional surplus production of renewable energy. They require integration of different systems and infrastructures and interaction between buildings, the users and the regional energy, mobility and ICT systems, while securing the energy supply and a good life for all in line with social, economic and environmental sustainability.”⁶

The PED framework also provides functions and guiding principles of PEDs as a part of the larger energy system. However, larger discussions on the classification of PEDs are still ongoing, and these discussions include facing the challenge of categorizing PEDs in areas where managing a surplus of both heating and electricity is not always feasible. This includes the Nordic countries, where producing enough electricity locally might not be possible during the winter months.

In terms of urban energy, the PED approach means local sustainable generation, transmission and use of energy near urban areas. This includes local RES and carbon-free production, energy efficiency, energy saving and the recycling of energy streams. Inclusivity and citizen engagement should also be considered when developing energy solutions within built areas, to ensure reduced inequality between districts and neighbourhoods. In terms of urban mobility, the PED approach similarly refers to mobility practices taking place in and between urban areas. Sustainable mobility modes, high quality urban environment, and accessible mobility modes for different user groups are in the core of the PED thinking. PED development aims to increase opportunities for district-level self-sufficiency, with an end goal of 100 PED’s in Europe by 2025.

3.1.2 Overall roadmap results

The key overall results of the two workshops are presented in this section in tables and as visualized roadmaps. They both cover the discussion and outcomes of the workshops, where the possible roadmaps for future sustainable, PED-related, smart city scenarios for 2050 were developed between the participants representing different thematic expertise (see sections 3.1.3 and 3.1.4 for more details about the workshop process and roles).

These future scenarios for 2050 PED development were based on a previous phase of the project (see 3.1.3). Four scenarios were developed for both the energy and mobility key strategic areas (KSAs) to be used in this road-mapping workshop process. They each present possible future scenarios related to PED development from a rather specific perspective. They are presented briefly in the next section.

⁶ <https://jpi-urbaneurope.eu/ped/>



Future scenarios

The scenarios for 2050 all present positive future possibilities on the thematic areas of urban energy and urban mobility. Although the topics here are examined through the ‘PED-lens’ – focusing on zero-carbon and energy positive solutions, interlinked on a area/district/block or other system-level – other relevant perspectives to sustainable solutions on energy and mobility topics are also considered (and also taking note of the fact that there is no uniform concept or definition for PEDs, see section 3.1.1 – Focus on PED). In other words, the PED thinking provides a novel perspective to approach the broad energy and mobility topics in Espoo, but the outcomes and solutions are not exclusively PED-related but rather encompass sustainable and human-centric urban solutions in a broader scale. Additionally, ‘urban’ here refers to a focus on solutions and processes relating directly to the built environment, and how energy and mobility solutions can be developed, integrated and used in that context.

The scenarios have also been reflected with relevant local and national strategies and action plans (see section 3.1.3 for more details about the process). The four scenarios each tackle different aspects of a sustainable and smart urban energy system, with considerations for technological, policy and social aspects.

The examined scenarios for the energy topic are:

- **The local energy system is carbon free.** One of the main goals of PED development is to aid in achieving carbon neutrality by using local district- and block-level solutions. PED development can serve as a catalyst for the use and increased understanding of carbon-free energy solutions on the district level, while working together with the larger system for future optimization. Within the Espoo context, the city is expanding due to fast population growth and construction continues both in new districts and as infill construction in already built areas, leading to a need in taking local sustainable energy solutions into account to ensure that the city’s goal of achieving carbon neutrality by 2030 is achieved even with the increase in population. PED development can serve as an aid in this.
- **People are energy conscious and participate actively in the energy system.** At the heart of PED development is increasing the role of consumers in the energy transition, to ensure that the transition is both fair and inclusive while giving new opportunities (and responsibilities) to local populace. As an effect from the increased use of renewable energy solutions, such as solar panels, energy systems decentralize, and consumers also have the opportunity to participate on the energy market. As renewable energy production is intermittent based on local weather conditions, new needs of increasing flexibility options in both production and consumption also arise, leading to even more opportunities for added value to consumers as they have the opportunity to participate in reserve markets. Within the Espoo context, local residents are already active in investing towards local renewable energy such as solar panels, which can be seen from values and information provided by the regions’ DSO (distribution system operator). The number of possible prosumers is increasing rapidly in Espoo. This shows that the local residents are interested in new energy solutions, and PED development can be an opportunity in increasing this change even further. However, equal possibilities for accessing the energy market need to be provided.
- **Energy is stored, recycled and shared, and is affordable.** The ‘recycling’ of energy through e.g., the full utilization of excess heat, and sharing energy both locally and to the grid is a key point of achieving energy positivity locally, and also to meet the needs of a circular economy. One of the main challenges in increasing renewable and carbon-free



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energy production is the need for new storage solutions to achieve full utilization of weather-dependent generation and excess heat. Thus, research and implementation of new short- and long-term storage solutions for both electricity and heating is important to achieve full benefits of the energy transition. Within the Espoo context, implementation of storage solutions has been an important part of both local SPARCS demonstration areas. The recycling of excess heat is an important part of local energy solutions, as well as the Espoo Clean Heat programme which is a collaboration process towards carbon neutral district heating by 2029 with the local energy utility company. PED development can serve in the R&D of storage solutions, and aid in the further identification and use of excess heat sources.

- **Many urban districts and areas are self-sufficient energy-wise.** PED development aims to increase opportunities for district-level self-sufficiency, with an end goal of 100 PED's in Europe by 2025. Aiming towards self-sufficiency can also be an opportunity in increasing the carbon-neutrality of local energy systems especially in areas without district heating grids, where heating may have traditionally been concentrated on, for example, oil heating. Collaboration can provide new opportunities in implementing new energy solutions without the need for large investments for individual homeowners. Within the Espoo context, discussions on self-sufficiency can aid development towards sustainability in the many different types of districts that the city contains. In addition to urban areas concentrated near the local rail transport infrastructure, Espoo also contains suburban and rural areas with different opportunities and challenges in terms of sustainable energy.

The examined four future scenarios for the mobility topic were:

- **Sustainable mobility modes are most frequently used.** Sustainable mobility modes refer to walking, bicycling, public transportation, and often also to shared mobility services, such as public city bicycles or car sharing services. Utilization of these mobility modes decreases the local transportation related energy use, supporting PED-thinking locally. 'Active' mobility modes, such as walking and bicycling, are also carbon-free mobility modes, and they directly link to public transportation use as well. Rail-based solutions, such as the train or the metro, can help to optimize the energy use of transport. Within the Espoo context, major investments to rail-based public transportation have been made in recent years: the city's first metro line opened in 2017 (extension in 2022), and a tramway line is set to open in 2024. Mobility services are actively developed in collaboration with the city and service providers. The focus on district and block level mobility solutions of PED can help to identify local drivers and barriers for sustainable mobility mode usage.
- **Repurpose of street space for sustainable mobility.** Utilization of sustainable mobility modes is closely tied with the (perceived) quality of the built environment. The repurpose of street space for other than traffic related uses, or developing it more to support active mobility modes or public transportation use, can support the change from private mobility modes towards shared and mass transportation modes by increasing their accessibility, attractiveness, ease-of-use, and safety, and thus lower the overall local energy consumption related to transportation. Within the Espoo context, the development of new major urban districts – such as Kera and Finnoo – are potential sites for testing new street concepts. A pilot of new street design has recently been carried out in Kera in summer 2022. The integration of energy and mobility solutions infrastructure – such as e-mobility – influence how street space is (re)designed, which, in turn, can have long term effects on the attractiveness of using shared or public transportation services.



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- **All mobility modes are fossil-free.** The type of energy used to propel the public/shared or private vehicles has direct effects to the overall PED concept locally. The utilized fuels and powertrains have also major effect on the generated carbon emissions. Electricity is one possibility for the utilized energy source in vehicles, which can, when produced through renewable energy sources, support carbon free transportation solutions from bicycles to buses and heavy trucks. Within the Espoo context, electric mobility is increasing rapidly. The local bus fleet is turning electric through future service line procurement processes, organized by the regional transportation authority HSL.
- **Autonomous solutions used actively in human transportation and logistics.** Autonomous transportation is major topic in smart city development currently. Many of the autonomous solutions aim to optimize human transportation (e.g., autonomous buses) or decrease unnecessary travel (e.g., automated delivery robots) altogether, which can have an impact on the PED. Most of the developed solutions also utilize electricity to power the engines. Within the Espoo context, autonomous vehicles in passenger transport and logistics have been tested in different parts of the city, including the Kera area

Espoo's Roadmap for urban transformation

The aim of the workshops was to identify possible steps and measures that would be critical for urban transformation towards the future scenarios (see section 3.1.2, subsection 'Future scenarios'). The overall graphic roadmap, including the identified milestones for the roadmap timeline – 2030, 2040, and 2050 – are presented in this section (for the identified measures related to these milestones and the timeline, see subsection 'Key identified measures and actions'; for a more comprehensive presentation of the identified milestones see the Milestones Tables in Appendix 2, section A).

KSA1: Sustainable and smart urban energy

The key identified milestones for the KSA#1 Sustainable and smart urban energy can be summarized as follows:

- **The local energy system is fully carbon free (1.1-1.3).**
 - Currently, large-scale developments within the electricity and heating sectors aim towards carbon-free district heating and increased RES investments. Focus is set on expanding carbon-free energy generation, expanding grid capacity, smarter bi-directional grids and new demand response and flexibility solutions, together with advancing local RES production and energy efficiency measures. The city of Espoo, together with the local energy utility Fortum, has committed to the Espoo Clean Heat roadmap towards carbon-free district heating by the end of this decade. Several solutions have already been implemented as a part of this roadmap. Energy efficiency measures are constantly implemented across all sectors, including the municipal sector as the city implements the Energy Efficiency Contract for the Municipal Sector.
 - 2030: Local RES potential needs to be identified in more detail, supported by zoning practices and plot reservations. Energy guidance and counselling is needed to increase knowledge and interest from residents, and stabilize energy communities as operational models.
 - 2040: Solutions based on circular economy are at the forefront, especially related to construction and energy efficiency.
 - 2050: New carbon free energy solutions have been adapted locally, and the overall energy consumption has been decreased. Measures to tackle energy poverty are also needed in the transition towards carbon free solutions.



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The Espoo SPARCS scale-up plan is not yet completed (Task 5.5 ‘Project Upscaling and replication in LHCs’), but SPARCS interventions on smart energy solutions (Leppävaara demonstration) and integration of RES solutions (Espoonlahti demonstrations) can provide insight for the activities presented above, together with the Co-creation model for sustainable and smart urban areas (Kera demonstrations), developed as a toolbox for district or block level development of sustainable solutions.

This theme also has central connections to the sustainable Espoo development programme, in the following topics:

- Espoo aims to promote new local energy production solutions as part of a well-functioning energy system.
 - Espoo aims to promote energy efficiency, RES production and new smart and flexible solutions in Espoo’s new construction, renovation and supplementary construction projects.
 - Espoo aims to respond to the wide-ranging challenge of society’s increased electrification, as both the mobility and energy sectors transition from fossil fuels to new solutions which utilize carbon-free electricity.
 - Espoo aims to develop advice and guidance to support sustainable energy choices and promote energy citizenship.
- **People are energy conscious and participate actively in the energy system (2.1-2.3).**
- Currently, local RES production is increasing, supported by technological advancements, national and regional energy counselling, and the emergence of prosumer roles and opportunities. Price of energy is a major influencing factor in consumer behaviour due to the energy crisis in Europe. Energy information and counselling is available through e.g., the regional environmental authority HSY, and available knowledge is constantly increasing.
 - 2030: The further increase and development of energy communities needs to be supported by the development of regulatory frameworks and further counselling towards energy citizenship. Further pilots on new energy solutions are needed. New energy solution uptake can be supported by policies, e.g., land use agreements.
 - 2040: The effects of RES production need to consider also the effects on biodiversity and sustainable production of infrastructure.
 - 2050: Energy citizenship has become the norm, supported by automated and energy-as-a-service solutions as well as information sharing and education. ‘Test beds’ and ‘living labs’ are required for continuous development of urban energy solutions.

The scalable solutions from SPARCS related to these goals includes the city’s 3D-model, which could act as a basis for providing an accessible data platform to support the development of energy communities, and to raise awareness of the energy transition.

This theme has central connections to the sustainable Espoo development programme, in the following themes:

- Espoo aims to promote new local energy production solutions as part of a well-functioning energy system.



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- Espoo aims to provide every resident a good opportunity to make sustainable choices in their everyday lives and influence their surroundings, also in energy matters.
 - Espoo aims to cooperate in the development of new functional and economic models and services to increase local renewable energy production and energy efficiency measures. These can include, for example, the piloting of energy communities.
 - Espoo aims to develop advice and guidance to support sustainable energy choices and promote energy citizenship.
- **Energy is stored, recycled and shared, and is affordable (3.1-3.4).**
- Currently, demand response and other smart urban systems are actively piloted. Circular economy is becoming ever more present within the energy sector, through e.g., excess heat utilization. Energy market price fluctuations have had a major effect in increased investments into relevant solutions, while also leading to increased discussions into the affordability of energy. Implementation of storage solutions has been an important part of both the Sello and Lippulaiva demonstration areas within the SPARCS project. The recycling of excess heat is an important part of both local energy solutions, and the Espoo Clean Heat collaboration.
 - 2030: A ‘big picture’ of energy in urban planning and zoning would be needed to utilize new energy solutions to their fullest extent. This also covers transparency in the energy production for clean energy. Measures that aim to prevent inequality with energy consumers are needed, and the possibility of participation in the local energy system for all needs to be supported. New pricing models will be needed to accommodate inclusive energy market participation.
 - 2040: Plans for how to integrate old infrastructure to new solutions need to be covered.
 - 2050: Focus should be set onto system-level and sector integration of the solutions for district level optimization. Automated solutions and ‘platform’ based operational models create the basis for smart systems. Smart grids and other automated and smart technologies enable prosumer models in becoming an integral part of the energy system.

The potential scalable solutions from SPARCS demonstrations include the smart energy solutions, tested in the Espoonlahti and Leppäävara demonstration areas. Similarly to the first scenario (1.1-1.3), a co-creation process is required to develop district or block level solution packages, and here the Co-creation model can act as a scalable solution.

This theme has central connections to the sustainable Espoo development programme, in the following themes:

- Espoo aims to promote new local energy production solutions as part of a well-functioning energy system.
- Espoo aims to cooperate in the development of new functional and economic models and services to increase local renewable energy production and energy efficiency measures. These can include, for example, the piloting of energy communities.
- Espoo aims to respond to the wide-ranging challenge of society’s increased electrification, as both the mobility and energy sectors transition from fossil fuels to new solutions which utilize carbon-free electricity.
- Espoo aims to investigate and report on the city’s role in promoting emerging and new energy technologies.



- **Many urban districts and areas are self-sufficient energy-wise (4.1-4.5).**
 - Currently, RES production is increasing and is actively promoted and encouraged. Pilots exist within the theme of self-sufficient districts or blocks. Collaboration is done both on the zoning level and on the strategic level.
 - 2030: Focus would need to be set on developing local ecosystems and strategies on urban energy solutions. Decrease of energy use should be the basis of all development work, as it reduces production needs and thus also the size of capital investment. Measures that support the development of energy citizenship and information sharing can support in the further uptake of RES solutions. Local potentials for sustainable energy solutions are needed to identify areas for self-sufficiency.
 - 2040: Energy use would need to be lowered in general, which can be connected to local energy production and utilization targets.
 - 2050: There is a high awareness of energy topics and solutions, and development work is done in active collaboration between different stakeholders. New RES energy solutions have become an integral part of the urban built environment. The aesthetics of the solutions are considered in design and in integration to the built environment.

The smart energy solutions from SPARCS can act as guiding reference for incorporating new energy solutions to the built environment on a block level.

This theme has central connections to the sustainable Espoo development programme, in the following themes:

- Espoo aims to promote new local energy production solutions as part of a well-functioning energy system.
- Espoo aims to provide every resident a good opportunity to make sustainable choices in their everyday lives and influence their surroundings, also in energy matters.
- Espoo aims to guide energy planning via zoning, taking into account the special characteristics of each area.
- Espoo aims to take low-emission energy solutions and energy efficiency into account when developing low-rise residential areas in accordance with the principles of sustainable development.
- Espoo aims to develop regional energy solutions and energy control with extensive cooperation between different sectors, taking into account the different needs of different regions.
- Espoo aims to cooperate in the development of new functional and economic models and services to increase local renewable energy production and energy efficiency measures. These can include, for example, the piloting of energy communities.
- Espoo aims to develop advice and guidance to support sustainable energy choices and promote energy citizenship.

KSA2: Sustainable and smart urban mobility

The key identified milestones for the KSA#2 can be summarized as follows:

- **Sustainable mobility modes are most frequently used (5.1-5.3).**
 - Currently, active development is happening around new shared mobility services and on their linkages to public transportation. Improvement of walking and



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bicycling environments is increasingly on the local urban development agendas. Mobility patterns of cities have changed due to the effects of COVID-19 and e.g., remote working practices. In Espoo, 52% of all trips are made with sustainable mobility modes (walking, bicycle, public transportation). There are no set targets for the modal share development, but recent investments into rail-based transportation (new metro line, first part opened in 2017 and second part in 2022), and the development of the five urban centres of Espoo into dense urban areas, support the utilization of sustainable mobility modes in daily travel.

- 2030: The uptake of sustainable mobility modes would require further development of new mobility services, and linking them more to public transportation in order to form sustainable travel chains. The urban environment also would need to respond to the new spatial requirements and practices. Information sharing and action for attitude change could be used to further increase sustainable mobility mode use.
- 2040: Increased awareness of mobility behaviours and their relations to emissions needs to be highlighted together with active development of public transportation and mobility services. Urban air mobility will also be a relevant topic for planning as drone-based deliveries and transportation solutions will most likely increase considerably by then.
- 2050: There is a high awareness of mobility behaviours and their effects to emissions. The mobility needs of different users need to be better understood in planning and development of new solutions, and unnecessary travel can be decreased through developing automated services. Year-round accessibility of mobility services needs to be ensured to support lasting change on sustainable mobility mode usage.

The Espoo SPARCS scale-up plan is not yet completed (Task 5.5 'Project Upscaling and replication in LHCs), but SPARCS interventions on e-mobility solutions and research on sustainable mobility behaviour can provide a framework for future solutions development. The Co-creation model for sustainable and smart urban areas (Kera demonstration), which was developed as a toolbox for district or block level development of sustainable solutions, can be utilized to facilitate a process for developing the sustainable mobility solutions from a system-level perspective on different areas and locations.

This theme has central connections to the sustainable Espoo development programme, in the following themes:

- Espoo aims to develop transport services that increase the use of sustainable means of transportation, i.e., walking, cycling and public transport in cooperation with companies and other partners.
 - Espoo aims to developed transport hubs into spaces where mobility services are easily accessible.
 - Espoo aims to develop car parking that enables a functional travel chain from areas where the service level of public transport is not sufficient.
- **Repurpose of street space for sustainable mobility and social use (6.1-6.3).**
- Currently, there is active discussion about street space usage, and on the question how to create more attractive urban public spaces, in cities globally. New practices and concepts are emerging, and policies, such as lower speed limits, are enforced. In Espoo, active collaboration between different stakeholders is also done; Kera new street pilot from summer 2022 is an example of this collaboration.
 - 2030: More pilots would be required on new street concepts and their linkages to different mobility solutions, as well as continuous development of the walking and



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bicycling environments. Different mobility needs would need to be better understood, and the benefits of sustainable mobility modes more clearly communicated.

- 2040: Regulatory barriers on new street concepts might need to be decreased, and new planning guidelines, based on the learnings of different pilots, would need to be examined.
- 2050: Prioritization of walking and bicycling as mobility modes. Collaboration and co-creation activities can be used to developed new street space uses and aesthetics. Accessibility, safety and inclusivity of all potential users need to be ensured.

The SPARCS demonstrations do not directly involve this topic, but the development of sustainable mobility solutions, and awareness raising about sustainable choices, as demonstrated in SPARCS, goes hand in hand with the development of urban space that facilitates sustainable mobility mode usage.

This theme has connections to the sustainable Espoo development programme, in the following themes:

- Espoo aims to develop a Sustainable Urban Mobility Plan (SUMP) in cooperation between the city's industries and in interaction with partners and residents. The aim of the plan is to increase walking, cycling and usage of public transport, the flexible flow of traffic and the use of fossil-free fuels for transport.
- **All mobility modes are fossil-free (7.1-7.4).**
 - Currently, the development of new powertrains is active (e.g., hydrogen, biofuels) globally, and electrification of different mobility modes is progressing rapidly. In Espoo context, the regional transport authority HSL has clear targets for turning the local buses electric through line operation procurement processes. The number of electric charging points in the city is also growing rapidly, facilitating e-car use. E-bike charging in mobility hubs has been tested in SPARCS in Espoonlahti.
 - 2030: Carbon neutrality targets would need to be more clearly stated and followed in all transportation related development, including public procurements. Automated data gathering solutions could help to make the emissions and the effects of personal modal choices more visible. Infrastructure on new fossil free fuels would need to be also further developed, and the mobility needs of different user groups studied and understood better to create impactful change.
 - 2040: Autonomous transportation might be playing a major role, especially in dense urban areas, and long-term plans and big picture thinking for its development would be required. The electric (or other) vehicle charging network needs to be developed on the basis of real need. Attitude change towards sustainable mobility usage could be done e.g., through collaborative means.
 - 2050: Increase of (smart) charging services and their accessibility together with new innovations on other non-fossil fuels. Public procurements can support the transition to fossil free fuels, as can the identification of diverse mobility needs and their respective solutions. Improvement of walking and bicycling environments can lower the transportation related energy usage in general, and unnecessary travel can be decreased e.g., through automated delivery services.

The SPARCS demonstrations on e-mobility development – including charging service development and future charging requirements simulation from Espoonlahti and Leppävaara demonstration areas – can provide valuable insight for scalable solutions.



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Next to the technical solutions, operational models, together with awareness of new solutions, need to be developed.

This theme has central connections to the sustainable Espoo development programme, in the following themes:

- Espoo aims to develop the charging infrastructure for electric cars and other electric vehicles with companies and other partners.
 - Espoo aims to develop charging solutions for heavy traffic in cooperation with professional transport operators and other operators.
 - Espoo aims to promote use of biofuels by public procurement and by strengthening the conditions for the production and distribution of biogas.
- **Autonomous solutions used actively in human transportation and logistics (8.1-8.3).**
- Currently, there is active development work ongoing on urban air mobility globally. Tests and pilots are done on autonomous transportation, and especially big leaps are done in the logistics sector. Autonomous bus has been piloted in the Kera area, and autonomous delivery robots in different areas of the city.
 - 2030: More pilots are required to try out new solutions and the related business models. Information between different stakeholders needs to be shared more. Autonomous solutions use urban space in new ways, which might mean changes in how the space is regulated and organized. Mobility behaviour post-COVID-19 would need to be understood better to support the increase of shared mobility services use. (Social) Safety is a major challenge for autonomous solutions.
 - 2040: The traffic environment would need to be developed to support autonomous solutions e.g., through dedicated lanes, and by considering the solutions of urban air mobility.
 - 2050: Autonomous solutions are used in public transportation and other mobility services, and there has been a behavioural change related to their usage. Winter-time maintenance and use is a major factor in their popularity. Urban air mobility will introduce a new dimension to the urban mobility system.

The studies and inquiries done in SPARCS related to autonomous transportation, the utilization of 5G networks, and future mobility hub concepts, act as important frameworks for possible future development of the topics.

This theme has connections to the sustainable Espoo development programme, in the following themes:

- Espoo aims to support the development, testing and implementation of automatic transport solutions for both passenger and cargo transport.

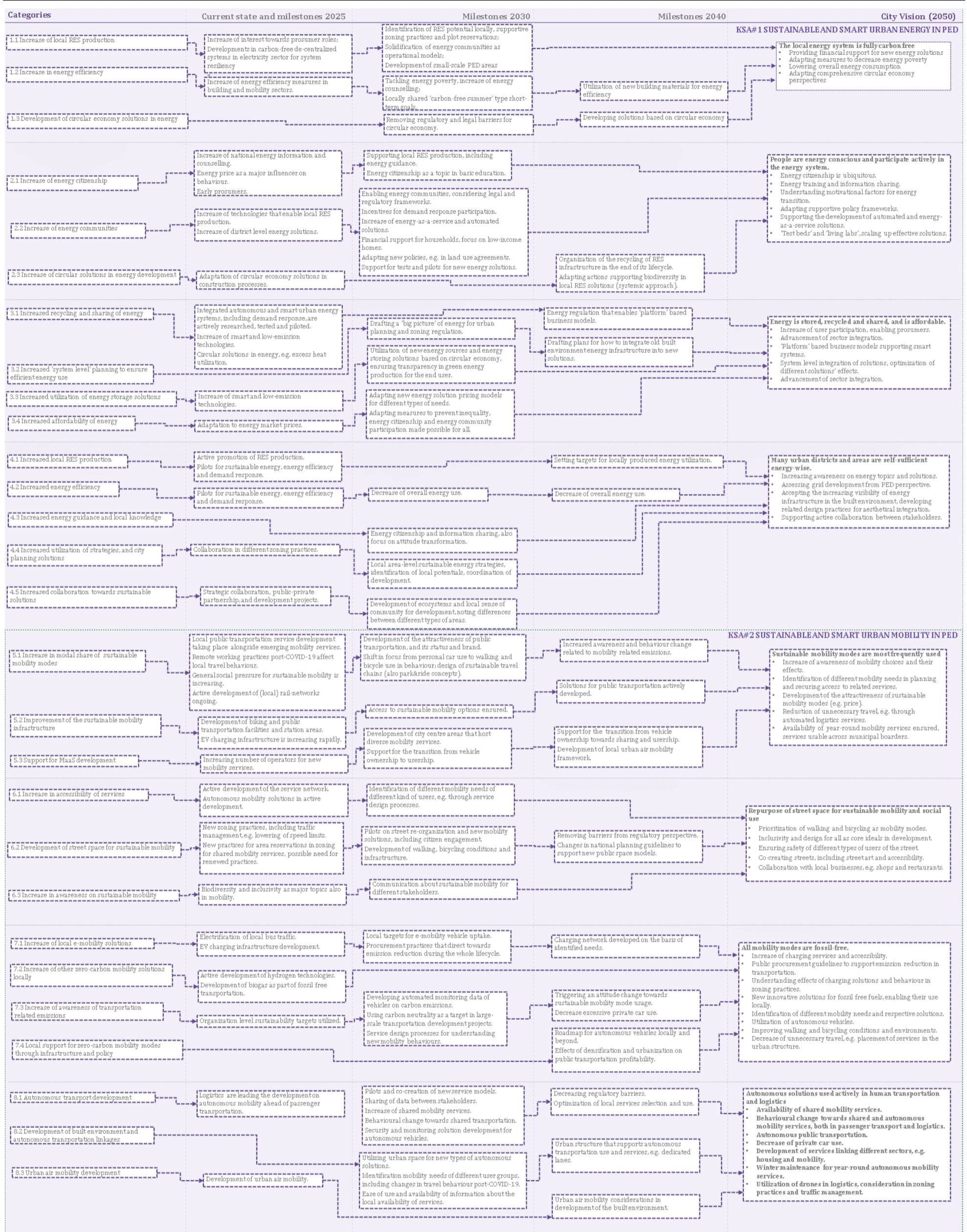


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Visual / Graphic Roadmap Espoo



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Topic: LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities

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Key outcomes per KSA

Identified Measures for KSA#1: energy

The key outcomes for both *key strategic areas* - (KSA#1) *Sustainable and smart urban energy solutions for PEDs* and (KSA#2) *Sustainable and smart urban mobility solutions for PEDs* - are presented in this section. These identified key outcomes include the practice, technology, policy and planning related measures that were discussed during the road mapping workshop as concrete tools through which the previously defined Milestones for 2030, 2040 and 2050 could be reached. The measures in **bold** presented in Table 3 are the ones that should be prioritized based on the workshop results, as these can provide cues on what the next steps could be in further sustainable and PED-related development in terms of sustainable and smart urban energy and mobility solutions.

Table 3. Key outcomes table – Espoo

Key outcomes for KSA1: Sustainable and smart urban energy solutions for PEDs	
Future Scenario / Categories	Identified measures
<p>The local energy system is fully carbon free</p> <p>1.1 Increase in local RES production;</p> <p>1.2 Increase in energy efficiency;</p> <p>1.3 Development of circular economy solutions in energy</p>	<p>a) 2030:</p> <ul style="list-style-type: none"> - Increasing energy guidance, including aspects related to zoning and construction permit processes (M1.1). - 'Sandbox areas' for piloting solutions and assessing barriers related to regulation (M1.2). - Creating suitable conditions for change, regardless of the selected technological solutions. - Smart apartments with smart sensors tracking appliances and heating. - Counselling support for consumers on energy topics. - Supporting the development of legal frameworks of energy communities. - Supporting low-income families to invest into new zero-carbon technologies. - Providing easy to use applications to observe potential of renewable energy use in plots. <p>b) 2040:</p> <ul style="list-style-type: none"> - Flexibility options in buildings taken into consideration during the planning phase (M1.3). - Renovations of existing building stock, minimize the need of new construction. - A peer-to-peer model for energy guidance. <p>c) 2050:</p> <ul style="list-style-type: none"> - Further development of smart grids. - The sharing economy as a part of everyday life. - Metering energy efficiency per person instead of per m².



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Key outcomes for KSA1: Sustainable and smart urban energy solutions for PEDs	
Future Scenario / Categories	Identified measures
<p>People are energy conscious and participate actively in the energy system</p> <p>2.1 Increase of energy citizenship;</p> <p>2.2 Increase of energy communities;</p> <p>2.3 Increase of circular solutions in energy development</p>	<p>a) 2030:</p> <ul style="list-style-type: none"> - Compiling best practises and models for construction, sustainable living, household purchases, and energy use (M2.1). - Communication, dissemination and marketing of existing solutions and related support mechanisms (M2.2). - New incentives and support systems for utilization/purchase of zero-carbon solutions. - Acknowledging energy communities in zoning practices, enabling different energy solutions. - Making the utilization of demand response and demand side management easy for consumers. - Developing regulation related to energy citizenship. - Energy guidance for residents. - New contract models and tariffs that enable increased flexibility. <p>b) 2040:</p> <ul style="list-style-type: none"> - Technological research and development focus on sustainable energy storage solutions and their increased use. - Ensure the update of the grid infrastructure. - Planning local energy solutions as a part of the whole urban environment, and its direct and indirect effects to other sectors and aspects. - Development of nuclear energy regulation and small modular reactors (SMRs). <p>c) 2050:</p> <ul style="list-style-type: none"> - Active international collaboration on sharing best practices.
<p>Energy is stored, recycled and shared, and is affordable</p> <p>3.1 Increased recycling and sharing of energy;</p> <p>3.2 Increased 'system level' planning to ensure efficient energy use</p> <p>3.3 Increased utilization of energy storage solutions</p> <p>3.4 Increased affordability of energy</p>	<p>a) 2030:</p> <ul style="list-style-type: none"> - Utilizing development commitments to encourage new pilot solutions in the storage, recycling, and production of sustainable energy (M3.1). - Update of the regulatory framework on energy communities and solutions. - Pilots, support and implementation of energy communities locally (M3.2). - Integrating public buildings in demand side management and energy solutions (M3.3). - Piloting vehicle-to-grid (V2G) solutions and operation models. - Defining the city's role in enabling pilots in the urban environment. - Developing new guidelines for development that consider e.g., the whole life cycle of the product/service, social equality, and business <p>b) 2040:</p> <ul style="list-style-type: none"> - Reducing regulatory barriers of new business models. - Developing energy communities from pilots to business-as-usual situation. <p>c) 2050:</p> <ul style="list-style-type: none"> - (No identified measures.)



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Key outcomes for KSA1: Sustainable and smart urban energy solutions for PEDs	
Future Scenario / Categories	Identified measures
<p>Many urban districts and areas are self-sufficient</p> <p>4.1 Increased local RES production</p> <p>4.2 Increased energy efficiency</p> <p>4.3 Increased energy guidance and local knowledge</p> <p>4.4 Increased utilization of strategies, and city planning solutions</p>	<p>a) 2030:</p> <ul style="list-style-type: none"> - Defining district-level energy plans (M4.1). - Defined plan, with identified practical measures, for energy guidance and education. - Easy to access information about the positive effects of energy efficiency investments (M4.2). - Assessing potential flexibility options for buildings. - Doubling the amount of energy renovations, energy efficiency is taken into account in all renovation projects. - Increase the availability and utilization of open data. - New business models for investments and operations of energy solutions. <p>b) 2040:</p> <ul style="list-style-type: none"> - Finding new energy efficiency measures by studying and gaining an understanding of different behaviour and lifestyles during different phases of the life course. - Increasing information sharing and education. - Utilization of data to identify and predict trends. <p>c) 2050:</p> <ul style="list-style-type: none"> - (No identified measures.)

Key outcomes for KSA1: Sustainable and smart urban energy solutions for PEDs		
Measures with most potential		
ID	Name	Description
M1.1	Increasing energy guidance, including aspects related to zoning and construction permit processes.	Municipalities have a key role in expediting the energy transition via streamlined zoning and permitting processes. Comprehensive and easily available guidance towards relevant parties can make bureaucratic processes easier for local businesses, residents and other actors. More detailed measures to achieve these goals should be assessed and implemented as suggested by assessment results. Easy availability of information on zoning and permitting processes and guidelines on the Espoo website should be ensured.
M1.2	'Sandbox areas' for piloting solutions and assessing barriers related to regulation.	'Regulatory sandboxes' are generally known as regulatory tools, that allow for the experimentation and piloting of new innovations under the regulator's supervision. This can enable demonstrations in topics that are still not possible under the current regulatory environment. Implementing regulatory sandboxes can aid in the study and experimentation of e.g., energy communities, which are still ambiguous under the current Finnish law.
M1.3	Flexibility options in buildings taken into consideration during the planning phase.	A key issue in the increased use of RES production is the intermittence of renewable generation, as renewable energy is oftentimes weather-dependent. In addition, new solutions for carbon-free heating and mobility often depend on the use of renewable or carbon-free electricity, thus leading to a significant increase in energy consumption. Harnessing and utilizing available flexible consumption can be one solution among many to alleviate the need to increase generation and transmission capacity
M2.1	Compiling best practises and models	Energy guidance enables residents to become more energy-conscious and knowledgeable on how they can save energy in their everyday



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Key outcomes for KSA1: Sustainable and smart urban energy solutions for PEDs		
Measures with most potential		
ID	Name	Description
	for construction, sustainable living, household purchases, and energy use.	lives. The regional environmental authority HSY provides a comprehensive energy guidance programme to residents and HOA's. The municipality, and other stakeholders, can lead residents to their courses and materials, or provide guidance activities of their own. In the latter case, doing parallel work should be avoided.
M2.2	Communication, dissemination and marketing of existing solutions and related support mechanisms.	Marketing existing solutions can give motivating examples towards local residents on how to invest into renewable energy or energy efficiency. Existing examples can come from any actor, such as the municipality, but focus should be on solutions that are applicable for residential investment. Support mechanisms provided by public entities should be made known as solutions are marketed.
M3.1	Utilizing development commitments to encourage new pilot solutions in the storage, recycling, and production of sustainable energy.	The Kera development commitment is an addition to the land use agreement with the Kera area, implemented in 2021. The commitment steers the development of the Kera area in accordance with Espoo's carbon neutrality and sustainable development goals. The commitment can be replicated and scaled up to encourage local operators to implement new pilot solutions in key city districts.
M3.2	Pilots, support and implementation of energy communities locally.	Energy communities are new operational models that aim to enable the local production and sharing of energy between citizens. Currently, energy communities within a single building are possible within Espoo, as electricity produced on premises can be divided between local tenants. Future experimentation and regulatory support should focus on the implementation of energy communities between property lines.
M3.3	Integrating public buildings in demand side management and energy solutions.	The municipality has a key role in the local energy system as the owner and operator of public buildings. Even as private buildings over number the city-owned portfolio, public buildings can still provide a major platform for demand side management (DSM) and sustainable energy investments. Currently, public buildings are part of the DSM solution of the local district heating utility, and sustainable energy solutions are implemented in new and renovated buildings. Future measures can focus on the DSM options within the electricity sector, and in the scale-up of current development activities.
M4.1	Defining district-level energy plans.	The procurement and implementation of comprehensive district-level energy plans can be a method to focus district development into the most effective solutions, and assess the potential of district self-sufficiency. District-level planning is already in use at Espoo, and the current trend should be continued as new development projects are launched. A short-list of districts with the most potential for self-sufficiency, or with the most benefits gained, can be utilized to focus assessment work.
M4.2	Easy to access information about the positive effects of	Energy efficiency is at the basis of district self-sufficiency. Investments into energy efficient solutions will reduce the need for production, and provide monetary savings to investors. Thus, it is



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Key outcomes for KSA1: Sustainable and smart urban energy solutions for PEDs		
Measures with most potential		
ID	Name	Description
	energy efficiency investments.	highly important to issue effective guidance and dissemination activities on the positive effects of energy efficiency solutions, to ensure that local residents and other actors do not focus only on sustainable production when assessing their options. District planning should guide towards energy efficient buildings by utilizing pilot solutions, such as the Kera development commitment or Finnoo sustainability criteria. The best pilot solutions will depend on the case at hand.

Key outcomes for KSA2: Sustainable and smart urban mobility solutions for PEDs	
Future Scenario Categories	Identified measures
<p>Sustainable mobility modes are most frequently used</p> <p>5.1 Increase in modal share of sustainable mobility modes;</p> <p>5.2 Improvement of the sustainable mobility infra-structure;</p> <p>5.3 Support for MaaS development</p>	<p>a) 2030:</p> <ul style="list-style-type: none"> - Broad-scale collaboration between different stakeholders, identification of roles and business models in regard to new mobility solutions (M5.1). - Automated monitoring of personal transportation related emissions (M5.2). - Less emphasis on infrastructure development that generate more private car use (M5.3). - Further development of shared city bike services. - Vouchers for sustainable transportation use. - Improvement of bicycle parking facilities in urban centres, accessible bicycle paths between the centres. <p>b) 2040:</p> <ul style="list-style-type: none"> - Increasing the role of mobility hubs and local air-terminals (use of drones) in urban development and planning. - Utilization of different funding possibilities to increase the availability of accessible mobility services. - Dedicated spaces for shared vehicles in mobility hubs. - A single digital platform for shared mobility services. - Monitoring and visualization of logistics related emissions. - Lighter regulation for contracts and insurance policies for shared vehicles. <p>c) 2050:</p> <ul style="list-style-type: none"> - Data available about emissions related to different mobility modes and shared mobility services. - Increasing the resiliency of the mobility system by mapping and preparing for different future scenarios. - Mobility services packages. - Shifting users from private car use to bicycle use.
<p>Repurpose of street space for sustainable mobility and social use</p> <p>6.1 Increase in accessibility of services;</p>	<p>a) 2030:</p> <ul style="list-style-type: none"> - Pilots for new modes of street space use (M6.1). - Identifying funding possibilities for projects and pilots. - Applying new ideas into existing processes. - Increasing the use of public transportation and shared mobility services, utilizing new solutions for logistics in planning. - Identification of service needs through design thinking approaches.



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Key outcomes for KSA2: Sustainable and smart urban mobility solutions for PEDs	
Future Scenario Categories	Identified measures
6.2 Development of street space for sustainable mobility; 6.3 Increase in awareness on sustainable mobility.	<ul style="list-style-type: none"> - Conducting research through simulations and analyses of different scenarios to support decision making processes. - Co-creation with active residents and other social groups. - Information sharing and education about sustainable mobility for different stakeholders. - Pilots on utilizing urban air space in logistics. <p>b) 2040:</p> <ul style="list-style-type: none"> - Utilizing learnings from pilots and conducting further pilot projects. <p>c) 2050:</p> <ul style="list-style-type: none"> - (No identified measures.)
<p>All mobility modes are fossil-free</p> 7.1 Increase of local e-mobility solutions; 7.2 Increase of other zero-carbon mobility solutions locally; 7.3 Increase of awareness of transportation related emissions; 7.4 Local support for zero-carbon mobility modes through infrastructure and policy.	<p>a) 2030:</p> <ul style="list-style-type: none"> - Finding funding opportunities for developing new solutions. - Setting targets for urban logistics emission, creating tools for monitoring (M7.1). - Modelling different scenarios (M7.2). - Increasing information sharing about circular and sharing economies (M7.3). - Acknowledging urban mobility transformation in transport planning. - Open data - Automatization of emission monitoring. - Increased level of detail of transportation emission data. - Increasing citizen engagement. - Campaigns for behaviour and attitude change towards sustainable mobility. <p>b) 2040:</p> <ul style="list-style-type: none"> - Supporting construction projects targeting towards sustainable mobility. - New solutions for agile urban planning processes. - Incorporating sustainability and zero-emission targets to action plans. <p>c) 2050:</p> <ul style="list-style-type: none"> - (No measures identified.)
<p>Autonomous solutions used actively in human transportation and logistics</p> 8.1 Autonomous transport development; 8.2 Development of built environment and autonomous transportation linkages; 8.3 Urban air mobility development.	<p>a) 2030:</p> <ul style="list-style-type: none"> - Developing a digital twin of the city, updating in real-time (M8.1). - Shared logistics hubs in the urban environment for different operators (M8.2). - Enabling small scale parcel deliveries. - Developing a big picture of mobility behaviour in general after COVID-19, possibilities and big picture for autonomous transportation as part of that. - Co-creating new solutions between different stakeholders. - Developing possibilities for urban air mobility and logistics. - Pilot projects, testing new solutions. <p>b) 2040:</p> <ul style="list-style-type: none"> - Co-creating new solutions between different stakeholders.



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Key outcomes for KSA2: Sustainable and smart urban mobility solutions for PEDs	
Future Scenario Categories	Identified measures
	<ul style="list-style-type: none"> - Developing the urban structure to support autonomous transportation, also the movements between cities. - Developing the urban air mobility framework. <p>c) 2050:</p> <ul style="list-style-type: none"> - (No identified measures.)

Key outcomes for KSA2: Sustainable and smart urban mobility solutions for PEDs		
Measures with most potential		
ID	Name	Description
M5.1	Broad-scale collaboration between different stakeholders, identification of roles and business models in regard to new mobility solutions.	Espoo already works actively in collaboration with the local stakeholders on developing new sustainable and smart solutions. As the mobility field is undergoing major transformations – new energy sources are utilized, new business and operation models are tested, and a shift towards usership from ownership is taking place – focus on the roles of different stakeholder is key for developing appropriate solutions that support sustainable travel behaviour. Co-creation methods and tools are required to facilitate active collaboration between different stakeholders.
M5.2	Automated monitoring of personal transportation related emissions.	The piloted solution for personal transportation emission tracking application, as also conducted in SPARCS, can provide key insight for utilizing similar solutions more broadly. Some cities in Finland have already conducted larger pilots on similar applications and connected them more broadly to sustainable lifestyles and consumer solutions as well. More details, though, are need of their effectiveness.
M5.3	Less emphasis on infrastructure development that generate more private car use.	New area development projects provide a possibility for developing the mobility system to support sustainable travel modes. For example, in Kera area, the aim is to develop the area to support walking, bicycling, public transportation use, and the use of shared mobility services. A rail-based public transportation system, as developed in Espoo through the metro line (2017-2022) and the upcoming tramway RaideJokeri (2024), can support sustainable travel behaviour.
M6.1	Pilots for new modes of street space use.	The development of a built environment that supports and encourages sustainable travel behaviour is best approached through pilots and tests that provide new perspectives to how street space could be organized. In Espoo, a pilot on a new street concept has been done in the Kera area in summer 2022, and the concept has been further examined in collaboration with a local higher education institution's design field students. New, developing areas, such as Kera and Finnoo, could act as natural pilot areas for new concepts.
M7.1	Setting targets for urban logistics emission, creating tools for monitoring.	Next to the development and monitoring of passenger mobility (private mobility and public transportation), focus on local logistics could provide a better picture of the current transportation related emission and their trends. Targets for the emissions could be set to support the transition towards fossil-free transportation as a whole.
M7.2	Modelling different scenarios.	Models and scenarios of development trends and possibilities are essential for supporting the work on setting local targets for emission reduction.



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Key outcomes for KSA2: Sustainable and smart urban mobility solutions for PEDs		
Measures with most potential		
ID	Name	Description
M7.3	Increasing information sharing about circular and sharing economies.	Shared mobility modes have increased recently almost exponentially, and, for example, new mobility modes have been introduced in cities in recent years, such as the e-kick scooters. Data and information sharing and exchange is important for further developing the new solutions and to integrate them to the existing mobility framework. Espoo works actively in collaboration with all mobility service providers in the area.
M8.1	Developing a digital twin of the city, updating in real-time.	A digital twin, with real time updates about traffic conditions, transportation related emissions, air quality, or other attributes could provide new tools for further development of the mobility system in general, as well as support autonomous transportation development. The autonomous vehicles could be integrated to the system, and use the data for the operation, or it could be used to form scenarios for development and planning purposes. Espoo 3D city model could provide a basic framework for the data sharing.
M8.2	Shared logistics hubs in the urban environment for different operators.	Espoo is actively developed as a networked city with multiple city centres and smaller transportation hubs (e.g., station areas). Autonomous logistics solutions could be further developed to utilize the hubs and centre-areas as major transportation hubs.

3.1.3 Adopted methodology and procedures

Methodology for the roadmapping process

This section presents the planning and preparation phase of the Roadmapping workshop process, following the general guidelines and methodology created by SPI, in collaboration with KLD/CVUT.

A task force was formed to organize the workshops and to deliver this report. The task force included five persons from the city of Espoo's SPARCS project team, of which two, Elina Wanne and Jani Tartia, have also been part of the earlier Draft City Vision 2050 workshop task force in autumn 2020. The other task force members were Angela Juslin (up to September 2022), Joni Mäkinen and Mia Kaurila. The task force planned the co-creation process, prepared the materials, sparred with SPI on the topics, and organized the online workshops.

Revising the Draft City Vision 2050 statements

In the Draft City Vision 2050, compiled on the basis of a workshop organized in fall 2020, various (desirable) futures for the Espoo area in terms of sustainable urban environment and sustainable lifestyles from energy, mobility and digitalization thematic perspectives, are presented for the year 2050. These possible futures were based on the views and expectations of experts and specialists working in the fields of energy, mobility and digitalization – i.e., how the built environment and urban lifestyles might look like in 30 years into the future. The experts and specialists that participated in the workshop were



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from the different departments of the city of Espoo. The key outcomes of the report, the ‘vision statements’ for future sustainable development from the PED-related topics of energy/mobility/digitalization, formed the basis for the Roadmapping workshop planning. They acted as the ‘destinations’ for the possible ‘development roads’ that were mapped and examined in the workshops. The vision statements, or future scenarios, were modified from the ones presented in the City Vision 2050 draft report (D1.11 “City Vision 2050 – Draft”) in order to bring them up to date. The statements were modified by:

- Reviewing briefly current smart city, energy, mobility and digitalization development topics on EU, national and local city levels.
- Reviewing city of Espoo’s strategy, Sustainable Espoo development programme plan, and other relevant documents on sustainable development (e.g., SECAP) to identify the already set targets and actions affecting the development of the urban energy and urban mobility sectors in the city, especially in relation to the city’s carbon neutrality 2030 target and the SDGs.
- Sparring one-to-one with SPARCS WP3 consortium partner organizations’ experts and specialists on current energy and mobility topics. In total, twelve (12) short one-to-one meetings were conducted online through Microsoft Teams during the summer 2022.
- Utilizing documented SPARCS insights on PED development.
- Reviewing available data about citizen attitudes towards their living environments and mobility habits, including *Espoo 20X0* workshop series⁷ results from 2022.

It was also decided in the planning phase that from the three KSAs examined in the previous workshop for the Draft City Vision, the KSA ‘digitalization’ should be merged with the ‘energy’ and ‘mobility’ thematic areas to prevent unnecessary overlap between the topics. Digitalization is a key component of most *smart city* development, and it is often already implied (directly or indirectly) that digital tools, platforms and/or methods are utilized where required when developing smart city solutions, such as urban energy and mobility solutions in this case.

Designing an online workshop

The Roadmapping workshops for PEDs were designed for an online setting. The COVID-19 pandemic has increased the capacities for both organizing and attending remote online workshops, and it was deemed as the most efficient and approachable way to gather multiple stakeholders to attend the workshops. Two workshops – one for each examined themes, urban energy and urban mobility – were designed. They were identical in terms of the general workshop process, utilized tools and methods, and agenda. The basic formula for the workshop and its main goals, as provided by SPI, was interpreted into a whiteboard (Figure 4) in the online Miro tool, to facilitate easy-to-use and accessible collaboration between the different stakeholders.

⁷ <https://www.espoo.fi/en/20X0>



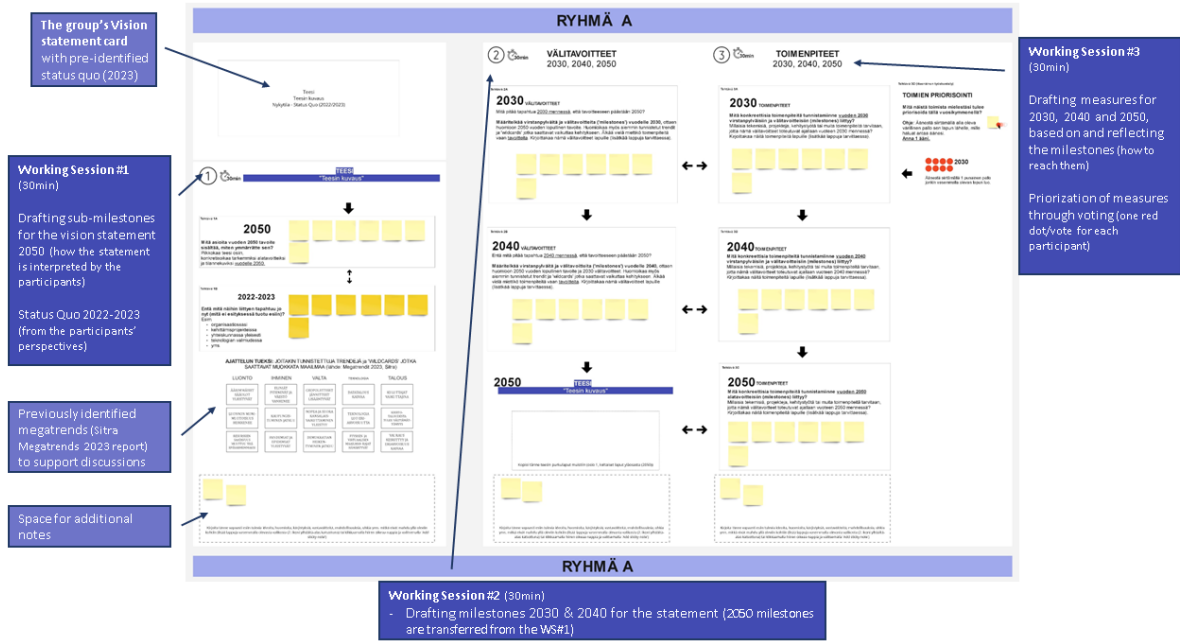


Figure 4. A whiteboard was created in Miro for the participants to provide their input (in Finnish). The board covers all the steps (Working Session #1-3) of the workshop process. In the workshop, the attendees were divided into small groups, and each group focused on one vision statement. The board also includes a selection of megatrends (Sitra 2023) to support the discussion and futures thinking

Sitra’s Megatrends 2023 report

The Finnish Innovation Fund, *Sitra*, is a publicly funded entity, which focuses on following, communicating and developing future-oriented topics and themes. Sitra has published *Megatrends* reports since 2011 with yearly updates. The Megatrends reports⁸ aim to bring different future visions together from different sources for easy-to-use format for utilization for any kind of future oriented works and processes. Alongside the report, Sitra has published trend cards (in 2020 and 2023⁹) covering the topics from the reports both in printed and digital formats, which can be used, for example, as part of workshops to stimulate thinking on future oriented topics. The materials are available in Finnish, Swedish and English.

In the first SPARCS Draft City Vision workshop (organized in fall 2020), the Megatrends report from 2020 (Sitra 2020) was utilized to stimulate the discussions and thinking in the workshop. The updated report from 2023 (Sitra 2023) was similarly utilized here in the Roadmapping workshops to provide tangible and approachable future trends as ‘food for thought’ and to help stimulate the discussions. Some of the key trends from the 2023 report were selected for the workshop and added to the canvas to support the discussions

⁸ <https://www.sitra.fi/en/publications/megatrends-2023/>

⁹ <https://www.sitra.fi/en/publications/megatrendcards-2023/>



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and futures thinking. This seemed to help the participants especially to think about the initial milestones for 2050 in the beginning of the workshop, but they were also used in later steps of the workshop as well. The selected megatrends were grouped under five themes – nature, people, power, technology, and economy – which were relevant to the urban energy and urban mobility topics examined in the workshops. The themes included megatrend topics related to the increase of extreme weather conditions, decrease of biodiversity, aging population, continuing urbanization, increase of pandemics, increasing geopolitical tensions, growth of data economics, and necessity of circular economy, among others.

Online workshop tools

The workshops were held online. Different online digital tools were utilized in the workshop process.

Microsoft Teams and Outlook – Microsoft Outlook was used to send the invites to the selected participants, and to organize the communication (e.g., instructions for attendance) before and after the workshops. Microsoft Teams was used as the main platform for the online workshop, including the use of breakout rooms for the small group working sessions.

Miro – The co-working activities during the workshop were organized through the Miro whiteboard tool. A whiteboard template was created for the workshop in advance (see subsection 'Designing an online workshop', in section 3.1.3), and all the participants were given access to the board to add their own notes. Facilitator in each group was ultimately in charge of writing down the key points from the discussions. All the participants had had prior experiences on working with Miro or other similar online whiteboard tool due to the COVID-19 remote working practices, so there were no noticeable difficulties or barriers in the use of the online tool during the workshops.

Mentimeter – Feedback and general thoughts and experiences from the workshops were gathered after both workshops (see subsection "Feedback – Value of co-creation" in section 3.1.4). Mentimeter online participation tool was used to gather the feedback. All the participants had had prior experiences on working with the tool (or similar) due to the COVID-19 remote working practices, so there were no noticeable difficulties or barriers in the use of the tool during the workshops.

Roadmapping Workshop Agenda

The Roadmap process consisted of two (2) workshops that ESP organized for the SPARCS Espoo local consortium. The workshops focused on the two main SPARCS topics: sustainable and smart urban energy solutions, and sustainable and smart urban mobility solutions.

The workshops were both organized in January 2023 – first, the urban energy themed workshop on January 18, and the second one on the urban mobility theme on January 25. Both workshops were organized fully online as it was deemed the most efficient and accessible way to both organize and attend the workshops. The remote working practices from the COVID-19-era, including online workshops and meetings, have provided good experiences and methodical skills on organizing online events. There are of course



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challenges and possible pitfalls with remote workshops – such as inactive participation, disengagement from the working process, absence of physical presence and face-to-face interaction, and technical challenges. These risks were mitigated by extensive planning.

Workshop agenda and working process

A detailed agenda for the three-hour (or 180min) workshop process was created by the task force. The same agenda template was used for both workshops. There was an option of updating/changing the agenda for the second workshops based on the experiences from the first, but there was no need to do so as the agenda was deemed fitting for the purpose. The agenda template is presented below in Table 4.

Table 4. The workshop agenda - Espoo. Source: authors

Roadmapping 2050 workshop, agenda (4th and final version)		
Number of workshops: 2 (energy theme, mobility theme)		
Duration: 3 hours for each workshop; 180min		
Venue: online, Teams, Miro, Mentimeter		
Time: Wed 18.1.2023, 12:00-15:00 (energy), and Wed 25.1.2023, 12:00-15:00 (mobility)		
PROGRAMME		
Stage	Content	Time
PART 1. INTRODUCTION (In Teams)	Opening words: SPARCS project and the Roadmapping 2050 workshops	12:00
	Focus of the workshop: Vision statements for PED development (from Draft City Vision 2050)	12:10
	Workshop process and the Miro tool	12:20
PART 2: SMALL GROUP WORK (in Teams breakout rooms)	Working Session #1 (WS#1) • Turning the vision statement into milestones for 2050	12:30
	(BREAK)	13:00
	Working Session #2 (WS#2) • Drafting milestones for 2030 and 2040 (based on WS#1)	13:10
	(BREAK + 'Virtual gallery walk')	13:40
	Working Session #3 (WS#3) • Mapping possible measures for the milestones (based on WS#1 and WS#2), and prioritization of the most relevant measures.	13:50



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PART 3: CONCLUSION (in Teams)	Discussion <ul style="list-style-type: none"> • Each small group presents the final results briefly to others, focus on the main milestones and main measures • General discussion 	14:20
	Closing words	14:50

There were three (3) main parts of the workshop: 1) introduction and presentation of the examined future scenarios, 2) the actual co-working session in small groups, comprising majority of the workshop's duration, and 3) presentation of the results and final discussion. The workshops were three hours or 180 minutes in duration.

The part 1 (30 minutes) of the workshop included brief presentations about SPARCS project (for participants not working in the project directly), the 2050 process in the project so far, and instructions for using the Miro whiteboard tool during the Working Sessions #1-3 in part 2 (see next paragraph). This part also included presentations of the four future scenarios and their respective *status quos* from the local Espoo context perspective, which were then also further built upon in the beginning of the part 2 of the workshop. The participants also introduced themselves through the chat to one another.

The part 2 (110 minutes) included three Working Sessions, each focused on different aspects of the road-mapping process. The Working Sessions #1-3 were all done in smaller working groups, led by a dedicated facilitator for each group. A round of introductions was done in the beginning of the group work. In the Working Session #1 (30 minutes), the participants first familiarized themselves with the given future scenario and 'dissected' it into smaller topics and subject matters as Milestones for 2050. Additionally, they discussed what was the current state (2022-2023) of the topics related to the scenario and the identified milestones, reflecting the brief presentations given in part 1 about the *status quo*. The Sitra Megatrends were utilized as points of discussion here as well. After a small break (10 minutes), the work continued in Working Session #2 (30 minutes), where the Milestones for 2030 and 2040 were identified. These intermittent milestones were reflected with the current state and the milestones identified for 2050. A small break (10 minutes) followed, during which the participants were also directed to do a 'virtual gallery walk' where they could go and see the work of other small groups so far. Lastly, in the Working Session #3 (30 minutes), the Measures to achieve the identified Milestones for 2030, 2040 and 2050 were drafted. In the end of the process, a quick prioritization exercise was also done through voting of the most important identified Measures.

The part 3 of the workshop (40 minutes) included brief presentations from each small group about their main results from part 2 activities, general discussion about the topics and results with the whole group, and a brief feedback survey through Mentimeter participatory tool.

Defining roles

A detailed script for the workshops was created, indicating the different roles and responsibilities, timings, and technical issues required in the different stages of the workshops. This script also included supportive questions for the breakout room facilitators for sparking conversation between the participants. A WhatsApp group was



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also set up between the organizers to communicate quickly if needed during the workshop.

A main facilitator hosted the event and was responsible of the timing of the different phases of the workshop, MS Teams breakout room management, and hosting the final general discussion. The main facilitator also visited each breakout room multiple times during the breakout sessions, ensuring there were no technological hick-ups or uncertainty about the tasks and steps of the workshop process. Also, if someone dropped out, or there were some technical difficulties in accessing the breakout rooms, the main facilitator helped to resolve those issues.

Four (4) facilitators managed the four (4) breakout rooms in both workshops. In addition to the task force, three members of the city of Espoo's *Centre of excellence for sustainable development* supported the workshop process as breakout room facilitators. The role of the facilitators was mainly to help generate discussion between the participants, and to make sure that the main discussed things were also written down in the Miro board. A separate briefing session before the workshops was held for the facilitators coming from outside the Task Force to give instructions for the facilitator role and the aims of the workshop.

Participants

The invited participants of the workshop were SPARCS WP3 Espoo local consortium partners. As the idea of the workshops and the roadmap was to identify possible paths towards more sustainable future(s), the project partners provided a wide range of expertise and knowledge on the workshops' topics of urban energy / urban mobility. The invitation was extended also to the partner organization representatives outside of the SPARCS project. Additionally, key experts from the city of Espoo departments – dealing with sustainable development, urban planning, energy planning, and traffic planning – were invited to join.

Thirty-five (35) participants (and seven [7] organizers) from five (5) different SPARCS Espoo local consortium organizations participated in the two workshops in total. Some of the participants joined both workshops, some only participated in one of them: there were twenty-eight (28) 'unique' participants. In the first workshop with the urban energy focus, nineteen (19) participants from five (5) different organizations participated. In the second workshop with the urban mobility focus, sixteen (16) participants from five (5) different organizations participated.

3.1.4 Lessons learned and next steps

Some practical lessons learned from the process are presented below. In general, the workshop process has acted as trigger for exploring the possibilities of local PED development. The key lessons learned include:

Futures of PEDs:

- Active development work is taking place on the urban energy and urban mobility topics on new technologies, processes and service models, and regulation and



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policies. Tests and pilots are key for advancing the topics, with the long-term goal of making the most viable solutions business-as-usual activities.

- Citizen engagement, energy guidance, and energy counselling were highlighted as relevant topics in the energy theme. Citizen's role is integral in several other themes as well, such as energy renovations and energy communities. It is important to include citizens more actively in the future development of energy solutions, and utilize participatory and co-creation methods and tools.
- In the mobility theme, one highlighted aspect was the need for improving built environment quality to support walking, bicycling, and public transportation use. Additionally, further challenge is presented by the integration of new shared mobility services, autonomous transportation, and urban air mobility solutions to the urban space. The spatial question is an important factor in defining the practicality, accessibility, efficiency, and aesthetical experience of the mobility mode use.
- Both the energy and mobility related workshops highlighted the importance of co-creation in the development of new solutions, regulations and policies. Co-creation between different stakeholders can provide insight to the different sides of the developed topics and solutions, and to the different temporal phases of it, from design and planning to construction and use, and to dismantling and redevelopment of the solution, service, space or model.

On utilizing workshops as a method for future thinking:

- Within workshops focusing on future(s) thinking, it seems to be easier to focus on the near future issues for the participants, and thus leave the more distant timelines on a lesser focus. This means that much more work on these topics is needed to expand the roadmap beyond 2030 in more detail, and even with the nearest milestone of 2030, many uncertainties remain.
- The focus of discussions during the workshop seem to depend more on which participants attend which small work group than on the theme of the group itself. Thus, the notes and outcomes of the group depend on the composition of the group itself, more than the topic provided.
- The insights, notes and ideas from the different working groups are rather easy to mix and match between each other, and also between each decade examined. This suggest that the most important part of the workshop is to understand future needs, milestones and measures, while the more detailed issues, such as the decades when measures need to be taken, can be defined further later down the line.
- One or two workshops is not enough to gain in-depth insight on the topics spanning multiple decades but can act as a precursor to a longer development process(es). Similarly, to initiate the realization of any of the ideas or insights developed – on practical, policy or strategic levels –another kind of process that supports the commitment of all relevant stakeholders to the process would be required. Many of the topics here are challenges that cannot be resolved by any party alone, but require active collaboration and co-creation. Additionally, including citizen engagement into such a process would also require that the topics



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arise from the citizens themselves, and their needs and aims, and not from the institutional side, to be successfully applied.

Realization of measures beyond the workshop:

- The report has provided insight for possible PED development, but the role of PEDs in the local sustainable development work remains to be seen. Also, how the results crafted during this work might transition to reality, is something that the process presented here cannot directly answer to.
- The workshops process and this report have collected notions from different stakeholders, providing a multi-voiced account about possible PED development pathways. This can act as a precursor for realized development of these issues, which are ones that no one partner can solve on their own. Regardless of the future steps taken, active collaboration between different stakeholders is most likely required to reach impactful results.

Feedback – Value of co-creation

Anonymous and voluntary feedback from the participants was gathered in the end of both workshops to gain understanding about the workshop process itself. A brief questionnaire, with the possibility to answer numerically (1 to 5 scale), was prepared in advance in an online live questionnaire tool (Mentimeter).

The gained feedback is presented in Table 5 below. The workshop contents, relevance and level of interest, and practical organization all gained good grades from the participants. The number of responses, however, was lower than the actual participants so no feedback was gathered from all the workshops' participants. Especially the co-creation and co-thinking process about future topics was seen as relevant, gaining the highest-grade values in both workshops (4,3 and 4,7 out of 5, respectively). It is also notable that the lowest grade in each feedback questionnaire was given to the question "How likely it is that the possibilities and solutions examined in the workshop will take place at some point from your opinion?", which highlights both the emergent nature of the PED concept, as well as the inherent uncertainty related to all futures thinking. The grade is above 3, which could be interpreted to mean that there are trends and patterns emerging on the topics that can be identified, but that they also come with a considerable amount of vagueness in terms of certainty and details. Also, the possibility of disruptions is a major factor – as experienced recently in terms of COVID-19 pandemic, and the energy crisis in Europe.



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Table 5. The results from the workshop feedback surveys

Workshop #1: focus on urban energy in PEDs Date: Jan 18, 2023 Number of respondents: 9 Scale: 1-5, where 1=not at all ... 5=very much so	Results
How useful are the topics and solutions examined in the workshop for a sustainable future from your opinion?	3,9
How likely it is that the possibilities and solutions examined in the workshop will take place at some point from your opinion?	3,6
How useful was the workshop for developing your own thinking on the matter?	4,2
How well were you able to participate in the discussion? Did you feel that your ideas and comments were considered in the group?	4,2
How useful was it for your own thinking to work together with different kinds of people from different organizations?	4,3
Workshop #2: focus on urban mobility in PEDs Date: Jan 25, 2023 Number of respondents: 7 Scale: 1-5, where 1=not at all ... 5=very much so	Results
How useful are the topics and solutions examined in the workshop for a sustainable future from your opinion?	4,6
How likely it is that the possibilities and solutions examined in the workshop will take place at some point from your opinion?	3,9
How useful was the workshop for developing your own thinking on the matter?	4,1
How well were you able to participate in the discussion? Did you feel that your ideas and comments were considered in the group?	4,7
How useful was it for your own thinking to work together with different kinds of people from different organizations?	4,7

Dissemination

The dissemination plan is included in this report as an appendix (Section C, Appendix 2). The plan covers the key communication activities of the report and its linkages to other relevant processes, mainly inside the city of Espoo organization and related to the ongoing carbon neutral Espoo 2030 work.



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3.2 Leipzig Roadmap

3.2.1 Introduction

With the adoption of the Energy and Climate Protection Program 2030 (SECAP) in 2022, the city of Leipzig continued to formalize its ambitious climate protection and sustainability goals and committed itself not only to a strategic program, but also concrete implementation measures. Every two years, the implementation program will be updated, adapted to changing conditions, and further concretized to actually implement the goals of the SECAP and achieve climate neutrality by 2040. Thus, the city of Leipzig aims for climate neutrality well before the SPARCS deadline of 2050 and before the deadline of the German Federal Government of 2045.

Leipzig's climate protection efforts and commitments were appreciated by the European Commission by selecting it as a Mission City of the EU mission "100 climate-neutral and smart cities". While the city administration is playing a pioneering role in the transition process to a climate-neutral city, climate neutrality requires the cooperation of the entire urban society, including businesses and civil society. Therefore, in a broad participation process for the creation of a Climate City Contract, further climate protection measures are currently solicited.

In order to achieve climate neutrality and to continue to maintain the city as a place worth living in, a wide variety of measures are necessary, ranging from a change in transportation to the decarbonization of energy and heat supply to sustainable land use planning. The Leipzig roadmap maps precisely this complexity of measures. The roadmap is a snapshot that visualizes this enormous task and the incredibly diverse activities with their multitude of actors. It is a growing document that is subject to continuous change. Continuously, decisions are made in the council and city administration that pay into the account of climate neutrality. There are further action plans for air pollution control and the promotion of pedestrian mobility, digital tools are being developed to promote the energy and traffic turnaround. Companies are helping to shape the energy transition and transform their business processes. And, last, but not least, Leipzig's civil society not only calls for transition processes, but also provides incredibly creative and forward-thinking impulses. All of these measures are pieces of the puzzle that make up the city of Leipzig's path to climate neutrality.

Roadmap and City Vision

In the course of creating the SPARCS roadmap for the city of Leipzig, the "City Vision 2050" was updated. Since the City Vision and the roadmap, which are being developed in the SPARCS project, are to be used sustainably by the city of Leipzig, they had to be adapted to new developments in city policy and changes in goals that occurred since the creation of the City Vision in 2020. This concerns primarily the new strategic Energy and Climate Protection Program 2030 (SECAP), which is decisive for the further development of the city.



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In order to achieve significant GHG savings and, at the same time, to shape a transformation to a sustainable city, the city of Leipzig has identified the following ten success factors, which will be used to the future energy and climate protection work of the city up to the year 2030, continuously developing further measures and taking up impulses from the public and integrating them into the work. These success factors are:

1. Sustainable mobility
2. Sustainable Energy and heat supply
3. Sustainable land-use
4. Climate-friendly green-blue infrastructure
5. Climate-friendly urban district development
6. Climate-neutral city administration
7. Regional circular economy
8. Sustainable nutrition
9. Climate education
10. Climate protection initiative

After careful consideration, the decision was made to restructure the original City Vision and define the success factors as new Key Strategic Areas (KSAs). This alignment of the SPARCS outcomes - City Vision and roadmap - with Leipzig's most central strategic documents is highly valuable in terms of recognition, and significantly increases the likelihood of integrating SPARCS outcomes into the regular work within the city. Additionally, the revision process helped to identify and address previously overlooked areas, resulting in a comprehensive picture of the necessary path to climate neutrality. Both the SPARCS City Vision and roadmap were (re-)clustered based on these new KSAs during the work process. Below you find a comparison of the KSAs according to the initial and the new City Vision (see Table 6 below).

Table 6. Comparison of Key strategic areas of the initial and revised City Vision - Leipzig

KSA according to revised City Vision and roadmap (2023)	KSA according to initial City Vision (2020)
KSA1. Sustainable mobility	KSA2. Mobility KSA5. Digital City
KSA2. Energy and heat supply	KSA1. Energy and Heat KSA3. Housing KSA5. Digital City
KSA3. Sustainable land use	KSA5. Digital City
KSA4. Climate-friendly green-blue infrastructure	KSA3. Housing KSA4. Urban Society KSA5. Digital City
KSA5. Climate-friendly urban district development	KSA3. Housing KSA4. Urban Society KSA5. Digital City



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KSA according to revised City Vision and roadmap (2023)	KSA according to initial City Vision (2020)
KSA6. Climate-neutral city administration	KSA5. Digital City
KSA7. Regional circular economy	KSA5. Digital City
KSA8. Sustainable nutrition	KSA4. Urban Society KSA5. Digital City
KSA9. Climate education	KSA4. Urban Society KSA5. Digital City
KSA10. Climate protection initiative	KSA4. Urban Society KSA5. Digital City

Even more visibly than in the first version of the City Vision, it becomes clear that the topic "Digital City" is located as a crosscutting theme in all KSAs, and smart city and other digital approaches are of particular relevance in the transformation process. This is also reflected in several major smart city measures in the roadmap, which are also described in detail within the Digital Agenda of the city of Leipzig, which was approved by City Council only in 2023.

The roadmap now contains 60 milestones in 10 Key Strategic Areas and 30 subcategories and focuses on the most important milestones on the path to climate neutrality. The milestones vary in their "altitude" – while the short-term milestones are specific tasks in operational implementation, the medium and long-term ones are more strategic objectives. Over time, these strategic objectives will also be supported by operational measures, and thus the roadmap will evolve over time. The following table provides an overview of the subcategories for each KSA (see Table 7 below).

Table 7. Subcategories per KSA in the Leipzig roadmap

KSA	Subcategory
KSA1. Sustainable mobility	<i>1.1 Framework for climate neutrality in the mobility sector</i> <i>1.2 Pedestrian traffic</i> <i>1.3 Cycling traffic</i> <i>1.4 Public transport, intermodal mobility and motorized private mobility</i>
KSA2. Energy and heat supply	<i>2.1 Framework for climate neutrality in the energy and heat sector</i> <i>2.2 Expansion of the production of renewable energies (heat)</i> <i>2.3 Expansion of the production of renewable energies</i> <i>2.4 Expansion of storage capacities for renewable energies</i> <i>2.5 Development of the regional hydrogen supply</i> <i>2.6 Smart energy monitoring systems</i>
KSA3. Sustainable land use	<i>3.1 Implementation of a sustainable and climate-friendly land-use</i>



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KSA	Subcategory
KSA4. Climate-friendly green-blue infrastructure	<i>4.1 Infrastructure measures</i> <i>4.2 Protection an expansion of tree population and green areas</i>
KSA5. Climate-friendly urban district development	<i>5.1 Framework for a climate-friendly urban district development</i> <i>5.2 Digital Tools to support the urban district development</i> <i>5.3 Pilot projects for climate-friendly urban district development</i>
KSA6. Climate-neutral city administration	<i>6.1 Strategies for a climate-neutral city administration</i> <i>6.2 GHG accounting</i> <i>6.3 Energetic refurbishment and energy saving measures in municipal buildings and production of renewable energy</i> <i>6.4 Climate-friendly mobility</i> <i>6.5 Awareness rising and capacity building</i> <i>6.6 Circular economy</i>
KSA7. Regional circular economy	<i>7.1 Zero Waste Management</i> <i>7.2 Circular economy</i>
KSA8. Sustainable nutrition	<i>8.1 Municipal nutrition strategy</i> <i>8.2 Sustainable nutrition in city administration and associated companies</i> <i>8.3 Awareness-rising and capacity building</i>
KSA9. Climate education	<i>9.1 Climate education</i>
KSA10. Climate protection initiative	<i>10.1 Networking and encouraging climate action</i> <i>10.2 Supporting SMEs activities</i>

The SPARCS roadmap is the result of an intensive examination of Leipzig's climate protection goals and measures. It provides a condensed overview of the strategic path towards achieving carbon neutrality. During the working process, central strategic documents were analysed, discussions with experts from seven departments took place, a comprehensive roadmap with 170 measures was developed (see Appendix 3, section A), which was finally condensed into the SPARCS roadmap. Given the complexity of the task, it can be said that this process was not easy.

All measures in the roadmap are already specifically planned, either within the SECAP, its implementation program or in other work programs, or they are projects currently being implemented. In the two Replication districts the LWB-Stock and the Virtual Energy Community, SPARCS Use Cases are undergoing further development and subsequent replication. These districts are not physical. Detailed descriptions of these Use Cases can be found in Deliverables D4.7 and D5.14. It's important to note that these Deliverables are intricately connected to Key Strategic Area (KSA) 5.

In addition, the majority of the measures that are to be completed by 2024 are already in progress. The Leipzig roadmap is, therefore, not a statement of intent but a concrete work program for the coming years.



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A look at the SPARCS roadmap – and at the comprehensive roadmap – highlights the complexity of the endeavour and demonstrates the impressive range of specific measures that the city of Leipzig has already initiated on its journey towards becoming a carbon-neutral city. Nevertheless, we would like to underline the fact that climate systems are extremely complex and characterized by a variety of interactions. Climate change itself is influenced by many different factors such as natural variations, human activities, feedback loops, and rebound effects. Therefore, it is difficult to predict the specific impact of a single action on the complex climate system. We can therefore assume that the measures of such a roadmap always have multiple impact mechanisms and that an assignment to Key strategic areas, success factors or other thematic categories serves to simplify and make them more manageable. After all, the goal of a roadmap as a strategic planning instrument is to show the direction, goals and milestones for achieving a specific project or undertaking. In other words, to outline ways to achieve a concrete goal. However, the impact mechanisms and actual impacts of the roadmap measures and thus a statement about which key strategic areas they actually influence can only be analysed ex-post.

3.2.2 Overall roadmap results

Below, the results of the roadmapping process are presented in detail. The graphic roadmap includes the 10 KSA, along with their milestones and key outcomes, which are described in detail. To ensure that the path the city has chosen is clear and that the roadmap inspires other cities and provides tangible assistance, the milestones table, with a thorough description of the milestones, and the comprehensive roadmap are presented in Appendix 3 (sections A and B).

Leipzig's Roadmap for urban transformation

Basic framework: The municipal climate neutrality strategy

Leipzig is currently working on a municipal climate neutrality strategy, which will be finalized in 2024. The municipal climate neutrality strategy aims to highlight further potentials, possible scenarios, and additional measures on the path towards a climate-neutral city, including central infrastructures like energy and water supply, building and urban development processes, the mobility sector, the economy, private households, and consumption. Additionally, the strategy intends to demonstrate an integrative consideration of climate protection, sustainable development, adaptation to the consequences of climate change, and the utilization of possible synergies. The climate neutrality strategy will serve as a basis for guiding further energy and climate protection efforts at the municipal level. The concept includes an inventory analysis, a potential analysis, a scenario development for the years 2030, 2035, and 2040, as well as a strategy with further measures to achieve climate neutrality.

KSA1: Sustainable Mobility

Strengthening the environmental alliance of walking, cycling and public transport with links to intermodal transport services like car sharing, park/bike & ride as well as the



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electrification of private transport is the main goal of KSA1 Sustainably mobility. By integrating these modes of transportation, Leipzig seeks to provide seamless and convenient options for its residents, encouraging them to choose sustainable alternatives to private cars. By investing in infrastructure improvements, creating safe and accessible pedestrian and cycling networks, and enhancing the efficiency and attractiveness of public transport services, the city aims to encourage a shift away from private motorized transport. In addition, the charging infrastructure to support the growing number of electric vehicles will be expanded, thereby reducing reliance on fossil fuel-powered cars and contributing to lower emissions.

KSA2: Energy and heat supply

The focus of the activities in the municipal energy and heat sector lies in expanding the production and storage capabilities of renewable energies and the necessary local-regional infrastructure for their distribution. In Leipzig, the expansion of renewable energies is being promoted with concrete construction measures currently being implemented in districts such as Lausen and Seehausen. In the district of Lausen, the largest solar thermal plant in Germany is under development, capable of covering 20% of the local heat demand during the summer months. The construction of the 30 MW electrical generation capacity PV plant "Energieberg Seehausen" ("Energy mountain Seehausen") can be characterized as a milestone on the path towards achieving 400 MW municipal electrical generation capacity until 2030. Currently, strategic concepts for decarbonizing the municipal heat and energy supply in Leipzig are being developed, specifying the major infrastructural measures and the corresponding necessary steps to achieve this kind of transformation. Additionally, projects such as updating the solar roof cadaster and the development of the Energy Atlas Leipzig (as part of the SPARCS project) accelerate the expansion of decentralized renewable energy generation facilities. The SPARCS project has enabled the city of Leipzig to identify the potential of decentralized energy generation at the district and residential block level as a crucial element in the energy transition. The virtual power plant developed in the project plays a fundamental role in controlling energy production and consumption and will be further expanded in the coming years. Furthermore, Leipzig is exploring the potential of hydrogen and the measures required for hydrogen supply; the city is part of the hydrogen network in Central Germany. Finally, yet importantly, the deployment of smart meters will be advanced to support the intelligent control and utilization of energy resources.

KSA3: Sustainable land-use

The potential of sustainable urban development lies in the direct influence on sustainable land-use planning and the city's future design. Due to population growth and the increased attractiveness for the real estate sector, numerous new development projects have been initiated in Leipzig. This presents an opportunity to actively shape climate-friendly neighbourhood development in a growing city based on ambitious standards and newly established technical infrastructure. In line with the concept of dual inner development, the development of residential, commercial, and transportation areas is closely integrated with the development of green spaces, promoting a climate-friendly green-blue infrastructure. In this context, KSA3 is of central importance, because it focusses on the resolution of the intensifying land use competition between renewable



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energy expansion, residential, commercial, and transportation areas as well as a functioning green-blue infrastructure through integrated planning for the common good in a growing city.

KSA4: Climate-friendly green-blue infrastructure

Maintaining the green-blue infrastructure incentivises exercise and recreation, preserves biodiversity, provides cold and fresh air and water retention, and promotes health through an improved microclimate. Green-blue infrastructure also helps to mitigate urban heat islands. In order for the urban green-blue infrastructure to make its contribution to greenhouse gas reduction, the unsealing of areas to expand green spaces and water bodies must be promoted, as must the extensive management of municipal and agricultural land. Furthermore, ecological stabilisation of natural areas, especially the rewetting of alluvial forest, is essential. Consequently, Leipzig's path to climate neutrality also includes various measures to expand and protect the green-blue infrastructure. Two measures are of particular importance: The development of a digital green space management system for the ongoing development and maintenance of green infrastructure, and the overall concept of water management for a water-sensitive urban development.

KSA5: Climate-friendly urban district development

The city of Leipzig aims to develop climate-friendly neighbourhoods and urban districts. To achieve this, it utilizes the available instruments of building law and opportunities for collaborative neighbourhood refurbishment. Climate-friendly neighbourhoods are characterized by high levels of innovation, energy efficiency, and a high use of renewable energy sources, resulting in no negative impact on the climate and mitigating existing negative effects in the surroundings. The city promotes and protects the multifunctionality of open spaces both within and outside the city. Additionally, Leipzig maximizes its carbon sink potential through sustainable land and water management, habitat restoration, and expansion of green-blue infrastructure. Climate-friendly urban district planning includes measures for both climate protection and climate adaptation. To systematically and structurally integrate principles of climate-friendliness and climate justice into urban planning processes, models for city development are currently being developed, including the standard model for climate-friendly neighbourhood development within the SPARCS project. Planning processes are supported by digital tools such as digital twins and the Urban Data Platform, which can integrate open and standardized sensors and systems. Furthermore, pilot projects lift potentials for the urban district development, such as the model project "Leipzig BlauGrün II: Blue-Green District Development in Leipzig" (funded by BMBF), but also smart city lighting approaches and planned model projects regarding the realization of new residential areas with low car-use.

KSA6: Climate-neutral city administration

The goal of this KSA6 is achieving a climate-neutral city administration by 2035. The necessary measures for this include various fields of action, such as GHG accounting, the



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decarbonization of municipal building stock, climate-friendly mobility, and the implementation of circular economy principles. The framework for all actions is provided by the concept "Climate-neutral City Administration 2035," which will serve as a guiding document for the upcoming years. Infrastructure measures taken by the city administration and its affiliated companies, which go beyond the SECAP 2030 and its current implementation program, will be integrated into the Climate City Contract, created as part of the EU Cities Mission "100 climate-neutral and smart cities." In addition, various events and awareness-raising and capacity-building activities will accompany the process to prepare all employees of the city of Leipzig for their pioneering role in the transition to a climate-neutral city.

Effective internal structures and coordinated work processes are the most important prerequisites for implementing the challenging tasks regarding reaching climate neutrality in the city of Leipzig and its administration. With the establishment of the Office for Sustainable Development and Climate Protection, a necessary unit for the overall coordination has been established in 2020, having, since then, been strengthening forms of interdepartmental and cross-functional collaboration within the city administration. The close collaboration with the Digital City Unit and their expertise in smart city approaches for climate protection elevates the city of Leipzig to a new level of competence.

KSA7: Regional circular economy

KSA7 Regional Circular Economy aims to close regional economic and material loops to reduce transportation and transaction costs and promote local value creation. By joining the Zero Waste Europe Network, Leipzig has committed to taking appropriate measures to achieve the following targets by 2035: a) 10 percent reduction in residual waste, b) maintaining a high level of waste separation, c) supporting the commercial sector in reducing residual waste, and d) achieving a 90 percent recycling rate of municipal waste. The goal is to obtain the Zero Waste City certificate. To achieve this, various measures have already been taken and planned, including the development of a Zero Waste Strategy, the establishment of a municipal second-hand department store, and the promotion of a hardware-based circular economy (Hardware4Future). The cultural sector in Leipzig is a pioneer in developing a sector-specific approach to regional circular economy and shares its experiences with other sectors. The objective is also to integrate circular economy principles into urban planning and infrastructure projects to ensure sustainable development. However, circular economy also involves actions by businesses to extend the lifespan of products and use resources efficiently. In a circular economy, products and materials are designed in a way that allows them to be reused, repaired, recycled, or remanufactured to minimize waste and the consumption of finite resources. Leipzig's Office for Economic Development advocates for a stronger integration of these circular economy principles within Leipzig businesses. The "Leitbild nachhaltiges Wirtschaften" ("Sustainable Business Vision") by the Forum Nachhaltiges Leipzig, a coalition of Leipzig's residents, private and public institutions committed to sustainable development, is also pioneering in this regard and provides companies with useful indications on how to implement circular economy in their processes.



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KSA8: Sustainable nutrition

KSA8 Sustainable nutrition aims to develop a comprehensive food strategy that combines municipal measures in the form of projects, initiatives, and guidelines. The urban food landscape is being realigned to prioritize the production and consumption of ecological, regional, and seasonal food. The city administration and affiliated companies play a pioneering role in this transition, therefore, procurement rules for canteens are being adjusted to facilitate the sourcing of sustainable food, inspiring other companies and institutions to follow the same path. By sourcing sustainable food for municipal canteens, including schools, the production sector is strengthened, and the availability of sustainable food is expanded. Long-term awareness-raising measures are implemented to promote the consumption of sustainable food in private households. Additionally, the expansion and utilization of orchards and self-harvest fields are supported to provide the opportunity for urban residents to grow their own fruits and vegetables and experience nature-friendly cultivation methods firsthand.

KSA9: Climate education

The goal of KSA9 Climate Education is to implement broad-based climate education measures to raise awareness and build capacity throughout the Leipzig urban community, so that climate-friendly behaviour becomes the "new normal" and relevant measures and behaviours are considered in all everyday activities. KSA9 aims to create a "background noise" for climate protection, meaning that climate education will be ubiquitous and diverse, sensitizing the entire urban community. It acknowledges that climate education needs to be sensitive and impactful, especially in the face of climate change and its associated threats, as well as considering the costs of climate protection measures, which will also affect everyday living expenses.

Climate education encompass various activities and measures over several years. A key element is the formation of partnerships between the local government, educational institutions, environmental organizations, and engaged citizens. Through this collaboration, the campaign ensures diverse perspectives and tailors its approach to the specific needs and circumstances of the community. The climate education campaign employs a wide range of measures to reach as many people as possible. These include information sessions, workshops, and trainings on topics such as renewable energy, energy efficiency, sustainable mobility, waste reduction, and recycling. These events take place in schools as well as public and other facilities, providing participants with opportunities to expand their knowledge and actively contribute.

KSA9 Climate education is directly linked to KSA10 Climate protection initiative, in which the urban society is called upon to develop and implement concrete climate protection measures. Climate education is a central requirement for the successful implementation of the transition process towards a climate-neutral city. Only through educational measures can all members of society be included and engaged.



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KSA10: Climate protection initiative

The KSA10 Climate protection initiative aims to engage the entire Leipzig city community in increasing climate protection and sustainability. The goal is to expand the network of active stakeholders. Existing climate protection activities will be recognized and supported, and the already active actors from civil society, business, research, etc., will be encouraged to continue and take the next steps, with the support of the city. The objective is also to gather commitments for concrete climate protection measures and monitor their actual implementation. This approach makes the transition to a carbon-neutral city and the individual activities leading to this transition visible. Additionally, companies will be supported in their transition towards sustainable businesses through consultation and funding programs. The Climate protection initiative benefits from existing networks of active stakeholders and aims to expand the circle of participants. In this regard, KSA9 Climate education also plays a role, as it is expected that participants in educational events or similar activities will become active actors. While the goal of Climate education is to raise awareness, the Climate protection initiative focuses on concrete climate protection measures.

By participating in the EU Cities Mission "100 climate-neutral and smart cities," Leipzig has a valuable instrument for gathering commitments and monitoring climate protection activities across the entire city community.

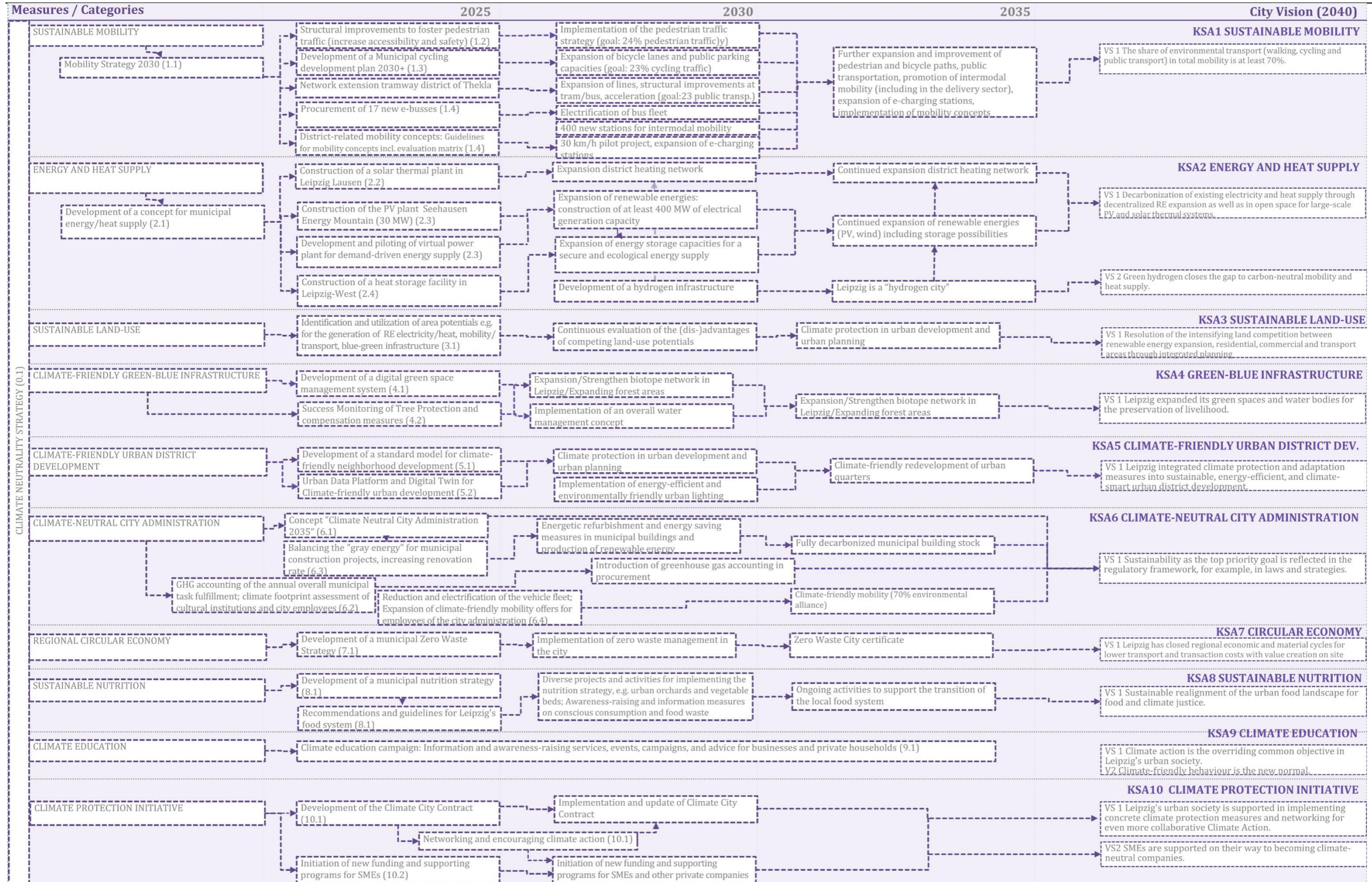


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Visual / Graphic Roadmap Leipzig



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Key outcomes per KSA

This chapter highlights the most important expected outcomes per key strategic area. These key outcomes (Table 8) result from the measures outlined in the Graphic roadmap, further developed in the milestone tables in Appendix 3 (section A). The key outcomes were discussed during the roadmapping workshop and further elaborated in the subsequent working process.

Table 8. Key outcomes table – Leipzig

Key outcomes for the 'Climate Neutrality Strategy'		
ID	Name (type)	Description
0.1	Climate neutrality strategy for the city of Leipzig (type: strategy)	The municipal climate neutrality strategy is to identify further potentials, possible scenarios and measures on the way to a climate-neutral city in the areas of central infrastructures such as energy and water supply, building and urban development, the mobility sector, the economy, private households and consumption, among others (delivery date: 2024, responsible: Office for Sustainable Development and Climate Protection).
Key outcomes for KSA1: Sustainable Mobility		
ID	Name (type)	Description
1.1	Framework for climate neutrality in the mobility sector: Mobility strategy 2030 (type: strategy) and introduction of environmentally sensitive traffic control (type: solution)	The "Framework Plan for the Implementation of the Mobility Strategy 2030" consolidates all mobility projects of the city of Leipzig and the Leipzig Public Transport Company, even beyond the year 2030. It includes over 300 measures, overarching concepts, guidelines, as well as specific initiatives and projects for implementation. In a participatory process, the Leipzig Citizens' Representation unanimously voted in favour of the sustainability scenario, which prioritizes the equal expansion of cycling and pedestrian traffic along with public transportation (ÖPNV). Additionally, the aim of the measure is an implementation of traffic control measures depending on the environmental pollution (among others NOx) at LSA and digital information media (LED boards). This makes it possible to defuse hotspots with increased environmental pollution and to liquefy traffic (delivery date: 2030).
1.2	Structural improvements of the infrastructure for pedestrians (type: solution)	By investing in infrastructure improvements, the city aims to create safe and accessible pedestrian networks in order to increase the share of pedestrians on the overall mobility in the city (24% until 2030). This is implemented through a variety of measures: Crosswalk Program (Improvement of the crossability of busy roads), City Square Program (Upgrading of public spaces into city squares with a high recreational function), Sidewalk Renovation Program (creation and repair of sidewalks), an attractively designed network of paths along open space structures and bodies of water for bicycle and pedestrian traffic to increase the comfort and safety of being able to move around away from busy roads (part of the Green Master Plan), as well as structural improvements at junctions and crossing areas for pedestrian traffic to increase accessibility and safety. Responsible for the implementation of these measures is mainly the Office for Traffic Planning and Road



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Key outcomes for KSA1: Sustainable Mobility		
ID	Name (type)	Description
		Construction, with the measure-specific support of the Office for Urban Parks and Bodies of Water Authority and the Office for City Planning.
1.3	Structural improvements of the infrastructure for cyclists (type: solution)	By investing in infrastructure improvements, the city aims to create safe and accessible bicycle networks in order to increase the share of cyclists on the overall mobility in the city (23% share of total transport until 2030). This is implemented through a variety of measures: Development and implementation of a Municipal cycling development plan 2030+ (conceptual basis for municipal cycling promotion, serves to plan and prioritize all measures in the cycling field of action up to the year 2030 and beyond), realization of high-speed cycling connections (address urban-rural and commuter traffic, reducing reliance on private transport), expanding the capacity of bicycle parking facilities in public spaces (e.g. near the main station and transport hubs), and the designation of further bicycle lanes. The aim is to improve the quality and flow of traffic for cyclists and to increase the visibility of cyclists. Furthermore, climate-neutral delivery traffic is promoted by cargo bikes (cargo bike promotion for SMEs by the Office for Economic Development; piloting of cargo bike rental - 30 loanable cargo bikes at 11 stations in the city area - by the Office for Traffic Planning and Road Construction and the Office for Economic Development).
1.4	Public transport, intermodal mobility and motorized private mobility	
	1.4.1 Expansion of infrastructure for intermodal mobility (type: solution)	The promotion of intermodal transport is a central objective of the Leipzig Mobility Strategy 2030 and aims to provide an attractive alternative to motorized individual transport in order to reduce the share of individual transport to 30% (share of total transport in 2030). The measures to achieve this goal are manifold and include, in the broadest sense, all measures for the promotion of the environmental alliance of walking, cycling and public transport. To complement this, the city is implementing the following three measures to support intermodal mobility: new construction and expansion of at least 400 mobility stations (stations at transportation hubs with possibilities to change the mode of transport - tram, bus, bicycle, regional/interregional traffic, e-scooter, car sharing), capacity expansion of Park&Ride and Bike&Ride stations, and further enhancements of the app for multi- and intermodal mobility LeipzigMOVE (enhance LeipzigMOVE as a multimodal mobility platform, providing diverse transportation options based on factors like travel time, cost, CO2 emissions, and purpose of travel, the platform seeks to optimize transportation choices considering traffic conditions and vehicle availability).
	1.4.2 Expansion and modernization of public transport	By investing in infrastructure improvements and expansion as well as expansion and modernization of the vehicle fleet, public transport will become more attractive. The goal is a share of 23% (share of total transport in 2030). The measures to promote public transport mainly concern infrastructure modernization and expansion, the purchase of



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Key outcomes for KSA1: Sustainable Mobility		
ID	Name (type)	Description
	(infrastructure and vehicles) (type: solution)	modern vehicles (busses and trams), and the optimization of routes and operations.
	1.4.3 Expansion of e-charging stations (type: solution)	Infrastructure measures: network extension tramway (at the moment: district of Thekla, Südseite, Wahren), tram infrastructure development "main axes", structural improvements at tram and bus stops to increase accessibility and safety, e-charging infrastructure development for e-buses.
	1.4.4 Mobility concepts (type: strategy)	Vehicles: procurement of new vehicles for bus, streetcar and commuter rail transport (wider streetcars, e-buses, hydrogen-powered buses; from 2024, main axes will be modernized, offering streetcars with 10% to 15% more space; conversion to e-buses), optimization measures of the charging processes of e-buses of the LVB.

Key outcomes for KSA2 Energy and heat supply		
ID	Name (type)	Description
2.1	Framework for climate neutrality in the energy and heat sector: Development of a concept for municipal energy/heat supply (type: strategy), development of a Municipal heat plan (type: strategy) and modelling of a climate-neutral district heating system (type: research)	The municipal energy supply concept analyses the energy transition potentials, identifies required generation infrastructure, and assesses land requirements for renewable energy production. It is being developed in collaboration with Leipzig municipal utilities. The measure also involves creating a waste heat register, as per the council resolution (delivery date: 2024; responsible Office for Sustainable Development and Climate Protection as well as Leipziger Stadtwerke/Leipzig Municipal Utilities). Heat planning is essential for energy-saving measures, aiming to reduce heat consumption. Multiple offices contribute to developing scenarios and measures, including approaches to district cooling. The long-term implementation involves various investments and construction projects (delivery date: 2023; responsible Office for Sustainable Development and Climate Protection). The Institute for Infrastructure and Resource Management at the Leipzig University has developed a simulation model for Leipzig's municipal utilities to plan the district heating system. The model considers technical data, energy source prices, and future heat demand to provide sustainable scenarios for 2038. Results are evaluated for cost and supply security.
2.2	Expansion of the production of renewable energies (heat) (type: solution)	The backbone of a climate-neutral electricity and heat supply by 2040 is the district heating network, which is to be expanded and densified. Heat generation is to be gradually transformed, and the construction of solar plants in urban and peri-urban areas is pushed. Construction of a solar thermal plant in Leipzig Lausen: 65,000 m ² gross collector area (delivery date: 2025 responsible: as Leipziger Stadtwerke/Leipzig Municipal Utilities). Hydrothermics: making potentials visible and preparing pilot applications (delivery date: 2024, responsible: Office for Urban Parks and Bodies of Water Authority). Planning of a district heating route with potential co-construction of a hydrogen route from the Leuna industrial site to Leipzig (delivery date: 2026, Leipziger Stadtwerke/Leipzig Municipal Utilities).



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Key outcomes for KSA2 Energy and heat supply		
ID	Name (type)	Description
2.3	Expansion of the production of renewable energies (type: solution)	The backbone of a climate-neutral electricity and heat supply by 2040 is the district heating network, which is to be expanded and densified. Electricity generation is to be gradually transformed, and the construction of solar plants in urban and peri-urban areas is pushed. Identification and utilization of area potentials for the generation of electricity/heat by means of regenerative energies: Action steps: a) Potential analysis of suitable and available areas for the use of regenerative energies, b) Comparison of theoretical potential areas with other existing uses as well as area requirements, c) Prioritization of the areas on the basis of differentiated criteria, d) Securing the areas under planning law, e.g., by amending the land use plan. Leipziger Stadtwerke plans to build an installed capacity of 400 MW of solar and wind power plants by 2030. The Westsächsische Erneuerbare Energien GmbH & Co. KG (WEE) plans to build a ground-mounted photovoltaic plant on the Seehausen landfill site with 30 MW of electrical generation capacity. To support the expansion of renewable energies, a funding scheme for private, plug-in photovoltaic systems has been developed. This aims to provide financial assistance to households, especially those with low incomes, for installing PV systems. Additionally, PV systems shall be installed on all possible roofs of municipal properties. The "Leipzig Energy Atlas" is a pilot project (SPARCS, Connected Urban Twins Project) to track renewable energy expansion and identify potential areas for development. It collects and visualizes data, enabling the evaluation of various energy supply options. The atlas supports sustainable decision-making for climate protection and achieving climate neutrality in Leipzig. The solar roof cadaster database is being updated to support the expansion of PV electricity and solar thermal heat generation. It will be linked to a green roof cadaster, providing information on suitability, impact, and estimated costs of green roofs. Combining solar use and green roofs is possible if static conditions allow.
2.4	Expansion of storage capacities for renewable energies (type: solution)	In addition to the expansion of the production capacities, storage capacities are required to smooth the volatile energy supply from renewable sources. In addition to thermal storage for the district-heating network, this also concerns electrical storage for the power supply. The storage facility in Leipzig-West will make the operation of the district heating network in Stadtwerke Leipzig's hot water network more flexible and enable the integration of unsteady renewable heat sources (delivery date: 2023, responsible: Leipziger Stadtwerke/Leipzig Municipal Utilities).
2.5	Development of the regional hydrogen supply (type: solution)	Study "Hydrogen City Leipzig", formation of a strategic monitoring committee, development of an action plan: Engagement with and later inclusion of hydrogen solutions in various application fields (delivery date: 2030, responsible: Office for Economic Development).
2.6	Smart energy monitoring systems (type: solution)	Various projects and approaches to test, replicate and upscale smart monitoring systems for an efficient energy use, e.g., Load management at the "Baumwollspinnerei" includes shifting energy consumption to off-peak times, using energy storage, and implementing demand response programs. Ensuring a balanced grid frequency in a diverse



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Key outcomes for KSA2 Energy and heat supply		
ID	Name (type)	Description
		energy mix and growing consumer complexity is crucial for a positive energy district (SPARCS project). Digital energy management at the "Baumwollspinnerei" includes remotely readable meters and LoRaWAN signals for real-time monitoring and analysis of energy consumption. This promotes energy-saving strategies, prioritizes renewable energy generation, and reduces reliance on non-renewable sources (SPARCS project). Piloting the use of smart sockets in private homes: Testing opportunities and readiness to link consumer devices with incentives for dynamic usage (SPARCS project).

Key outcomes for KSA3 Sustainable land-use		
ID	Name (type)	Description
3.1	Implementation of sustainable land-use practices (type: solution)	In order to develop a sustainable land-use and climate protection in urban development and urban planning, the potential influence of the planning instruments is identified and specifications are made for the coordination procedure in the various planning and procedural steps. Area potentials for different use cases (residential and commercial areas, generation of electricity/heat by means of regenerative energies, traffic/mobility, green-blue infrastructure) are being identified and utilized, including a potential analysis of suitable and available areas for the use of regenerative energies, the comparison of theoretical potential areas with other existing uses as well as area requirements, the prioritization of the areas on the basis of differentiated criteria, and securing the areas under planning law, e.g. by amending the land use plan. Competing land uses are weighed (delivery date: 2030, responsible: Office for City Planning).

Key outcomes for KSA4 Climate-friendly green-blue infrastructure		
ID	Name (type)	Description
4.1	Infrastructure measures	
	4.1.1 Digital green space management system for further development and maintenance of green infrastructure (type: solution)	The digital green space management system is used to collect and administer the urban green-blue infrastructure. The data is used for climate protection and adaptation measures as well as the preservation of biodiversity and controls all administrative and operational processes for its protection and development (delivery date: 2023, responsible: Office for Urban Parks and Bodies of Water Authority, Digital City Unit).
	4.1.2 Integrated water management concept (type: solution)	The goal of an integrated water management concept is to stabilize the local water balance in the expanded Leipzig city area. In addition to climate change, numerous extensive sealing and the resulting loss of natural soil functions pose significant challenges. The concept includes both scientific basic research and the implementation of specific measures (delivery date: 2030, responsible: Office for Urban Parks and Bodies of Water Authority).



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Key outcomes for KSA4 Climate-friendly green-blue infrastructure		
ID	Name (type)	Description
4.2	Expansion and protection of green-blue infrastructure (type: solution)	Leipzig intends to strengthen and expand its biotope network and urban forests. Leipzig's forest management aims to preserve European natural heritage through various steps: increasing the proportion of oak and other native tree species, creating a balanced age structure, preserving biotope trees and deadwood, and protecting strong oak trees. Private forest owners are provided with consultation. Within the city, areas are unsealed, e.g., with infrastructural projects like Parkbogen Ost, but also by the intensification of plantings along streets in both new construction neighbourhoods and existing neighbourhoods. The revitalization of Leipzig's floodplain landscape, supported by extensive land management of the open land, will strengthen its function as a carbon sink (see concept for the Elster-Pleisse-Luppe Aue). The potential of "Senken" (e.g., moors, marshes, etc.) to reduce greenhouse gases will be evaluated, this includes an evaluation of the extent to which the city can help maximize the potential of "Senken" through the care, use, and maintenance of its lands. A success monitoring of tree protection as a digital inventory of trees and woody vegetation, as well as an enforcement of tree protection regulations will be implemented. Furthermore, funding programs for the promotion of measures for the ecological upgrading of (inner) courtyards and front gardens are planned. Main actor regarding these measures is the Office for Urban Parks and Bodies of Water Authority.

Key outcomes for KSA5 Climate-friendly urban district development		
ID	Name (type)	Description
5.1	Standard model and principles for climate-friendly urban district development (type: solution)	Development of a standard model for climate-friendly neighbourhood development, consisting of a further development of energetic refurbishment concepts to climate-friendly neighbourhood concepts, incl. energy-positive design of neighbourhoods. Result: annotated standard table of contents (for internal and external use, e.g., also by agencies) as well as a process diagram (SPARCS project) (delivery date: 2024, responsible: Digital City Unit (coordinating) together with other Offices). The goal is to implement criteria for CO2 reduction in urban planning and procedures in a structured manner. To achieve this, the influence of planning instruments will be identified, and decisions on coordination procedures will be made in the various planning stages. As of 2023, new urban development plans and urban contracts will exclude fossil heat systems, and the objectives of the municipal heat plan must be particularly taken into account. By 2024, objectives for the share of renewable energies and the reduction of grey energy in the construction of buildings and infrastructures will be developed in line with sector-specific greenhouse gas reduction targets. These objectives will become binding in urban development plans and urban contracts from 2025 onwards (responsible: Office for City Planning).
5.2	Digital Tools to support the urban district development	Digital tools support urban planning processes by making data available and visualizing it. Urban Climate Analysis: Leipzig's microclimate data is accessible at www.leipzig.de/stadtklima , showing heat load reduction measures. These include street tree concepts, green



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Key outcomes for KSA5 Climate-friendly urban district development		
ID	Name (type)	Description
	(type: solution)	roof promotion, and the master plan for green spaces. Administrative processes, like development planning, support the implementation of these measures (delivery date: 2022, responsible: Office for Sustainable Development and Climate Protection). Introduction of an ICT platform and open and standardized sensors and systems: Leipzig is establishing an environmental and climate data sensor network to improve citizens' quality of life. The network enables the installation of various sensors for air quality, noise levels, lighting, parking availability, and city temperature. It fosters collaboration, innovation, and transparency by using open standards for seamless integration and data exchange (delivery date: 2024, responsible: Stadtwerke Leipzig, Digital City Unit). The UrbanGreenEye project, funded by the German Aerospace Centre (DLR), aims to integrate satellite data into municipal planning for climate adaptation. It provides a standardized information base for landscape, land use, and urban development plans. The project contributes to the national Copernicus strategy and supports municipal administration in addressing climate change (delivery date: 2024, involved: Office for Urban Parks and Bodies of Water Authority). Urban Data Platform and Digital Twin for Climate-friendly urban development: The Urban Data Platform of the City of Leipzig is to be expanded as a platform/data hub for all data of the SECAP implementation program and serve as a basis for the development of a digital twin of the city of Leipzig. In this context, the interlinking of data from Offices and associated companies, the increased acquisition of environmental and climate-related data via sensor technology, and the creation of a binding set of rules for the exchange of data between Offices and with the associated companies within the framework of the SECAP are aimed for (delivery date: 2025, responsible: Digital City Unit, Office for Geoinformation and Land Management).
5.3	Pilot projects for climate-friendly urban district development (type: research/solution)	Implementation of pilot projects for climate-friendly urban district development to test new approaches and lift potentials for city planning procedures. E.g., focusing on expanding and strengthening of the green-blue infrastructure within the city, new digital concepts such as the use of satellite data as a basis for planning measures, new mobility concepts, and smart lighting approaches. Within SPARCS, the following use cases have developed, which have significant replication potential (these are described in more detail in Deliverable D4.7): a) Replication District: Virtual Energy District (Including: Virtual Power Plant; Energy-and Load Management; Integrated Resource Planning and Optimization Energy System Model); b) Replication District: LWB-Stock (including: Energy-Management for constant optimization of the heating systems; Constant expansion of PV-Installation and development of a social model for sale; Citizen engagement).

Key outcomes for KSA6 Climate-neutral city administration		
ID	Name (type)	Description
6.1	Concept "Climate-neutral city administration 2035"	For "Climate-neutral city administration 2035", a concept is to be created for the first time that places the city administration as an acting organization at the centre of municipal climate protection activities and



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Key outcomes for KSA6 Climate-neutral city administration		
ID	Name (type)	Description
	(type: strategy)	consequently deals with its underlying internal processes. The concept will define the accounting boundaries and present a roadmap with binding interim targets and specific measures to reduce GHG emissions to a climate-neutral, technically feasible minimum level. Offsetting emissions through compensations is exclusively intended for residual emissions that are technically unavoidable (delivery date: 2024, responsible: Office for Sustainable Development and Climate Protection, with support from the Office for Central Services, Office for Building Management among others).
6.2	GHG accounting of the annual overall municipal task fulfilment and procurement (type: solution)	<p>In a pilot project, the overall budget of the city of Leipzig is underpinned by GHG accounting. The goal is to initially determine the total amount of CO₂ or CO₂ equivalents emitted in one year through the municipal tasks and activities carried out by the city of Leipzig. The pilot project intends to answer the question of inventory (What CO₂ emissions are caused by fulfilling municipal tasks in the city of Leipzig?), of instruments for climate neutrality (What contribution do specific municipal and budgetary policy decisions make to achieving climate neutrality? What are the costs associated with approaching climate neutrality?) and of monitoring (What progress is the city of Leipzig making? Are the set goals being achieved? What can the departments learn from each other? What can other cities learn from Leipzig?) (delivery date: 2030; responsible: Department for Finances).</p> <p>The direct and indirect GHG emissions generated in the procurement process along the supply chain will be recorded, allowing for well-founded identification of leverage points and their implementation. Through monitoring, steps will be taken towards emissions-neutral or lower-emission deliveries and services. Implementation: Gradual establishment of a monitoring system for GHG emissions in procurement, and where technically feasible, achieving a transition to climate-neutral and circular deliveries and services (delivery date: 2030, responsible: Office for Central Services).</p>
6.3	Energy refurbishment of the municipal building stock (type: solution)	<p>According to the exclamation of climate emergency ("Klimanotstand"), the administration is to become climate-neutral by 2035. To achieve this goal, it is particularly important to reduce the greenhouse gas emissions caused by the municipal building stock due to electricity and heating demand. The Energy Guideline already provides a roadmap for implementing this objective. To adhere to the timeline, it is necessary to continue and expand the measures that have already been established in the past, in addition to providing the necessary financial resources. When selecting buildings for renovation, prioritization should be based on the potential for energy savings and the expected costs. The aim is to increase the annual rate of energy-efficient renovations in the entire municipal building stock, moving towards a fully decarbonized municipal building stock by 2050 (responsible: Office for Building Management, Offices/Departments as clients for renovations). Installation of PV systems on all possible roofs of municipal properties (delivery date: 2030, responsible: Office for Sustainable Development and Climate Protection, Office for Building Management). The replacement and modernization of lighting is an</p>



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Key outcomes for KSA6 Climate-neutral city administration		
ID	Name (type)	Description
		important lever for reducing electricity consumption. The gradual use of LED light sources and intelligent lighting control in all areas of the buildings are focal points of the implementation (delivery date: 2030, responsible: Office for Building Management, Offices/Departments as clients for modernization). The energy management of the properties of the city of Leipzig is to be improved and expanded (2030, responsible: Office for Building Management). A Study of "gray energy" in new construction and renovation will be drawn up incl. the balancing of environmental impact costs within the scope of the study, the development of a concept for dealing with gray energy, the derivation into a general building standard, and the integration into existing funding programs (delivery date: 2024, responsible: Office for Building Management).
6.4	Climate-friendly mobility in the city administration (type: solution)	As a contribution to the traffic turnaround, the city's internal vehicle fleet is designed to be climate-friendly. Inner-city transport is provided by (electric) cargo bicycles. Climate-friendly mobility offers for employees increase the use of environmental transport. A digital, user-friendly management system centrally links supply and demand (delivery date: 2030, responsible: Office for Central Services).
6.5	Awareness rising and capacity building within the city administration (type: solution)	The city of Leipzig is increasing the proportion and promoting target-group-specific training opportunities on sustainable and climate-friendly action in the city administration for all employees (delivery date: 2030, responsible: Office for Human Resources).
6.6	Circular economy principles within the city administration (type: solution)	Introduction of zero-waste management throughout the city administration. Introduction of circular economy principles within the city administration. Establishment of zero waste management in the cultural sector: The measure aims at establishing a zero-waste management culture, which accompanies and coordinates the municipal cultural institutions and (cultural) events in the implementation of an efficient circular economy (delivery date: 2024, responsible: Department for Culture and Arts).

Key outcomes for KSA7 Regional circular economy		
ID	Name (type)	Description
7.1	Zero waste management (type: solution)	By joining the Zero Waste Europe Network, Leipzig has committed to taking appropriate measures to achieve the following targets by 2035: a) 10 percent reduction in residual waste, b) maintaining a high level of waste separation, c) supporting the commercial sector in reducing residual waste, and d) achieving a 90 percent recycling rate of municipal waste. The goal is to obtain the Zero Waste City certificate. To achieve this, various measures have already been taken and planned, including the development of a Zero Waste Strategy, the establishment of a municipal second-hand department store, the promotion of a hardware-based circular economy (Hardware4Future), and the promotion of reusable tableware in the gastronomy sector as a coordinated effort of Stadtreinigung/Municipal waste management, the Office for Economic Development, and BUND Leipzig.



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Key outcomes for KSA7 Regional circular economy		
ID	Name (type)	Description
7.2	Closing regional economic and material loops (type: solution)	The principles of regional circular economy will be established in businesses and urban planning. This involves closing regional economic and material loops to reduce transportation and transaction costs while promoting local value creation. To achieve this, increased efforts are required to support local companies, especially SMEs, and to integrate the principles into urban planning processes in a structured manner. Experiences from the cultural sector and contributions from Forum Nachhaltiges Leipzig, such as the "Leitbild nachhaltiges Wirtschaften" (Sustainable Business Vision), play a significant role in this endeavour.

Key outcomes for KSA8 Sustainable nutrition		
ID	Name (type)	Description
8.1	Municipal nutrition strategy (type: strategy)	Based on the analysis of Leipzig's food system, a comprehensive food strategy is being developed, which combines municipal measures in the form of projects, initiatives, and guidelines, following defined principles. The strategy aims to address the requirements for a contemporary, sustainable realignment of the urban food landscape in terms of food and climate justice. The measure contributes to promoting climate and food justice, strengthening regional value chains, fostering independence from global supply chains, and enhancing local resilience in the agriculture/food sector. Responsible for this measure is the Office for Sustainable Development and Climate Protection (delivery date: 2024)
8.2	Adapted procurement rules for sustainable food for canteens of city administration and associated companies (type: solution)	Regional and organic farming offers significant potential for reducing greenhouse gas emissions in agriculture. The procurement of food for communal catering will include criteria such as increasing the use of organic products, prioritizing regional sourcing, and promoting seasonal availability. These three aspects (organic, regional, and seasonal) form a triangular goal that needs to be harmonized, providing consumers with guidance. Regional products, for example, require less energy for transportation, while seasonal products do not require extensive storage (such as refrigeration). The city administration and municipal corporations play a leading role in adjusting their procurement processes to prioritize the sourcing of sustainable food, particularly in their own canteens and in providing meals in kindergartens and schools. Measures: Adjustment of procurement criteria to incorporate sustainability aspects such as organic production, regional sourcing, and seasonality in the provision of meals in kindergartens, schools, and (company) canteens. Development of a regional triangular goal approach with solutions considering the EU procurement directives. Implementation of pilot projects. Responsible for this measure is the Office for Sustainable Development and Climate Protection with support from Office for School and Education and Office for Central Services (delivery date: 2030).
8.3	Awareness-rising and capacity building	



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Key outcomes for KSA8 Sustainable nutrition		
ID	Name (type)	Description
	8.3.1 Capacity building among actors from the agricultural and food sector (type: solution)	The value chain from "field to plate" encompasses the key areas of cultivation, processing, and distribution. The objective is to support this chain for regional, sustainably produced products. The agricultural concept has already made an important contribution by addressing land allocation at the beginning of the chain. The goal of this measure is to identify synergies within the actor network along the value chain, establish more efficient workflows, and raise awareness for regional value chains. Measures: initiating stakeholder exchange, establishing exchange formats with stakeholders, expanding and consolidating the network, conducting professional field trips for knowledge transfer with other regions, implementing joint awareness-raising measures. Responsible for this measure is the Office for Sustainable Development and Climate Protection with support from the Office for Economic Development (delivery date: 2030).
	8.3.2 Campaign for rising awareness (type: solution)	In conjunction with the development of the Municipal nutrition strategy, an information and education campaign is being created to raise awareness among citizens and practitioners about climate-friendly regional food. Following the principles of Education for Sustainable Development (ESD), the campaign aims to empower individuals and key actors to actively engage in shaping sustainable nutrition by fostering self-efficacy and key competencies. The outcomes of the food strategy will be compiled into a practical guide for knowledge transfer to municipal stakeholders and an informational brochure for citizens. Responsible for this measure is the Office for Sustainable Development and Climate Protection with support from Office for Environmental Protection Authority, Office for Urban Parks and Bodies of Water Authority, the local Nutrition Council, and Environmental Information Centre Leipzig (delivery date: ongoing).
	8.3.3 Care and expansion of orchards and pick-your-own fields (type: solution)	In the city, there are opportunities to cultivate fruits and vegetables and experience nature-friendly cultivation methods up close. Various initiatives have been established in Leipzig for this purpose. The existing activities are planned to be expanded and intensified throughout the city. The urban traditional orchards and community spaces will form a core setting in this regard, and efforts will be made to restore and maintain them in good condition. Their care and maintenance will be ensured not only through collaborative partners but also through biodiversity conservation measures. Responsible for this measure is the Office for Urban Parks and Bodies of Water Authority (delivery date: 2030).

Key outcomes for KSA9 Climate education		
ID	Name (type)	Description
9.1	Climate education campaign (type: solution)	In order to raise awareness for effective climate protection in the city of Leipzig, topic-specific and target group-oriented climate education activities are planned and implemented. This includes information and awareness-raising offers, events, campaigns, and advice for businesses and private households. Measures: a) Planning, development and implementation of campaigns, b) Target group/topic-specific events citywide and in the neighbourhood, c) Communication and public relations activities, d) Examples: Climate theatre, campaigns with high



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Key outcomes for KSA9 Climate education		
ID	Name (type)	Description
		<p>personal identification factors/on energy retrofits/on strengthening the environmental network, etc. Responsible: Office for Sustainable Development and Climate Protection.</p> <p>Additionally, Leipzig participates in the annual European Mobility Week (Conceptual design of the EMW and the car-free day within the framework of the annually changing priorities of the Federal Ministry for the Environment, implementation of the EMW and the car-free day, promotion of the EMW and its objectives, evaluation and reporting); responsible: Office for Traffic Planning and Road Construction.</p>
Key outcomes for KSA10 Climate protection initiative		
ID	Name (type)	Description
10.1	Networking and encouraging climate action	
	10.1.1 Transition network (type; network)	<p>With regard to the KSA “Climate protection initiative”, the city is convinced that central instruments to win many citizens to protect the climate are the promotion and initiation of climate protection projects and measures. With the Climate protection initiative, the city administration would like to actively support this commitment and encourage direct action through various approaches. Measures: Creation and designation of funding programs, support for projects and initiatives, management of the climate protection fund, competitions.</p> <p>Network of active stakeholders from the entire urban community (civil society, businesses, associations, initiatives, research institutions, educational institutions, social facilities, etc.) for mutual learning and encouragement, gradually expanding the circle of active actors to make the transition to a climate-neutral city visible and highlighting the importance of each individual measure. There will be different networking activities and networks itself, e.g., KlimaHub (new), Forum Nachhaltiges Leipzig (pre-existing), Klimabeirat (pre-existing), Klimakonferenz (pre-existing), and other participation formats.</p>
	10.1.2 Climate City Contract (type: commitment of action)	<p>The declared goal is to develop and implement concrete measures for a climate-neutral Leipzig together with Leipzig's civil society, business and science on the basis of a Climate City Contract in order to act as a role model for other European cities and to share or scale successful approaches. The first CCC will be delivered in 2024. After that, the transition team will monitor the implementation of the actions. The urban society is encouraged to continuously contribute actions to the CCC. The contract will be updated every two years (delivery date: 2024).</p>
10.2	Support for SMEs (type: solution)	<p>SMEs are supported on their way to become sustainable companies. Existing support programs include the purchase of cargo bikes, the promotion of private energy efficiency measures, the conversion of value chains in the food and agriculture sector, the conversion to renewable energies by supporting the construction of facilities for the generation, use and storage of renewable energies for Leipzig's</p>



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Key outcomes for KSA10 Climate protection initiative		
ID	Name (type)	Description
		economy, general business consulting with regard to climate protection and resource efficiency, load testing for solar roofs and roof greening, and measures for sustainable growth. Appropriate funding guidelines have already been or will be developed and published. The Office for Economic Development is a major actor in the field of economic support for SMEs.

3.2.3 Adopted methodology and procedures

Methodology for the roadmapping process

The work process regarding the development of the Leipzig roadmap took place from April 2022 (M31) to June 2023 (M45) with an intensification of work from November 2022 (M38) to June 2023 (M45). The development of the roadmap followed the recommendations of the work package lead SPI:

- forming a task force
- framing the roadmapping process
- identifying the relevant stakeholders and resources
- designing and preparing the roadmapping workshop
- carrying out the workshop incl. gathering feedback
- preparing a dissemination strategy, and finally,
- preparing the roadmapping report.

Task Force and relevant stakeholders

The task force for the creation of the Leipzig roadmap consisted of five employees from the Digital City Unit as representative of the Leipzig SPARCS team and the Office for Sustainable Development and Climate Protection as professional expertise and gatekeeper for the participation of other central stakeholders. The Digital City Unit was responsible for the coordination and implementation of the work on the roadmap. Within this unit, the corresponding employees met once a week, initially to clarify the methodology, the Offices to be involved, and the planning of the work process, and later to reflect on the progress of the roadmap's development and agree on the next steps. The Office for Sustainable Development and Climate Protection was involved whenever decisions regarding the content of the roadmap had to be made and stakeholders from other Offices needed to be involved. The Office plays a central role in gathering information about the work of city climate protection managers, and weekly meetings are held to coordinate sustainability and climate protection efforts in Leipzig. This close thematic collaboration of the two units has proven to be very valuable, allowing the roadmap to be gradually supplemented and refined.

The task force decided to invite the city's climate protection managers to the roadmapping workshop. In Leipzig, seven climate protection managers are currently located directly within the respective Departments/Offices to ensure a professionally appropriate and



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effective climate protection work. They are well informed about the current developments and measures within the Departments/Offices. Through regular meetings, the climate protection managers exchange ideas among themselves and with the Office for Sustainable Development and Climate Protection, thereby driving forward the city's active climate protection and sustainability policies. The following departments were represented at the workshop: Office for Traffic Planning and Road Construction, Office for Urban Parks and Bodies of Water Authority, Office for Building Management, Office for Culture and Arts, and Office for Economic Development. A total of 12 people participated in the roadmapping workshop, representing the central offices involved in the transition process to a climate-neutral city.

Framing the roadmapping process

Since the development of the Leipzig City Vision in 2020, there have been significant further developments in the local climate protection and sustainability policy in Leipzig, which have a significant impact on the work within the SPARCS project. Special attention should be drawn to the Energy and Climate Protection Program 2030 (SECAP), including the implementation program for the years 2023 and 2024, which has been adopted by the council in November 2022. With the SECAP and the current implementation program, the course is set for ambitious climate protection and sustainability activities up to 2030 with concrete targets for significantly reducing greenhouse gases. Given the scope of SECAP's impact, Leipzig's SPARCS team decided to **revise the City Vision** to promote its alignment with it. This way, the City Vision and the roadmap will continue to be used after the submission deadlines and even after the SPARCS project ends. As mentioned earlier, 10 success factors for achieving climate neutrality in the city of Leipzig now structure the documents; they are the new Key Strategic Areas against which all measures and milestones are schematically organized: Sustainable mobility, Sustainable energy and heat supply, Sustainable land-use, Climate-friendly green-blue infrastructure, Climate-friendly urban district development, Climate-neutral city administration, Regional circular economy, Sustainable nutrition, Climate education, and Climate protection initiative. The definition of the new key strategic areas and the restructuring of the City Vision were, therefore, the first steps in the content creation of the roadmap.

In addition, the start of the SPARCS roadmapping process coincided almost simultaneously with the announcement by the EU that Leipzig is one of the 112 mission cities of the **EU Cities Mission "100 climate-neutral and smart cities"**. The task force for the creation of the roadmap, therefore, had to consider how both approaches could be strategically integrated and interconnected, not only to achieve synergies but also to bring together similar processes with the same objective. Hence, the Leipzig team decided to involve the two City Advisors who support Leipzig in the implementation of the City Mission in the workshop. They acted as moderators for the **workshop**. By doing so, we were able to bring together and address questions that are relevant for both processes simultaneously. The results of the SPARCS roadmapping process can now be directly incorporated into the work on the Climate City Contract of Leipzig.

While working on the roadmap, the substantial significance of existing **strategic documents** became apparent, as they had already undergone extensive



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interdepartmental coordination and participation processes. The roadmapping workshop within the SPARCS project can thus be understood as a component in a pre-existing complex strategic planning process with the aim of achieving climate neutrality. The central uniqueness of the roadmapping process lies in the compilation and visual representation of measures from ALL sectors – no Office has dedicated itself to this comprehensive representation before, and discussions during the development process of the roadmap have shown that the Offices see significant benefit in this SPARCS outcome.

In addition to the roadmapping workshop itself, the analytical work on strategic documents and their translation into a visual representation were crucial in the work process. Among the analysed documents are the SECAP 2030 and its implementation program 2023/24, the Digital Agenda, the Mobility Strategy 2030, the Pedestrian Strategy, the Green Masterplan, the Integrated Urban Development Concept, and the Work Program of the Mayor of Leipzig. All relevant measures of these documents were assigned to the KSAs, located chronologically in the roadmap, and responsibilities were identified. The analysis of these documents regarding climate neutrality measures revealed the diverse and far-sighted way in which the Offices already align their work with the goal of climate neutrality. At the same time, the analytical work once again highlighted the limited time available, especially for large-scale infrastructure measures.

Roadmapping Workshop Agenda

All participants were urged to thoroughly prepare for the workshop to enable active engagement in the substantive discussions right from the start. They were provided with a roadmap template and a set of questions to be addressed during the workshop. The following were the questions to prepare:

- What are the planning cycles for different overarching urban development and other plans (such as master plan, SUMP, climate plan)?
- What are the major foreseen urban development and infrastructure projects of the city?
- What are the current timelines for major multi-year service contracts (such as public transport, waste, maintenance etc.)?

The roadmapping workshop (Table 9) took place on February 8, 2023, 1:00 pm to 3:30 pm.

Table 9. Agenda of the roadmapping workshop – Leipzig

Time	Content
13:00 - 13:15	Intro
13:15 - 14:30	Key milestones <ul style="list-style-type: none"> • Write on the post-its all big infrastructure and urban planning projects, procurement processes and related contracts, regulatory changes, in short events and processes with a potentially big impact.



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Time	Content
	<ul style="list-style-type: none"> • Find a place for the post-its on the roadmap. If applicable, add clear start and end, add both on the timeline (such as plant building start/plant building end). <p>Impacts, barriers, and opportunities</p> <ul style="list-style-type: none"> • Elaborate what are the impacts, as well as opportunities and barriers of the milestones you mapped for achieving net zero? • Locate impact, opportunities and barriers on the timeline next to the milestones.
14:30 - 15:15	<p>Elaborating Stakeholders</p> <ul style="list-style-type: none"> • Which stakeholders have you previously engaged and have existing relationships with? • Who are the stakeholders in your city (and region) you would like to engage and work with?
15:15 - 15:30	Wrap-up and next steps

In the workshop, the participants worked on a Miro board where the milestones could be placed on a timeframe. Additionally, an overview of stakeholders was created.

3.2.4 Lessons learned and next steps

The work on the roadmap was very complex and involved dealing with all central sectors for achieving the goal of climate neutrality. Confronting this complexity, systematically addressing it, and finding solutions was not easy at the beginning. The participants in the roadmapping workshop reflected this complexity and the resulting uncertainty regarding the task. Almost all participants in the workshop agreed that the task was very complex and challenging. At the beginning, almost all participants were unsure about which measures should be included in such a roadmap and which should not and by the end of the workshop, it became clear that the roadmap needs further elaboration and refinement. Implementing the measures, quantifying their impact, as well as methods to involve and engage third parties were seen as challenges by all involved stakeholders. Despite these challenges, the interdepartmental discussion was productive and yielded valuable insights.

The methodology for creating the roadmap has significantly supported the city in its efforts to systematically address the issue of climate neutrality. At a higher level of discussion regarding the methodology, it became evident that roadmaps can enrich existing and future strategies by providing a clear and comprehensive overview of planned and envisioned measures, thus supporting operationalization. Roadmaps can also help identify and address gaps in existing strategies. Therefore, we will suggest that future strategies and/or operational programs, such as the next SECAP implementation program, also include a roadmap.

The SPARCS roadmap and the underlying analytical work provide concrete support to the city of Leipzig in its work within the City Mission, the initiation of the comprehensive transformation process, and the development of the Climate City Contract. Particularly,



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the in-depth consideration of the key strategic areas and the structure of the roadmap will play a crucial role in the Climate City Contract. We also suggest including a roadmap within the Climate City Contract. Moreover, the SPARCS outcomes serve as a basis for the implementation of measures as well as the development of new ones with internal and external stakeholders in the city. For a roadmap to produce these positive effects, it is crucial that the methodology used to create it aligns with the working processes of the municipality. In Leipzig, we have been able to achieve this through the close integration with existing work structures.

To incorporate the roadmap into further strategic and operational documents, it can and should be differentiated by specific topics. With the comprehensive roadmap containing 170 measures, we already have a good basis for sector-specific versions that can be further expanded. In this context, measures from the Climate City Contract will hold particular significance in complementing the overall picture of the path towards climate neutrality, incorporating contributions from third parties such as companies and civil organizations.

The city of Leipzig is currently evaluating the extent to which the SPARCS roadmap can be made publicly available. On one hand, the roadmap offers a comprehensive overview of the intricacies involved in the transformation process. However, it is crucial to consider how the public can effectively engage with this complexity and whether the roadmap can truly foster a deeper understanding and engagement within the city's community. To explore this, we will experiment with a German version of the roadmap. Additionally, thematic roadmaps will be developed, focusing on specific sectors such as the energy transition.



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3.3 Kifissia Roadmap

3.3.1 Introduction

The roadmapping process is a complex and long-term project that needs to be reviewed and updated regularly. The work done during and prior to the workshop set the basis for further development and implementation. The six key strategic areas that were elaborated during the City Vision workshop were all included in the roadmapping process. Strategic documents like the implementation plan that was developed during the work done in WP5 were also included into the process. More than 30 project proposals were developed during and prior to the workshop.

This report presents the participatory process of roadmapping, the goals and visions of the Municipality of Kifissia for the future, the selected KSAs, methodology and the key outcomes of the workshop.

3.3.2 Overall roadmap results

The following section presents the results of Kifissia's roadmapping workshops in terms of projects and measures which will form the city's milestones on the pathway towards climate neutrality. The main aspects regarding each KSA, approached during the roadmapping process and workshop, are summarised in an introductory text, followed by the graphic overall roadmap, containing the identified milestones and connections, and by a description of the key outcomes from the roadmapping process. A milestones table, summing up the milestones and goals from the roadmapping process is presented in Appendix 4 (section A) of the deliverable.

Kifissia's Roadmap for urban transformation

KSA1: Mobility

For KSA1 Mobility, the city has defined four main lines of action, namely setting up a strategic framework for sustainable urban mobility, improving public transportation, traffic management and parking, and investing in micromobility and e-mobility.

During the workshop, the discussion was centred on current infrastructure, identified inefficiencies in policy and infrastructure as well as the opportunities that were apparent for the short and mid-term period for the city of Kifissia.

Being a metropolitan municipality functioning as a suburban area in the northeast of Athens, the city has increased interdependencies with its neighbouring municipalities and the Athenian conurbation in overall. The car is identified and measured as the dominant means of transportation leading to traffic congestion and active mobility infrastructures – although significant compared to other small sized municipalities - are insufficient. E-mobility, although defined as a clear strategy through the EV charging allocation plan, is still underdeveloped in the area. Parking remains a core issue in the area as there are critical observations that show illegal parking especially during peak hours in key arteries



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in the city. Observations were also made regarding the inability to control traffic and illegal parking in the area.

The city of Kifissia presents critical opportunities in demographics regarding the high level of education of its residents, along with their income and their participation in decision making processes. Furthermore, the city presents advantages in planning policy terms regarding low building factors (in terms of building height and land use coefficient) and street grid characteristics, which show large geometric features, along with the utmost opportunity of having newly developed areas (new in the urban planning grid) and current mobility measures of traffic calming around school infrastructure and other critical amenities.

Participants identified the hindering elements functioning as threats such as the lack of social consent and awareness, the procurement difficulties, the lack of resources (both in terms of funding and qualified municipal staff), the current bureaucracy and separation of responsibilities in various local and supra-local actors, and lack of political will.

Picturing the future (2025), participants see a number of measures to be implemented and promote the mobility transformation of the city, including the enhancement of pedestrian accessibility (i.e., routes to transport stops and stations, widening sidewalks and new infrastructure, street regeneration projects, increasing traffic control for illegal parking, removal of street and sidewalk obstacles, providing ramps for disabled where necessary etc.). Cycling will be upgraded through the expansion of the current bike network within the city; the use of electric bicycles and shared EVS (incl. scooters and e-bikes); and, with the critical cycle lanes foreseen in the Athens Metropolitan Cycling Network. Public transport is considered a key aspect of mobility, but it is essential that municipal services are established freely connecting urban nodes with clean vehicles and with increased incentives for users. In the long term, people demand new tram line services to interlink with local bus services, increasing the modal share of PT, and also the undergrounding of Kifissias Avenue and EL. Venizelos Ave., which will allow for more open green spaces.

The implementation of controlled parking services with sensors and technology assisted monitoring can alter the current image of the city if combined with the EV charging scheme, financial incentives, applications (Park around) and other interventions including park and ride areas near public transport stations. An overall smart parking system that will function along with EV infrastructure can assist in altering the current image of the city.

Megaprojects are foreseen in 2040 where participants mentioned the undergrounding of Andros Street and the opening of Thiseos Ave. The role of technology is predicted to be critical in terms of driverless municipal transportation, traffic control, inductive vehicle charging, and installation of variable road traffic signage in the city centres of Kifissia and N. Erythrea and throughout the municipality. Smart carpooling platform and other monitoring system will assist in the predicted transformation. Pedestrian accessibility will be assured in each and every street of the city, with at least one adequate and quality sidewalk per street section, and all office buildings and public facilities will be equipped with bicycle changing rooms.



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KSA2: Energy consumption of buildings

In terms of the energy consumption of buildings, Kifissia's roadmap sets the pathway for the improvement of energy efficiency in municipal and private buildings, implementing RES solutions for heating and cooling, providing automation and energy management systems, as well as promoting behavioural change in users. As KSA2 "Energy consumption of buildings" and KSA3 "Green energy" are strongly interconnected, some of the identified outcomes in both KSA complement one another.

Existing building stock is one of the most energy demanding and CO₂ emitting areas in Kifissia. The majority of the buildings within the city are houses, privately owned and built prior the energy efficiency regulations in Greece. Renovating and energy upgrading these houses is challenging, time consuming and has a high initial cost. Most of the buildings have inclined roof with ceramic tiles which, due to local morphology and architectural standards, make it more difficult for PV installations. During the workshop, one of the relevant themes in focus was about how houses with no available space to install PV could have access to RES. As a response to this challenge, a project is being implemented (through SPARCS), centred on the creation of an energy community and the installation of a PV park in an area with better conditions which, via virtual net metering, would allow members to benefit from the energy produced.

KSA3: Green Energy

The city's roadmap concerning Green Energy focuses mainly on 3 themes, namely energy from RES, storage systems, and energy from municipal waste. As stated before, KSA3 and KSA2 are strongly interdependent in terms of challenges and solutions.

During the workshop the discussion was mainly focused on future plans for creating RES parks and specifically on a PV park for the needs of the energy community. The possibility and advantages of implementing a small hydroelectric plant was also discussed, as well as the use of solar and PV panels for the needs of street lighting.

Energy production from biomass created from garden waste is a long-term project proposed. This project requires changes in national regulations, as waste treatment is not possible in municipal level at the time.

KSA4: Urban Planning

The inputs presented for KSA4 are centred mainly in two categories with significant impact in the city's overall urban planning decision-making and therefore play a considerable role in Kifissia's roadmap for urban transformation. Firstly, and complementary to the measures presented for KSA1 'Mobility', the roadmap identifies proposals for improving pedestrian accessibility and micromobility. Secondly, the most relevant measures concerning planning options, allocation of green areas and use of public space are presented.

During the workshop, the discussion was mainly centred on urban planning policies and infrastructure as well as the long procurement and implementation timetables. The reported issues included the low-rise residential zone and sparsely populated area, the presence of various unused large public spaces, and the major roads entering or passing



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in close proximity to housing areas. Participants identified the current hindering elements functioning as threats such as the procurement difficulties, the lack of resources (both in terms of funding and qualified municipal staff), the current bureaucracy and time-consuming processes of project maturation and implementation, as well as the fragmentation of responsibilities between various local and supra-local actors. The importance of national funding programs such as the Green Fund or the Tritsis program were also identified as relevant for this theme.

Introducing two pilot superblocks in the centre of Kifissia and N. Erythrea, widening sidewalks, introducing bioclimatic and environmentally friendly materials, and allowing for pocket parks with crowdfunding, present the image of the near future. The traditional city centre land use plan will also be reviewed and updated. Picturing the future (2030) participants highlighted the importance of the connection between the municipality and the nearby mountainous areas through green routes and also the expansion of the cycling network through routes with architectural interest.

KSA5: Digital city

For KSA5 Digital City, four main priority categories of interventions were identified focused on the implementation of sensors at a city-wide level and at a building level, solutions for traffic regulation and mobility, and digitization of municipal services.

Digitisation of the city's services is a major project that needs to be implemented in order to facilitate daily tasks of citizens. This will also help reduce energy demand and provide a more reliable energy management. Some projects like air quality sensors and the pilot of fire prevention are already implemented within SPARCS project. Smart irrigation system is under development and is planned for conclusion within 2023 (also a project within SPARCS). These two projects include also the creation of a smart control room which in the future will manage all smart city features.

Besides these interventions, energy measurement and management are also seen as a priority. An electricity measurement system is installed in one municipal building but the system needs to expand. Furthermore, proper training for all users of smart city new features must be included within project implementation.

KSA6: Citizen Engagement

In reference to KSA6 Citizen engagement, the main focus areas concern empowerment and/or behavioural change concerning energy saving, alternative ways of transportation, energy communities, and circular economy.

During the workshop, the discussion identified lack of perceived political credibility as a concerning obstacle. Insufficient communication between citizens and municipality was also seen a subject of concern. Participants proposed the formation of an office that could give information about sustainability and support citizens through the process for building permits and apply for funding concerning energy upgrades of their homes. The municipality should find new ways of promoting and engaging citizens with PPP models in order to increase collaboration and build stronger relationship with citizens. The creation of an energy community with the participation of the municipality and citizens is a pilot project under development within SPARCS.

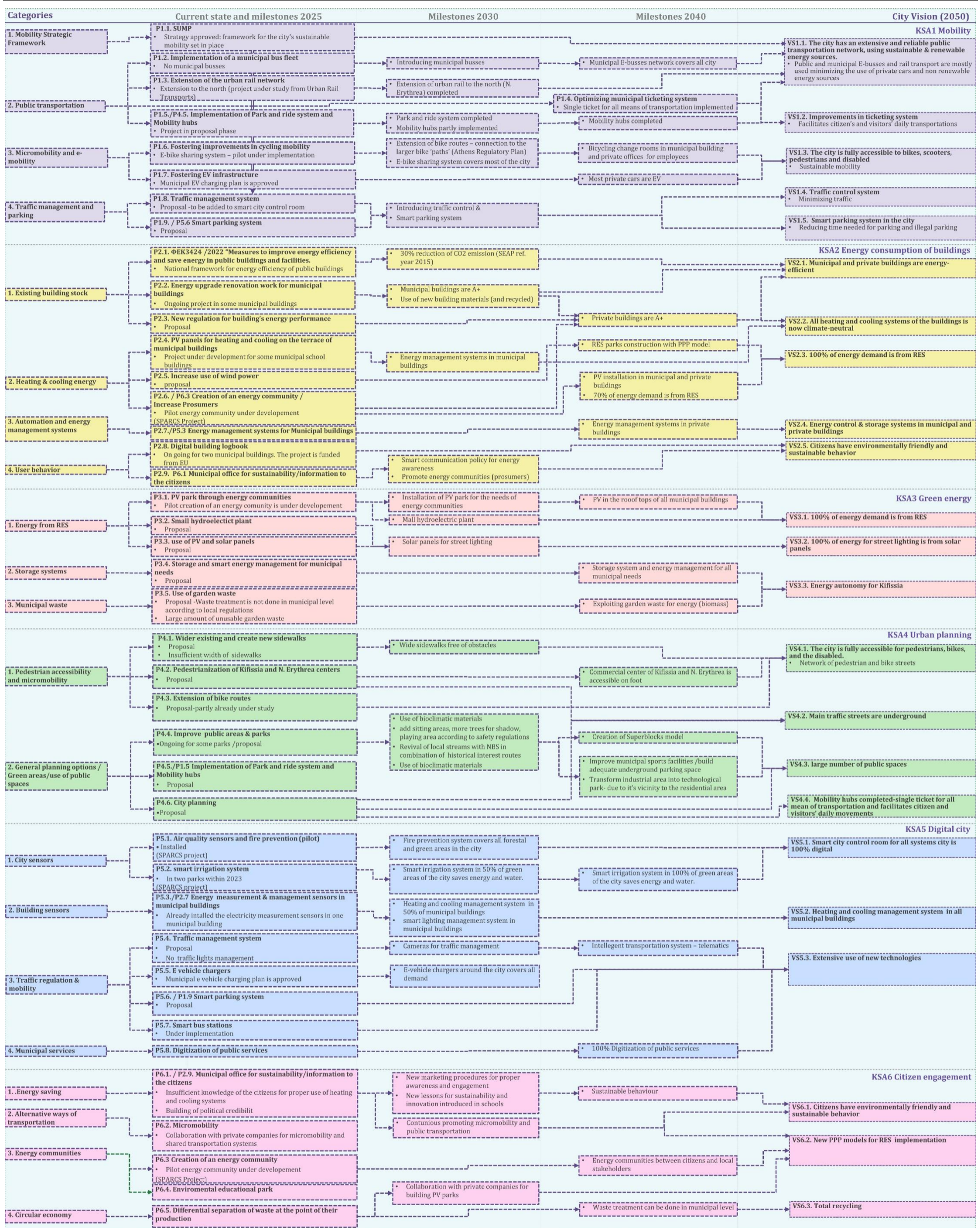


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Visual / Graphic Roadmap Kifissia



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Key outcomes per KSA

The most relevant outcomes from the roadmapping process, in terms of strategies, projects, and measures are described in Table 10. These outcomes, which consist of existing initiatives that directly contribute for each KSA, as well as new ones, resulting from the WS and collaborative work developed for Kifissia's roadmap, are described below, according to their level of development and available information.

Table 10. Key outcomes table – Kifissia

Key outcomes for KSA1: Mobility		
ID	Name (type)	Description
P1.1	Sustainable Urban Mobility Plan (SUMP) (type: strategy)	Sustainable Urban Mobility Plan was approved in 2021 setting the framework for the city's sustainable mobility development. The plan sets the goals for the next 5, 10 years and 15+ years. Initiatives in the following areas of intervention are in phase of proposal, planned or under development: public transport; micromobility; e-vehicles; bike routes; green areas; walkability; infrastructures for the disabled; road safety; integration of innovative technologies in the transportation system; smart parking system; and increased revenue through mobility management. Category: Mobility strategic framework
P1.2	Municipal Bus fleet	Currently there is no municipal transportation; existing busses and train are not operated by the Municipality. The city is promoting a multilayered approach to its public transports network by introducing the idea (proposal in SUMP) of a municipal bus fleet, taking into account the plan for the extension of the urban rail network (regional plan), implementation of a park and ride system, and creation of mobility hubs. Category: Public transportation
P1.3	Extension of urban rail network	The urban railroad network plan includes the extension of the network until N. Erythrea. The expansion plan is operated by the Region. The Municipality is taking into account the plan for related urban development and future municipal transportation projects. Category: Public transportation
P1.4	Optimizing transport ticketing system	Currently an idea. This project will start in parallel with the introduction of the municipal bus fleet and the implementation of mobility hubs. The scope is to facilitate transportation using single ticket for both municipal and regional operated busses. Category: Public transportation
P1.5 / P4.5	Park and ride system and mobility hubs.	Project in proposal early stage. The idea is to be able to move around the city without the use of private car minimizing traffic and pollution. The project will be planned in relation with future projects regarding micromobility, municipal fleet, etc. Category: Public transportation
P1.6	Fostering improvements in cycling mobility	The first e-bike sharing system is under implementation. The city has assured the funding for 50 bikes and 7 rental docking stations. At the moment only an e-scooter (free float) sharing system is operating within the limits of the municipality. Future study for improvements



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Key outcomes for KSA1: Mobility		
ID	Name (type)	Description
		will include also the extension of bike routes, bike parking areas and changing rooms in municipal buildings for cyclists. Category: Micromobility and e-mobility
P1.7	Fostering EV infrastructure	Currently there are not enough EV chargers in the city. The municipal e-vehicle charging plan proposes the installation of (about) 100 chargers around the city. The e-vehicle charging plan was issued in 2022, in line with national laws and regulations, and includes the description of proposed types of chargers, proposed locations, timeline of phases of implementation, scenarios, and total cost of the project. Category: Micromobility and e-mobility
P1.8	Traffic management system (to be added to central smart city control room)	Project in proposal phase. The goal is that this will be one of the features of the smart city control room. Category: Traffic management and parking
P1.9/ P5.6	Smart parking system in the commercial centre of Kifissia	This project is a proposal in SUMP. Finding a parking space in the commercial centre of Kifissia is a hard task. Most people spend a lot of time (and fuel) driving around searching for a parking spot. This increases traffic, air, and noise pollution, and often leads to illegal parking. The use of a smart parking system with the possibility of prior reservation of the available parking space could be a solution to this common problem of the citizens. Category: Traffic management and parking

Key outcomes for KSA2 Energy consumption of buildings		
ID	Name (type)	Description
P2.1	ΦEK3424 /2022 “Measures to improve energy efficiency and save energy in public buildings and facilities	National framework for energy efficiency of public buildings. The law sets the percentage of annual energy saving, proposing measures and minimum and maximum temperatures for the use of heating and cooling systems. Category: Existing building stock
P2.2	Energy upgrade renovation work for municipal buildings	This is a proposal for all municipal buildings that includes energy upgrading of building’s cell, upgrading heating and cooling systems as well as existing lighting. A renewable energy system, like photovoltaic or solar panels, and a building energy management system will contribute to the desired goal. Currently the municipality has concluded inspections of the heating systems of 30 municipal buildings in order to have a more detailed analysis of the energy status of the buildings, and to select the most efficient energy refurbishment actions. Feasibility study for energy upgrades of Municipal school buildings is underway and some of them have already received appropriate funding (from national funding schemes-2021) for energy refurbishment. Category: Existing building stock



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Key outcomes for KSA2 Energy consumption of buildings		
ID	Name (type)	Description
P2.3	New regulation for building's energy performance	The energy building regulation currently is a national regulation applied for new buildings. The idea is that the Municipality will set the highest standards in all future energy related renovation work in municipal owned buildings. Category: Existing building stock
P2.4	PV panels for heating and cooling on the terrace of municipal buildings	The project will be developed in collaboration with P2.2 energy upgrade renovation work of municipal buildings. Adding PV panels on the terrace will help create nZEB via net metering system. Category: Heating & cooling energy
P2.5	Increase use of wind power	The project consists of installing wind generators for creating a RES park. This project is just an idea currently, discussed during the workshop. Category: Heating & cooling energy
P2.6	Increase prosumers	This ongoing proposal consist in the creation of an energy community between the municipality and the citizens. This pilot project will give the opportunity to the citizens / members of the community to benefit from the energy produced, via virtual net metering, from the future PV park that will be installed on the terrace of a municipal building. Category: Heating & cooling energy
P2.7 / P5.3	Energy management systems for Municipal buildings	This proposal could be implemented in addition to the energy renovation of municipal buildings (P2.2). Currently, Kifissia has installed the cloud-based "Sense One IoT Monitoring Platform" in order to remotely monitor electrical energy consumption in three municipal buildings. Category: Automation and energy management systems
P2.8	Digital building logbook	Ongoing project for two municipal buildings. The project is funded by EU. Category: User behaviour
P2.9 / P6.1	Municipal office for sustainability/ information to the citizens	This proposal consists in the creation of a municipal office for sustainability, a reference point for information to the citizens regarding proper energy management and the benefits of RES installations. In addition, the office could help creating energy communities among the citizens. Category: User behaviour

Key outcomes for KSA3 Green energy		
ID	Name (type)	Description
P3.1	PV park through energy communities	Currently there are no RES parks in the municipality. Energy from RES is produced only from a few PV panels already installed on the rooftops of a few private buildings. Some PV panels are under installation on a couple of municipal buildings (energy renovation work in schools). Solar panels for hot water are quite common in private houses. The installation of a PV park for the needs of members of the energy community that is under creation by the municipality is a project



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Key outcomes for KSA3 Green energy		
ID	Name (type)	Description
		proposal. The plan proposes the creation of a PV park of 99kW on the roof top of a municipal building (school) which will produce 150000kWh/year. This is a pilot project. The goal is that more PV parks will be implemented in the near future. Category: Energy from RES
P3.2	Small hydroelectric plant	Another proposal for a RES is the implementation of a small hydroelectric park. This is a more complex project due to the environmental permissions needed and the total cost of implementation. Category: Energy from RES
P3.3	Use of PV and solar panels	Production of green energy within the municipality for local use is being considered and under study within two projects. The installation of a PV park for the needs of the pilot energy community and the installation of PV panels on the terrace of municipal buildings. In addition, there is a proposal for installation of PV or solar panels for the needs of street lighting. Category: Energy from RES
P3.4	Storage and smart energy management for municipal needs	Build storage systems and energy management for all municipal needs. In collaboration with the project for PV installation within the municipality there is also a need for proper energy management and energy storage systems. This is a proposal (currently it's a future goal) that could be implemented in multiple phases. Category: Storage systems
P3.5	Use of garden waste	Kifissia is a city with a lot of private gardens, trees and parks. Every year there is a big amount of garden waste that is unused. A proposal for the use of garden waste as well as other municipal waste as biomass for energy production has been discussed. Currently according to the local laws, waste treatment cannot be done by municipal authorities. Category: Municipal waste

Key outcomes for KSA4 Urban planning		
ID	Name (type)	Description
P4.1	Widen existing and create new sidewalks	For the same reason as P4.2, this proposal consists of making sidewalks more "attractive" and also accessible for the disabled, improving walkability. Category: Pedestrian accessibility and micromobility
P4.2	Pedestrianisation of Kifissia and N. Erythrea centres	According to the analysis of the questionnaires stated in the 1st phase of the SUMP (2021), the main mode of transportation for citizens of the Municipality is private vehicle, and accounts for 72% while walking is preferred by 12% of the people and bicycling only by 4% of the inhabitants. This proposal could help change "bad" habits and promote alternative ways of transportation, improving walkability within the city. Category: Pedestrian accessibility and micromobility



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Key outcomes for KSA4 Urban planning		
ID	Name (type)	Description
P4.3	Extension of bike routes	<p>Aligned also with the goals of SUMP and the bike sharing system that is under implementation this project proposal consists of the extension of existing bike routes, connecting a big part of the city. The future municipal bike route extension, will take into account the metropolitan network of bike routes proposed in the new Master plan of Athens. The proposed network of bike routes connects the Municipality of Kifissia with Faliro, in the southern part of Attika, through a 27 km ride.</p> <p>Category: Pedestrian accessibility and micromobility</p>
P4.4	Improve public areas and parks	<p>As stated before, there is a need to increase and promote alternative ways of transportation and increase walkability. This proposal consists of upgrading public areas and parks making them more inviting for the citizens as well as visitors. The idea is to add sitting areas with trees for shadow, kids playing areas and in general create a public space for common use of citizens without cars, using the superblock model. In addition, “green” corridors where people can walk could be created, combining revival of local streams using natural based solutions and routes of historical interest.</p> <p>Category: General planning options/ Green areas/ use of public spaces</p>
P4.5 / P1.5	Implementation of Park and ride system and Mobility hubs	<p>Project in proposal early stage. The idea is to be able to move around the city without the use of private car, minimizing traffic and pollution. The project will be planned in relation with future projects regarding micromobility, municipal fleet, etc.</p> <p>Category: General planning options / Green areas/use of public spaces</p>
P4.6	City planning	<p>The proposal is to revise the city’s land use plan and change the industrial area located in the vicinity of residential areas into a technological park. In addition, the revised city plan could improve municipal sports facilities by creating underground parking space to avoid local traffic and illegal parking.</p> <p>Category: General planning options / Green areas/use of public spaces</p>

Key outcomes for KSA5 Digital city		
ID	Name (type)	Description
P5.1	Air quality sensors and fire prevention (pilot) (SPARCS project)	<p>This project is already implemented through SPARCS. Three air quality sensors have been installed, covering the city. The pilot fire prevention system was also installed in the forest area in the northern part of the municipality. These smart city sensors are monitored and controlled by a common platform which is the groundwork for the creation of a smart city control room where more features will be added in the future.</p> <p>Category: City sensors</p>
P5.2	Smart irrigation system	<p>The project is under implementation through SPARCS. The smart irrigation system will be installed in two parks in the city helping</p>



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Key outcomes for KSA5 Digital city		
ID	Name (type)	Description
	(SPARCS project)	reduce use of water and energy. The goal is that this project will expand in the future covering all parks and green areas of the city. Category: City sensors
P5.3 / P2.7	Energy measurement & management sensors in municipal buildings	This proposal could be implemented in addition to the energy renovation of municipal buildings (P2.2). Currently Kifissia has installed the cloud-based “Sense One IoT Monitoring Platform” in order to remotely monitor electrical energy consumption in three municipal buildings. Category: Building sensors
P5.4	Traffic management system	Project in proposal phase. The goal is that this will be one of the features of the smart city control room. Category: Traffic regulation & mobility
P5.5	E-vehicle chargers	Municipal e-vehicle charging plan is approved. Category: Traffic regulation & mobility
P5.6/ P1.9	Smart parking system	This project is a proposal in SUMP. Finding a parking space in the commercial centre of Kifissia is a hard task. Most people spend a lot of time (and fuel) driving around searching for a parking spot. This increases traffic, air, and noise pollution, and often leads to illegal parking. The use of a smart parking system with the possibility of prior reservation of the available parking space could be a solution for this common problem of the citizens. Category: Traffic regulation & mobility
P5.7	Smart bus stations	Kifissia has initiated the installation of smart bus stations. In the next couple of months 32 bus stations will be replaced by smart ones. The bus stations will have PV panels on top, covering their energy need for lighting. The project is funded by national funding program «Φιλοδημος». Category: Traffic regulation & mobility
P5.8	Digitization of public services	Digital services for the citizens and visitors will help reduce time and energy spending. The project has been initiated adding slowly more features. Currently many applications and requests can be executed online by the citizens. In addition, all city council meetings can be viewed on line by everyone. Category: User behaviour

Key outcomes for KSA6 Citizen engagement		
ID	Name (type)	Description
P6.1 / P2.9	Municipal office for sustainability/ information to the citizens	This proposal consists in the creation of a municipal office for sustainability, a reference point for information to the citizens regarding proper energy management and the benefits of RES installations. In addition, the office could help the creation of energy communities among the citizens. Category: Energy saving



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Key outcomes for KSA6 Citizen engagement		
ID	Name (type)	Description
P6.2	Promoting micromobility	Collaboration with private companies for promoting micromobility and shared transportation systems. This project is under development; e-scooter sharing system is operating and bike sharing system is under development. Category: Alternative ways of transportation
P6.3	Creation of an energy community/ increase prosumers (SPARCS Project)	This ongoing project consist in the creation of an energy community between the municipality and the citizens. This pilot project will give the opportunity to the citizens / members of the community to become prosumers and to benefit from the energy produced, via virtual net metering, from the future PV park that will be installed on the terrace of a municipal building. The project will also promote the creation of more energy communities and increase RES. Category: Energy communities
P6.4	Environmental educational park	Proposal for the creation of an environmental educational park for young (and older) citizens and visitors. The park could explain and show simple but interesting ways for sustainable living and its benefits for the environment. Category: Circular economy
P6.5	Differential separation of waste at the point of their production	In early stage. Currently waste treatment is allowed at a regional level (not municipal). Category: Circular economy

3.3.3 Adopted methodology and procedures

The task force for the roadmapping process is formed by three members of local SPARCS team (Artemis Giavasoglou, Kleopatra Kalampoka and Eleftheria Tzika) with the help and support of Deputy Mayor, the technical department and general secretary of Municipality.

Methodology for the roadmapping process

The roadmapping process for the Municipality of Kifissia started in September 2022 with the formation of the local task force. Prior of the final decision about the formation of the task force, a meeting was organised between SPARCS team, deputy mayor, general secretary and representatives from different departments of the municipality with the scope of informing and involving everyone for the upcoming tasks and work. During the meeting it was decided that the task force would be formed by members of SPARCS local team, supported when needed by the general secretary and deputy mayor.

The second step was to review all KSA and vision statements from the City Vision workshop and report, which was developed in November 2020, and decide their relevance and needed updates. Strategic documents like the Implementation plan and outcomes from the work done in WP5, as well as recent strategies of the Municipality, were taken into account in order to fill our version of master spreadsheet. This step was subject to continuous updates until the execution of the workshop, due to newer approved strategic documents and decisions.



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The majority of the stakeholders involved and invited to participate in the workshop were the same as the ones from the City Vision workshop, as they were already familiar with the project and the procedures. In order to involve as many stakeholders as possible, the task force performed interviews and meetings prior to the workshop with many departments of the municipality. This helped reduce the time needed for the workshop as some information was prefilled in the relevant roadmap templates of the six KSA. This information and ideas acted as a trigger for further discussion during the WS.

The agenda and the final dates for the WS were decided by the task force and the Deputy Mayor considering many options, taking into account available dates, time, and resources. The workshop was organized face to face in a conference room of the town hall. The aim was to keep the workshop as short as possible so attendees would not get tired. For that reason, we decided to invite only 15 persons and to divide them in 3 groups of five. The attendees could select and join the group and the relative KSA that they preferred, preferably because they had more knowledge in the subject.

The hall was organized similarly to the prior City Vision WS with moving walls and tables, divided in three groups. Posters of the status quo of the city and trends from the City Vision WS were pinned on the wall for everyone to see. The vision statements and outcomes from the City Vision WS were also available as a reminder and a point of discussion. Each group was assigned with a KSA and was given the relative printed template, with some prefilled points, post-its and colour pens. A combination of the exercises of "forecasting" and of "backcasting" was used to fill out the template of the roadmap.

The two days' workshop was organized between 13 & 14/3/2023 and had a 4 hours per day duration (Table 11). The three members of the task force acted also as facilitators during the workshop. All six KSA from the city vision were discussed, divided in the 2 days of the workshop.

Roadmapping Workshop Agenda

Table 11. The temporal ordering of the workshop – Kifissia

Time	Description	Duration
Day 1 (13/03/23)		
9:00-9:45	Welcome from the task force, short presentation and goals of SPARCS, scope of the roadmapping workshop and agenda and practicalities.	15
9:45-10:00	Round of presentation from all attendees and groups formation Group 1: energy consumption of buildings Group 2: green energy Group 3: mobility	15
10:00-11:15	First part of group discussion (from "status quo" to the vision of 2050)	75
11:15-11:30	Coffee break	15



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Time	Description	Duration
11:30-12:45	Second part of group discussion	75
12:45-13:00	Coffee break	15
13:00-14:00	Presentation of results per group/KSA	60
Day 2 (14/03/23)		
9:00-9:45	Welcome from the task force and groups formation Group 1: citizen engagement Group 2: digital city Group 3: urban planning	15
9:45-11:00	First part of group discussion (from “status quo” to the vision of 2050)	75
11:00-11:15	Coffee break	15
11:15-12:30	Second part of group discussion	75
12:30-12:45	Coffee break	15
12:45-13:45	Presentation of results per group/KSA /Free discussion Closing workshop	60

The Roadmap workshop was organized in March 2023 in a face-to-face model, within the premises of the Municipality (Figure 5). Three members of local SPARCS team, Artemis Giavasoglou, Kleopatra Kalampoka and Eleftheria Tzika, are the main organizational task force that acted also as facilitators during the workshop. Different experts from the technical department of the municipality, buildings permit office, transportation office, department of greenery, energy office, office of programs and resource utilization, MOH, University of Peiraeus and citizens of Kifissia attended the two-day workshop. Most of the attendees were already familiar with the project and the scope of the workshop, as they had participated previously in the City Vision workshop.

The attendees were divided in three groups of five and worked on two key strategic areas each. Each KSA was presented and discussed at the end of the day with the other groups and their feedback and comments were added to the roadmapping template of the KSA.

Individual interviews with other experts including the general secretary of the municipality and deputy mayors were held prior to the workshop in order to pre fill part of the templates. The information already pre filled worked as a trigger for discussion, shortening the time needed for the final workshop.

The workshop started with a short welcome from the task force and presentation of the agenda. The attendees were then asked to join one of the three groups and to present themselves and their expertise to the others.

During the first day of the workshop the three KSA that were introduced were energy consumption of buildings, green energy and mobility. The posters of the status quo from the City Vision workshop were used as a reminder of the current situation and the vision statements were used as points of discussion.



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Each group worked separately and at the end of the day, each team presented their outcomes to the other groups.

In the second day, the same groups worked on the other three KSA, urban planning, digital city and citizen engagement. At the end of the day there was some free time left for everyone to comment or add new data in all the KSA.

The duration of the workshop was 4 hours/day including the coffee break and introductions. Printed material from the City Vision workshop such as status quo and vision statements were helpful to initiate the discussion. Trends and wild cards were confusing and disorienting for the attendees. Most of them found difficult to ‘plan’ until 2050 and the majority of the milestones and projects discussed were foreseen up to 2040.



Figure 5. Pictures taken during the WS - Kifissia

3.3.4 Lessons learned and next steps

During the workshop participants identified many threats and opportunities within all key strategic areas. Two points were common in all discussions, lack of perceived political credibility and financial issues. There is a need for more funding options for energy upgrades of private houses and RES installations. As all funding programs are national and not implemented by municipalities, one solution proposed is to establish an



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office that will give necessary information and support citizens throughout the process of energy upgrades.

Energy communities and the need for local renewable energy production were also key points of the discussions. The formation of energy communities was positively accepted by everyone.

All priorities and key points of discussion during the workshop are reported for further study and will be taken into consideration by the city council.



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3.4 Kladno Roadmap

3.4.1 Introduction

Kladno has made a quite significant progress regarding the vision process, design of the strategies and stepping into the implementation part also related to the project phase.

Thus, the vision roadmapping has had some heritage to build on. Also, the partners were expecting a specific dialogue and tangible outcomes. This was one of the challenges for the city team and CVUT – how to lead the debate about the vision process with parallel to the concretization of the strategic project proposals. Thus, the discussion with the partners was focused more on the project outlines.

To balance such expectations the city team and CVUT prepared a large package of supporting documents in advance and facilitated the discussion as specifically as possible.

One of the learnings confirmed by the discussion is that the City Vision and its statements are still general and not targeted enough, contain many components from multiple sectors (so decomposition is difficult and aggregation back as well); making it hard to digest and to imagine the specific steps and projects in 2040 or 2050 (also due to the difficult times and geo-political situation the market is dealing with).

Systematic approach first

The city team and CVUT prepared the whole system of decomposition from the vision statements to the projects through city strategies. Thematic clusters and groups of measures were defined to bridge the vision and specific proposals and milestones. The whole mechanism was prepared to show a logical pathway.

It is necessary to understand that the city vision is, of course, being designed in line with the framework target of carbon neutrality. In this term, the city transformation is foreseen by the year 2050. To tackle the “industrial” change the vision is focusing on the modernization of the infrastructure and sources, on the innovation and technology exploitation, and on citizens’ needs. The city focuses on energy transformation with economic opportunities to be revealed and detected, and with regard to its social impact. The focus is set on the reduction of coal and gas, changing the transport behaviour, and also transforming the composition of the other relevant sectors.

How to understand the goals we would like to achieve

The city goals were also defined and elaborated based on massive analytical works (energy and climate inventory). The sectors included in the inventory are those whose activities have an impact on or directly emit CO₂ or other greenhouse gases that are calculated according to emission factors. The baseline is 2019. See the breakdown of the data in Figure 6.



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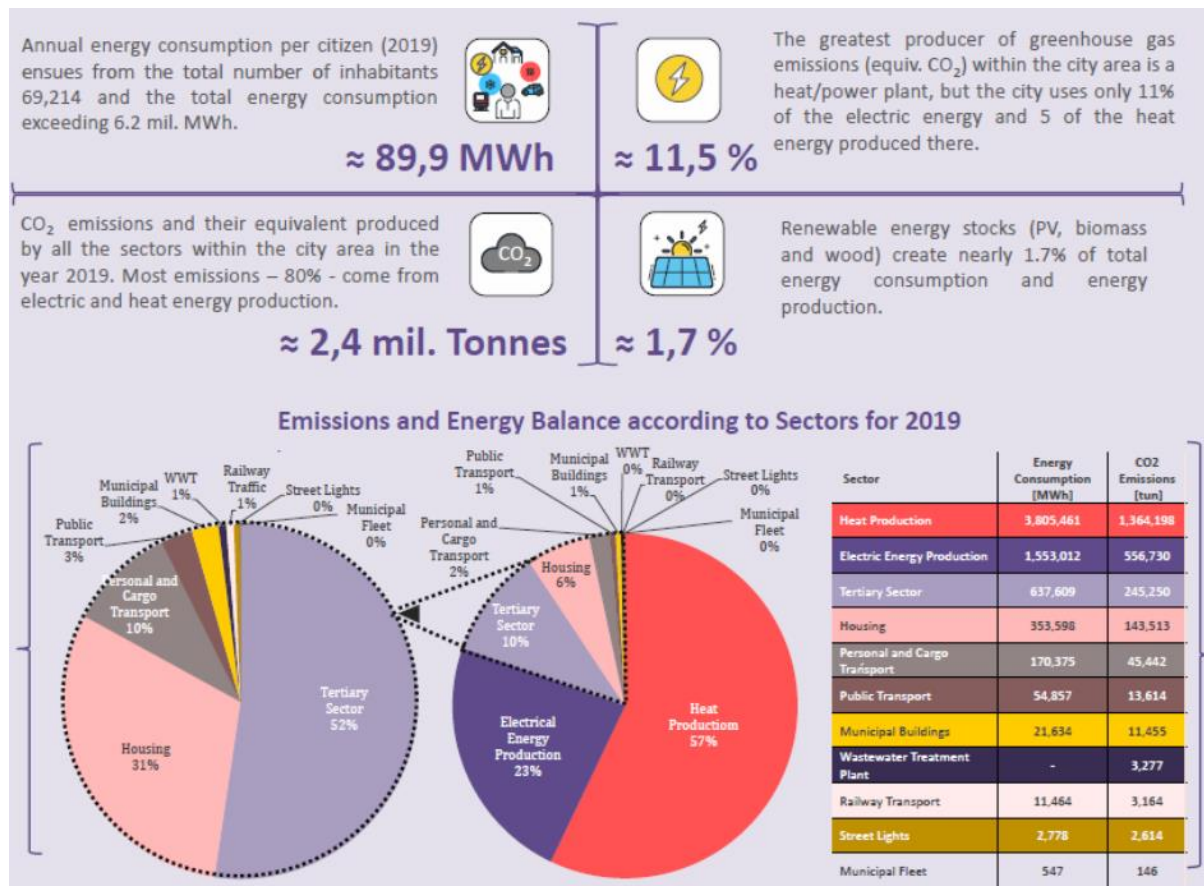


Figure 6: Preliminary Emission Inventory (Action Plan for Climate and Energy)

The roadmapping process was also about introducing the main strategic streams. The SECAP is the main blueprint of the future plans. It combines strategic priorities, linkage to the city vision, but at the same time it suggests systemic and long-term investments.

During the workshop, participants appreciated there was a pre-developed timeline with reference to the main strategic streams that was validated throughout the discussion.

There was an overall understanding that the milestones and overall roadmap components need to follow the strategic stream defined by the SECAP and other key city political documents. Beyond the targets anticipated by the SPARCS City Vision, the city's SECAP is even more ambitious and builds on the climate neutrality by 2050 (see Figure 7).



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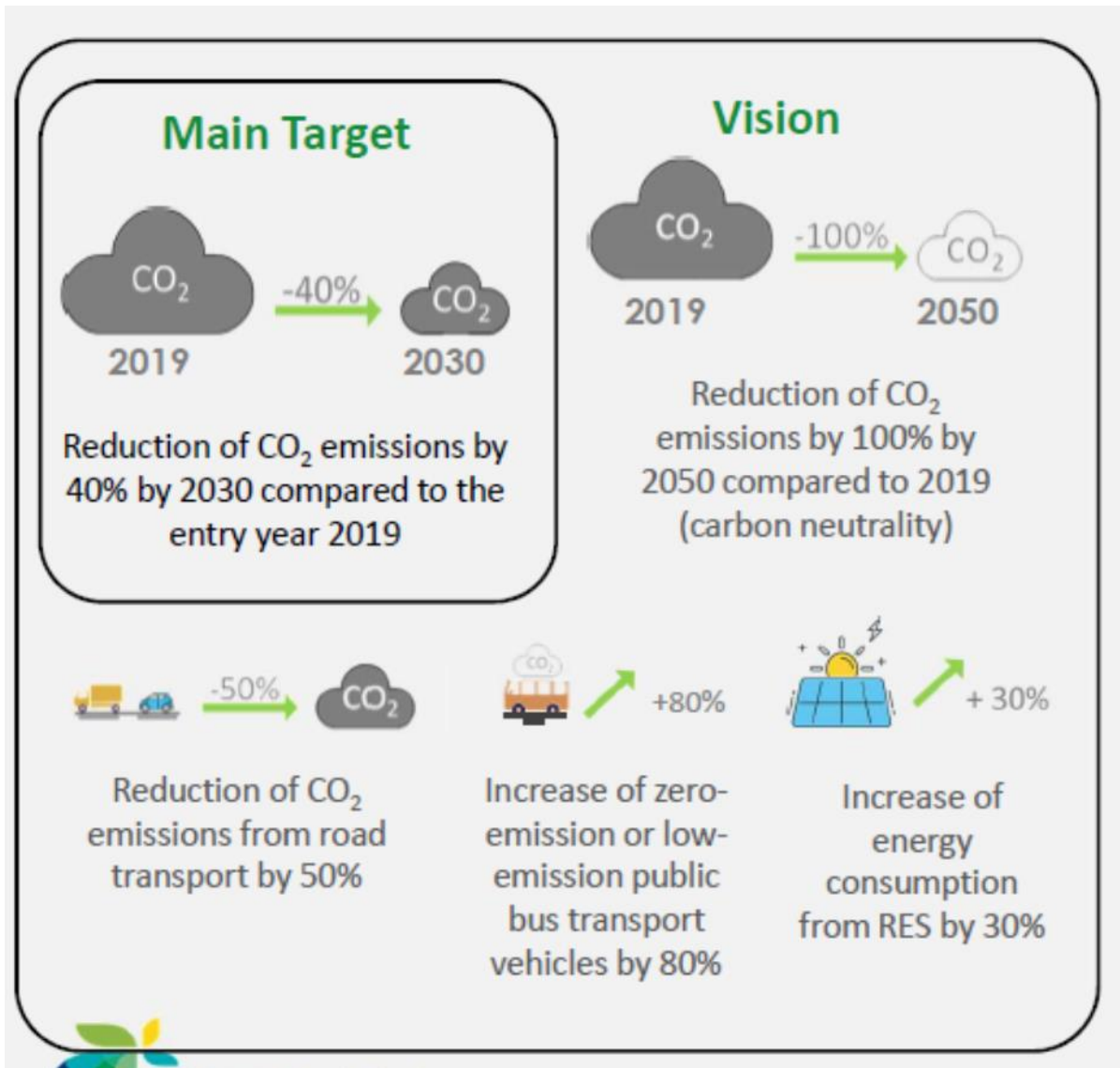


Figure 7: City targets (SECAP, 2022)

3.4.2 Overall roadmap results

During the designing phase the overall scope had to be narrowed and the number of KSA and topics (areas and sub-areas according to terminology, see tables below) to be discussed during the workshop had to be reduced. Only the most important ones for fulfilling a given vision statement and the most suitable ones (e.g. because of the difficulty of the topics or the need to have a broader discussion with the stakeholders) were picked. KSA3 Digitalization and KSA4 Good governance were merged to the Smart City topic since most of the relevant issues concerning smart city, discussed at a city level, correlate with digitalization and people.

Besides the four KSA that were discussed during the three workshops, the fifth KSA dedicated to Positive Energy District was developed in parallel by a dedicated PED



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working group. Conceptually the PED is a testing ground for the measures (solutions, projects, processes) on a district-scale. The results of discussions within this group are summarized in the Milestones table (see Appendix 5, section A).

Kladno's Roadmap for urban transformation

KSA1: Energy

The SECAP sets out proposals for how the city should develop in the field of energy, what targets should be designed, and an accurate system for the implementation to be met. The SECAP captures emissions from all fuel and energy consumption in the study area; electricity transmission and distribution in the city; heat from CHP sources, etc. For each measure, the SECAP defines a description, the person or entity responsible for implementing the measure, timing, cost estimate, estimated energy savings/increase in renewable energy production, and estimated CO2 emission reductions.

Also, the process of the vision road mapping has confirmed the right pathway towards energy transformation and underlined the importance of the renovation waves and production of clean energy (wind, water but especially when it comes to solar energy from PV systems). During the discussion, there was a strong consensus to prioritise the development of a district heating network (up to 90% coverage), however, in terms of the resource base, it is still on the side of coal (private heat producer).

At the same time, the diversification of the sources is necessary, both at the level of the major producer and at the level of decentralized systems. All relevant partners see potential in the waste-to-energy projects (especially regarding the huge waste-to-energy facilities in the city, but also smaller facilities using waste from sewage treatment and industry technologies should play an important role). Hydrogen could be important in 2040+, but it is very difficult to say now what role it will play. Nuclear power is still in the shadows because of government policy.

KSA2: Mobility (individual mobility)

One of the biggest problems of the city of Kladno is the traffic load of the city. This is logically linked to noise pollution and air pollution, as well as parking issues. This is caused by a combination of several elements; commuting to and from Kladno, the age of some housing areas that were not built for such a large number of cars, insufficient infrastructure for other alternative modes of transport, the absence of important transport structures, the location of the city between two motorways, etc.

The shift to more sustainable modes of transport should help eliminate these negative elements. In addition to the long-planned transport infrastructure works, such as the double-tracking of the railway line to Prague to ensure regular and more frequent connections, the construction of infrastructure for electric vehicles and cyclists should also help the transition. Kladno has a feasibility study for electromobility and sustainable urban mobility plan on which it can build upon.

The city has already implemented a bike-sharing system and there is a huge potential for cycling in Kladno, as most of the city is located on a relatively flat area. Providing quality



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and safe cycle paths with connections to other transport links can reduce the need for car transport in the city and for transport to nearby Prague.

KSA3-4: Smart City (merged digital services and e-governance)

Being open and inclusive is one of the key priorities of the city. The mutual collaboration e.g. with research or business should ensure reaching the commitments and common development goals of the city.

Reaching the overall smart and interconnected ecosystem supported by local administration might speed up an urban transformation. And again, all should result in ensuring the good quality of life in the city, the local development, the attractiveness and reputation of the city.

Digital networks will distribute data for evidence-based decision-making, while providing accessible information to all stakeholders and enabling efficient communication within the municipal organizations and with citizens, visitors and businesses

KSA5: Positive Energy Districts (PEDs)

PEDs in Kladno have the potential to provide sustainable liveable places for residents, businesses, and other users. PEDs contribute to the sense of community by building upon the interdependence between all stakeholders and municipal authorities. This interdependence could take the form of sharing energy and strengthening local services, etc.

Energy solutions maximize the local production from renewable resources from the sun, air, and geothermal, including mine-water, or biomass. Mobility solutions should be based on carbon-free transport modes, favouring shared user models. They contribute to the local economy by saving building operation costs and by offering an opportunity for additional income to citizens and businesses that decide to actively participate in the energy market instead of paying outside suppliers.

Companies should use the districts to apply innovative methods and new business models, especially in the fields of energy, data services, and mobility.

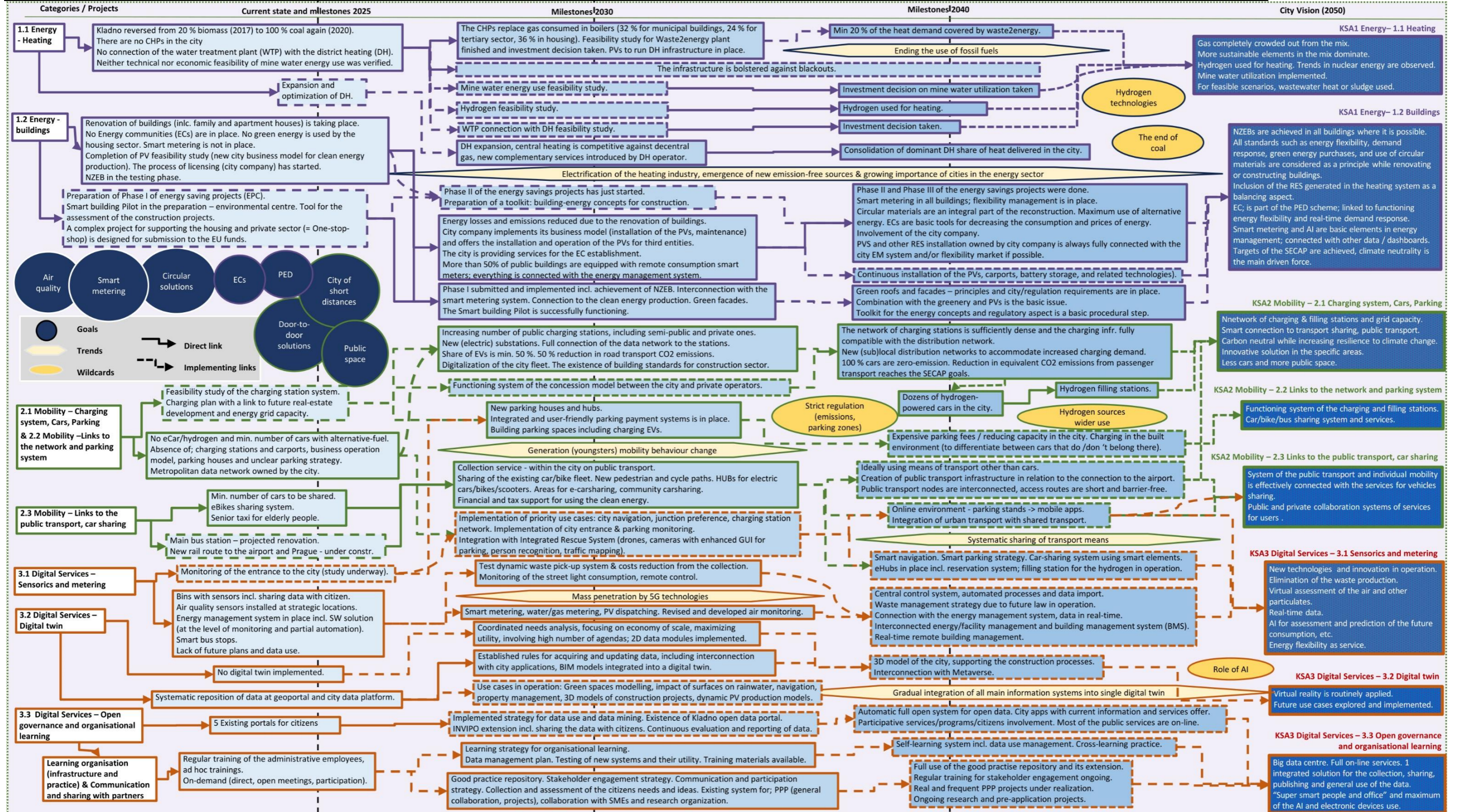


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Visual / Graphic Roadmap Kladno



Note: Detailed roadmaps for the following topics: (1) Energy, (2) Mobility, (3) Digital services, can be found in Appendix 5, Section B.



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Key outcomes per KSA

A combination of the strategic and project aspects was defined and discussed during the roadmapping process and workshop itself. Partners were more participatory to define project outlines and specific measures towards 2030, as it was more tangible and imaginable. Also, an important aspect that influenced the process and results relates to the long period between the pilot workshops (April and May 2022) and the final workshop (June 2023), which was almost one year, and entailed substantial progress within KSA1 and KSA2 (regarding the project proposals, investment made, EU grants announcement, etc.).

For the purpose of the roadmapping process not all areas and topics were taken into discussion due to the scale and cumbersomeness. Each KSA has also other categories which are developed aside of the SPARCS process.

Below, the key outcomes per KSA are presented (Table 12).

Table 12. Key outcomes table – Kladno

Key outcomes for KSA1: Energy		
Sub-area 1.1: Heating		
ID	Name (type)	Description
1.1.1	Local combined heat and power to substitute decentralized gas boilers <i>Project (research, investment)</i>	Description: Decentralized production of heat and power is proposed as an alternative to gas boilers (where there is no district heating) with a long-term goal of replacing inefficient local boilers. Implementers: City DH operator or ESCO company. Resources: Investment into a single small district-serving CHP can reach around several million EUR.
1.1.2	Change in energy mix for both central source and in the district heating distribution <i>Project (research, investment)</i>	Description: The central source of heat (Sev.en Power Plant) runs on coal (used to be 20 % biomass in 2015). The goal is to replace coal with a combination of waste2energy, biomass, and other complementary sources on the central source, plus finding opportunities for local DH sources (e.g., excess heat from the Winter Stadium). Implementers: Sev.En energy company, DH Operator TEPO, other investors. Resources: Up to tens of million EUR investment.
1.1.3	Expansion and optimization of the district heating (DH) <i>Project (research, investment)</i>	Description: The DH network covers around 30 % (2023) of the residential heat consumption points. The long-term goal is to bring the number close to 90 % (2050). The losses should be reduced to less than 10 %. Low-temperature distribution networks shall gradually replace the high temperature ones. Implementers: DH operator company TEPO, City of Kladno. Resources: For the complete modernization tens of million EUR can be accounted for.



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Key outcomes for KSA1: Energy		
Sub-area 1.1: Heating		
ID	Name (type)	Description
1.1.4	Use of mine water for seasonal heat accumulation <i>Project (research, investment)</i>	Description: The vast mine water reservoir beneath Kladno promises some potential for seasonal heat accumulation. This potential is subjected to pre-feasibility (2025) and later to feasibility assessment (2030). Implementers: City of Kladno, Czech Technical University, Palivový Kombinát. Resources: In case feasibility is confirmed, the overall cost of the solution can be in order of tens of million EUR.
1.1.5	Utilization of hydrogen, esp. green hydrogen <i>Project (research, investment)</i> <i>Smart solution</i>	Description: Green hydrogen will most likely not be used for burning under current scenarios on a large scale. However, for storing the power on different scales (public transport, buildings, district) the feasibility assessment will need to be done. Implementers: City of Kladno, private partners (e.g. Arriva). Resources: The resources can be estimated based on future feasibility study.
1.1.6	Connecting water treatment plant with DH <i>Project (research, investment)</i> <i>Smart solution</i>	Description: The potential needs to be assessed in terms of sludge utilization or waste heat utilization. Any heat production and connection to the DH must be confirmed by feasibility assessment. Implementers: City of Kladno, private WTP operators, consultants. Resources: The resources can be estimated based on future feasibility studies.
1.1.7	Energy system robustness, ensuring the security of supply <i>Strategy</i> <i>Project (research, investment)</i>	Description: Thanks to the long-term contracts and utilization of in-house coal by the Sev.en company the city's DH withstood the energy shocks of 2022-23 well. The long-term goal is to maintain resilience by relying on local energy sources. See also the "Change in the energy mix". Implementers: City of Kladno, DH operator TEPO, Sev.En. Resources: Especially human resources on part of the city, ensuring independent and highly skilled personnel that can negotiate with the (mostly) private supplier(s).
1.1.8	Central cooling distribution <i>Project (research, investment)</i>	Description: As the effects of climate change bite in (2023 proved one of the hottest years on record again), Kladno is weighing possibilities of using the unused piping capacity (in places where the distribution went down from 4 to 2 pipes) for district cooling on secondary circuits. However, heating has a higher priority now and a feasibility study needs to be carried out first. Implementers: City of Kladno, DH operator TEPO, Czech Technical University, Energy consulting Resources: The resources can be estimated based on future feasibility studies.



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Key outcomes for KSA1: Energy		
Sub-area 1.2: Buildings		
ID	Name (type)	Description
1.2.1	Energy savings in the public buildings <i>Projects (design and investment)</i> <i>Standardization</i> <i>Legislation</i> <i>New technologies</i> <i>Innovations</i>	<p>Description: A public renovation is one of the city's priorities; thus, the discussion during the roadmapping WS took quite a time. City's plans were introduced and served as a demonstration case for further discussion and inclusion of other sectors in the city. While achieving the highest energy standards in the long-term perspective is a clear goal of the city, the pathway and milestones were elaborated, incl. increasing the RES in the balance and shifting from coal and gas.</p> <p>Also, the security issues and stable resources of electricity and heat were defined as critical conditions, and readiness for building renovation was considered a problematic point. Hydrogen could become relevant in 2040+, it is very difficult to say its role now. Nuclear power is still in shadow because of the state policy.</p> <p>Implementers: city departments, city companies, ESCOs, investors, Resources: city budget, private capital, regional and state investments, EU funds, and financial schemes.</p>
1.2.2	Energy savings in other buildings <i>Projects (pre-application and investment)</i> <i>Collaboration agreements</i> <i>Legislation</i> <i>New technologies</i> <i>Innovations</i>	<p>Description: It is not only public administration building stock that plays an important role, but other sectors were also discussed – housing, private, other entities, etc. Generally, it is obvious that all partners are heading towards a maximum of low or zero emission status of the facilities, through a combination of the RES installation due to the coal abolition and phasing-out from the gas due to the current situation. The potential was seen in the waste-to-energy projects. How to use energy e.g. from the PVs during the summer was one of the discussed topics; here an increasing need for cooling, and its demand on energy, could play an important role.</p> <p>It is essential to create strong partnerships, in this area, between the city and region (hospital, high schools, other administration buildings), companies such as AVE (waste management), Arriva (transport), and Teplárny (power plant), and other partners from housing and private side.</p> <p>Implementers: city departments, city companies, the private sector, the housing sector, regional authority, state. Resources: city budget, other private and public sources, EU funds.</p>
1.2.3	RES installation in the buildings <i>Project (investment)</i> <i>Licence</i>	<p>Description: All efforts of the city administration are focused on increasing use of the RES technology. Therefore, a new business case has been established within the city company, to cover city buildings in the 1st phase. Covering all relevant spots of the “story” such as offering this as a service to the public/other partners, installing other technologies incl. battery storage, carports etc., are planned as well, but as a step no. 2. The importance of the RES use is also being recognized by other entities thus monitoring of other installation should be designed. General aim is to maximise use of the buildings and other spaces for RES installation, or include energy from RES generated in the heating system as a balancing aspect. Several barriers need to be tackled such as capacity (e.g., lack of experts), legislative obstacles, education and awareness.</p>



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Key outcomes for KSA1: Energy		
Sub-area 1.2: Buildings		
ID	Name (type)	Description
		Implementers: city company TEPO, city departments, other entities (private, public, etc – upon their interests), buildings and owners. Resources: city (company) budget, EU funds, private sources.
1.2.4	Energy communities <i>Processes</i> <i>Legislation</i> <i>Project (pre-application, investment)</i>	Description: The establishment of the EC is a basic goal of the city administration and generally it resonates among the professional public. The city needs to define its precise role – active (via using the concept for business potential with surpluses and energy purchase and/or for establishing the ECs and/or moderate discussion among the partners and offering some consulting support), passive (being a member of the EC or monitoring the situation on the market). Implementers: city company TEPO, city departments, other entities (private, public, etc – upon their interests), buildings, and owners. Resources: City (company) budget, EU funds, private sources.
1.2.5	Smart metering <i>New technologies</i> <i>SW solution</i>	Description: Digitalization is a crucial approach for the city – to have all information at disposal ideally in 1 IT tool, to monitor real-time flows of energy, to have support for installing a smart metering in the buildings; and have a good relationship with a distributor to provide the data. Implementers: city company TEPO, city departments, other entities (private, public, etc – upon their interests), distributor. Resources: city (company) budget, EU funds, private sources.
1.2.6	Other measures <i>Projects (design, investment).</i> <i>Innovations</i> <i>Legislation</i>	Description: All relevant aspects which relate more closely with the category 1.2.1-1.2.5 could be defined here. Such as new construction toolkit and regulation; support of other climate and smart elements within the building (green roofs, cooling, innovative HVAC system, green facades, circular and waste material, etc.). There is an ongoing project dealing with the positive balance of energy, so the PEB concept could be one of the testbed and pathways demonstrated in other future cases. Implementers: city departments, other entities (private, public, etc – upon their interests), buildings, and owners. Resources: city budget, EU funds, private sources.

Key outcomes for KSA2: Mobility (individual)		
Sub-area 2.1: Charging system, Cars, parking		
ID	Name (type)	Description
2.1.1	Charging stations infrastructure <i>Innovation</i> <i>Infrastructure</i> <i>Projects (investment, research, pilots)</i>	Description: The goal is to increase the number of public charging stations, including semi-public; and private ones as well. It seems (from a deep analytical work) the concession model should be exploited. The concessionaire assumes the costs of installation and subsequent operation of the stations (location and connection organized by the public entity). The conditions for implementation and operation should be defined in the concession project (tender documentation). The City should support clean mobility through plenty of activities (funds, awareness, sharing the data). There are



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Key outcomes for KSA2: Mobility (individual)		
Sub-area 2.1: Charging system, Cars, parking		
ID	Name (type)	Description
		<p>some specific patterns in the city that should be examined; an innovative concept/pilot of the charging system should be considered, such as in high-density old apartment house areas.</p> <p>Implementers: City departments, concessionaire/private operators, and investors.</p> <p>Resources: city budget, national funds, private funding.</p>
2.1.2	City fleet <i>Project</i> <i>Innovation</i>	<p>Description: The city should target the maximum zero-emission car fleet, fully digitalized, incl. piloting the concepts with hydrogen-powered cars, carports including PVs and storage, and ideal charging stations network both for public and private use.</p> <p>Implementers: city department, city companies, employees, and private investors.</p> <p>Resources: city budget, EU funds, private funding</p>
Sub-area 2.2: Links to the network and parking system		
2.2.1	Network reinforcement and security <i>Collaboration</i> <i>Agreements</i> <i>Projects (investment, pilots)</i>	<p>Description: The goal is to develop all aspects of clean mobility incl. the charging system in the city, but also ensures sufficient grid capacity since it is necessary for real-estate plans, securing the energy stability for households, companies, critical infrastructure, and other reasons. Thus, the full compatibility of charging infrastructure with the distribution network needs to be a priority. Also, the innovation concepts with energy flexibility and clean mobility production should be tested and put into practise (such as vehicle2grid solutions). For all these aspects proper and strategic planning is essential.</p> <p>Implementers: city department, energy distributor, spatial and construction entities, university, and private sector.</p> <p>Resources: city budget, private funds, international project.</p>
2.2.2	Parking <i>Strategy</i> <i>Projects</i> <i>Infrastructure</i>	<p>Description: The existence of a parking strategy is an essential 1st step. The long-term goal is focused on fewer cars and more public space, accompanied by proper car/bike/bus sharing systems and services and charging and filling networks. Also, the HUBs or new parking houses are important.</p> <p>Implementers: city departments, architects and urban planners, and private investors.</p> <p>Resources: city budget, private funding, research activities.</p>

Key outcomes for KSA2: Mobility (individual)		
Sub-area 2.3: Links to the public transport, car sharing		
ID	Name (type)	Description
2.3.1	Connections to train, bus, pedestrian, cycling <i>Projects (investment)</i>	<p>Description: The aim is to ensure an idea of short-distance city. All public transport nodes should be interconnected, access routes are short, logical, and barrier-free. Both, in the city and out of the city [while coming to a city or transferring to the city or traveling for work, fun, or to other connections, to Prague, the airport, and other cities, it</p>



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Key outcomes for KSA2: Mobility (individual)		
Sub-area 2.3: Links to the public transport, car sharing		
ID	Name (type)	Description
	<i>Partnership (incl. PPP)</i> <i>Transport scheme</i>	is necessary to design a good multimodal strategy, and ensure, with partners (including transport operators and other cities), that all aspects work]. Implementers: city department, private entities, railway organization, bus organization, sharing, and other mechanism owners. Resources: city budget, private capital, state funding, etc.
2.3.2	Car, bike and scooter sharing <i>Projects</i> <i>Agreements</i>	Description: Higher support of the sharing systems should be introduced. HUBs for electric cars/bikes/scooters, areas for e-carsharing, community carsharing and also services for the users (incl. apps with information, reservation, news) are the future tasks. Implementers: city department, sharing organization, private investors. Resources: city sources, private sources, investors.
2.3.3	Business and city services <i>Services</i> <i>Projects</i>	Description: The long-term goal is to ensure that public and private collaboration systems are providing good services for users. Maximum effective use of transport and vehicles will be welcomed. Higher use of walking, cycling, or vehicle sharing is conditioning the overall goals. The regulation, sanctions, and other restrictions will play a crucial role. Implementers: city departments, private sector, expert associations. Resources: city funds, private funds.

Key outcomes for KSA3-4: Smart city (Digital services and good governance)		
Sub-area 3.1: Sensorics and metering		
ID	Name (type)	Description
3.1.1 3.1.2 3.1.3	Waste & Recycling; Transport - telematics, signposts, eBike system; Environment and health <i>Strategy</i> <i>Smart solution</i> <i>New technology</i> <i>Project (research, investment)</i> <i>Processes</i>	Note: For categories 3.1.1, 3.1.2, and 3.1.3 the description is more or less the same, an exception being the thematic focus and some aspects (see also in the Milestones table – Appendix 5, section A) Description: In 2018-2020 the city implemented a pilot package of smart solutions incl. smart sensors, the city also purchased the smart system INVIPO which aggregates data from the sensors and enables also the citizens to see/check the data, e.g. online system of filling of the underground containers for the sorted waste, so they can use this information while deciding to empty their bins in homes. Several systems are still under decision process or development, and several systems are observed as relevant for future use. Wide discussion needs to be done and qualitative and economic assessment as well. Generally, the city approach needs to be considered as a whole ecosystem and complex mechanism, meaning strategic framing, HW installation, SW solution including the INVIPO or future layers, integration with the other systems, data use/extraction, and continuous testing of the new technology and solution. Parallel factors/conditions must be in place, e.g. collaboration and partnership, human resources capacity, viable economic and efficient mode



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Topic: LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities

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Key outcomes for KSA3-4: Smart city (Digital services and good governance)		
Sub-area 3.1: Sensorics and metering		
ID	Name (type)	Description
		Implementers: ICT Kladno company, city departments, private operators (waste, transport, IT, bike, etc.), technical market providers Resources: city budget, EU funds, private capital, new sources incl. international projects.
3.1.4	Energy management <i>Smart solution</i> <i>New technology</i> <i>Project (research, investment)</i> <i>Processes</i>	Description: The city has implemented a smart energy management IT solution (EnergyBroker) which includes all data of the city assets which allows to see records of consumption, building inventory, energy and service accounting, heating dispatching, obligation according to standards ISO 50001:2019, or connection to energy stock market. The goal here is focused on creating a complex/integrated system for energy also including the management of the buildings in real-time, BIM system features, incorporation of the other dispatches (PVs, etc.), and AI setup. Also, a creation of the environment for energy flexibility testing and introduction and connection to the market Implementers: city departments, ICT Kladno company, EnergyBroker provider, other market solutions providers Resources: city budget, research and pre-application funds, and new sources.
Sub-area 3.2: Digital twins		
3.2.1	Digital twin development <i>Strategy</i> <i>Project (research, investment)</i>	Description: Digital Twin offers many opportunities for systematic integration and visualization of Kladno city data. First, Kladno will define its own ambition and prioritize use cases to be included based on needs assessment, and pragmatic criteria such as economic benefits and feasibility. Implementers: ICT Kladno company, city departments, private providers Resources: ICT Kladno and city sources (human and budget)
3.2.2	Digital twin inputs collection <i>Smart solution</i> <i>Project (research, investment)</i> <i>Innovation</i>	Description: It is expected that the following inputs will be integrated in the first phases of Digital Twin in Kladno (2025-2030): 2D aerial maps, geoportal GIS inputs, Invipo platform inputs. The pre-identified use cases include modelling of green spaces; modelling on surfaces accounting for precipitation and temperatures; 3D modelling of construction investments and other spatial development, supporting decision-making with regard to land use planning, e.g., changes in transport system; dynamic models for PV generation assessment (including, e.g., shading effects); crisis/contingency management (e.g., emergency water supply). Implementers: ICT Kladno company, city departments, and private providers. Resources: ICT Kladno and city sources (human and budget), external suppliers, international collaboration, and projects.
3.2.3	Digital twin interoperability <i>Smart solution</i>	Description: Data sources will be integrated with external applications; BIM models of the city will be integrated. The link to Metaverse is foreseen.



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Key outcomes for KSA3-4: Smart city (Digital services and good governance)		
Sub-area 3.1: Sensorics and metering		
ID	Name (type)	Description
	<i>Project (research, investment)</i> <i>Innovation</i>	Implementers: ICT Kladno company, city departments, and private providers. Resources: ICT Kladno and city sources (human and budget), external suppliers, international collaboration, and projects.

Key outcomes for KSA3-4: Smart city (Digital services and good governance)		
Sub-area 3.3: Open governance and organisational learning		
ID	Name (type)	Description
3.3.1	Open data and data-oriented services to citizens <i>Strategy</i> <i>Processes</i>	Description: Gradual opening of datasets will take place across an upcoming period (5-10 years), based on a strategy defining the priorities and standards for the publication of datasets. Implementers: ICT Kladno in collaboration with city departments and a coordinating innovation manager (the role needs to be established). Resources: personnel resources
3.3.2	Learning organisation (infrastructure and practice) <i>Strategy</i> <i>Processes</i>	Description: Organizational learning at the municipal office level has not been systematized (as opposed to employee training which is carried out on both regular and ad hoc basis). Mechanisms for organizational learning will be defined, including data treatment-related aspects (city data management plan). Piloting that took place in the past will be re-assessed and new pilots will follow common logic to evaluate the effectiveness of the new systems. Implementers: innovation manager, ICT Kladno company, relevant departments. Resources: city sources, EU funds, external experts, and sources.
3.3.3	Communication and sharing with partners <i>Project (research, investment)</i> <i>Strategy</i>	Description: Participatory strategy of the city will be re-designed to accommodate new processes and digital tools, including internal training and a database of good practices/lessons learned. A cooperation with the private (PPP, SMEs) and the research sector is envisaged as crucial. Implementers: innovation manager, ICT Kladno company, city departments. Resources: city sources, EU funds, research projects, and private funds.

Key outcomes for KSA5: Positive Energy Districts		
ID	Name (type)	Description
5.1.1	SPARCS PED realization <i>Project (research, investment)</i>	Description: SPARCS has initiated the PED design process, kick-started the local working group and spun out into first partial investments into PED infrastructure at PED Sletiště (new energy centre at the Winter Stadium). Gradual implementation of the plan based on the Pre-feasibility study for the implementation of PEDs. Implementers: Kladno (strategic department, investment department), SAMK, TEPO, Private real estate, CVUT.



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Key outcomes for KSA5: Positive Energy Districts		
ID	Name (type)	Description
		Resources: a combination of municipal assets with investment from modernization fund and other grants, the expected investment can reach 2-4 M EUR.
5.1.2	Several implemented PEDs (PED replication) <i>Project (research, investment)</i>	Description: The city is now driving the PED innovation, but in the future, it is clear that private real estate is the way forward to speed up the replication. City's experience coupled with the technical know-how will be offered to private investors in Kladno. Implementers: Kladno (strategic department, investment department), Private real estate, CVUT. Resources: private investment (several investors in Poldi brownfield/greenfield areas are considering PED).
5.1.3	PED ecosystem partnership developed <i>Processes</i>	Description: SPARCS kick-started the PED ecosystem, however, the culture misses common philosophy (conservative approaches are still dominant) and deeper institutional anchoring with the city structure. The next step is to interlink the PED ecosystem on both local areas' and city levels with decision-making bodies of the city. Implementers: City of Kladno (innovation managers, leadership), key PED ecosystem partners (listed in stakeholder analysis). Resources: Personnel resources, EU funding (e.g., EUFC/ELENA type)
5.1.4	Energy communities integration with PEDs <i>Processes</i>	Description: The city is now planning first pilot projects outside the PED Sletiště boundary. First experiences will be transformed into a city Energy Community (EC) process, preparing the ground for interlinking ECs with the relevant PED projects. First candidates are newly built residential housing projects. Implementers: Private associations of apartment owners (SVJ) and public housing company (SBF), together with the PED working group, mainly represented by the city innovation managers, CVUT. Resources: Personnel, grants for EC preparation (Národní program obnovy etc.), grants for technology (Nová zelená úsporám etc.)
5.1.5	Non-energy aspects of PED <i>Strategy</i> <i>Project (research, investment)</i>	Description: The city has already several times initiated the process of having urban planning studies and master plans for some areas (including the area of Sletiště). In the future, both energy master plan and other innovative elements (such as digital infrastructure on a district scale, e.g. IoT use cases and pilots) shall be considered to allow tailoring innovations to local district needs. This strategic activity goes beyond the positive energy balance ambition. Implementers: City, Department for urban planning, city leadership, innovation managers, CVUT. Resources: internal city resources, personnel.

3.4.3 Adopted methodology and procedures

Methodology for the roadmapping process

The city of Kladno was selected to become a pilot city within SPARCS consortium to test, validate and fine-tune the common methodology for the roadmapping process (Colombo,



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et al., 2021). All activities served the double purpose: 1) to develop the roadmap for Kladno itself (KSAs Energy, Mobility and smart city) and 2) to provide a blueprint for other SPARCS cities in their roadmapping process (KSAs Energy and Mobility). The Kladno roadmapping process started earlier than in other cities (in M23, August 2021) so that it could serve as a pilot.

The original six-step methodology for preparing the KSA workshops was adapted to suit the needs of the city of Kladno. All deviations and adjustments were continuously recorded in a separate document including methodological notes which later served as a basis for completing the roadmapping report (this document).

Step 1 (Task force formation)

The task force was formed in month 23. The core organizing team of the task force included:

- For city of Kladno David Škorňa.
- For technical partner CVUT Michal Kuzmič and Nicol Staňková.

The complete group of collaborators included:

- For city of Kladno Daniela Cimrmanová, Jakub Hříbal, Marcela Zderadičková, Jitka Placatová and Michal Koníček.
- For technical partner CVUT Vít Janovský, Tomáš Vácha, Wojciech Bełch, Martina Sýkorová, Nikola Pokorný and Petr Wolf.
- External experts invited as partial thematic contributors.

The task force was established as a continuation of the task force from the visioning process.

Step 2 (Framing the roadmapping process in the Bold City Vision 2050, in the cities' relevant strategic documents, and with the outcomes from WP5)

The framing of the roadmapping process took place between M23 and M31.

The Kladno roadmap was foreseen as an integratory document linking together the results of the SPARCS Vision (Mello & Colombo, 2021) with the key city strategies and following analytical and technical studies:

- Sustainable Energy and Climate Action Plan - SECAP (Statutory City of Kladno, 2021).
- Sustainable Urban Mobility Plan - SUMP (Statutory City of Kladno, 2021).
- Sustainable Development Strategy - SDS (Statutory City of Kladno, 2021).
- Project outlines developed together with Kladno Implementation plan (WP5) (Skorna, a další, 2022).
- Feasibility study of the charging infrastructure for individual electromobility in the city of Kladno (Statutory City of Kladno, 2022; internal document).
- Analysis (an investment plan) of the potential for the renewable energy generation and distribution equipment on infrastructure of the city of Kladno (Statutory City of Kladno, 2022).



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The roadmapping process also left room for generating other new projects and measures to be implemented.

The Vision 2050 statements were re-assessed and – where necessary – rephrased, to smoothly operationalize the Vision during the roadmapping workshop.

Each of the strategic documents contained a host of specific project outlines and sub-projects (also called measures). These were catalogued in a support Master document (in a form of extensive xlsx file). Overall, over 90 projects/measures were identified.

Apart from the measures from the strategic documents, trends, and wild cards (extreme scenarios changing the “rules of the game”) were formulated for each KSA by selected CVUT and external experts using the formerly formulated trends from visioning phase.

Framing questions formulated by the roadmapping workshop moderators that were used to facilitate the discussion during the workshop were also included in this file.

The Master document further:

- Classified the projects/measures across the key strategic areas.
- established relation between Vision 2050 statements and the measures.
- established relation of projects/measures towards PED KSA.
- included the defined trends and wildcards and ranked them due to their importance in framing given KSAs and suitability for the workshop discussion.
- categorized the measures into smaller number of groups due to their large amount (categories such as buildings, PVP, electricity, heat, governance, transport etc.).
- established the status quo and milestones for the years 2025, 2030, 2040 and 2050 for each measure, including quantified KPIs where appropriate.
- prioritised the measures due to their importance for fulfilling given vision statement and due to their suitability to be discussed during the roadmapping workshop.

Even though recommended by the guidelines, the formulation of strengths, weaknesses, opportunities, and threats was omitted because this work has already been covered in the visioning phase.

A template of the Master document (Figure 8) is included as a separate Excel file (see Appendix 5, section C).



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A		B		C		D		E		F		G		H		I		J		K		L			
Vision																									
KSA		Vision statements		Description		Measure name		Sector		SECAP		SUR		Project outline		Category		Priority		Deadline		Framing questions		Status	
1	Energetika	1.1 Kladno má stabilní systém distribuce tepelné a elektrické energie, který významnou měrou integruje bezeměrné a obnovitelné a decentralizované zdroje a přispívá ke snížení uhlíkové stopy města.		Integruje bezeměrné, obnovitelné a decentralizované zdroje do energetického systému. Nahrazuje uhlé zdroje elektrické a tepelné energie. Zkoumá potenciál důlních vod pro získávání a uchovávání energie.		Energeticky úsporná opatření, na již zateplených budovách		Bydlení		SECAP24		SUR3.1(3), SUR3.1(8)		P21 (osvětla)		bud-ee		1		2022-2030		Jak motivovat soukromé vlastníky?		Spotř 355 S	
3	Energetika	1.1 Kladno má stabilní systém distribuce tepelné a elektrické energie, který významnou měrou integruje bezeměrné a obnovitelné a decentralizované zdroje a přispívá ke snížení uhlíkové stopy města.		Integruje bezeměrné, obnovitelné a decentralizované zdroje do energetického systému. Nahrazuje uhlé zdroje elektrické a tepelné energie. Zkoumá potenciál důlních vod pro získávání a uchovávání energie.		Komplexní energetická modernizace nezateplených budov		Městské budovy		SECAP02				P1, P18				1		2022-2030					
4	Energetika	1.1 Kladno má stabilní systém distribuce tepelné a elektrické energie, který významnou měrou integruje bezeměrné a obnovitelné a decentralizované zdroje a přispívá ke snížení uhlíkové stopy města.		Integruje bezeměrné, obnovitelné a decentralizované zdroje do energetického systému. Nahrazuje uhlé zdroje elektrické a tepelné energie. Zkoumá potenciál důlních vod pro získávání a uchovávání energie.		Energeticky úsporná opatření, na již zateplených budovách		Městské budovy		SECAP03				P1 (jen minoritně)		bud-other		1		2022-2030					
5																oze-other									
6		etc.																							
7						e.g. PVs on the roofs																			
8		We used this table to pair planned measures to the city vision						e.g. housing stock, buildings owned by municipality, commercial buildings																	
9																									
10																									
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18																									
19																									
20																									

(see Appendix 5, Section C for complete information)

Figure 8: Thumbnail of the Master document template



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Step 3 (Stakeholder Involvement)

A database of Kladno's stakeholders was established in the beginning of SPARCS project and was further adjusted for the visioning process and roadmapping workshop. The database was established and adjusted based on a desk research, internal knowledge of Kladno city representatives and expert advice from selected experts.

Step 4 (Dedicating Resources for the Roadmapping Workshop)

In the pre-workshop phase (M29-31 and again in M43-44 for the third workshop) the human and material resources needed were fine-tuned. Also, additional supporting documents were developed by the core team.

The workshop phase of the roadmapping process was divided into three separate events covering the different KSAs: Energy (7th April 2022), Mobility (25th May 2022) and Governance and IT (7th June 2023). The last KSA (Positive Energy District) is transversal and the roadmapping exercise did not have a form of a workshop, but rather it is a continuous work based on an expert discussion within the core PED working group.

Workshop 1 (Energy): A smaller conference room for approx. 20-30 participants equipped with data projector and a screen was booked in Kladno's City Hall. Small catering including drinks (water, coffee and tea) and snack (sandwiches and desserts) was provided. Printed Miro boards as well as the vision report were provided to all the participants.

Workshop 2 (Mobility): A smaller conference room for approx. 20-30 participants equipped with data projector and a screen was booked in the Kladno City Hall. Small catering including drinks (water, coffee and tea) and snack (sandwiches and desserts) was provided. Printed Miro boards as well as the vision report were provided for all the participants.

Workshop 3 (smart Kladno = ICT and Governance): A smaller conference room for approx. 20-30 participants equipped with data projector and a screen was booked in the Kladno City Hall. Small catering including drinks (water, coffee and tea) and snack (sandwiches and desserts) was provided. Printed Miro boards were provided for all the participants.

Relevant experts from the university (CVUT), the city of Kladno and additional external experts were invited to all three workshops to take part in topical KSA discussions to 1) serve as a source of relevant technical information, 2) stimulate discussion on additional new projects (not yet elaborated in the existing documents) and 3) help to steer the discussion where the stakeholders veer off topic or present irrelevant facts.

Step 5: Designing the Roadmapping Workshop at the city level

The designing phase of the workshop run parallelly with the whole roadmapping process since month 25, however the most intensive part took place within one month before the first workshop focusing on Energy.

During the designing phase the overall scope had to be narrowed and the number of projects and measures to be discussed during the workshop had to be reduced. Only the most important ones for fulfilling given vision statement and the most suitable ones to be discussed during the roadmapping workshop were picked. The same process was applied



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to the formulated trends and wild cards, only the most useful and important ones for framing the given KSA were chosen.

A first draft of a workshop agenda was made consisting of three main workshop phases: introduction and framing, discussion of categories of measures and their connection to the vision statements and discussion of the milestones of measures. This general structure was slightly adjusted according to the needs of each KSA.

Step 6: Developing the Roadmapping Workshop at the city level

The developing phase of the workshop run in parallel to the whole roadmapping process since month 25, however the most intensive part took place within one month before the first workshop focusing on Energy.

In this phase the intentions formulated during the designing phase had to be translated into supporting materials to be used during the workshop.

For each workshop the resources were planned separately. The Master xlsx document (as described in Step 2: Framing the roadmapping process...) served as a source for all the needed information.

First, an introductory and framing Power Point presentation including general information about the SPARCS and the roadmapping process and introducing the relevant strategies and formulated trends and wild cards was prepared for each KSA. The presentation was mainly used to prime the attendees and frame the following discussion.

As a main visual aid for the next two phases of the workshop a Miro board was prepared (Figure 9). Known information about each of the KSAs was pre-filled. Known information included 1) a visual representation of how each category of measures contributes to the fulfilment of the vision statements, 2) status quo and milestones for the years 2025, 2030, 2040 and 2050 for the selected project categories and 3) trends and wildcards relevant to given KSA. Miro board was presented and together with the framing questions served as a main basis for the moderated discussion. All the suggestions and comments from the participants were included in real time. Each participant was also given a printed version of the Miro boards for easier orientation. The templates of Miro boards that were used during the workshop can be found [here](#). This general structure was slightly adjusted according to the needs of each KSA.

In summary the whole phase was built on the Master document and included:

- preparation of an introductory presentation.
- preparation of the Miro boards.
- further cooperation and consultation with selected experts.
- booking of the premises and catering.
- setting up the list of participants.
- inviting the participants (external participants and experts from the municipality, university and others).
- preparation of the printed materials.



The agenda for each KSA, as further described in the next chapter) was adjusted to suit the subject and stakeholder composition while keeping the overall philosophy.

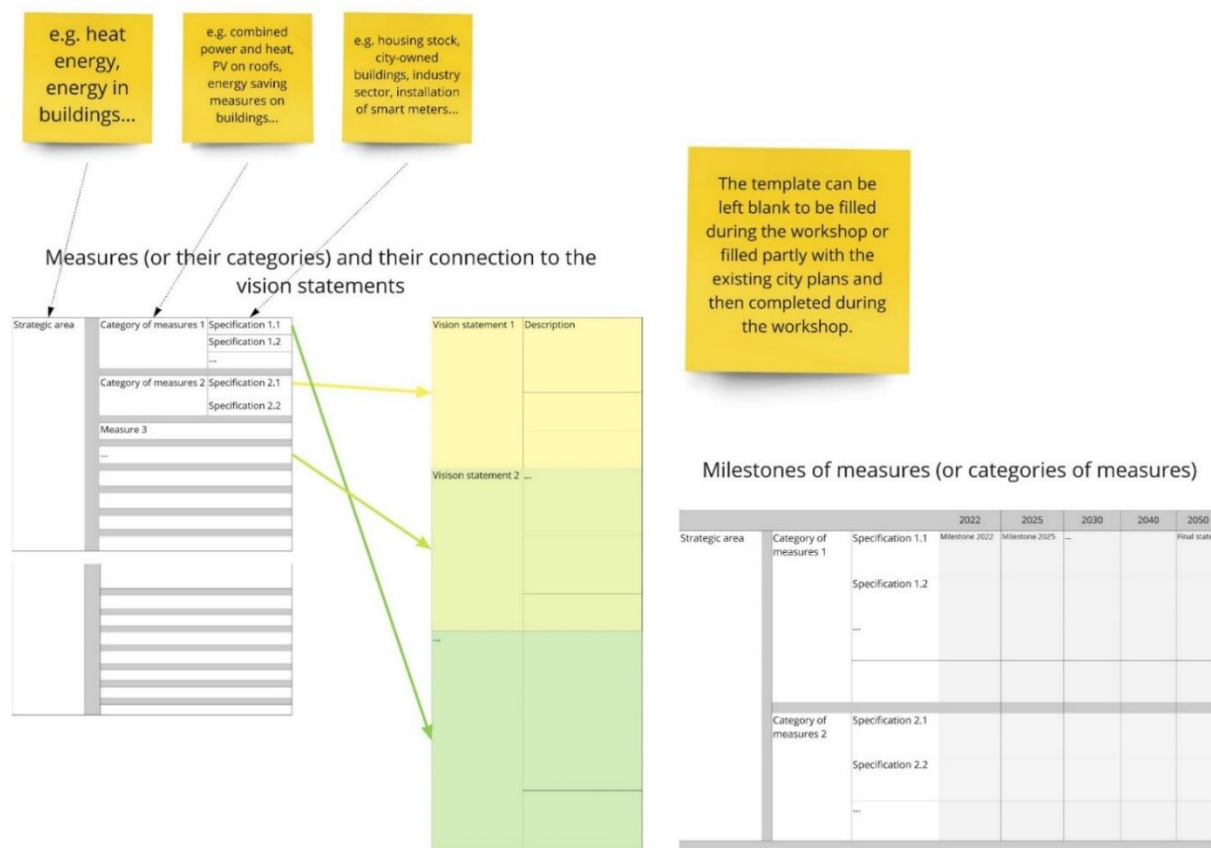


Figure 9: Template of the Miro boards used during the workshop

Roadmapping Workshop Agenda

Each workshop took 3 to 4 hours with 1 or 2 short breaks. The detailed agenda (slightly adjusted for each KSA) is included in separate Excel file (see Appendix 5, Section D).

Workshop progress:

- 3 to 4 hours long physical meeting,
- catering was provided,
- introductory presentation from the members of the project team followed by an interactive discussion over Miro boards,
- printed materials were provided,
- 1 person served as a moderator and facilitator, 1 person worked with the Miro boards and made notes in Miro, 1 person made more detailed additional notes in separated document (Word file), 1 or more were additional experts on the topic.



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The outcome of the workshops was recorded and incorporated into the roadmap (see section 3.4.2 and Appendix 5, section A). The table below summarizes main context of each of the workshops (Table 13).

Table 13. Workshops' structure - Kladno

Parameters	Workshop 1 (Energy)	Workshop 2 (Mobility)	Workshop 3 (Smart City)
Date	7. 4. 2022 9 a.m.–12 p.m.	25. 5. 2022 9 a.m.–12 p.m.	7.6.2023 11 a. m. -3.00 p.m.
Moderator(s)	David Škorňa (city) Michal Kuzmič (Uceeb)	David Škorňa (city)	David Škorňa (city) Michal Kuzmič (Uceeb)
Operator of a Miro board	Nicol Staňková	Nicol Staňková	Nicol Staňková
Note taker	Wojciech Bełch	Jakub Hříbal	Michal Koníček
Invited experts	City Council and companies, a private heat power plant, a city heat distributor, private or public bodies (hospital, regional authority), waste and water companies	City Council, city companies, transport operators, Prague Airport, experts from regional and national companies (planners, owners of sharing systems)	City Council, city companies, CVUT UCEEB, a representative from the City of Písek, officers from the Ministry of Regional Development, IT and energy related companies, independent experts
Nr. of participants (excl. the expert and task force)	25 (35 invited)	22 (30 invited)	31 (40 invited)

3.4.4 Lessons learned and next steps

Lessons learned

If we were to reflect on the content and organisation of the workshops, it is certainly worth mentioning that the workshops sparked quite a varied debate, so in the end it turned out that the events could have been longer. Another element that may have influenced the outcomes of these workshops was the composition of the groups and e.g. not inviting some other stakeholders (although this was not by any means targeted).

Together with the long-term strategic focus the dialogue with the partners has shown the significant role of the current trends and geo-political circumstances we are currently going through. The vision should take into account the impact of war conflicts and security matters regarding the energy supply, also the high prices of energy, materials, technologies and work force, which are causing huge problems and could lead to spiral of obstacles and even deep crisis.



Therefore, there was a lack of willingness to commit to any clear milestones in the long-term due to high uncertainty and a clear preference for short-term planning. The production and use of coal in the central heat source was envisaged by the main heat producer. However, coal will be probably phased out by 2038, but a clear process and phasing steps are not yet clear. Neither gas nor a switch to nuclear seems to provide a long-term sustainable scenario, at least so far. However, it is generally expected that by 2030+ the country's electricity supply will be insufficient, and electricity will be imported.

The outlook 2030-2050 thus seems unclear and there is currently no coherent strategy at the national or the regional level. The strategic supply of the energy for next winter season(s) is a crucial task now. Thanks to the wide network of the heating system and connection to most of the households and industry the supply of energy is ensured, incl. the fact that there is no significant increase of the prices of the heat in comparison with electricity and gas.

Next steps

The elaboration of the next steps is assumed in four layers:

- Vision process itself (common understanding, roadmap design).
- Decomposition of the vision to the implementation (project and activities) level.
- Systematic evaluation of the vision (and key strategies) based on the implementation of the roadmap.
- Learning process.

The aim is to manage a vision as a continuous and dynamic process; clarity of the vision, translation into the practise and feedback loop are crucial principles of the different layers and common sense of this work).

Ad (1)

- Vision roadmapping design elaboration.
- Vision report update (as a result of the learnings from the roadmapping, vision workshops, current situation and other influencing factors).
- Utilization of the vision to the different target groups in an understandable way

AD (2)

- Elaboration of the hierarchical system - from the vision through the city strategies (SECAP, SUMP) to the project level (incl. utilization within some tool).
- Indicators setup incl. use of the Smart City Compass tool.
- Elaboration of the project outlines and project proposals – incl. responsible bodies, task forces, timeline and other project elements.

Ad (3)

- Design of the evaluation and feedback loop process – system, volume, form, period, links to the evaluation process of the strategies.



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- Reporting system and re-design process of the roadmap, vision itself and the milestones.

Ad (4)

- Identification of the stakeholders (within the city administration) responsible for the roadmapping (its particular parts).
- Political awareness and commitments improvement.
- Motivation package design and self-learning process.

Horizontally, an elaboration of the materials, inputs and outputs from the work done need to be shared and discussed with the partners even individually. The PED working group should meet regularly, in Autumn a pre-feasibility study for a locality of Sletiště should be discussed and pushed forward.



3.5 Lviv Roadmap

3.5.1 Introduction

The status of Lviv carbon-neutral in 2050 remains a very ambitious goal for the city and at the same time a long and difficult one. Achieving it requires a large number of initiatives, efforts and stakeholders. This document is a continuation and update of strategic steps to achieve this goal, established in 2020. The resulting ideal image of climate-neutral Lviv 2050 is called City Vision Lviv 2050 and this report focusses on the roadmap to achieve that envisioned goal.

In 2020 a draft version of City Vision 2050 was formed, within which 3 aspects of Lviv's development were highlighted, namely 1) spatial development, 2) mobility, 3) infrastructure and housing, which were reflected in strategic documents. Because of COVID and the war, it became expedient to revisit and differentiate them, particularly since both infrastructure and housing have undergone changes due to military actions and a large number of internally displaced persons to Lviv and it is not appropriate to consider them in a complex.

In order to achieve significant GHG savings and, at the same time, to shape a transformation into a sustainable city, the city of Lviv has identified the following three Key Strategic Areas¹⁰ as success factors, which will be used for the future energy and climate protection work of the city up to the year 2050, continuously developing further measures and taking up impulses from the public and integrating them into the work. These KSA are:

- KSA1. Energy infrastructure and spatial development.
- KSA2. Mobility and transport.
- KSA3. Climate-neutral city.

Under the coordination of the team of Municipal Institution City Institute and with the participation of a joint group of stakeholders representing various departments of the Lviv City Council, associations and engineering organizations, workshops were conducted in order to develop statements that explain the pathway towards the general City Vision. These inputs will be improved and transformed with the involvement of responsible persons and will be incorporated into the political agenda for the development of Lviv for the next 30 years. These workshops were developed within the framework of several important strategic documents conceived for the city:

- Integrated development concept: Lviv 2030.
- Sustainable urban mobility plan (SUMP).
- Sustainable Energy and Climate Action Plan (SECAP).

¹⁰ As part of the roadmapping process the city updated the scope and designation of the KSA defined during the City Vision process. The presented KSA already reflect those changes.



As part of the SPARCS project, the city of Lviv has been implementing two major projects, which were also taken into account for the development of Lviv's roadmap for urban transformation. The projects are:

- Spatial energy plan.
- Data-Driven Sustainable Mobility Plan.

3.5.2 Overall roadmap results

In this section, the results from Lviv's roadmapping process and workshops are presented, consisting in a comprehensive array of plans, projects and measures, organised by KSA and category. Some of these inputs represent projects that have already been implemented, but whose relevance for the upcoming milestones justifies their inclusion in the roadmap. In addition to the categories directly connected to the KSA and the defined inputs and milestones, a cross-sectional category 'normative framework and institutional solutions' was defined to encompass city-level plans and strategies that influence several other categories. The most relevant information concerning the milestones and the projects/measures that support them is displayed below in the Graphic overall roadmap and also in the Key outcomes table. In Appendix 6 (section A) a Milestones table with more detailed description of the milestones is presented.

Lviv's Roadmap for urban transformation

KSA1: Infrastructure, spatial development and energy efficiency

In the context of Infrastructure, spatial development and energy efficiency, the city of Lviv will focus on creating an upgraded urban environment, with high quality public space and infrastructures and energy efficient neighbourhoods. For public space and infrastructure, emphasis should be placed on the construction of a "green line" that connects the Sykhiv district to the city centre and also on the design and implementation of high-quality public space projects, with the involvement of stakeholders. In respect to the energy theme, the implementation of the "European Energy Award" and the "Spatial Energy Plan" - a project developed in the context of SPARCS implementation plan - stand out, as well as a set of ongoing projects focused on the implementation of energy saving measures in key neighbourhoods.

During the workshops the participants addressed the need to leave behind old approaches to design, for example, street projects without landscaping and beautification, low quality of work and excessive minimization of the intervention of developers in the street space, non-inclusiveness and politicization of solutions. Several urgent issues concerning public space and infrastructure were referred, such as sidewalk maintenance (clearing snow and sand); drainage maintenance (fixing emergency drains that do not work in rainy weather and flood the streets); upgrading the existing underpasses; keeping and maintaining the paving stones on the tracks.

The discussions were also set on other initiatives related to these themes, namely the need to update the old housing stock and infrastructure; the importance of reducing the use of fossil fuels; the affordability of energy resources; the need to modernize outdated



treatment facilities, in order to minimize air pollution; and also, the need to address the problem of waste sorting and processing.

KSA2: Mobility and Transport

KSA2 "Mobility and Transport," outlines Lviv's comprehensive vision to transform its transportation system with an emphasis on sustainability, accessibility, and safety. The creation and realization of the Sustainable Urban Mobility Plan of Lviv (SUMP) is key for this transformation process by fostering a balanced development of all transportation and mobility modes while incentivizing the transition towards more sustainable mobility. Other city wide strategic and operational instruments such as the "Electromobility development plan" or the "Data-driven Sustainable Mobility Plan" - a project developed on the context of SPARCS implementation plan - will also play an important role in this transformation process.

In terms of specific investments and projects, the city will go on undertaking significant infrastructure renovations, such as updating tram and trolleybus systems, and committing to renewable energy sources for public transport. As regards electromobility and parking facilities, the city is set on implementing a shared parking and EV charging infrastructure (ShareP) and, in terms of pedestrian and cycling traffic, the city expects to develop its bicycle network, primarily within the framework of street reconstruction projects.

During the workshops, besides these outcomes, the participants focused on the need to modernize the fields of mobility and transport. Overcoming issues such as road congestion, low speed of public transport, and non-integration of suburban transport into the city network was considered crucial, as well as the need to update the old stock of public transport and overcome prejudices regarding the development of bicycle transport.

KSA3: Climate-neutral city

With the goal of achieving a climate-neutral city, Lviv has been undertaking a considerable effort, namely with the development and implementation of projects with international partners and funding focused on climate neutrality transition, climate change adaptation and mitigation, risk reduction and local resilience building, and energy efficiency and renewable energy use. Besides these cross-cutting initiatives, the focus of the roadmap is also set on developing a strategy to deal with heat islands in the city.

The workshops were rich in suggestions and future visions for the path and goal of a climate-neutral Lviv. This goal was seen as highly desirable as it will ensure a high quality of life in the city, confidence in one's health and the health of children, a decrease in the level of morbidity and the desire to continue living in Lviv. Of course, this requires greater flexibility of the community to new challenges, and also an active participation of residents in the development of the city. The status will provide opportunities for the development of new technologies, reduce budget costs, and ensure greater attractiveness of the city (for tourism, business); and it will also have a relevant impact on mobility in the city and on the environment, environmental conservation, and biodiversity. An



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increase in the share of alternative energy sources will be of great importance in reducing the rate of climate change by reducing CO₂ emissions.

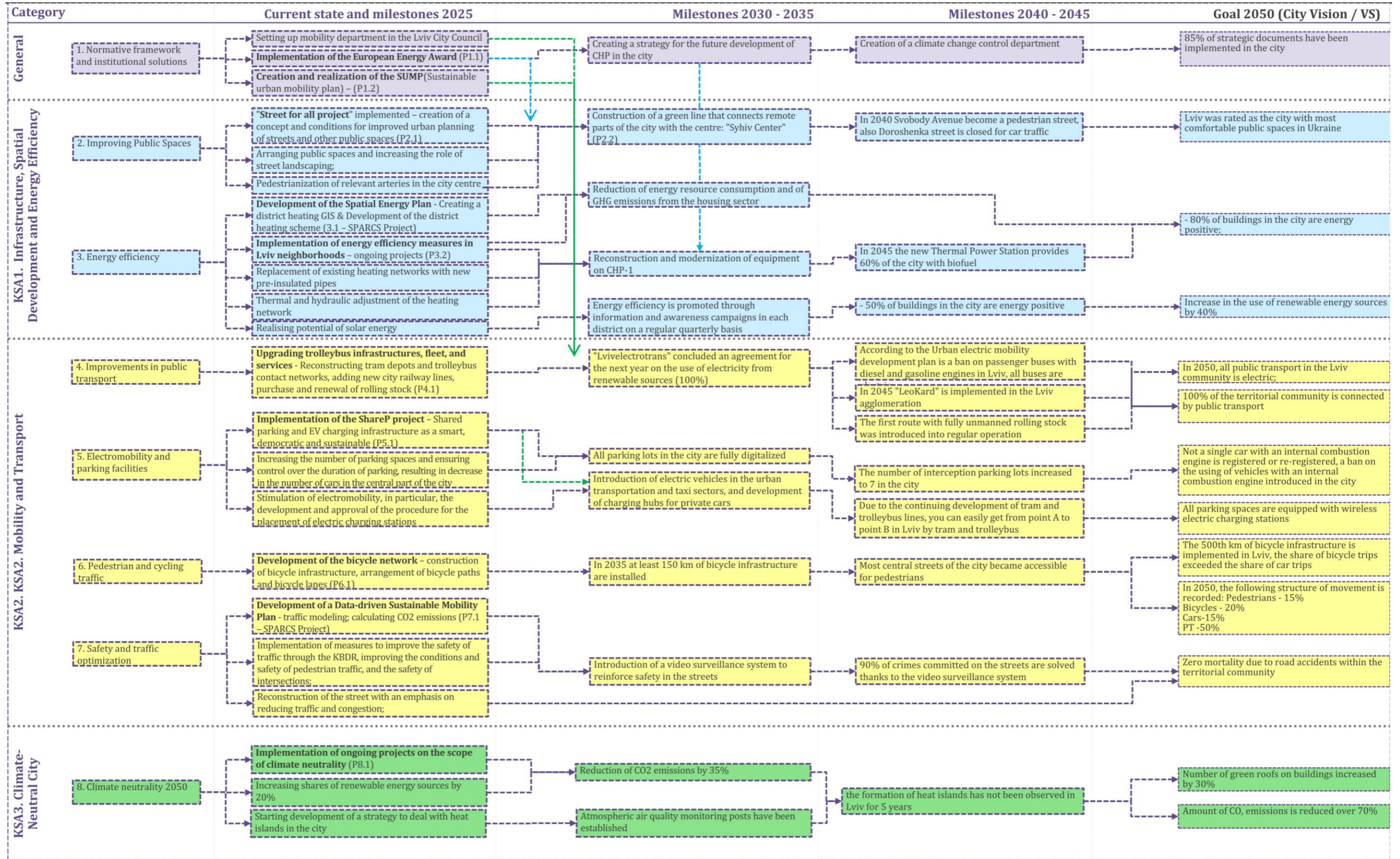
Reaching climate neutrality will also mean setting up international standards, ensuring the formation of international cooperation and exchanging experience and practices with other cities. This, of course, will attract more investments and make Lviv one of the leading cities in the field of climate neutrality.



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Visual / Graphic Roadmap Lviv



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Key outcomes per KSA

The following tables contain the description of the projects and measures, identified during the roadmapping process and workshops, that will contribute to the city's roadmap (*Table 14*).

Table 14. Key outcomes table – Lviv

Key outcomes for KSA1: Infrastructure, spatial development and energy efficiency		
ID	Name (type)	Description
P0.1	“Implementation of the European Energy Award in Ukraine” (project)	<p>Project organized by the State Secretariat for Economic Affairs of the Swiss Confederation (SECO)</p> <p>Within the framework of the project:</p> <ul style="list-style-type: none"> Working group for the realization of the project “Implementation of the European Energy Award in Ukraine” was created and operates in the city. meetings are held to form the Municipal Energy Plan of the city, which includes a list of energy efficiency measures that can be implemented in the city over the next 4 years. as part of a pilot project, modern LED lighting was installed in the "Na Valakh-2" park in cooperation with Lvivsvitlo. The total amount of work performed was 51.1 thousand Swiss francs (UAH 1.6 million). city received 60% (the minimum required score is 50%) and became the largest Ukrainian city that won such a prestigious award. <p>Category: Normative framework and institutional solutions</p>
P1.1	“Street for all” (project)	<p>“Street for all” project was the push to change the concept of urban planning in Lviv. The project took place from October 2015 to December 2018. It can be divided into three stages:</p> <ul style="list-style-type: none"> Stage 1: preliminary analysis, street selection, and analysis of stakeholders' opinions on the future reconstruction. Stage 2: street planning by experts with active involvement and consideration for the interests of various stakeholders. Stage 3: creation of the final concept and modelling of the conditions laid down in the concept to check the feasibility of implementing the plans. <p>Project has stimulated qualitative changes in the field of urban planning in Lviv and, hopefully, in Ukraine as well. Stakeholder involvement in the planning of streets, squares, and other types of public spaces in Lviv is becoming more and more common. Lviv Communal Enterprise "Institute for Spatial Development" advises and develops quality projects not only in Lviv but also in other cities of Ukraine.</p> <p>Category: Improving public spaces</p>
P1.2	Construction of a green line that connects remote parts of the city	<p>Green Line as the Demonstration Infrastructure Project is a pedestrian / bicycle connection from Sykhiv District to the city centre, passing through green territories, an industrial zone and</p>



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Key outcomes for KSA1: Infrastructure, spatial development and energy efficiency		
ID	Name (type)	Description
	with the centre: "Syhiv Center" (project)	connecting buildings of Ukrainian Catholic University. The concept has been developed and working documentation is being prepared for the first section along the southwestern part of Park Ivan Pavlo II to Shuvar Market at Khutorivka. This project is being implemented by Integrated Urban Development in Ukraine project. The project "Integrated Urban Development in Ukraine I and II" is implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and funded by the Federal Ministry of Economic Cooperation and Development of Germany (BMZ) and the State Secretariat of Switzerland for Economic Affairs (SECO). The Project is being implemented in the field of international cooperation to promote development at the initiative of the Governments of Ukraine, the Federal Republic of Germany and the Swiss Confederation. As for 2023, the project is 10% completed Category: Improving public spaces
P2.1	Development of the Spatial Energy Plan (SPARCS project)	Spatial energy plan consists of a geographical information system that supports the data collection, analysis and visualisation in a format of maps of energy potential, energy supply, and consumption in Lviv. As a tool for developers of energy solutions and a beta version of a digital twin of the energy infrastructure of Lviv, it provides opportunities to create algorithms for data analysis and justification of innovative actions. One of the key tasks that will be implemented within the framework of this project will be a topographic survey of the thermal power plant's heating networks. Category: Energy efficiency
P2.2	Implementation of energy efficiency measures in Lviv neighbourhoods – ongoing projects	This measure comprises the set of ongoing projects related to the implementation of energy efficiency measures in the city's neighbourhoods. The projects are described below. Category: Energy efficiency
	P2.2a Ukrainian-German innovation project Between the partner cities of Fraiburg and Lviv "Ryasne-district of a green technologies" (project)	"Ryasne-district of a green technologies" project is being implemented under a cooperation agreement between the municipality of Freiburg (Germany) and the Economic Development Department of the Lviv City Council. Project envisages the implementation of a number of energy-saving measures in Lviv's Ryasne and Ryasne-2 neighbourhoods, including: <ul style="list-style-type: none"> • Modernization of the heating system in a residential building and a school in the neighbourhood; • Installation of modern lighting systems in 4 schools of the neighbourhood; • Installation of a video surveillance system in the neighbourhood school; • Educational activities for children; environmental lessons and modern measuring equipment to motivate students. Category: Energy efficiency



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Key outcomes for KSA1: Infrastructure, spatial development and energy efficiency		
ID	Name (type)	Description
	P2.2b Energy efficient district in Lviv (project)	<p>Project provides support for housing cooperatives in Sykhiv district in implementing energy-saving measures, which includes co-financing energy audits and preparation of design and construction documents for participation in the Energy Efficiency Fund programs. The possibility of additional funding is also being considered. EUR 2.3 million is envisaged for 4 years. The terms of the loan and the mechanisms for selecting buildings are currently being discussed. The EE Fund, after verification of the project, will be able to compensate up to 70% of the cost of package B. About 25 housing cooperatives of Sykhiv district participate in the project.</p> <p>Category: Energy efficiency</p>
	P2.2c Project on installation of individual heating points in the city of Lviv (EBRD) (project)	<p>The estimated cost of the works is EUR 10.0 million (grant from the Eastern European Energy Efficiency and Environment Partnership). As part of the project, we installed 165 IHP units in 2019 and 244 IHP units in 2020.</p> <p>Category: Energy efficiency</p>
	P2.2d Construction of an alternative fuel power unit (wood chips) at Pivdenna shopping center (Kinescope boiler house) (EBRD) (project)	<p>The estimated cost of the works is UAH 560,370 thousand (funds from the EBRD loan).</p> <p>Lvovteploenergo has announced an international tender (design and construction documents + works) to convert the Pivdenna shopping center to alternative fuel.</p> <p>Category: Energy efficiency</p>

Key outcomes for KSA2: Mobility and Transport		
ID	Name (type)	Description
PO.2	Creation and realization of SUMP (Sustainable urban mobility plan) (strategy)	<p>The Sustainable Urban Mobility Plan of Lviv (SUMP) is a strategic document that defines the city's transport policy for the next ten years and answers the question of how to optimize the city to make it efficient for its residents, in terms of time, comfort, value, health safety and the least negative impact on the environment.</p> <p>The Sustainable Urban Mobility Plan of Lviv was developed for:</p> <ul style="list-style-type: none"> • employees of the Lviv City Council, executive authority in charge of quality of projects who directly supervise the implementation of urban projects in the fields of transport, street infrastructure, and public spaces; • MPs and politicians, such as decision-makers prioritizing activities to be funded by the city; • NGOs and community activists as change agents in the development of the city; • residents of Lviv – end users of the outcomes of activities and project implementation;



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Key outcomes for KSA2: Mobility and Transport		
ID	Name (type)	Description
		<p>SUMP fosters a balanced development of all transportation and mobility modes while incentivizing the transition towards more sustainable mobility. The plan provides for an integrated set of technical, infrastructure, policy and other measures to increase the efficiency and economic feasibility of city council activities in the field of transport, which must meet the stated goal and specific objectives. SUMP addresses such issues as public transport, walking and cycling, intermodality (combining several mobility modes in one trip), traffic safety, motor vehicles (traffic and parking), urban logistics, mobility management, and smart transportation systems.</p> <p>Category: Normative framework and institutional solutions</p>
P0.3	Preparation of an electromobility development plan for the city of Lviv (strategy)	<p>As part of the European Green Deal, the EU aims to become carbon neutral by 2050. To achieve this, the EU's transportation sector must reduce CO2 emissions by 90%. The EU Sustainable and Smart Mobility Strategy describes the Commission's planned steps to transform the EU's transportation system to meet the ambitions of the European Green Deal. With this in mind, electric mobility will be the basis for further development of the transportation industry. As part of Ukraine's post-war recovery and European integration process, Lviv should take a new path towards a green economy and, in particular, implement the best practices of urban mobility.</p> <p>Lviv City Territorial Community Electromobility Development Plan was developed, in particular, for:</p> <ul style="list-style-type: none"> • Representatives of the city council and executive authorities responsible for strategic planning of the city's development, financing and implementation of projects in the areas of transport, land use, energy, and investment. • Civil society organizations and activists who are agents of influence on the city's development. • City residents and businesses who are the end users of mobility improvements envisaged by the Plan. • Employees of the Lviv City Council, the executive branch of government who care about the quality of projects and directly manage the implementation of urban projects in the field of transport, street infrastructure, and public spaces; • deputies and politicians who make decisions on which activities will be funded by the city; • NGOs and civic activists as agents of influence in the city's development; • Lviv residents who are the end users of the results of the measures and projects. <p>Implemented within the project TUMIVolt as a part of the Sustainable Urban Mobility Plan (SUMP) realization.</p> <p>Category: Normative framework and institutional solutions</p>



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Key outcomes for KSA2: Mobility and Transport		
ID	Name (type)	Description
P3.1	Upgrading trolleybus infrastructures, fleet, and services (project)	<p>The city is set on improving its trolleybus infrastructures by reconstructing tram depots and trolleybus contact networks, adding new city railway lines, and launching a competition for a street with tram traffic. In terms of the fleet, the investments concerning the purchase and renewal of the rolling stock include 50 trolleybuses and 10 trams.</p> <p>In medium and long-term, improvements are expected in the use of electricity from renewable sources and implementation of the "LeoKard" system.</p> <p>Category: Improving public spaces</p>
P4.1	ShareP (Lviv – Shared parking and EV charging infrastructure as a smart, democratic and sustainable mobility solution in order to reduce GHG emissions and improve life quality in Lviv) (project)	<p>Parking digitization is a key to a more efficient system of parking management. Share.P System will be installed at selected parking lots in Lviv. The mobile app will allow users to search for parking spaces, reserve them in advance ("pre-book"), and open the parking barrier with a smartphone. The possibility to track individual users' energy consumption will enable to provide accessible charging infrastructure. The city will receive a state-of-the-art system that multiplies the available parking space without major infrastructure investments, makes parking safer, reduces cruising for parking as well as the number of cars parked illegally in the city.</p> <p>Category: Electromobility and parking facilities</p>
P4.2	European Mobility week (initiative)	<p>European mobility week is the European Commission's flagship awareness-raising campaign on sustainable urban mobility. It promotes behavioural change in favour of active mobility, public transport, and other clean, intelligent transport solutions. The main event takes place from 16-22 September each year, culminating in the popular Car-Free Day. Local authorities are encouraged to use the main week to try out innovative planning measures, promote new infrastructure and technologies, measure air quality, and get feedback from the public. Since 2019, Lviv has been participating in the European Mobility Week, which annually hosts many useful mobility initiatives.</p> <p>Category: Normative framework and institutional solutions</p>
P5.1	Development of the bicycle network (project)	<p>The project includes the development of the bicycle network (primarily within the framework of street reconstruction projects), including construction of bicycle infrastructure, arrangement of bicycle paths and bicycle lanes.</p> <p>Category: Pedestrian and cycling traffic</p>
P6.1	Development of a Data-driven Sustainable Mobility Plan (SPARCS Project)	<p>The main task for Data-Driven Sustainable Mobility Plan is to introduce and promote sustainable urban mobility practices in our city. As part of this project, due to SPARCS, the city purchased Software for modelling traffic and calculating CO2 emissions from the transport that will be used for justification of mobility solutions in Lviv. After collecting the statistical data, new public transport network will be developed in the city to reduce CO2 emissions.</p> <p>Category: Safety and traffic optimization</p>



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Key outcomes for KSA3: Climate-Neutral City		
ID	Name (type)	Description
P7.1	Implementation of ongoing projects on the scope of climate neutrality	This measure comprises the set of ongoing projects related to the theme of climate neutrality. Category: Normative framework and institutional solutions
	P7.1a SPARCS (Sustainable energy Positive & zero cARbon CommunitieS) (project)	SPARCS is working to create a network of Sustainable energy Positive & zero cARbon CommunitieS in two lighthouse and five fellow cities. The project supports these cities as they deal with the multifaceted challenges they face on their path to sustainability. By setting up inclusive management and planning models and processes, SPARCS aims to demonstrate and validate innovative solutions for smart and integrated energy systems that will transform these cities into sustainable, zero carbon ecosystems with improved quality of life for their citizens. It will do this by engaging with all the relevant stakeholders from industry and innovative SMEs and research organisations, to urban planning and technical departments. A key criterion for success is citizen involvement, and SPARCS has a clear focus on engaging with citizens and putting urban dwellers at the heart of its efforts. The city of Lviv participates in the project as a fellow city. Category: Normative framework and institutional solutions
	P7.1b DISTENDER (DevelopIng STRatEgies by integrating mitigation, aDaptation and participation to climate change Risks) (project)	DISTENDER is an EU-funded project developing actionable strategies for climate change mitigation and adaptation. The strategies will result from the integration of climate change adaptation and mitigation actions with participatory approaches bringing scientists, businesses, governments, policy makers and citizens together. 5 Case Studies at the EU level will be involved for testing the holistic approach developed by the project against specific climate risks and 6 additional Follower Case Studies are first in line for replication. Finally, a Decision Support System will be developed to help policy makers to take the most out of the knowledge, tools and recommendations generated by DISTENDER and further replicate them. The ambition of DISTENDER is to provide a methodological framework that supports climate adaptation and mitigation strategies, that integrate top-down and bottom-up approaches into a multi-scale cross-sectoral framework (agriculture, health and well-being, energy, water, biodiversity, forestry, transport and urban planning) and to use this framework to examine multi-scale interactions of climate adaptation and mitigation actions. A Decision Support System (DSS) based on a multicriteria analysis tool will be developed to take into account PROS and CONS and make a final classification of the different proposed robust strategies. DISTENDER will bring together the mathematical model tools and the policy maker strategies and produce robust strategies which will be classified using an ad-hoc DSS. The city of Lviv participates in the project as a follower city. Category: Normative framework and institutional solutions



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Key outcomes for KSA3: Climate-Neutral City		
ID	Name (type)	Description
	P7.1c Making Cities Resilient 2030 (program)	<p>Making Cities Resilient 2030 (MCR2030) is a unique cross-stakeholder initiative for improving local resilience through advocacy, sharing knowledge and experiences, establishing mutually reinforcing city-to-city learning networks, injecting technical expertise, connecting multiple layers of government and building partnerships. Through delivering a clear 3-stage roadmap to urban resilience, providing tools, access to knowledge and monitoring and reporting tools, MCR2030 will support cities on their journey to reduce risk and build resilience. MCR2030 aims to ensure cities become inclusive, safe, resilient and sustainable by 2030, contributing directly to the achievement of Sustainable Development Goal 11 (SDG11) “Make cities and human settlements inclusive, safe, resilient and sustainable”, and other global frameworks including the Sendai Framework for Disaster Risk Reduction, the Paris Agreement and the New Urban Agenda.</p> <p>Category: Normative framework and institutional solutions</p>
	P7.1d Urban Transition Mission (project)	<p>The Urban Transitions Mission (UTM) was launched at the COP26 in November 2021 with the aim to increase the capacity of cities worldwide, empowering them to shape urban transitions based on robust knowledge and a strong net-zero community of support and exchange. Thanks to increased capacity and access to knowledge, cities will be able to mobilise their inherent strength and the potential of their communities – and develop their own customised solutions to effectively transition to net-zero. The Mission aims to close the gap between research, development and deployment on systemic transition pathways to net-zero, resilient and human-centred cities through multi-level, multi-sectoral, and outcome-oriented partnerships. The Urban Transitions Mission (UTM) aims at demonstrating that systemic urban strategies along with climate resilience and social aspects of the transition can boost reliable, affordable, feasible and cost-effective solutions for reaching net-zero cities. Successful urban transitions will leverage innovative policies, technologies, financial instruments, business models and cooperative approaches. These points must be integrated for the satisfaction of citizens’ needs, building on renewable energy sources and circular economy principles and enhancing resilience for a people-centred urban transition globally. Lviv was chosen as one of 50 cities participating in the project.</p> <p>Category: Normative framework and institutional solutions</p>



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Key outcomes for KSA3: Climate-Neutral City		
ID	Name (type)	Description
	P7.1e Development of SECAP (Sustainable Energy and Climate Action Plan) (action plan)	<p>The SECAP is one of the key documents in the field of energy efficiency in communities, which, based on collected data on the current state identifies and provides guidance on the implementation of projects related to energy efficiency and renewable energy use, as well as adaptation to climate change at the local level. The key sections of the Action Plan include an overview of the baseline emission inventory (BEI) in the base year, a list of mitigation measures for the entire duration of the of the plan, risk and vulnerability assessment of climate change climate change risk and vulnerability, adaptation actions and measures for the entire plan period, and a section on financing mechanisms. Main goal of the Action Plan is to reduce CO2 emissions by more than 30% until 2030 and achieve climate neutrality by 2050 through the implementation of the proposed measures.</p> <p>Category: Normative framework and institutional solutions</p>

3.5.3 Adopted methodology and procedures

Methodology for the roadmapping process

The development of Lviv's roadmap took place over 9 months, from November 2022 to July 2023 with an intensification of the work process from December 2022 to July 2023. Since the development of Lviv's City Vision 2050 in 2020, there have been significant further developments in the local climate protection and sustainability policy in Lviv, which have a significant impact on the SPARCS work.

The preparation of the workshops and the workshop activities were based on the elaboration of three major city strategic documents:

- SECAP 2030 (Sustainable Energy and Climate Action Plan).
- SUMP (Sustainable urban mobility plan).
- IDC 2030(Integrated development concept).

These documents go beyond supporting the achievement of climate neutrality in 2050. The Lviv SECAP, SUMP and IDC measures also affect the quality of life in the city through a shift in inner-city mobility to a more environmental friendly mix of walking, cycling, and public transport, by investing in more space for pedestrians and cyclists, less private motorized traffic, further expansion of the green-blue infrastructure, and significantly improved air quality.

Taking into account the City Vision 2050, the task force revisited the KSA and vision statements proposed in 2020. As a result, 3 success factors for achieving climate neutrality in the city of Lviv now structure the Roadmap and the City Vision documents; they are the new Key Strategic Areas against which all measures and milestones are schematically organized:



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1. Infrastructure, spatial development and energy efficiency.
2. Mobility and transport.
3. Climate-neutral city .

The task force for the creation of the Lviv Roadmap consisted of a total of 10 people from seven municipal offices/departments, NGO's and companies:

- Department of transport.
- Department of street infrastructure.
- Security department.
- Department of ecology.
- Energy management unit.
- Association of Energy Efficient Cities.
- EGIS.

Roadmapping Workshop Agenda

The roadmapping workshops were held in the shelter of the Lviv City Council, during January-February 2023 (Table 15). The first workshop was attended by 7 participants and the second by 6 participants, representing various departments of Lviv's City Council, associations and engineering organizations. Workshops were organized and coordinated by managers of the City Institute.

During the first workshop, the development of mobility and transport infrastructure and the spatial development of Lviv in general were discussed. In the second workshop the discussion was focused on energy development, climate, and housing and infrastructures.

The participants of the workshops, with the help of graphic display (namely, stickers on a flipchart), described the measures that had already been implemented, prescribed measures and goals for the future, voiced their contribution and emphasized the importance of Lviv achieving the status of a climate-neutral city. These contributions were also discussed taking into account the status quo of the city, the relevance of the approach, and, in parallel, the existing relevant plans for the future.

On a second stage, the participants continued to work with newspaper headlines. This part of the workshop was interesting, the headlines were well prepared, because the participants took this stage of the workshop in a fun and productive way. In such a relaxed atmosphere, it was possible to formulate milestones and vision statements and many aspects of the headlines also became clearer. As a result of the joint work, several outputs were identified for each KSA in discussion.



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Table 15. Agenda of the roadmapping workshops – Lviv

Time	Content
09:30-09:45	Intro
09:45-10:30	Discussion «City Vision for Lviv in 2050»
10:30-11:15	Discussion of challenges status quo of the city
11:15-12:00	Discussion: Headlines of the future
12:00-12:30	Selection and transformation of thesis:
12:30-13:00	Discussion of examples
13:00-13:10	Conclusion

The workshop process, including the description of each planned stage, is described below:

- Introduction and getting to know the participants:
This stage consisted of a brainstorm for general thoughts on the long-term future. This helped participants learn more about each other and adjust to perspective and normative thinking.
- Discussion «City Vision for Lviv in 2050»:
As a starting exercise, it was suggested to imagine the situation: Lviv is already on the way to become a climate neutral city. Many technical, regulatory and economic challenges that were considered almost insurmountable in 2020, were overcome because Lviv achieved the most ambitious target for reducing CO₂ emissions. You as specialists also played an important role in achieving this goal.
Subsequently, the discussion was focused on:
 - what measures and projects were implemented?
 - what goals were met?
 - what was your contribution?
 - why is it especially important for you that Lviv could soon call itself carbon neutral?
- Discussion of challenges status-quo of the city:
“Today is always the starting point for the desired future day”. The discussion was centred on the topics, issues and challenges to achieving climate neutrality by 2050 which were considered most relevant for the future and most important for us, and also on the ones which are less important and do not need implementation. Indeed, the questions asked were the following: «What do I want to take with me to future?» and «What do I want to leave behind?» in context of the City Vision.
The discussion was also focused on what challenges await in the future with the current point of view and what tasks need to be solved for the formation of City Vision within the limits of climate neutrality cities.



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As a result, the most relevant inputs for achieving the City Vision in context of a climate neutral future, were ranked and ordered by KSA.

- Discussion of concepts:

This stage consisted on a brainstorming session, during which participants used a flip-chart, outlined current concepts, and discussed which of them could be implemented in the near future. The purpose of the discussion was to promote forward thinking and future-oriented inputs.

- Headlines of the future:

An integral part of this discussion was the creation of various plans for the desired carbon-neutral vision the future of Lviv in 2050. The key main question was: what should be achieved in 2050 for achieving climate neutrality of the city?

In fact, it was supposed to become the basis for the further process of achieving the City Vision. Participants were invited to write fictional data about climate neutrality recently achieved in their city in 2050. Imaginary situation: they were appointed to the post of fictional editor daily newspaper. The goal is to fill cover with headlines and articles about "Carbon-neutral city of Lviv in 2050" for information purposes the general public about what has been achieved for climate neutrality. The results of this task were the basis for the expected results of the Roadmapping workshop, and subsequent update of the City Vision 2050.

- Selection and transformation of thesis:

Gaant diagram: the headings created in the previous exercise contain raw material on the roadmap to achieve the City Vision. These titles have been transformed into more objective theses. The key question was: what statements about City Vision do we agree with and how important are they to us? As a result, the identified relevant theses that lead to the City Vision were ordered by importance and KSA and structurally displayed in the Gaant diagram.

- Discussion of examples:

Leipzig's example was approached in context of the city vision discussion of common examples and tips. Example: "Green colour" instead of concrete: green and water areas on roofs, facades, etc. is a plus because it states an alternative to the status quo (concrete). The approach should go beyond the "Quick response" to emergency situations, which is, in general – "because it is a convention".

Following Leipzig's example, all statements had to be positive and within the shared core values of the city or participants. Dystopian positions can also be useful as a counter-image, but should not be part of the City Vision/Roadmap. For this stage, these theses were not supposed to be very specific in terms of goals and contain, for example, information about how long it will take and how much it will cost. The statements were simply a modelled desired state of affairs. Example: (i) the last passenger car that runs on fossil fuel is deregistered - the car is shown in a museum; the central part of the city is free from motorized vehicles private transport; (ii) in peripheral areas movement is allowed only on cars with an alternative management. The statements should not be too general, either. For example: "In 2050 everything will be better this year." Statements may contain



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quantitative definitions for expression of strategic goals, for example: "There are Internet hotspots almost everywhere in the city of Lviv"; "Over 98% of road users in Lviv use only vehicles with an electric engine or walking". Also, such theses may contain data about who is doing something and who benefits from it, as it makes it easier to understand. Example: "Residents of the city of Lviv benefit financially from proposals of city companies regarding control and optimization use of electricity".

- **Conclusions:**

Joint decision: a reflection of each jointly agreed strategic decision, milestones, and vision statements, and approval of results. Creation of Lviv's Roadmap.

3.5.4 Lessons learned and next steps

The roadmap for urban transformation in Lviv helped gather and summarise important inputs that will contribute to the city's development in relevant fields with the goal of achieving sustainability and climate neutrality in the next 30 years. In this sense the next stages for the process include further development and discussion of the inputs with relevant stakeholders and decision makers in order to attain an adequate level of maturity for the city's political and investment agenda.

As a result of the roadmapping participatory process, involving representatives of public opinion, and taking into consideration their contribution to the sustainable development of the city, the following actions are considered essential for the realization of the roadmap and achievement of the City Vision 2050:

- involvement of external finance and external experts; coordination and organization of the city's work in the direction of energy efficiency; designing and implementing a number of measures to save budget funds for paying for energy resources;
- involvement of Lviv residents in various projects and ensuring residents' conscious attitude to electricity and natural gas consumption;
- dissemination of Lviv's experience in the field of energy efficiency and climate change among the cities of Ukraine and Europe, i.e., popularization of energy efficiency;
- participation in the design of individual streets and participation in the work of the jury for the architectural competition for the best street concept;
- defining the design of public spaces and improvement of parking space as a priority;
- purchase of traffic management system - Vissum, Vissim;
- cooperation with international organizations, coordination and participation in discussions, formation of technical tasks.

The roadmap is a key document that will serve as a guide to the status of a climate-neutral city in 2050. Selected KSAs are crucial for our city. In the future, core departments and offices (Department of Housing, Mobility Department, Economical Department, etc.) at Lviv city council will use this document to monitor and further understand how close the city is to this status, when implementing goals and strategies.



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3.6 Maia Roadmap

3.6.1 Introduction

Maia's Municipality has a long tradition of promoting decarbonisation through various actions linked to the environment, urban planning and management, sustainable development and promotion of citizenship. SPARCS Project has contributed to the consolidation of the City's ambitious commitment, with relevant inputs that feed the hope of going further and achieving energy positivity in its territory.

Based on innovative planning solutions, capable of implementing intelligent and integrated energy systems enabling the transformation of cities into sustainable, citizen-centred and carbon-neutral ecosystems, SPARCS Project is an important agent of change capable of contributing to generate a bold vision of the city by 2050, in line with the new EU strategy.

With the ambition to become a smart, sustainable, inclusive, integrated, and carbon neutral community, Maia's Municipality worked on the draft of the City Vision 2050, which incorporates 26 "vision statements", representing the synthesis of the result of co-production of knowledge and visionary perspectives, in a context of collaborative production, carried out with the participants of the "Maia City Vision 2050" workshop, held in November 2020.

The 2050 City Vision for Maia is based on five Key Strategic Areas (KSA), which, in turn, frame the vision statements considered decisive in the pathway towards carbon neutrality and energy transition. These Key Strategic Areas are¹¹:

- KSA1. Sustainable Urban Development;
- KSA2. Energy Transition;
- KSA3. Mobility;
- KSA4. Smart City;
- KSA5. Inclusive and Integrated City.

With reference to the 2050 City Vision, and maintaining a collaborative approach, the Municipality also worked on the Implementation Plan, with a set of 15 project ideas, developed in the context of WP5.

In this framework, the Roadmap for Urban Transformation represents a new exercise of collaborative prospective reflection that, having in mind the baseline and the current context of development of the KSA as a starting point, seeks to identify and describe the pathway towards the achievement of the vision statements for 2050.

¹¹ In the context of the roadmapping process, the scope of the existing KSA scopes and names were partly adjusted. The present naming already reflects these adjustments.



This report intends to summarise the set of activities developed in the context of the roadmapping process and workshops, which involved an extensive set of relevant stakeholders and experts, systematising the resulting actions.

Anchoring the roadmap in Maia’s development strategy

Maia’s Municipality trajectory to achieve its long-term goals, encompassed by the roadmap, was anchored, on the one hand, in the vision statements for 2050 (T1.7 – Maia Draft City Vision 2050) (Figure 10) and on the other, in the main sectoral planning documents, framed within the public policy strategic references. The main projects and measures that resulted from the roadmapping activities were thus aligned with the defined strategic areas.

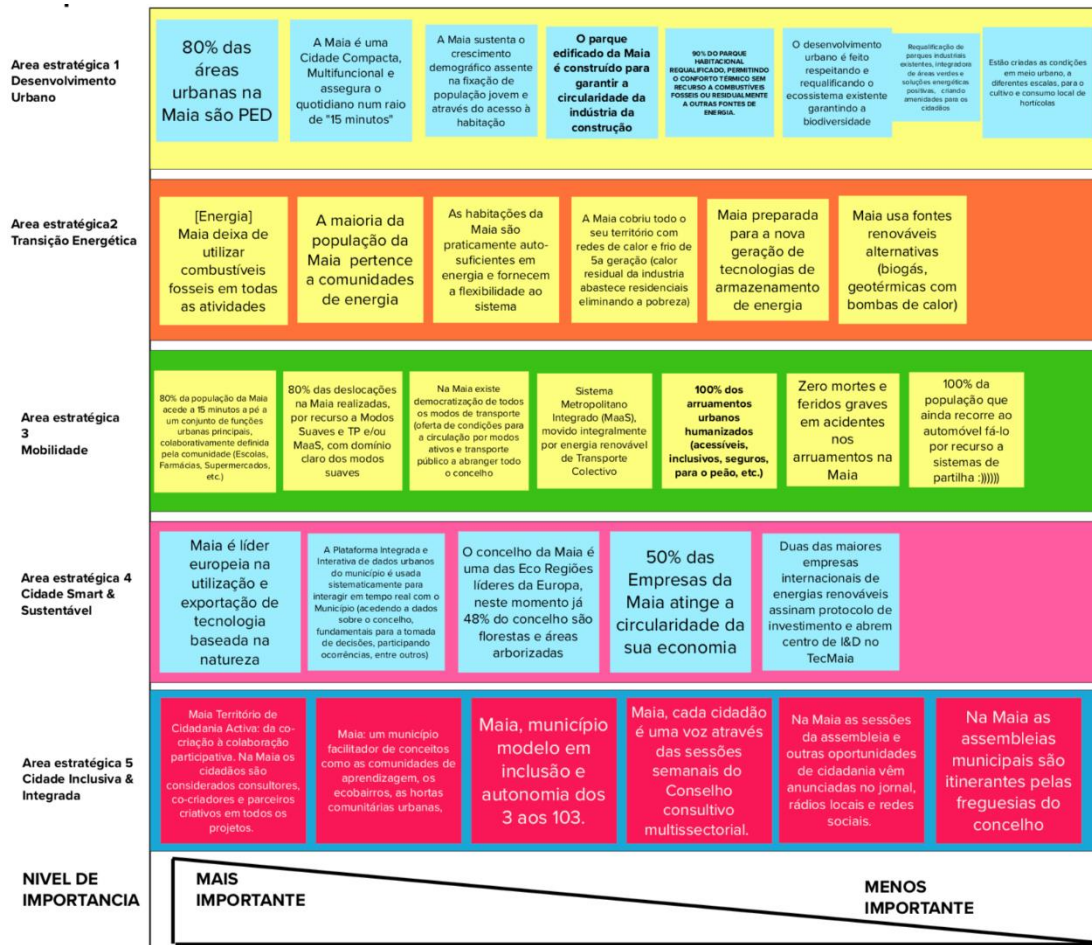


Figure 10. Maia Vision Statements 2050 board (Source: Maia Draft City Vision 2050 report)

Alongside, categories were defined to organise the results in a logical and simplified sequence, allowing a generalised understanding of the city vision and the pathway to achieve it.



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The 2050 city vision definition was supported by Maia’s commitment to achieve carbon neutrality by 2050. In this regard some main drivers were considered: 1) growing decentralised production of energy based on renewable sources, which will enable the efficiency of the electrical production system; 2) energy efficiency, supported not only through investments in building construction and rehabilitation and installation of more efficient equipment, but also through increasingly responsible consumption; 3) the electrification of the economy, especially in the field of mobility and industry; 4) the availability of GHG capture sources; and 5) a participatory and inclusive governance model.

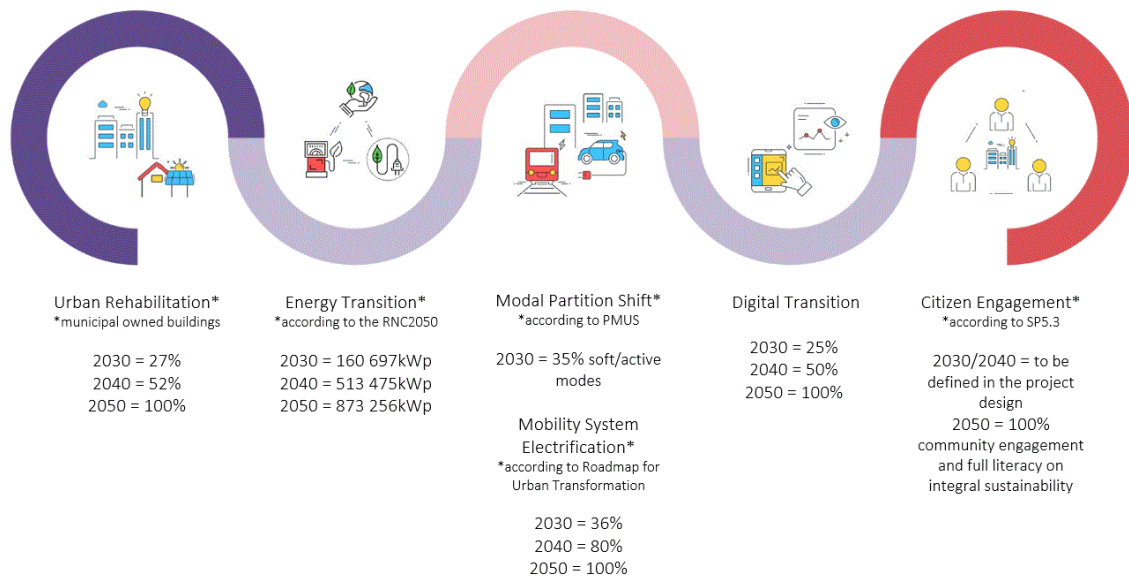


Figure 11. City goals (Source: adapted by authors)

The above image (Figure 11) shows a summary of the main objectives for 2050, providing the reference for the work under SPARCS project. Regarding the main milestones, by category of projects and measures, and in the absence of specific local targets, defined in the content of some of the sectoral documents, national strategies were also used as a reference, with special relevance to the Roadmap for Carbon Neutrality 2050 (RNC20250) and the Long-Term Strategy for Building Renovation (ELPRE).

Furthermore, having the city’s vision statements as a reference, as well as the identified categories, a set of KPIs were defined to assess Maia’s performance towards the long-term city vision goals, as well as to define and structure a strategic monitoring system. These KPIs were further fine-tuned and adjusted to the features of the structuring projects identified in the road mapping workshops. The rationale behind the definition of these indicators and their baseline can be better analysed in Appendix 7, section B. Milestones and Impact Assessment Key Performance Indicators (KPIs).

3.6.2 Overall roadmap results

What will be presented next (overview of the results per KSA and graphic roadmap) is an overall summary of the extensive work carried out in the participatory process of the



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Roadmap for Urban Transformation for Maia city and the inputs given by all participants – task force, experts and key stakeholders – involved in the process that culminates with this report content. The fruitful debates over all five key strategic areas resulted in the identified structural projects, listed along with their respective actions, that will pave the way for the city to achieve its goals and vision statements.

For a deeper understanding of the appointed structural projects that follow, we advise a careful reading of the content presented in Appendix 7, section A. Maia's milestones tables per KSA and section B. Milestones and Impact Assessment Key Performance Indicators (KPIs).

The presented results derive, as aforementioned, from the valuable insights and professional knowledge of all the participants in the road mapping process and workshops, thus not representing any official/formal views of partner organisations. Nonetheless, Maia Municipality is strongly determined to use it to feed its strategic territorial approach.

Maia's Roadmap for urban transformation

KSA1: Sustainable Urban Development

For Maia's Sustainable Urban Development, the main categories/subjects that need to be addressed to achieve the envisioned future are: i) the social demographic dynamic, ii) the rehabilitation of the existing housing stock, iii) the circularity of the economy, and iv) the provision of green spaces and biodiversity as a life support, food sovereignty and adaptation to climate change. As mentioned before, these categories have been defined to organise the projects and measures and to help explain how they can lead us to the ambitious achievements.

In this context, in addition to the milestones, whenever possible, specific targets were proposed for the defined KPIs, to measure the population living in affordable conditions, the social housing provision, the urban rehabilitation process, the circularity of economy and the growth of urban green spaces and local agriculture.

In terms of structuring projects and interventions, Maia prioritises the rehabilitation of its building stock, in accordance with the energy performance of buildings directive, and also a local housing strategy to provide conditions to have affordable dwellings for their inhabitants.

Regarding the circular economy and, additionally, the energy efficiency domain that is going to be specifically addressed in the Energy KSA, Maia will monitor the waste sent to landfill (reduction) and the incorporation of materials in the productive process (increase).

Finally, by increasing the green areas, reforestation and promoting organic and local farming, Maia will contribute to balancing GHG emissions and provide a better quality of life for its citizens.



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KSA2: Energy transition

The Energy Transition theme is wide-ranging and significantly challenging. The envisioned milestones aim both at incorporating improvements in energy efficiency and reducing consumption while being aligned with the RNC2050's milestones.

The categories addressed in this KSA are: i) decentralised RES production, ii) energy efficiency and flexibility in buildings, and iii) heat and cold networks. To monitor the energy transition theme, a proxy variable - the installed PV power in Maia (kWp) as well as the number of installations for self-consumption - will be analysed.

The majority of the projects identified for this KSA are dedicated to decentralised production using renewable sources, focusing on the theme of CSC (collective self-consumption) and RECs (renewable energy communities). The increasing energy efficiency in buildings – mainly through rehabilitation - the introduction of more efficient equipment, storage solutions and intelligent systems, and the electrification of sectors are some of the appointed solutions.

In parallel, for the heat and cold networks, significant collaboration will be held with the industry sector, which in Maia's case is a very robust one, with potential for the use of thermal effluents. Given Portugal's lack of tradition in the use of these infrastructures, additional studies and on-site assessments should be carried out in tandem with local industry partners.

KSA3: Mobility

Being one of the most important KSA, Mobility is a crucial part in the design of a carbon free, and energy positive community. For that reason, the appointed projects reflect not only the necessity to shift the modal split as well as the necessity to develop a different territorial approach - as is the case of the 15 Minutes Communities project.

Therefore, the main categories addressed are: i) easy accessibility, ii) soft mobility, iii) intermodality and sharing systems, and iv) green mobility.

In terms of structuring projects, the evolution of the Electrification of the Mobility System, alongside with the promotion of Soft Mobility, Shared Mobility Services and Public Transport will greatly contribute to city's decarbonisation goals. In this sense, in order to implement a proper monitoring system, the evolution of the modal split will be dully monitored, with regular mobility surveys, as will the evolution of the electric vehicle's fleets (% in relation to the total number of vehicles) and of the charging infrastructure (number of public charging stations and their location).

KSA4: Smart City

To attain the goal of a carbon neutral society, digitalization of several urban functions and of the energy and mobility sectors is essential. To promote these efforts, support for the production, collection, storage and analysis of data in an integrated and interoperable way is required, which leads us to the concept of smart cities, that goes beyond the digitalization of the energy system.



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The implementation of an Integrated and Interactive Urban Data Platform is the key feature of the roadmap concerning KSA4. In this sense, the city must assume the importance of not only collecting the available data, but also to organize, analyse and systematise it and share it with the main stakeholders and citizens. City data interoperability is the key category to consider in KSA4.

To fully assure Maia's territory digitalization, it will be essential to strengthen the municipal structure with a dedicated service, including a workforce capable of understanding, managing, and innovating in complex technological and urban environments, provide better communication and storage infrastructures, prioritize the key sectors to digitalize, and assure the horizontal data integration.

A digital twin solution, with virtual representations (whether it's a physical object or a system) of the infrastructures and building environment, with the ability to span its lifecycle and with real-time updating, is another important tool to be incorporated in this digital transition process for an effective improvement of procedures.

All identified projects proposed in this KSA are in line with the Implementation Plan (WP5).

KSA5: Integrated and Inclusive City

This KSA focuses primarily in initiatives related to governance models and civil society engagement, for which a commitment to information and awareness-raising are considered fundamental in boosting results that may benefit all.

In this sense, to fulfil the vision statements concerning KSA5 Maia will put its efforts, on one hand, on the implementation of cross cutting initiatives such as the projects dedicated to creating the Cross-Sectoral Advisory Board; increase the environmental literacy for sustainability; and set up a local environmental and urban sustainability fund.

On the other hand, a relevant role is given to the development of specific projects aimed at improving families' quality of life, by offering community services to help deal with day-to-day issues concerning people's houses and their neighbourhood living environment, and also with the aim of boosting the rehabilitation of the building stock.

The categories that guided all appointed projects in this KSA were Citizen Engagement and City Stakeholders Engagement. Building a civil society friendly community implies a governance model that works alongside its citizens. In the same way, citizens are expected to take an active role in the decision-making processes.

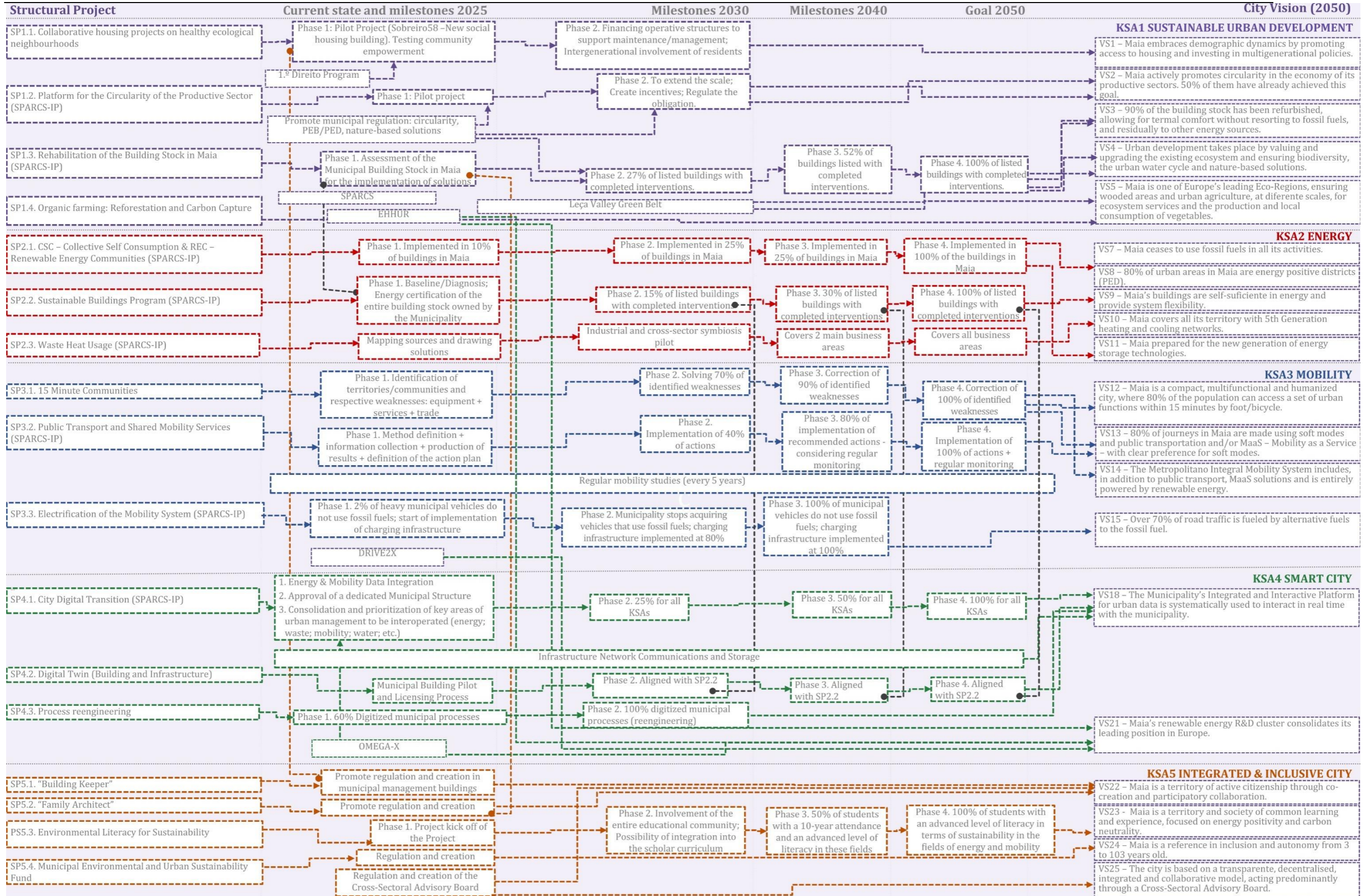


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Visual / Graphic Roadmap Maia



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Key outcomes per KSA

The two workshops held for the roadmapping process resulted in the identification of 82 projects/measures. Subsequently, Maia's local team worked on fine-tuning the results and assessing their relevance to the KSA to which they were allocated.

It was possible to conclude that there is a predominance of some vision statements (VS) over others, and that some VS can/should be revised, for example, through their fusion/integration with other, or through the reformulation of their scope. In chapter 3.6.4. Lessons learned and next steps of this report, in the 'Contributions to the adjustment and consolidation of the City Vision for 2050' subsection, the conclusions drawn from this exercise are systematised.

In a second step, some repeated project ideas/measures were identified and, therefore, merged or, in other cases, reorganised, for example, through their integration as components and/or milestones of another project. An example of the first case is the definition of a project aimed at promoting literacy in the community on issues concerning integral sustainability and digital transition. This project responds to VS23 and systematises about a dozen actions identified for the issue of raising awareness and empowering stakeholders and citizens.

An example of the rearrangement of inputs can be the case of the Urban Intelligence Platform project, a necessary step for the digital transition of the city. In this case the "creation of a dedicated municipal structure" to address these responsibilities was aggregated as a short-term milestone for the aforementioned structural project.

The following conclusions (Table 16) were the result of such exercises, here presented by KSA and VS.

Table 16. Key outcomes table – Maia

Key outcomes for KSA1: Sustainable Urban Development		
ID	Name (type)	Description
SP ¹² 1.1	Collaborative housing projects, held in ecological and healthy neighbourhoods, to replicate the logic of the "Bairros Saudáveis" municipal project. (Type: Project)	<p>This project aims to achieve a liveable experience in which its residents, of all ages and backgrounds, are integrated in an environment suited to its needs and lifestyle. Thus, it is necessary to build it following the logics of Neighbourhood Communities (of actual physical proximity) promoting a shared living experience.</p> <p>These infrastructures should incorporate the latest demands to assure the energy efficiency component of all buildings and services provided.</p> <p>This particular project will directly benefit from the SP5.1 and SP5.3 projects and contributes to VS1.</p> <p>Responsible: Maia Municipality, Espaço Municipal, EM, Local Social Housing Company.</p> <p>Involved: Social workers, architects, civil engineers, to name a few, will be involved.</p>

¹² SP – Structural Project



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Key outcomes for KSA1: Sustainable Urban Development		
ID	Name (type)	Description
		Category: POPULATION AND SOCIAL CONDITIONS
SP 1.2	Platform for the Circularity of the Productive Sector (Type: Research/Solution)	<p>The project for the circularity of the construction industry aims to safeguard the reuse of materials. Thus, a catalogue should be made available to include the practices to be adopted, as well as the list of materials available. Sustainable construction should, in an initial phase, be awarded and then become mandatory with the proper regulation.</p> <p>Several technical aspects should be considered: i) physical space for the reusable materials; ii) required technology to implement solutions (assessment of material quality, specific reuse, etc); iii) benefits (fiscal or other) to ease the adoption of said solutions.</p> <p>This particular project is directly related to SP1.3 and SP2.3.</p> <p>Responsible: Maia Municipality</p> <p>Involved: Private technological suppliers.</p> <p>Contributes to: VS2 / VS3</p> <p>Category: CIRCULAR ECONOMY IN BUILDINGS; SOCIAL HOUSING BUILDINGS</p>
SP 1.3	Rehabilitation of the Building Stock in Maia (Type: Program/Solution)	<p>Aligned with the Implementation Plan, all building refurbishment/retrofitting operations must contemplate nature-based solutions (green roofs, vertical gardens), alongside with various other solutions previously mentioned – see SP1.2.</p> <p>A refurbishment and retrofitting operations program must be the priority and achieving this project's goal implies a joint effort of all those involved.</p> <p>With a vast array of human/technical/financial resources involved, this SP will benefit from the work carried out at SP1.2, SP1.4, SP5.1 and SP5.3.</p> <p>Responsible: Maia Municipality</p> <p>Involved: Real estate developers; and other relevant private stakeholders.</p> <p>Contributes to: VS3 / VS4 / VS6</p> <p>Category: BUILDING REFURBISHMENT / RETROFITTING; URBAN SUSTAINABLE DEVELOPMENT; COMMUNITY GARDENS</p>
SP 1.4	Organic Farming; Reforestation and Carbon Capture (Type: Project)	<p>From an in-continuum point of view, this project will, at the same time, contribute to improve the involved communities' life conditions as it improves the environment, feeding the sustainability goal. Several resources, human/financial/technical, must be allocated to help implement said solution.</p> <p>This project will benefit from the appointed solutions of SP1.1, SP1.3 and SP5.3.</p> <p>Responsible: Maia Municipality</p> <p>Involved: civil society and agriculture and waste management sectors</p> <p>Contributes to: VS 6</p> <p>Category: LOCAL AGRICULTURE</p>



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Key outcomes for KSA2: Energy Transition		
ID	Name (type)	Description
SP 2.1	CSC - Collective Self-Consumption - and RECs - Renewable Energy Communities. (Type: Project)	<p>Energetic positivity materialised in a Positive Energy District is this project's goal. It also responds to the Implementation Plan considering it represents one of the main vectors for emissions reduction. The involved communities will be the agents of change themselves. Such paradigm change will happen through CSC - Collective Self-Consumption - and RECs - Renewable Energy Communities.</p> <p>Partnerships with strategic stakeholders will provide the necessary resources - technical solutions, funding, etc.</p> <p>The implementation of such solutions will directly benefit from SP1.1, SP1.3, SP5.1 and SP5.3.</p> <p>Responsible: Maia Municipality</p> <p>Involved: Civil society; housing and energy sectors. Contributes to: VS8</p> <p>Category: DECENTRALISED RES PRODUCTION</p>
SP 2.2	Sustainable Buildings Program (SPARCS – IP) (Type: Program/Project)	<p>In response to the Implementation Plan, this program represents the municipality's effort to improve its buildings stock. Thus, all the necessary changes will be implemented to achieve energetic self-sufficiency. In addition, it is expected to contribute to a substantial reduction in GHG emissions.</p> <p>This program comes aligned with SP1.2, SP1.3, SP1.4 and SP5.3.</p> <p>Responsible: Maia Municipality will bridge the necessary procedures to certify its buildings and to equip them with efficient solutions and smart meters.</p> <p>Involved: The Energy Agency (ADENE); Technology suppliers (IOT, 5G).</p> <p>Contributes to: VS9</p> <p>Category: ENERGY EFFICIENCY AND FLEXIBILITY IN BUILDINGS</p>
SP 2.3	Waste Heat Usage (Type: Research)	<p>This project responds to both the Implementation Plan and industrial synergy projects. Circular economy is also contemplated in this solution.</p> <p>Mapping all the possible heat sources is the first step. Due to the inexistence of heat distribution infrastructures, an industrial and intersectoral symbiosis pilot would be ideal to start with.</p> <p>This solution comes in straight connection to SP1.1, SP1.2 and SP2.1.</p> <p>Responsible: LIPOR (Municipalities Association for Sustainable Waste Management).</p> <p>Involved: Industrial/Scientific/Technological/Business sectors¹³.</p> <p>Contributes to: VS8</p> <p>Category: HEAT AND COLD NETWORKS</p>

¹³ LIPOR has its own Energy Recovery Centre where they receive waste that cannot be used for composting and recycling processes. There, and through a controlled burning process they produce steam that generates electricity.



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Key outcomes for KSA3: Mobility		
ID	Name (type)	Description
SP 3.1	15 Minutes Communities (Type: Program/Solution)	<p>This project is mirrored to the “15 minutes city” paradigm. An inclusive and humanised public space is seen as “mandatory” to facilitate soft/active modes use.</p> <p>In the short term, a first phase was proposed to assess the public space status quo, identifying the needs to ensure the accessibility to several daily life goods/services/equipment and draft an investment program, defining the median and long-term goals.</p> <p>In connection with SP1.1 and SP5.3.</p> <p>Responsible: Maia Municipality.</p> <p>Involved: The business/cultural/educational sectors.</p> <p>Together they will allocate the needed resources to implement the project: planning consultancy, financing, etc.</p> <p>Contributes to: VS12/ VS13 / VS14</p> <p>Category: PUBLIC TRANSPORT; INTERMODALITY AND SHARING SYSTEMS</p>
SP 3.2	Public transport and shared mobility services (Type: Program/Commitment of Action)	<p>The reinforcement of the public transport sector as well as a multimodal hub integration are crucial to foster the modal split, particularly reducing the percentage of own vehicles for daily transport needs.</p> <p>Technological/financial/consultancy services will be provided to materialise this solution.</p> <p>In straight connection to SP1.1 and SP5.3.</p> <p>Responsible: Metropolitan Transport Authority and public transport operators.</p> <p>Involved: Municipalities.</p> <p>Contributes to: VS13/ VS14</p> <p>Category: INTERMODALITY AND SHARING SYSTEMS</p>
SP 3.3	Electrification of the Mobility System (Type: Research/Solution)	<p>This project will contribute to reducing the energy intensity of the transport sector, through the incorporation of renewables in the sector. It covers the infrastructure and the fleets.</p> <p>As this is an area in which technological changes often produce efficiency gains, the DRIVE2X¹⁴ project, that addresses V2G technology, and flexibility on the energy sector, will be important as a milestone towards the future of the electric mobility and the energy systems.</p> <p>In close relation to SP1.3, SP3.2 and SP5.3.</p> <p>Responsible/Involved: Citizens, real estate developers, station holders, charging points operators (CPO), electric mobility suppliers will be the main promoters.</p> <p>Any technology/equipment/financial/mobility solutions providers to cooperate.</p> <p>Contributes to: VS15</p> <p>Category: E-MOBILITY</p>

¹⁴ DRIVE2-X - Orchestrating an interoperable sovereign federated Multi-vector Energy data space built on open standards and ready for GAia-X



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Key outcomes for KSA4: Smart City		
ID	Name (type)	Description
SP 4.1	City Digital Transition (Type: Program/Solution)	<p>This project aims to develop an Urban Intelligence Platform (interoperable and with open data). In the short term, the existing pilot projects from BaZe – Living Lab Maia Project – (for the energy, waste, mobility and water management) must be consolidated in order to help prioritise the city’s key sectors to digitalize and assure the horizontal data integration.</p> <p>This project also implies work on the governance model (orgware) and internal competencies. The reinforcement of the municipal structure with a dedicated service and with a workforce capable of understanding, managing, and innovating in complex technological and urban environments is another milestone.</p> <p>This project as well as the other projects of the KSA4 will need investment on communication and storage infrastructures, something to assure over time and aligned with the needs of the distinct projects that will be identified, after deeper analysis of the Innovation and Digital Transition Action Plan.</p> <p>In connection to SP5.3.</p> <p>Responsible: Maia Municipality.</p> <p>Involved: scientific/technological sectors will provide the necessary resources for: data science/data analysts; funding; infrastructure.</p> <p>Contributes to: VS18</p> <p>Category: CITY DATA INTEROPERABILITY</p>
SP 4.2	Digital Twin (Buildings and Infrastructure) (Type: Research/Solution)	<p>The Digital Twinning Project consists of digitalizing – BIM (Building Information Modelling) – the Construction, Maintenance, Energy and Mobility Department (at Maia’s Municipality). For that, digital twins for buildings and infrastructure will support any building/equipment/infrastructure planning, design and maintenance operations. Another key element of this project is to work towards an e-licensing platform for the municipality.</p> <p>In the short term the idea is to work in a pilot project, probably a research-based project, and, in the medium term, define some regulations in order to scale up the project, alongside the implementation of SP2.2. Sustainable Building Program.</p> <p>This implies having financial resources for introducing and developing the BIM - Building Information Modelling technology; a strategy defining the LOD – Level of Development and local regulations if needed; communications network; data storage (Big Data databases) and maintenance, as well as well-prepared work force.</p> <p>The project has connection to SP2.2, SP4.1 and SP5.3</p> <p>Responsible: Maia Municipality</p> <p>Involved: Science/tech sectors</p> <p>Contributes to: VS18.</p> <p>Category: CITY DATA INTEROPERABILITY</p>



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Key outcomes for KSA4: Smart City		
ID	Name (type)	Description
SP 4.3	Process reengineering (Type: Solution)	<p>This project focusses on redesigning the workflows of the municipal key processes, placing citizens at the centre of decision-making processes and minimising waste and costs. This will be the baseline for the second step of the project that aims to achieve the entire digitalisation of the municipal processes.</p> <p>The measure will involve, in one hand, the definition of a responsible for the coordination of the implementation and, on the other hand, multiple offices contributions to develop the processes redesign, which means having their commitment with the programmed work. Financial resources will be needed to support consultancy and eventual investment on hardware and software for the digitalization phase.</p> <p>The project has connection to SP 4.1, SP4.2 and SP5.3 Responsible: Maia Municipality Involved: Science/tech sectors; Consultants. Contributes to: VS21. Category: INNOVATION</p>

Key outcomes for KSA5: Inclusive & Integrated City		
ID	Name (type)	Description
SP 5.1	“Building Keeper” (Type: Solution)	<p>The “Building Keeper” is a recreation of the “gatekeeper” or “housekeeper”, however with the active role of training the community on issues involving the rehabilitation of buildings as well as energy/water efficiency and sustainability in general, and also promoting the vision of a community supported by participatory governance models through community involvement and active citizenship.</p> <p>In the short-term, the intention is to establish this concept in the social housing buildings and, in a second phase of development, with the involvement of civil society, extend it to the community. Financial resources will be needed to support consultancy and training.</p> <p>The project is in straight connection to SP1.1, SP1.3, SP5.2 and SP5.3. Responsible: Maia Municipality, Espaço Municipal, EM, Local Social Housing Company. Involved: Residents' associations, condominium management companies, energy agency, energy suppliers, the academy, researchers, architects, civil engineers, ONGs, volunteers, citizens. Contributes to: VS22. Category: CITIZEN & STAKEHOLDERS ENGAGEMENT</p>
SP 5.2	“Family Architect” (Type: Solution)	<p>This project reflects the vision of a community focused on a society of common learning towards carbon neutrality and energy positivity.</p> <p>The “Family Architect” will assume a role of a community consultant for interventions to “heal” the buildings, focusing on energy/water efficiency and the improvement of the general living/working conditions for all.</p>



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Key outcomes for KSA5: Inclusive & Integrated City		
ID	Name (type)	Description
		<p>In the short-term, the intention is to establish the concept and define the rules for implementation. This could start with the implementation of the measure “Maia Energy Hub”, that aims to support energy efficiency and renewable energy projects to mitigate energy consumption and improve living conditions (comfort and health). The measure includes the installation of a One-Stop-Shop for integrated services that will support the implementation of energy efficiency measures, through support in the identification of business models, financing, and contractual models, based on the national funding opportunities (Environmental Fund).</p> <p>The project is in straight connection to SP1.1, SP1.3, SP5.1 and SP5.3 Responsible: Maia Municipality, Energy and Mobility Division Involved: Porto Energy Agency, Residents associations, energy suppliers, the academy, architects, civil engineers, NGOs, volunteers, citizens. Contributes to: VS22. Category: CITIZEN & STAKEHOLDERS ENGAGEMENT</p>
SP 5.3	Environmental Literacy for Sustainability (Type: Program/Solution)	<p>It consists of campaigns to raise awareness and train services, stakeholders, and the community in general on issues of sovereignty and energy efficiency, water efficiency, sustainable mobility, and the promotion of digital literacy.</p> <p>The project will begin with the planning phase (short-term), where the concept and raising awareness programme will be designed in a co-creative process, considering that this is a crosscutting issue, involving multiple offices in the city administration.</p> <p>The second phase will include the training and communication events.</p> <p>This project has connection with all other projects. Responsible: Maia Municipality. Involved: Energy Agency, Residents associations, Local business companies, energy suppliers, science/technological sectors, NGOs, Schools; Condominiums. Contributes to: VS23. Category: CITIZEN & STAKEHOLDERS ENGAGEMENT</p>
SP 5.4	Municipal Environmental and Urban Sustainability Fund (Type: Solution)	<p>Inspired by the idea of funding a fair and inclusive transition, the “Municipal Environmental and Urban Sustainable Fund” aims to reach a broader segment of population.</p> <p>This project requires municipal financial resources and regulation (type of projects, awarding process)</p> <p>This project has connection to SP1.3, SP3.2, SP3.3, SP5.1 and SP5.3. Responsible: Maia Municipality Involved: Local business companies, energy agency, science/technological sector. Contributes to: VS22/ VS24/ VS25</p>



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Key outcomes for KSA5: Inclusive & Integrated City		
ID	Name (type)	Description
		Category: CITIZEN & STAKEHOLDERS ENGAGEMENT; SOCIAL INCLUSION; TRANSPARENT GOVERNANCE

3.6.3 Adopted methodology and procedures

Methodology for the roadmapping process

The city of Maia carried out a series of steps (between M30 and M48) which led to the Roadmap for urban transformation workshops held on March 2nd (M42) and April 12th 2023 (M43).

Task Force

A task force was set up, composed of elements previously involved in the workshop process for Maia's City Vision for 2050, and strengthened with additional elements of several expertise areas.

Aware of the importance of this exercise, Maia's Municipality consortium team, coordinated by the Strategy, Development and Innovation Office, was supported by i) SPI; ii) NEW R&D and iii) AdEPorto, during the whole process of designing and implementation of the activities.

City Vision for 2050's connection to the sectoral planning documents

The Roadmap preparation was based primarily on the analysis of the 2050 vision statements (T1.7 – Maia Draft City Vision 2050).

This analysis consisted of an assessment of the pertinence of all vision statements, considering not only the identification/list of projects contained in the Implementation Plan, but also a wide range of projects/structuring measures integrated in the main strategic documents of the Municipality of Maia, listed below.

- SPARCS-IP-SPARCS Implementation Plan
- PDM-Master Plan Revision Work - Programmed Actions
- PMAAC-Climate Adaptation Action Plan
- PAES-Sustainable Energy Action Plan
- PMUS-Sustainable Mobility Action Plan
- PEDT-Tourism Strategic Plan
- PEDD-Sport Development Strategic Plan
- EPAITD-Innovation and Digital Transition Action Plan
- CE-Education Chart
- MAIA30-Investment and Funding Action Plan
- PJF-Parishes Representatives
- PMS-Health Municipal Plan



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- PMJ-Youth Municipal Plan
- Others-Other Measures

The exercise of sorting/analysing the sectoral plans consumed much of the team's effort (M33-M41). In fact, having been developed alongside with the preparation of the programming exercise for the next structural financing framework (North 2030), it resulted in a collection of hundreds of identified projects/measures, many of which go beyond the scope of the SPARCS project.

For this reason, the local team decided to focus either on the SPARCS Implementation Plan or on a set of projects that better respond to the main vectors of the decarbonization goals.

Some adjustments to the KSA and vision statements resulted from this process: i) two KSA were re-named – Urban Development to Sustainable Urban Development and Smart and Sustainable City to Smart City; ii) some VS were merged; and iii) two new VS were created:

- VS27 Over 70% of car traffic in Maia is powered by alternative fuels - allocated to KSA3 Mobility;
- VS28 The urban water cycle has been consolidated in the city over the last 30 years - allocated to KSA4 Smart City.

The team also categorised project typologies, associated with the vision statements for 2050, to enable the definition of a monitoring methodology, and thus providing indicators for the ambitious goal of carbon neutrality and energy positivity. For this, SPARCS T2.1: Demo Evaluation, Impact Assessment and Cost-Benefit Analysis Framework and Associated Key Performance Indicators was considered alongside with the city's efforts for the implementation of ISO 37120 – Sustainable Cities and Communities.

Stakeholder involvement

For this step of the process the list of key stakeholders that were involved in the City Vision and Implementation Plan processes was taken into account, with the necessary adjustments derived from the evolution of the project and the task force knowledge regarding the relevance of the stakeholders for the roadmap. A comprehensive involvement of the chosen stakeholders in the process was carried out and, in some cases, bilateral meetings were held prior to the workshop to help bring consistency to the exercise.

Resources and general planning

The first workshop, focused on the municipality's "internal ecosystem", composed mainly by representatives of municipal offices involved with in the energy transition theme, was held at the municipality's premises. The session was attended by 29 participants. It involved the use of projection equipment, besides other internal resources.

The second workshop, involving the "external ecosystem" of stakeholders relevant for the 5 KSA, was held in a different venue, also belonging to the municipality, with conditions, in terms of space and resources, to accommodate the larger number of participants



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involved. The session was attended by 55 participants, and included coffee and lunch breaks.

Methodology definition

The workshop methodology, although based on Kladno’s experience concerning the pilot workshops, was slightly adapted in the two months preceding the participatory moments, with the aim of simplifying the exercise, which was quite complex in itself.

The following actions were taken:

- updating of Status Quo and Trends gallery;
- definition of the methodological exercises to be implemented - forecasting, backcasting, trends, wildcards or others, as a starting point for the roadmap;
- internal testing for methodological validation;
- testing of graphic supporting materials – per KSA – with final validation after the internal workshop;
- preparation of introductory presentations;
- selection and invitation of specialists for the energy, mobility, and digital transition themes;
- selection and invitation of moderators and rapporteurs for each KSA;
- invitation of participants;
- catering supply, for the external session;
- printing of all supporting materials (posters; worksheets).

Roadmapping Workshop Agenda

Based on a collaborative work methodology, and in line with Task 1.2 Roadmap for urban transformation, after carrying out the activities described, Maia’s team implemented its roadmapping process based on a robust forecasting exercise, carried out in two participatory moments (workshops), detailed in Table 17.

Table 17. Agenda of the roadmapping workshops – Maia

	Workshop 1 – Internal ecosystem	Workshop 2 – External ecosystem
Date schedule	02/03/2023 09:30h - 12:00h	12/04/2023 09:30h - 18:00h
	<ul style="list-style-type: none"> • Welcome / Intro • Intro – Why a roadmap for urban transformation? • Energy transition in Maia – Status Quo and Trends • Setting up work groups preparation of the exercises • Energy transition in Maia – Vision Statements for 2050 Brainstorming session 	<ul style="list-style-type: none"> • Opening of the session • SPARCS project – Overview and objectives • Session 1. Challenges and opportunities for urban transformation: <ul style="list-style-type: none"> - Sustainable urban mobility; - Energy transition - Smart city



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	Workshop 1 – Internal ecosystem	Workshop 2 – External ecosystem
	<ul style="list-style-type: none"> • Energy transition in Maia – Structuring projects Identification of relevant projects and discussion • Overall brainstorming session over the results Setting up the preliminary results on the template • Conclusion – presentation of the results 	<ul style="list-style-type: none"> • Session 2. Defining structuring projects for each KSA: <ul style="list-style-type: none"> - Brainstorming session - Preliminary results presentation • Session 3. Project implementation for each KSA <ul style="list-style-type: none"> - Brainstorming session, definition of the main features concerning the projects • Session 4. Presentation of results and co-creation of the Roadmap
Moderator(s)	1per table (two tables)	2 per table (five tables)
Operator(s) of Miro board	2 total	2 total
Note taker	1 per table	2 per table
Invited experts	City council experts and local consortium experts	City council experts, local consortium experts, academics and key strategic areas experts (urban development, energy, mobility, smart cities and digital transformation)
Nº of participants and fields of expertise	29 participants (23 city representatives, and 6 stakeholders representing areas such as government efficiency, environment, climate and energy, health, sports and education facilities, digital transformation of the territory. urban planning, energy, and ICT. 6 stakeholders of relevant public and private institutions and entities were involved.)	55 + 2 (city councillors) [21 city representatives (2 city councillors, representing areas such as government efficiency, environment, climate and energy, digital transformation, ICT, , urban planning, energy and mobility, and 19 city managers and technicians of those technical subjects) and 36 stakeholders, including elements of the civil society and of relevant public and private institutions and entities were involved. Topics related to all key strategic areas selected for this purpose were addressed, namely: transport and logistics, energy companies and institutions, commercial companies, non-governmental associations in the field of energy, environment and mobility, scientific and technological systems, representatives of residents' associations and professional orders)



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Workshop 1 – Internal ecosystem

For this workshop several specialists from Maia’s municipality were invited, as well as local consortium partners and specialists. The attendees were distributed in two working groups and the main focus of this exercise was the Energy key strategic area.

All 29 participants were assigned to two worktables where the following supporting material was made available: i) the matrix sheets for the Energy KSA; ii) a list of projects from municipal strategic documents; and iii) a list of municipal buildings and their status in terms of energy certification.

As supplementary material, posters of the status quo and Trends Gallery of all five KSA were posted for the participants to consult. To each table a rapporteur and a moderator were assigned. SPI and NEW R&D partners participated remotely and worked on the Miro board (Visual Collaboration Software). With a duration of 3 hours, this work session’s agenda is part of Appendix 7 (section D).

The SPARCS Project presentation was held by the Strategy, Development and Innovation Office coordinator. The importance of the project as a driver of change in the urban transformation model, anchored in the energy, digital and societal transition for the city of Maia, was highlighted.

The Municipality’s framework for the energy transition was presented by AdEPORTO, contextualising the municipality status quo in this regard.

For the first part of the Workshop exercise (and always taking the city’s carbon neutrality goal into consideration) both groups had to identify Projects/Measures/Transformative Actions – aligned with the Energy KSA specific vision statements – that might contribute to achieving said vision statements. For that purpose, working matrix templates were made available in both tables (Figure 12).

Several Projects/Measures/Transformative Actions were identified – 38 in total – of which the participants were asked to select the most relevant ones. This selection intended to facilitate the second part of the exercise, in which the following questions were to be pondered upon:

- How to implement?
- Who promotes it?
- What entities/partners should be involved?
- Technical resources?
- Human resources?
- What connections/interdependencies with other projects/measures?
- When? Short term goals (2025); medium term goals (2030); long term goals (2040-2050)?



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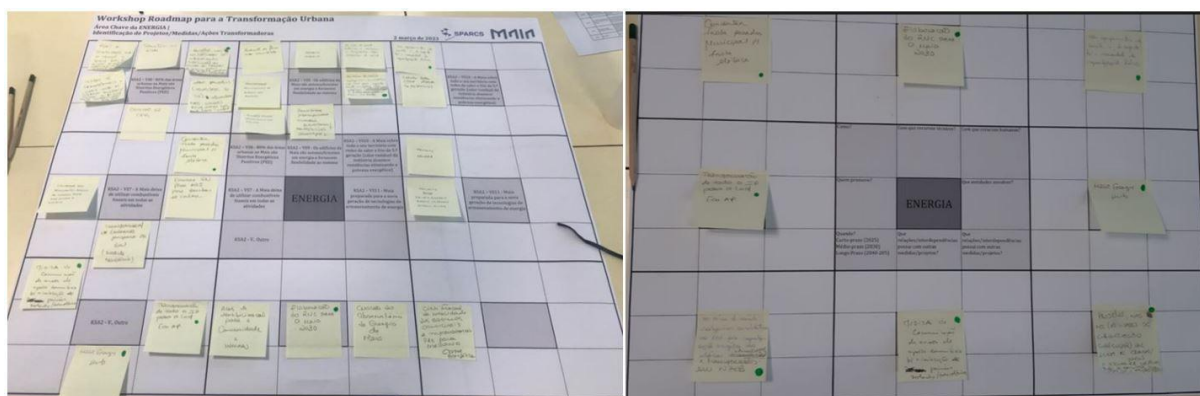


Figure 12. Matrix Sheet - 1st and 2d Exercise Results

The balance for this first approach was quite positive. The gathered information as well as the enthusiasm in the way participants embraced the proposed exercise allowed the coordinating team to adjust the methodology and support materials for the following phases of work and, in particular, for the preparation of the external workshop.

Workshop 2 – External ecosystem

On April 12th, an external workshop was held at Quinta dos Cónegos, for the design of the Roadmap for urban transformation for Maia city (Figure 13). The chosen venue had the capacity to accommodate the 55 participants in the same room, distributed in 5 working groups, according to their expertise areas. This option of creating specialized working groups allowed a greater focus on the defined KSA.

For the opening session, councilwoman for Quality of Life, Environment, Climate and Energy made a brief introduction to Maia’s Municipality, followed by a general presentation of SPARCS project, purpose of the workshop and its connection to the MAIA2030 Action Plan, carried out by the head of the Strategy, Development and Innovation Office.

For the first session of the workshop – *Challenges and Opportunities for Urban Transformation* –, experts in the strategic areas of Mobility, Energy, and Digital Transition made their introductory interventions, setting the stage for the subsequent exercises.

The subsequent sessions were of intensive work, where each of the 5 groups worked on identifying and defining the main features and implementation conditions for the structuring projects concerning their KSA. The results were gathered on the roadmapping templates and presented in the final session.



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Figure 13. Roadmap for Urban Transformation external Workshop - Maia

Post Workshop Considerations

The post workshop phase was set on dully organizing and registering all the outcomes of the participative moments, but also on reflecting on some important aspects noted by the *rapporteurs*:

- Participants took greater focus in detecting problems rather than identifying solutions (transforming projects/measures/actions);
- It was difficult to allocate transformative projects/measures/actions to the vision statements, as it was describing them and identifying links and connections between them;
- It was difficult to define indicators for implementing the proposed solutions;
- Participants tended to focus on the short term and showed difficulty in defining milestones for the medium and long term.

Aware of the difficulties inherent to forecasting exercises, the coordinating team developed an exercise – using the workshop outcomes – consisting in tidying up all collected ideas, deepening them and relating them to the vision statements and ultimately to one another.

An example of this tidying/deepening process can be found on the work Maia's team developed for SP5.3 - Environment Literacy for Sustainability. This project is the result of the systematization of over a dozen project ideas presented in all KSA, concerning literacy



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in energy efficiency, digital mobility, governance and participatory citizenship, and digital transition.

3.6.4 Lessons learned and next steps

Preparing the Roadmap for Urban Transformation not only allowed the coordinating team to identify projects/measures, but also to carry out a critical analysis of the work previously done in the preparation of the first version of the City Vision 2050 and the subsequent Implementation Plan, assessing their relevance to the KSA and VS they were allocated to.

In parallel, some gaps/difficulties in the appropriation of the implemented methodology were detected, as well as some unpreparedness of some of the teams and partners involved. These factors suggest the need to deepen the work developed, especially in regard to projects that have an absolutely decisive role in achieving the long-term goals.

Other identified critical aspects refer to the importance of defining governance models, a strategy and communication plan, along with a monitoring methodology that facilitates the pathway towards the objectives set and to guarantee a permanent evaluation of their achievement, always ensuring, in case of any deviations, that the initial established route is maintained.

Based on the lessons learned from this process, the next steps should be as follows:

1. consolidation of the 2050 City Vision;
2. identification of critical aspects to be considered in the process of urban transformation;
3. structuring of a systematic monitoring mechanism (strategic and operational);
4. approval of a governance model;
5. definition of a communication plan.

Contributions to the adjustment and consolidation of the City Vision 2050

Preparing the roadmap for urban transformation, in addition to identifying projects/measures, also allowed the team to analyse the results in light of the work previously carried out for the preparation of the first version of the city vision and the implementation plan; by assessing the pertinence of these for the KSA and VS to which they were allocated.

The analysis carried out made it possible to conclude the predominance of some city visions over others, and also that some can/should be revised, for example, through their merger/integration with other VS or through the reformulation of the VS.

Considering the cross-cutting dimension of the sustainability theme, it was understood that this domain would be better organised in KSA 1 - Urban Development, which would be renamed as “Sustainable Urban Development”. Consequently, the KSA 4 was renamed as “Smart City” – previously “Smart and Sustainable City”.



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The revision work carried out made clear that VS3, as it was drafted, was reductive and should refer to the entire building stock and not just housing, thus the term “building stock” was adopted and industry and services were also included in its scope. Now VS3 reads as follows: *90% of the building stock has been renovated, allowing for thermal comfort without resorting to fossil fuels, or residually to other energy sources.*

Subsequently, it’s understood that VS4 responds to VS5, related to the integration of green spaces and creation of amenities, and that VS3, 8 and 9, respond to the decentralised production component, therefore the elimination of VS5 was justified.

For the Energy KSA, considering that VS7 is transversal to all projects/measures and, therefore, secondary to all, it was decided that the VS should be maintained and used as a KPI in all projects.

Within the scope of the Mobility KSA, VS14 and 16 fit VS12. As both of them relate to the circulation conditions for soft/active modes, we propose to eliminate them and to add the term “humanised” to VS12, which now reads *Maia is a compact, multifunctional and humanised city, where 80% of the population accesses, within 15 minutes by foot or bicycle, a set of essential urban functions.*

For VS15, its initial wording becomes VS14 and a new VS was added, identified as VS15, to address the electrification of the mobility system.

Considering that the sustainability theme – Smart City KSA – was pushed to KSA1, and the fact that no project/measures were appointed for VS17, VS4 was rewritten to include the nature-based solutions, making it possible to frame this type of interventions and eliminate the VS17.

The same applies to VS19, as the theme of reforestation was integrated in VS5, which, in its new wording, integrates the themes of reforestation and urban agriculture and also local production and consumption, also merging the content of VS6.

Finally, for the Integrated and Inclusive City KSA, the proposal was to integrate/merge the content of VS20 into VS2. In addition, the content of VS25 and 26 was integrated/merged and, given that the Municipal Assembly is an established statutory body, reference to the Cross-sectoral Advisory Board was kept (VS25).

These and possibly other considerations will be the subject of a consolidation and legitimisation work with both key actors and local decision-makers until the end of the project (M60).

Critical aspects

Among the critical aspects identified we must emphasise the difficulty in defining objectives and milestones for the medium/long term horizons alongside the enormous challenge posed by this process of urban transformation, namely that of collectively aligning a multitude of initiatives of sectoral nature.

It’s fundamental to us to highlight that in some sectors this transformation can be easier, given that it is a transition that follows the flow of events and does not contradict the deep-rooted habits of a society. The digital transition can be identified as an example, although not without some difficulties.



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On the other hand, sectors such as mobility or the energy transition will bring additional difficulties, as they require, in addition to replacing technology, with considerable economic and financial replacement costs, a behavioural change in society – an example of such being the inversion of current mobility patterns, on the one hand, and, on the other, the collective awareness that a more responsible production and consumption of energy is essential.

Indeed, the foresight exercises, on which the visions oriented to the time horizon of 2050 are based, are rooted on assumptions that require a significant transformation not only at a technological level, but also at an infrastructural and, more importantly, civilizational level.

To that extent, the following aspects are critical: 1) the alignment and empowering of the main stakeholders, in a collaborative and participatory governance model; 2) detailed planning of the main intervention drivers, to be ensured in the short-term horizon, that is, until 2025; 3) the guarantee of economic and financial conditions to support the necessary level of investment and an inclusive transition; 4) the consolidation of a clear, transparent, and effective monitoring system that keeps the community informed about the evolution of its transition effort.

To integrate these results into the activity of the different municipal services and the main stakeholders to be involved, it will be crucial to legitimise the results of this work at the level of those responsible for decision-making. In this sense, it is essential to promote their integration into sectoral planning at the level of the main strategic areas, the negotiation of sectoral commitments for the achievement of the main targets, and the dissemination to the key stakeholders and society in general, aligning it in a collective commitment to its implementation.

Considering the programming of the next framework for the European structural and financing funds, bilateral meetings are already taking place with local officials, with the aim of stabilising the planning of interventions for the next 10 years. It is also planned to hold bilateral meetings with some of the stakeholders involved to deepen some of the identified projects.

Once the programming of all interventions has been stabilised, and the financing and governance model for the transition, as well as the monitoring system, have been clarified, it will be possible to undertake a broad communication and involvement strategy.

Systematic monitoring mechanism (strategic and operational)

The difficulty in accessing data and, above all, data from reliable sources, collected in an interoperable way and with sufficient granularity for the necessary analyses, especially in the field of energy, is a challenge that cuts across all cities.

On the other hand, the lack of regulation does not allow the structuring of a totally transparent, understandable and comparable calculation and monitoring system, especially in terms of calculating the energy balance and emissions (in particular for calculating indicators).



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The first steps for Positive Energy Buildings and Districts are being taken in Portugal and current (formal frame of) regulation is far from helpful in clarifying the concept, a fact that makes this process even more difficult.

The roadmap for carbon neutrality was also decisive in demonstrating how fundamental it is to work this domain and that it needs adjustments. In this context, the goals presented will be subject to a more in-depth analysis, seeking to align as much as possible with what has already been established at national level on this matter.

The approval of a governance model

A transformation process of such dimensions requires the mobilisation of a multiplicity of actors and areas of action. Aligning their intervention plans will only be possible with a good governance model that acts not only at the level of the internal coordination of municipal activity (political and technical), but also in the articulation with external actors, with influence on the municipality's results.

In fact, a transparent, decentralised, integrated and collaborative governance model is the motto of one of the VS, declared in the context of KSA5-Integrated and Inclusive City.

For that it will be crucial, at an internal level, to deepen planning mechanisms and the multisectoral project design and to closely monitor their implementation. On an external level, the definition of a structure/platform for aligning policies will be essential, with the Cross-Sectoral Advisory Board being able to constitute an important body for the design and consolidation of strategies and integrated projects, facilitating the assumption of commitments between partners towards the implementation of the decarbonization and climate adaptation strategy.

Communication Plan

Considering the methodology used, the work carried out and the development and consolidation of the themes, it is understood that the dissemination of results should be carried out in several phases.

Firstly, dissemination should be ensured in a more restricted circle, corresponding to the municipal ecosystem and all involved in the participatory process, in order to technically and politically consolidate the results – legitimise commitments – and subsequently organise an extended communication plan that includes all target audiences decisive for achieving the desired results.

In order to materialise the communication of the results in the more restricted core circle, a communication platform is being designed for sharing the results and deepening the themes/projects worked on in this Roadmap for urban transformation. This platform is intended to serve as the embryo of one of the projects/measures identified in the collaborative sessions, in this case the Cross-Sectoral Advisory Board (KSA5 Integrated and Inclusive City), which responds to the vision of a city based on a transparent, decentralised, integrated and collaborative governance model.

Once all measures/projects are consolidated, as well as the commitments between partners and the desired goals, it is essential to organise them in an integrated communication strategy, directed at the community as a whole.



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3.7 Reykjavík Roadmap

3.7.1 Introduction

This report details the Roadmap for urban transformation in the city of Reykjavík. It elaborates the roles and tasks involved in the process of building this map, the methodological instrumentation, background research and expert/stakeholder engagements going back to preparations for delivering the [Reykjavík City Vision 2050](#). It details our approach to the roadmapping workshop in May 2023, and the participant output which is presented here as strategic actions towards carbon-neutrality in two Key Strategic Areas (KSA): the **future of mobility and transport** and a **sustainable ecosystem for the built environment**. The overall Roadmap for urban transformation is presented as a diagram, the key outcomes per KSA are presented in table format and the milestone achievements up until 2050 are presented in Appendix 8 (section A) to this deliverable.

The choice of KSAs for the city of Reykjavík was not inevitable from the start of the SPARCS project but arrived at over time through a multitude of engagement exercises and status analyses. Onsite and virtual assessments, interviews, co-creation activities, structured consultations and deliberations, underpin the three future visions of *mobility*, *circular economy* and *society*, elaborated in the City Vision 2050 (Apr. 2021), plus 26 project ideas to get there. The *innovation workshop* that followed in May 2021, comprised of discussions and deliberations to reduce the 26 project ideas to 10, and vote on the top KSAs to follow (see [Implementation Plan, ch.9](#)). It transpired that the innovation workshop was strongly suggestive of the areas of practice that ought to have top priority in order to achieve the City's carbon-neutrality goals.

In January 2023, a memo was issued, titled, [Transposing the Reykjavík City Vision 2050 \(Annex 3\)](#), explaining the shift that had already occurred in the City's contributions to SPARCS, i.e., to align the KSAs and the City's stated top priorities. In short, the resulting KSAs refer to the practices that produce by far the largest amounts of GHG emissions, while being the most complicated in delivering social and cultural change, hence, presenting the authorities and a whole range of societal actors with persistent systemic challenges.

Roadmapping for urban transformation, as presented here, illustrates the City's commitment to SPARCS in framing the KSAs and the steps to deliver on them. It further illustrates the City's commitment, that the roadmapping workshop is framed to get at the most pressing challenges and concerns, applying a conceptual-analytic map for which to organise the combination of key measures, strategies, goals and timescales for city districts and the city as a whole. Accordingly, the work presented here will serve as a guiding document, defining the drivers of change and the actions that will gradually progress the City's development towards the desired future.

Sylva Lam served as Task Force leader and Principal Investigator in preparing and orchestrating the roadmapping exercise. She prepared as well and convened the roadmapping workshop, assisted by Krístrún Th. Gunnarsdóttir, workshop observer and rapporteur.



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3.7.2 Overall roadmap results

Reykjavik's Roadmap for urban transformation

In the 2-hour workshop through “backcasting” methodology in World Café format, the 17 attendees and SPARCS task force evaluated 32 pre-identified current policies and projects and mapped out the relevancy to the Vision Statements (VS) they selected to focus on (Table 18). 23 relevant projects were chosen for further discussion and completed their macro milestones for 2025, 2030 and 2040. In addition, 6 extra projects which would have measurable impact to the 2 KSAs, with other 15 Opportunities, Obstacles, Wildcards and Trend were identified. (See section 3.7.3 Adopted methodology and procedures, for more details).

Table 18. Proposed KSA and main VS for the Roadmap - Reykjavík

KSA	Main Vision Statements (VS)
KSA1. Future of Mobility and Transport	<p>VS1. Transportation is powered solely by local sustainable energy sources.</p> <p>VS2. It is easy to plan a trip where different means of transport are used with comprehensive transport technology solutions.</p> <p>VS3. Transport in Reykjavik increases the quality of living in the city and the public health of citizens.</p>
KSA2. Sustainable Ecosystem of the Built Environment	<p>VS1. Reykjavík is a diverse and multicultural society</p> <p>VS2. Reykjavík is a socially equal society based on a strong education and welfare and health system</p> <p>VS3. There is a good supply of stores with environmentally friendly and unpackaged products.</p>

The Milestones and Measures, which later are categorized into 4 categories during analysis stage, ensure an effective way for project implementation and upscaling at intermediate stages in 2025, 2030 and 2040, and to reach our targeted goals as reflected in the chosen VS in the desired future in 2050. The interrelations between some of the Measures within the KSA and cross-KSAs, are mapped out and reflected in the Overall Roadmap. This offers a clear visual understanding, and potentially guidance, on how the city of Reykjavík can move towards our carbon neutral goals in systematic way by closely monitoring a number of key macro-projects, and subsequently their “sub-projects”. Details of individual KSA are listed below and in Section “Key outcomes per KSA”.

KSA1: Future of Mobility and Transport

In 2022, the top figure in GHG emissions in Reykjavík continued to be the transportation sector, a total of 398,466 tCO₂ eq. (see [interactive data chart 2016-2022](#)), private cars emitting by far the most. In 2019 (pre-covid), the use of private cars accounted for 70% of all trips in the city and there have been only vague signs so far of post-covid reduction. The dependency on private vehicles, limited public transport services and an automobile-oriented infrastructure have been major obstacles in shifting people’s behaviour towards more active and green choices, including e-mobilities, sharing, and multi-modal mobility.



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The city of Reykjavík is committed to tackling this issue through policies and strategic actions such as the Reykjavík Green Deal, Climate Action Plan and the Borgarlínan City Line in coordination with the Icelandic government and neighbouring municipalities. That said, rapid rise in the popularity of micro e-mobiles and shared mobility options, serviced by the private sector, is playing a significant role in shifting mobility behaviours amongst publics. Also, the launch of a bus ticketing app with route mapping and live tracking of buses and e-scooter availability, is part of an ongoing development of MaaS for the City.

The outcomes in this KSA represent the work of workshop participants in forecasting milestone developments toward climate-neutrality goals in transportation and mobility. This work includes novel additions, e.g., green connection between Keflavík Int'l Airport and Reykjavík which constitutes an action of its own (1.2.5), also pushing up the complete transitioning of public transport to renewables (1.1.1), and adding AC-Charge hubs for tourists as part of the charging infrastructure (1.1.2). This work is also complemented with readily available updates on the progress of some of the public projects and partnerships that are directly supporting the ongoing developments. This information is filled in by the local team.

KSA2: Sustainable Ecosystem for the Built Environment

Reykjavík is transforming rapidly to cope with a fast-growing economy and major influx of migrant workers, students, experts and entrepreneurs. The rising number of residents has led to shortage in housing, educational and communal facilities. These demographic shifts add to the existing challenges in creating sustainable and inclusive communities across the city, with high living standards for all people. Public-private partnerships have been fostered to cope with the growing demand to refurbish old properties and build new ones. However, GHG emissions are second highest in the construction industries and the city of Reykjavík has implemented strategies at different scales to tackle that: 1. Policy on [15-minute neighbourhoods](#) and a densification of the built environment, presented in [Reykjavík's Municipal \(Master\) Plan 2040](#); 2. The [Green Bond Framework](#) to help finance green housing developments; 3. Requiring Life Cycle Assessments (LCA) for individual building sites; 4. Incentives to deploy greener machinery and more effective waste management at construction sites; and, 5. Improved waste and energy management in households.

The outcomes in this KSA represents the work of workshop participants in forecasting milestone developments toward climate-neutrality goals in the (re-)construction industries. This work is mostly confirming of actions and targets already monitored publicly. It includes as well novel additions, especially in reminding of the importance of “walkability” and its relationship with 15-minute neighbourhood (re-)designs and the densification of the built environment, albeit, along the new City Line. This work is also complemented with readily available updates on the progress of some of the public projects and partnerships that directly support the ongoing developments, filled in by the local team.



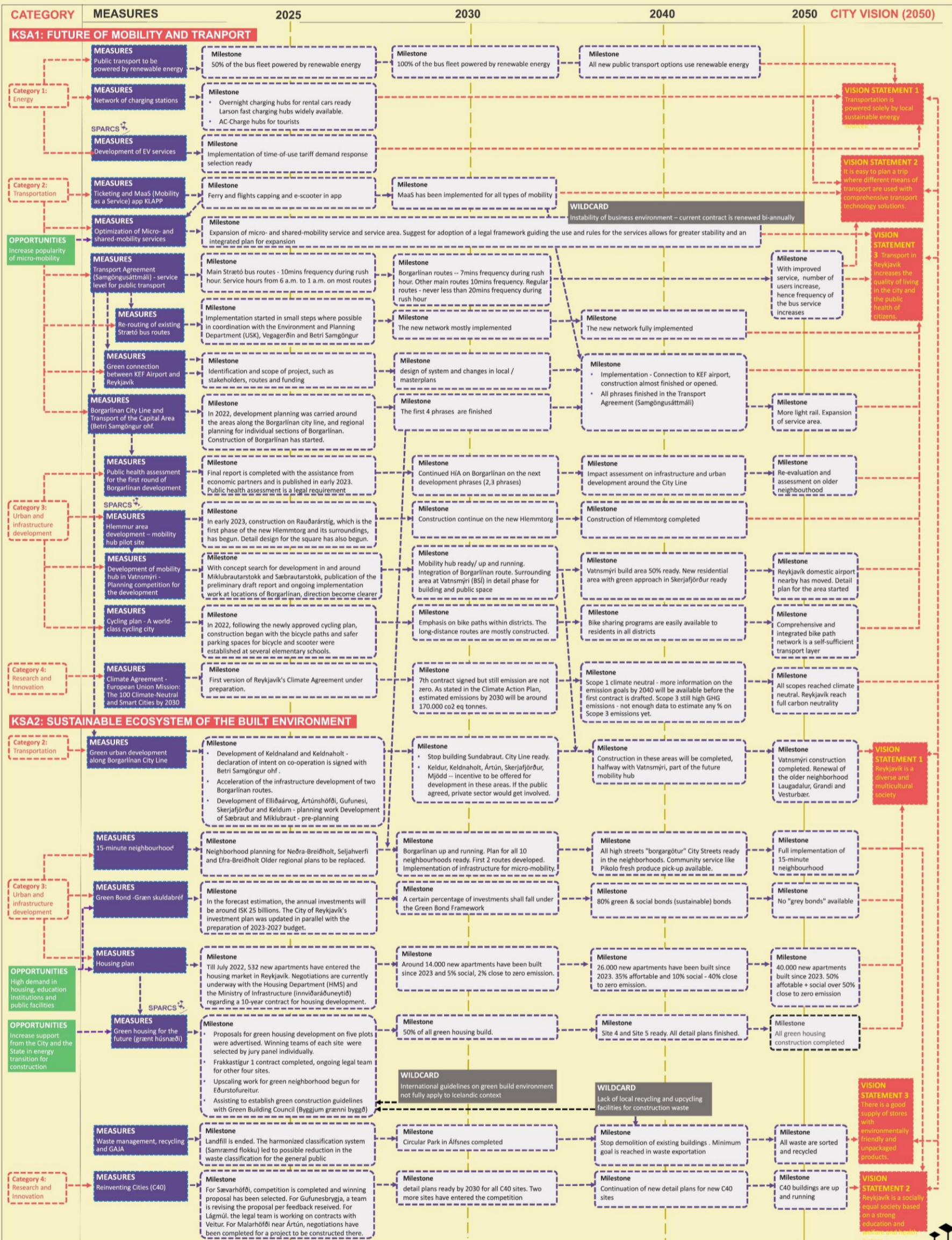
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City of Reykjavík | Overall Roadmap

ROADMAP FOR URBAN TRANSFORMATION



Key outcomes per KSA

The table below captures the internal investigations at the city of Reykjavík, with input from experts in both City and State administrations, stakeholder CSOs and enterprises (Table 19). In addition to that, there are a few novel ideas, which include projects, Wildcards and Obstacles, from participants in our roadmapping workshop, which were analysed, categorized into relevant categories, and their inter-relationship with other pre-identified Measures were established.

As we explain in subsection Methodology for the Roadmapping Process, in section 3.7.2, the conceptual-analytic mapping is used for all output for consistency of the ordering of practice-driven topics. Workshop attendees and SPARCS task force evaluated the relevancy of 32 pre-identified Measures; 23 of them were chosen for continuous discussion and intermediate milestones were mapped out. The overall description and analysis of the relevant Measures is summarized in the table below.

It is important to highlight the co-relations and inter-relations of measures under individual KSA. Several measures under both KSAs are related to the new City Line, such as the development of new neighbourhoods and mobility hubs, which is a reflection of the impact the SPARCS project will continue to have in the coming decades to the city. The rise of population and tourism also become the secondary catalyst in shaping the sustainability measures and infrastructure, such as EV charging network and massive construction for residential purpose. This complex relationship is reflected in the Overall Roadmap, which is crucial for policy-makers and key stakeholders to be aware of during the policy-making process, strategic planning or project development. Here are the observations on the Measures the attendees chose to focus on, based on the following categories:

- Category 1: Energy
- Category 2: Transportation
- Category 3: Urban and Infrastructure Development
- Category 4: Research and Innovation.

KSA1: Future of Mobility and Transport

- Each category contributes to the final goals (that is, Vision Statement 2050) fairly evenly, except for Category 4 – Innovation and Research, as the city of Reykjavík is still developing the framework for international collaboration in research.
- For the measures under Cat. 1 – Energy, most of the measures are R&D projects and solutions related to charging service and user behaviour for EV.
- For measures under Cat.2 – Transport, most of the measures fall under the Transport Agreement; other are actions taken / to be taken in response to the new City Line and the rising popularity in micro- and shared-mobility.
- For measures under Cat. 3 – Urban and Infrastructure Development, most of the measures are related to urban densification and new neighbourhood development,



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which is part of the ripple effect of the City Line, where it shall connect these new neighbourhoods and new mobility hubs.

- For measures under Cat. 4, there are large-scale EC-funded project partnerships in research and case trialling but also implementation actions in reference to new technologies and guidelines for the aforementioned areas.

KSA2: Sustainable Ecosystem of the Built Environment

- Majority of the measures contribute to the final goals (i.e., Vision Statement 2050) fall under Category 3 – Urban and Infrastructure Development.
- For Cat. 1 – Energy, the measure is related to development of new energy resources, which may contribute to the greener practice in the construction sector in the future, particularly with the trend of energy transition in greener machineries.
- For Cat.2 – Transport, the identified measure is directly related to the development of the new City Line.
- For measures under Cat. 3 – Urban and Infrastructure Development, most of the measures are the response to urban densification and huge demand in housing, thus the focus in the residential development is seen to be a mean to tackle the emission problem within the built environment sector. Most of the development plots will be within the City Line service areas.
- For measures under Cat. 4, there are large-scale EC-funded project partnerships in research and case trialling but also implementation actions in reference to new technologies and guidelines for the aforementioned areas.

Table 19. Key outcomes table – Reykjavík

Key outcomes for KSA1: Future of Mobility and Transport		
ID	Name (type)	Description
1.1.1	Public transport to be powered by renewable energy (type: strategy)	Development and implementation of emission free public transport system. Category: energy
1.1.2	Network of charging stations (type: solution)	ON Power envisions an increase in charging stations where there is demand and for users that cannot charge in their home, such as overnight charging for tourists. The network of fast/rapid chargers will be strengthened with larger hubs with more connectors. Within the charging service market there are many different players, and the environment is developing fast. It can be foreseen that the transition to EVs will continue and answer to market demand. It is yet likely that there will be a consolidation within the service provider group and services better targeted to the EV user group. <u>LINK to OR / Veitur / ON report</u> Category: energy
1.1.3	Development of EV services	With the charging subscription model of ON power, the possibility of large-scale direct load control of charging stations is possible.



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Key outcomes for KSA1: Future of Mobility and Transport		
ID	Name (type)	Description
	(type: solution, innovation)	<p>This is one type of demand response and has been researched within the Charging Better project.</p> <p>To support the uptake of EVs in Reykjavik and minimize their impact on the distribution network, demand response can be used. Different demand response strategies for EVs are being researched in the SPARCS Charging Better project. The results indicate that the simultaneous load factor from EVs can be reduced greatly, meaning that the peak from EV charging can be lowered. This increases the utilization factor of the distribution grid and reduces infrastructure investment cost. Different types of demand response strategies are being considered, both simple changes to the tariff structure as well as direct control of charging stations of customers.</p> <p><u>LINK to OR / Veitur / ON report</u> Category: energy</p>
1.1.4	Renewable synthetic fuels (type: research, innovation)	<p>Renewable synthetic fuels will play an important role in the energy transition for aviation and maritime transport sectors.</p> <p><u>LINK to OR / Veitur / ON report</u> Category: energy</p>
1.2.1	Transport Agreement (Samgöngusáttmáli) - service level for public transport (type: strategy)	<p>Government (city and state) commit to certain levels and quality of service (frequency, service hours, flexibility).</p> <p>Category: transportation</p>
1.2.2	Re-routing of existing Strætó bus routes (type: project)	<p>Strætó is working on adapting their routes in coordination with Borgarlínan. The new route network, which is currently under construction, is designed in such a way that both city line buses and other buses can drive out of the special space and travel part of the route in mixed traffic. This means greater flexibility and shorter journey times for passengers.</p> <p>See below on the route system. <u>https://eu.remix.com/map/92f93e4b?latlng=64.10282,-21.89042,10.291</u> Category: transportation</p>
1.2.3	Ticketing and MaaS (Mobility as a Service) app KLAPP (type: project, innovation)	<p>Strætó developed their new ticketing app, Klappir, and continue to implement new features to it, with the objective to become a multi-modal mobility platform (MaaS). Klappir is an account-based ticketing system that gives access to Strætó buses in the capital area. This type of system is known in public transport around the world, where customers use a personal web access to top up their bus cards or apps. With the Klappir app, you can use your smartphone to buy single tickets or period cards for Strætó in the capital area. When an app fare is activated, a code appears on the screen of the smartphone. This code is scanned on board the bus. Single ticket in the app is valid for 75 minutes after it is activated. Implemented new data displayed in the app, including scooter locations and air quality index.</p>



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Key outcomes for KSA1: Future of Mobility and Transport		
ID	Name (type)	Description
		Category: transportation
1.2.4	Optimization of Micro- and shared-mobility services (type: strategy)	<p>Micro-mobility is the most popular modes of mobility in Reykjavík. The leading service providers, HOPP and ZOLO, are improving and upgrading their services, including increase coverage areas in the capital region, expanding services to car rental / sharing, collaboration with private developers and more. Current contract is renewed bi-annually, causing instability to the business environment.</p> <p>Major service provider, HOPP, has the plan to provide / give Reykjavík residents more eco-friendly options to commute, with the terms where the City would offer more stability for their service development. Their demands include:</p> <ul style="list-style-type: none"> • longer contracts. • better infrastructure, for sidewalks and bicycle paths, and parking spots. • lower speed limit for streets in Reykjavík, current limit is 30km/h. • lower parking fee for shared cars. <p>Category: transportation</p>
1.2.5	Green connection between KEF Airport and Reykjavík (type: project)	<p>A green connection is to be established between Keflavík Airport and the city of Reykjavík. A green connection is a transport system that runs on local green energy, such as trains or electric buses</p> <p>Category: transportation</p>
1.2.6	Borgarlínan City Line and Transport For The Capital Area (Betri Samgöngur ohf.) (type: strategy, solution)	<p>The city line is a high-quality public transport system for the entire capital area. Together with Strætó, the public bus company, it will provide good connections with the neighbouring municipalities. It will mostly run along in dedicated road with priority at intersections, which increases both reliability and efficiency.</p> <p>Category: transportation</p>
1.3.1	Public health assessment for the first round of Borgarlínan development (type: strategy, project)	<p>Evaluation of the first round of the Borgarlínan City Line project within Reykjavík. The project is carried out in collaboration with Better Transport (Betri Samgöngur ohf.) with the objective to evaluate the impact of public health factors. Workshops have been conducted.</p> <p>Category: urban and infrastructure development</p>
1.3.2	Hlemmur area development (SPARCS project) (type: project, solution)	<p>Hlemmur and the surrounding streets will be improved and elevated in the coming years as private cars will be prohibited. The aim is to make the new square favourable for cycling and pedestrians.</p> <p>Category: urban and infrastructure development</p>



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Key outcomes for KSA1: Future of Mobility and Transport		
ID	Name (type)	Description
1.3.3	Cycling plan - A world-class cycling city (type: strategy)	<p>The revised cycling plan aims to make Reykjavík a world-class cycling city. The objective is to boost the use of cycling in the journeys made within the city. Population in the capital area has increased rapidly. The number of trips in the city has also increased, with each resident makes an average of four trips per day. Cycling is an economical, healthy and fun way to travel. A better cycling city increases the quality of life for all residents and visitors. Air quality will be better, residents will be healthier and car traffic delays will be reduced.</p> <p>Category: urban and infrastructure development</p>
1.3.4	Development of mobility hub in Vatnsmýri - Planning competition for the development (type: strategy)	<p>Planning competition for the development of a mobility hub in Vatnsmýri, which will be the main interchange for public transport within the capital area, Borgarlína and Strætó, as well as the starting and ending point for coach buses outside the capital area. Ideas about the area's main priorities in terms of transportation have not been firmly established till now. However, with the concept search for development in and around <u>Miklubrautarstokkur</u> and <u>Sæbrautarstokkur</u> underground infrastructure, the publication of a preliminary draft report and ongoing implementation work at the location of Borgarlínan, the direction has become clearer.</p> <p>Category: urban and infrastructure development</p>
1.4.1	EC-funded Project AMIGOS, with focus on Hlemmtorg multi-modal mobility hub and a Safety Improvement (type: research, innovation, solution)	<p>The city of Reykjavík and its partners recently received a four-year grant through the European Union's Horizon Europe framework program. The project looks at improving the safety and experience of different road users around transport hubs. Transformations at Hlemmur and the surrounding area in the coming years will be the main subject of Reykjavík's contribution to the project.</p> <p>The main objectives and implementation of AMIGOS will support the action plans of the Green Deal on carbon neutrality, green transport, 15-minute neighbourhoods and focus on public health, inclusive society, democratic participation, digital travel and user-oriented services. It will also support the city's welfare and democracy policies in that the area around Hlemmur will be examined and evaluated regarding accessibility issues, safety and health effects, and will be purposefully based on the participation of economic partners in co-creation workshops.</p> <p>Category: research and innovation</p>
1.4.2/ 2.4.2	Climate Agreement - EU Mission: Climate-Neutral and Smart Cities (type: strategy, solution)	<p>The city of Reykjavík has been selected to participate in this program with the objectives of the participating 112 cities to reach carbon-neutral and smart cities goal by 2030. There will be research and innovation to ensure that these cities act as experimentation and innovation hubs to enable all European cities to follow suit by 2050. There will be a review next year (2024) to look at the previous goals in preparation for the Climate Agreement, which is a prerequisite for participation in the project. The previous goal of carbon neutrality in 2040 will be revised and accelerated to 2030, at least within the definition of BASIC+.</p>



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Key outcomes for KSA1: Future of Mobility and Transport		
ID	Name (type)	Description
		<p>In 2022, Reykjavík received customized remote training, meetings and feedback from the NetZeroCities organization, which manages the project in collaboration with the Executive Boards of the European Union and its affiliated organizations Climate-KIC, Eurocities and ICLEI.</p> <p>In August 2022, a steering committee was established, with all the leaders of the city government parties. The task of the steering group is to lead the strategy regarding Reykjavík's participation in this project.</p> <p>The first version of Reykjavík's Climate Agreement is under preparation. It is required that such an agreement be drawn up in broad cooperation with the European Union, the Icelandic state, other local authorities, private parties, non-governmental organizations and detailed consultation with residents.</p> <p>Category: research and innovation</p>
Key outcomes for KSA2 Sustainable Ecosystem of the Built Environment		
ID	Name (type)	Description
2.1.1	Other renewable energy sources (type: innovation)	<p>To meet the demands in an increasingly versatile and fluctuating energy market, ON Power seeks further development in other renewable energy resources. ON Power owns and operates a small-scale hydro power plant named Andakílsárvirkjun (8 MW). The possibility of wind power and energy storage opportunities are actively being pursued and a couple of interesting areas being investigated. These projects are though only in exploration phase and too early to say when they could commence.</p> <p>Link to OR / Veitur / ON report</p> <p>Category: energy</p>
2.2.1	Green urban development along Borgarlínan City Line (type: strategy, solution)	<p>The city's development will all be within its defined growth limits, and 80% of residential development will be within a comfortable distance from Borgarlínan City Line.</p> <p>Category: transportation</p>
2.3.1	15-minute neighbourhood (type: strategy)	<p>Through the neighbourhood plan (hverfissskipulag), renewal of neighbourhood centres and investment in infrastructure, the city's neighbourhoods will be more walkable with access to green areas, outdoor activities and services guaranteed to be within a 15-minute walking or cycling distance. The goals of the neighbourhood plan are that the green neighbourhoods in the city will be more sustainable and ecological than before, the number of apartments will increase and it will be more convenient for homeowners to make changes to their properties.</p> <p>Category: urban and infrastructure development</p>
2.3.2	Green Bond (Græn skuldabréf)	<p>The Green Bond Framework is the city's investment initiative, where green investments and projects are being financed by issuing green bonds. The selection criteria are aligned with ICMA's Green Bond Principles and the Position Paper on Green Bonds issued by the</p>



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Key outcomes for KSA2 Sustainable Ecosystem of the Built Environment		
ID	Name (type)	Description
	(type: project, solution)	Nordic Public Sector Issuers. Eligible projects are projects that assist the city of Reykjavík in the transition to a low carbon economy and align with its long-term climate policy. Eligible projects have quantifiable environmental benefits, with environmental mitigation and/or adaptation potentials. Projects which lead to increased fossil fuel use cannot be financed using proceeds from bond issuances that fall under this Green Bond Framework. Category: urban and infrastructure development
2.3.3	Housing plan (Húsnæðismálum) (type: strategy, project)	The housing plan defines the main construction areas in Reykjavík, land allocation, financial contributions to housing, cooperation with housing associations (húsnæðisfélög , that make claims to non- or low-profit housing construction), sales plans for social housing and the resources dedicated for the city's social housing. In 2022, the masterplan has allocated plots for residential use with an estimation of 1,028 apartments; which include 400 apartments for the city's affordable housing project (for young people and first-time buyers), 260 apartments for housing associations (húsnæðisfélög) and plots for less than 367 apartments will be sold by bidding. The housing plan is updated annually. Category: urban and infrastructure development
2.3.4	Green housing for the future (grænt húsnæði) (SPARCS project) (type: project, solution)	The project involves five plots to support the development of greener buildings that reduce the negative impact to the climate and environment. The project is part of the Reykjavík Green Deal and aligns with the municipal plan and climate policy, in order to achieve sustainability in economic, social and environmental development. The plots in discussion are: <ul style="list-style-type: none"> • Site 1 – Breiðholt – Arnarbakki 6. • Site 2 – Breiðholt – Völvufell 13-23. • Site 3 – Breiðholt – Völvufell 43. • Site 4 – Miðborg – Frakkastígur 1. • Site 5 – Hlíðar – Veðurstofureitur . Category: urban and infrastructure development
2.3.5	Affordable housing and first-time buyer (type: project)	New solutions and ideas on housing matters are important to encourage innovation and progress in housing development. With this project, the city of Reykjavík is asking for ideas to increase the supply of affordable housing for young people and first-time buyers. The plots in discussion are in Úlfarsárdalur, in Kjalarnes, in Gufunes, in Elliðaárvogur (Bryggjuhverfi), at Stýrimannaskólinn, at Veðurstofureitur and in Skerjafjörður. Category: urban and infrastructure development
2.3.6	Housing for disabled residents (type: project)	Revision of the development plan for housing for disabled people has been made. According to the law, the city of Reykjavík must ensure suitable housing for disabled people. Housing for disabled people refers to housing resources in the sense of regulation no. 370/2016 on housing resources for disabled people, cf. Paragraph 3 Article 9 Act no. 39/2018 on services for disabled people with long-term



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Key outcomes for KSA2 Sustainable Ecosystem of the Built Environment		
ID	Name (type)	Description
		<p>support needs. It is a residential property that has been made accessible for a specific use or defined specifically for a specific group of disabled people.</p> <p>Until 2028, the total cost is estimated to be ISK 3,688 million, with the initial costs as of the price level of 2022. In addition to the revised plan, the group proposed the establishment of a joint consultation group with representatives from the Division of welfare and the Division of environment and planning, the Office of the Mayor and CEO and Félagsbústaðir to select locations for housing for persons in vulnerable situations and define the building plot designs.</p> <p>Category: urban and infrastructure development</p>
2.3.7	Waste management, recycling and GAJA (type: strategy, project)	<p>GAJA is a project under SORPA (the community association of waste collection/processing), already operating an industrial-scale natural systems solution for biowaste, producing compost and methene fuel from organic waste. This operation will scale to include all biowaste from households by end of 2023.</p> <p>Category: urban and infrastructure development</p>
2.4.1	Reinventing Cities (C40) (type: project)	<p>Reinventing Cities is an international competition that calls for outstanding ideas for development projects that are related to urban development, climate and environmental issues. The competition encourages ideas that demonstrate creative thinking and a bright vision of the future to develop a greener and more sustainable urban environment. The city of Reykjavík offered two sites for the competition in 2020, Sævarhöfði 31 and Gufunesbryggja. In 2018, lots at Lágmúli and Malarhöfði were put out for auction.</p> <p>Category: research and innovation</p>
2.4.2/ 1.4.2	Climate Agreement - European Union Mission: The 100 Climate-Neutral and Smart Cities by 2030 (type: strategy, solution)	<p>The city of Reykjavík has been selected to participate in this program with the objectives of the participating 112 cities to reach carbon-neutral and smart cities goal by 2030. There will be research and innovation and to ensure that these cities act as experimentation and innovation hubs to enable all European cities to follow suit by 2050. There will be a review next year (2024) to look at the previous goals in preparation for the Climate Agreement, which is a prerequisite for participation in the project. The previous goal of carbon neutrality in 2040 will be revised and accelerated to 2030. at least within the definition of BASIC+.</p> <p>In 2022, Reykjavík received customized remote training, meetings and feedback from the NetZeroCities organization, which manages the project in collaboration with the Executive Boards of the European Union and its affiliated organizations Climate-KIC, Eurocities and ICLEI.</p> <p>In August 2022, a steering committee was established, with all the leaders of the city government parties. The task of the steering group is to lead the strategy regarding Reykjavík's participation in this project.</p> <p>The first version of Reykjavík's Climate Agreement under preparation. It is required that such an agreement be drawn up in broad cooperation with the European Union, the Icelandic state,</p>



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Key outcomes for KSA2 Sustainable Ecosystem of the Built Environment		
ID	Name (type)	Description
		other local authorities, private parties, non-governmental organizations and detailed consultation with residents. Category: research and innovation

3.7.3 Adopted methodology and procedures

The approach to method and procedures leading up to and including the roadmapping workshop itself, was attended through multiple steps and stages. A task force was gathered for consultations on how to frame the overall roadmapping exercise. Local strategic documents and datasets were consulted, the City Vision 2050 was transposed onto target KSAs, the workshop was organised, and participants were recruited. Consequently, the resource base has continued to grow as the local team conducts periodic status analyses. Together, this work has contributed to the structuring of the workshop and the analytical approach to the KSAs, the results of which are extrapolated to deliver a roadmap that leads to the 2050 City Vision.

Methodology for the roadmapping process

The task force: The reasoning behind the task force was to bring together experts from within the administrative Divisions and Offices, from relevant CSOs and State agencies. They would be called upon for consultation on the development areas in question, to identify the measures to use in addressing the City Vision 2050 and building a roadmap from there. Originally, it looked as if the membership would grow to include 40-50 persons with the intention of involving them all in multiple substantial work sessions to discuss the issues and, eventually, frame the workshop in accordance with methodological instructions from our SPARCS colleagues at the [Sociedade Portuguesa de Inovação](#) (SPI). However, City and State administrations in Iceland are sparsely populated, facing persistent work overload, not at all affording the generous time allocations the suggested approach would have warranted.

That said, Icelandic civil servants tend to be rather adept at selecting if, when and how to use human and technical resources to achieve maximum results at a minimum cost in time and effort. The task force member list was limited to 15 experts (see list of members, in Appendix 8 – section J.), engaged in two rather brief meetings that were structurally prepared in detail by the task force leader who organised as well one-on-one open conversations with about 20 experts over roughly 10 months. Furthermore, a PR staff member in the Urban and Economics Development team contributed expertise in the step-by-step structuring of the workshop itself – a fresh pair of eyes with no obvious investment in the material contents or outcomes.

Approaching the City Vision 2050 and Reykjavík’s strategic documents: After delivering the Reykjavík City Vision 2050 and completing the follow-up innovation workshop in May 2021, the local team began re-evaluating some of conceptual bases and reference materials supporting the early engagement exercises. These status analyses take a more



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focused view of publicly available data on GHG emissions and begin exploring the complex constitution of industrial practices and private behaviours responsible for most of the emissions in the Capital Region. Accordingly, the team began exploring the interrelations of technological, practice-based and sociocultural entrenchments, aiming at material production, (re-)construction cycles and waste management, as well as the wider implications of emphasising a transitioning of the transportation fleet, potentially, at a cost of other developments that could shift the culture of mobility in more desired directions.

Which KSAs to pursue as a matter of urgency was already implied in the output of the innovation workshop in 2021, but a closer examination brought home the complications therein, considering the systemic barriers entrenched in these domains of practice, slowing down or preventing social and cultural change. This is the reason for transposing the original City Vision onto the KSA targets presented in the Jan. 2023 memorandum (see Appendix 8, section E.).

Stakeholder participation: The multi-stakeholder approach to recruitment and preparations for the workshop brought together the expertise and experiences of 17 professionals, business owners, public and 3rd sector parties. Workshop participants were identified via snowballing through the relevant institutions, organisations, and enterprise, seeking the involvement of people in positions of authority and/or in charge of strategic actions relating to the roadmapping topics (Appendix 8, section C. List of participants).

Resources: The project phase leading up to the innovation workshop in 2021, relied almost exclusively on pre-covid policies, strategies, action plans and available data. Writing up the Implementation Plan for the City brought this starkly into the foreground when the team was tasked to update every dataset across the profiles of economy, GHG, energy, mobility, waste management and smart city developments.

Datasets are updated periodically, e.g., the [GHG Emissions 2016-2022 \(Interactive Chart\)](#) and the official interactive data services of [Statistics Iceland](#) and [Registers Iceland](#). New policies, revised policies, revised strategies and new action plans also became part of our reference and resource listings, there amongst the [Reykjavík Green Deal](#), the [Reykjavík Municipal \(Master\) Plan 2040 \(2022\)](#), [Reykjavík's Climate Action Plan 2021-2025](#), a [Climate Agreement \(EU Mission for climate-neutral and smart cities\)](#), [City Line developments](#) w/forward-looking [Public Health Assessment](#), the [Transport Agreement](#) for the Capital Region, [Hlemmur area developments](#) (prototyping future mobility hubs) and updated planning for [Housing Developments](#), including competitive tenders for [Green Housing](#).

Other types of resources include the growing networks of expertise and cooperation, broader and more innovative consultations and a favourable political climate. For example, innovations in contracting for green housing developments involve legal expertise; thus, are widening the approach to manage complex interdependencies in the allocation of land and in construction cycles. An action plan for engaging international partnerships in grant writing and project design is funding research and innovation to advance Green Deal priorities and new task forces are commanded to coordinate work contributions that can further Green Deal objectives. All of these resources contribute to



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a growing knowledge base either directly or indirectly and they have shaped the direction of this roadmapping exercise.

Constructing the roadmap: Ideas, concerns, critique and measures to act, reported by participants in our workshop, complement and shape the overall input to the roadmapping exercise for the city of Reykjavík. All input is topically ordered into four conceptual and practice-driven categories, each of which is also addressed as actions (research, innovation, solution, strategy and ‘project’) the City engages. The categories are:

- Energy
- Transportation
- Urban and Infrastructure Development
- Research and innovation

This is the conceptual-analytic mapping created in preparations for building the roadmap. The “Energy” category focusses on resource utilisation, usage, user behaviour, and energy production. “Transportation” centres on public transportation networks, accessible services, micro mobility, sharing solutions, active lifestyles and MaaS. “Urban and infrastructure” centres on the built environment, e.g., the densification of neighbourhoods, the City Line, construction machinery, waste management, recycling/upcycling, financial incentives and green solutions more generally. Lastly, “Research and innovation” centres on the benefits of engaging international partnerships around grant applications and project designs that cater to the European and Icelandic Green Deals in matters of climate adaptation and the environment.

Roadmapping Workshop Agenda

The workshop itself comprised of an introductory session and three work sessions (Table 20). First, the SPARCS project and the orchestration of the event were introduced, and participants each said a few words about themselves. Thereafter, the first work session started in which individual ideas from the transposed City Vision were presented, discussed and voted on, followed by two sessions of interactive opinion exchange in line with **the World Café** (qualitative) participatory method.

Table 20. The temporal ordering of the workshop – Reykjavík

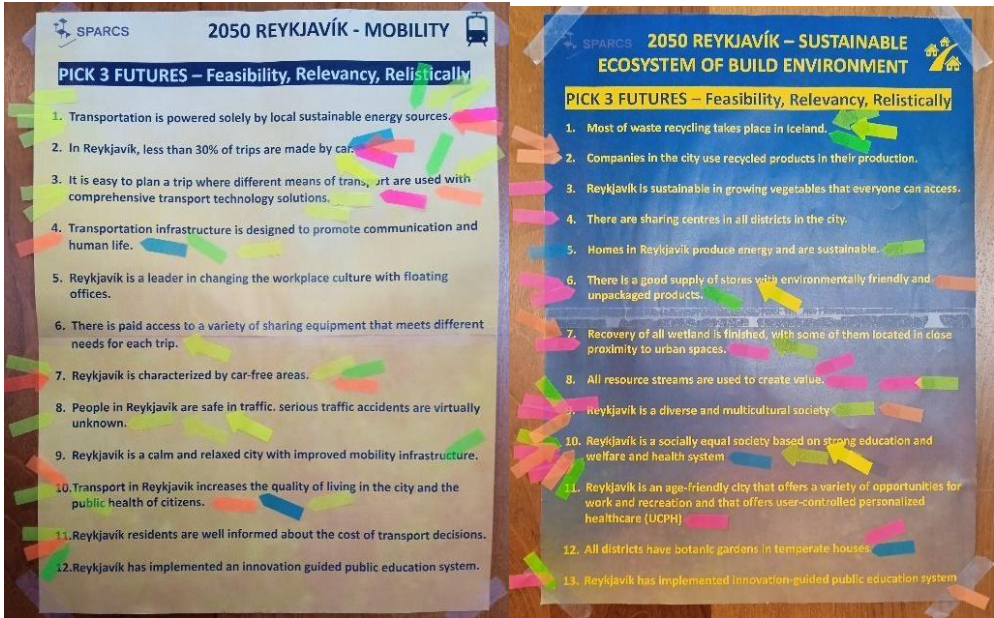
Stage	Content	Time
Introductory session	Introducing the orchestration of the Workshop, explaining the concept of “Reverse Brainstorming”, i.e., back-casting: from the future to the present	5 mins
	Introducing the SPARCS project and the contributions of Reykjavík as a partner, explaining the two areas of development <ol style="list-style-type: none"> 1. Mobility and Transport 2. Sustainable Ecosystem of the Built Environment 	5 mins
	Going around the table for self-introductions	10 mins



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Time travels – World Café work sessions	i) The FUTURE – discussing the City Vision 2050 statements, anchoring them in the present with a view on how to get there	15 mins	
	<ul style="list-style-type: none"> • Voting – Introducing 2050 Reykjavík! Vote your TOP 3 Visions 	5 mins	
			
	BREAK		5 mins
	(ii) The HERE and NOW – dividing into two groups according to a World Café arrangement	15 mins	
<ul style="list-style-type: none"> • Discussing the top listed strategies and projects • Working the card decks • Identifying the macro-structural milestones in order to build the two roadmaps towards the 2050 vision. 	15 mins		
(iii) Back to the FUTURE – working the wild cards, the opportunities and obstacles	15 mins		
<ul style="list-style-type: none"> • You are the fortune-teller! What do you see? What would you do? • What are the necessary resources, where are the key opportunities, what are the challenges? 	15 mins		
Closing	Summing up	5 min	

The **World Café** method is primarily a *technique of facilitation*, it is flexible, simple and effective in engaging people in open and informal dialogue (Löhr et al, 2020¹⁵). ‘World Café’ is also a metaphor of “*naturally occurring networks of conversation and social learning through which we access collective intelligence, create new knowledge, and bring*

¹⁵ Löhr, K., Weinhardt, M. and Sieber, S. (2020). The “World Café” as a Participatory Method for Collecting Qualitative Data. *International Journal of Qualitative Methods* 19: 1-15. <https://doi.org/10.1177/1609406920916976>



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forth desired futures."¹⁶ This method is often used to facilitate the exchange of opinions and ideas across very different backgrounds, knowledge domains, expertise and experience,¹⁷ the main reason being that it promotes respectful relations and equality, and it can be adapted to meet a wide variety of needs, specific to context, purpose and circumstance. In short, the **World Café** method refers to the "*café ambience that is created in order to facilitate informal conversation, representing a neutral public space where people feel free to engage with each other.*" (Löhr, et al, 2020, cf. Brown & Isaacs, 2005¹⁸).

Brainstorming and backcasting, suggested by SPARCS partner SPI in the methodological Guidelines for the roadmapping process, is commonly used in combination with the *World Café* participatory method, often involving voting, while primarily used as an icebreaker in opening sessions to encourage open dialogue and creative input. The local team is well versed in a variety of participatory methods, e.g., for design development. The team has also long-standing experience eliciting creative input in ways that are akin to gamification with the aim of encouraging participants to apply their expertise and experiences from alternate perspectives, potentially identifying new ideas, critique and concerns that otherwise might have been overlooked.

That said, the overall methodological approach to the workshop becomes predictive of certain outcomes. For example, the organisers cannot but anticipate beforehand which areas of expertise and experience their participants belong to and one can argue that a *quality and texture of participation* is already prefigured to some extent. Also, using statements from the City Vision 2050 as icebreakers to elicit initial responses, and to build further interactions upon the votes on those statements, is premised on the organisers' understanding of participants' capabilities and expectations—on how their contributions can be relevant and useful to a roadmapping exercise. This and other prescriptive characteristics of the approach are affording of procedures that keep in check the directions a workshop *can* take, while the output is still very much of practical relevance to the task at hand, i.e., to extrapolate the building blocks of a roadmap.

3.7.4 Lessons learned and next steps

The roadmap, particularly for the thematic roadmaps, will be shared with the task force, who are high level representatives of the divisions of the city and state government, PPP and private entities in the mobility and built environment sectors, and be a supporting document for their future works. The roadmap for Sustainable Ecosystem for the Built Environment will also be submitted to the Green Building Council as a complementary document for establishing the green building guideline in the future. This is part of the upscaling work within WP5; whilst both thematic roadmaps will be submitted to the key

¹⁶ <https://thesystemsthinker.com/the-world-cafe-living-knowledge-through-conversations-that-matter/>

¹⁷ <http://www.theworldcafe.com/key-concepts-resources/world-cafe-method/>

¹⁸ Brown, J. and Isaacs, D. (2005). *The World Café: Shaping our futures through conversations that matter*. Berrett-Koehler Publishers.



stakeholders of the City Line project, both from the Project Office of the Environment and Planning Division of the City of Reykjavík and Transport of the Capital Area (Betri Samgöngur) which are the key players in the City Line project; in addition to Strætó, the bus company, as an reference of overview, especially when it comes to the built environment projects that are related to the mobility development but often being overlooked as they are out of their scope of work.



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4. CONCLUSIONS

4.1 Summary of achievements

The roadmapping process that led to this deliverable constitutes an integrated approach to a co-creation process regarding the development of a strategic tool that complements and justifies the City Vision 2050 developed for each SPARCS LHC and FC. It involved the definition of a versatile methodology, the adaptation of that methodology to the specific conditions of each city, and the development of a participatory process involving relevant actors and stakeholders in the co-creation, co-development and defining the conditions to achieve a desired common future (City Vision 2050).

During the roadmapping process, which covered a period of about 1,5 years, a significant set of achievements was reached by the LHC and FC, together with their consortium partners.

- Development of roadmapping workshops in the 7 partner cities [2 pilot workshops (KLD) + 11 workshops (all partner cities) were held, along with several 1-to-1 meetings with specific partners/experts].
- Involvement of more than 250 participants/stakeholders in the co-creation of concrete measures and definition of milestones;
- Identification of specific milestones for 2030 and 2040 in each city, and definition of key outcomes that contribute to these milestones, in the form of measures, projects or strategies (in total, over 200 key outcomes were described by the local task forces);
- Stabilization and/or update of the key strategic areas for sustainable development in each partner city, including the most relevant vision statements / goals for these strategic domains, previously defined in the City Vision 2050 process.

Overall, the roadmapping process prompted the cities to reflect upon their strategies and projects concerning the relevant sectors of development, thus contributing to the creation of synergies between the SPARCS related actions and the existing city development processes and strengthening the urban transformation process towards climate neutrality.

4.2 Impacts

The definition of a Roadmap for urban transformation in each partner city lays the foundation for further implementation of measures in the cities' identified KSA, leading to the achievement of the identified milestones for 2030 and 2040. The definition of milestones sets a preliminary framework to monitor urban transformation towards the desired Bold City Vision 2050. As a process that is by nature systematic and iterative, the developed activities contributed to the empowerment of the cities regarding this strategic tool, allowing them to continuously define priorities and update goals, in a co-creation process involving the relevant stakeholders. Regarding the participatory process and



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stakeholder involvement, the roadmapping process also helped establish networks of cooperation at inter- and intra-institutional levels.

These results constitute the baseline for the LHC and FC to update their City Vision reports and for the **development of the final City Vision 2050** (D1.12). With the incorporation of the **Implementation Plan** projects in the FC roadmaps and the **replication activities** concerning PED in LHC, this task helps identifying the contribution of WP3, WP4 and WP5 to the City Vision 2050.

4.3 Other conclusions and lessons learned

The cities' experience throughout the roadmapping process, translated in their roadmapping reports, point to a set of relevant challenges and recommendations, concerning the results and further use of the roadmap. The present section comprises some of the most relevant reflections presented by the cities on their roadmapping reports.

- Adjusting the time and effort needed for the roadmapping process/workshop.** On the part of **Kladno**, the task force reports that “the workshops sparked quite a varied debate, so in the end it turned out that the events could have been longer”. Similarly, **Espoo** refers that “One or two workshops is not enough to gain in-depth insight on the topics spanning multiple decades but can act as a precursor to a longer development process(es)”. In turn, **Maia**'s task force also points out to the need to deepen the results of the process: “... some gaps/difficulties in the appropriation of the implemented methodology were detected, as well as some unpreparedness of some of the teams and partners involved. These factors suggest the need to deepen the work developed, especially in regard to projects that have an absolutely decisive role in achieving the long-term goals.” These concerns can be considered transversal in all partner cities and go in line with the iterative nature of the roadmapping process. This will, consequently, lead to further interactions with stakeholders, developments concerning the key outcomes, and updates of the cities' roadmaps.
- Coping with current trends and geo-political circumstances in the context of the workshop/roadmap.** **Kladno**, having promoted the pilot workshops at an earlier stage, felt the effects of the recent geo-political instability in a relevant way, with significant influence in the discussions held during the workshops. In this sense, the city reflects: “Together with the long-term strategic focus the dialogue with the partners has shown the significant role of the current trends and geo-political circumstances we are currently going through. The vision should take into account the impact of war conflicts and security matters regarding the energy supply, also the high prices of energy, materials, technologies and work force, which are causing huge problems and could lead to spiral of obstacles and even deep crisis. Therefore, there was a lack of willingness to commit to any clear milestones in the long-term due to high uncertainty and a clear preference for short-term planning.”
- Updating/adjusting the City Vision in line with the roadmapping process.** A fundamental aspect of the roadmapping process, as stated throughout this report



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concerns its relationship with the City Vision process and the expected updates to the latter derived from the cities' approach to the roadmap. In this sense, it is relevant to understand that most cities faced the need to update their KSA and vision statements due to the articulations that were deemed necessary with the existing city development processes (e.g., the strategic documents and projects of the city or region on mobility, energy, governance). Also, the natural changes that occurred in the status quo of the cities in the relevant strategic domains, in some cases, rendered the original KSA and VS obsolete.

In this context, **Kladno** reports that: "We have realized the statements are not entirely appropriate for assessing the possibility of implementing a vision, as they are (a) still general; (b) contain many components from multiple sectors; (c) difficult to grasp for discussion with partners". **Reykjavík**, in turn, also addresses this issue in a clear way "... the resulting KSAs (from the process of aligning the KSAs and the City's stated top priorities) refer to the practices that produce by far the largest amounts of GHG emissions, while being the most complicated in delivering social and cultural change, hence, presenting the authorities and a whole range of societal actors with persistent systemic challenges."

- Implementing of the roadmapping outcomes.** Regarding this theme, many relevant reflections from the cities should be highlighted. **Espoo** presents a very relevant and overarching reflection: "... to initiate the realization of any of the ideas or insights developed – on practical, policy or strategic levels – another kind of process that supports the commitment of all relevant stakeholders to the process would be required. Many of the topics here are challenges that cannot be resolved by any party alone, but require active collaboration and co-creation. Additionally, including citizen engagement into such a process would also require that the topics arise from the citizens themselves, and their needs and aims, and not from the institutional side, to be successfully applied." Similarly, **Leipzig** points out that "Implementing the measures, quantifying their impact, as well as methods to involve and engage third parties were seen as challenges by all involved stakeholders." In turn, **Kifissia** reports that "During the workshop, the discussion identified lack of perceived political credibility as a concerning obstacle. Insufficient communication between citizens and municipality was also seen a subject of concern. Participants identified the current hindering elements functioning as threats such as the procurement difficulties, the lack of resources (both in terms of funding and qualified municipal staff), the current bureaucracy and time-consuming processes of project maturation and implementation, as well as the fragmentation of responsibilities between various local and supra-local actors."

In line with the previous testimonies, **Maia** refers that "It's fundamental to us to highlight that in some sectors this transformation (derived from the roadmapping process) can be easier, given that it is a transition that follows the flow of events and does not contradict the deep-rooted habits of a society. The digital transition can be identified as an example, although not without some difficulties. On the other hand, sectors such as mobility or the energy transition will bring additional



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difficulties, as they require, in addition to replacing technology, with considerable economic and financial replacement costs, a behavioural change in society – an example of such being the inversion of current mobility patterns, on the one hand, and, on the other, the collective awareness that a more responsible production and consumption of energy is essential.” Furthermore, Maia also states that “To integrate these results into the activity of the different municipal services and the main stakeholders to be involved, it will be crucial to legitimise the results of this work at the level of those responsible for decision-making. In this sense, it is essential to promote their integration into sectoral planning at the level of the main strategic areas, the negotiation of sectoral commitments for the achievement of the main targets, and the dissemination to the key stakeholders and society in general, aligning it in a collective commitment to its implementation.”

- **Using the roadmap and roadmapping process for the city’s activities and strategies.** Reflecting upon the city’s experience through the roadmapping process, **Leipzig** reports that “The methodology for creating the roadmap has significantly supported the city in its efforts to systematically address the issue of climate neutrality. At a higher level of discussion regarding the methodology, it became evident that roadmaps can enrich existing and future strategies by providing a clear and comprehensive overview of planned and envisioned measures, thus supporting operationalization. Roadmaps can also help identify and address gaps in existing strategies.”
- **Aligning of the roadmap with the cities’ strategies and vision.** In some cases, the cities identified difficulties in terms of possible duplication or competition between, on one hand, the Roadmap and City Vision developed for SPARCS and, on the other, the city’s existing (or under development) strategic documents and vision. One of the approaches undertaken consisted in adjusting the format of the roadmap to complement those strategic instruments, by focusing on pathways of development which were more specific to the SPARCS context (e.g., development of PED) and provide contributions to other relevant development domains at a city level that go beyond these specific pathways (e.g. Espoo). In other cases, the strategic documents in question were taken as a structural reference for the development of the roadmap (e.g. Leipzig, Kladno, and Reykjavík).

The presented challenges and approaches translate the effort and thorough involvement of the cities in the roadmapping process. Some of the stated challenges were foreseen and some of the solutions were proposed in the roadmapping methodology, while other barriers were specific to the local ecosystems, having prompted tailored responses from the cities. These are examples of the cities’ versatility and commitment to the urban transformation process prompted by SPARCS project and, as a result, contribute to further promoting the ownership of both the City Vision and the Roadmap for urban transformation by the cities. These complementary approaches are examples of the heterogeneity of the methodologies and results achieved during the roadmapping process, offering a diverse array of possibilities for other cities to use as a reference for the development of their own roadmaps for urban transformation.



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5. ACRONYMS AND TERMS

List of abbreviations

2D: Two-Dimensional	EPC: Energy Performance Contracting
3D: Three-Dimensional	ESCO: Energy Service Company
AC: Alternating Current	ESD: Education for Sustainable Development
ADENE: Agência para a Energia (Agency for Energy of Portugal)	ESG: Environmental, Social, and Governance
AI: Artificial Intelligence	EUCF: European City Facility
BEI: Baseline Emission Inventory	EV: Electric Vehicle
BIM: Building Information Modelling	FC: Fellow City
BlauGrün: Blue-Green District Development	GHG: Green House Gas
CAT: Category	GIS: Geographic Information System
CCC: Climate City Contract	HMS: Housing Department
CE: Education Chart	HSL: Helsingin Seudun Liikenne (Helsinki Regional Transport Authority)
CHP: Combined Heat and Power	HSY: Helsingin seudun ympäristöpalvelut (Helsinki Region Environmental Services)
CO ₂ : Carbon Dioxide	HVAC: Heating, Ventilation, and Air Conditioning
CO ₂ -eq: Carbon Dioxide Equivalent	ICLEI: Local Governments for Sustainability
CPO: Charging Points Operators	ICMA: International Capital Market Association
CSC: Collective Self-Consumption	ICT: Information and Communication Technology
CSO: Chief Strategy Officer	IDC: Integrated Development Concept
CSO: Civil Society Organization	IHP: Individual Heating Point
DH: District heating	IoT: Internet of Things
DLR: Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Centre)	IP: Implementation Plan
DSM: Demand Side Management	KEF: Keflavík International Airport
DSO: Distribution System Operator	KO: Key Outcomes
DSS: Decision Support System	KSA: Key Strategic Areas
eBikes: Electric Bikes	kWp: Kilowatt peak
EBRD: European Bank for Reconstruction and Development	LCA: Life Cycle Assessments
EC: Energy Community	LED: Light Emitting Diode
eCar: Electric Car	LHC: Light House City
EE: Energy Efficiency	LIPOR: Intermunicipal Waste Management of Greater Porto
eHealth: Electronic Health	LOD: Level of Development
ELENA: European Local Energy Assistance	LSA Lichtsignalanlage (traffic light system)
ELPRE: Long-Term Strategy for Building Renovation	LVB: Leipziger Verkehrsbetriebe (Leipzig Transport Company)
EM: Energy Management	MaaS: Mobility as a Service
EMW: European Mobility Week	MAIA30: Investment and Funding Action Plan
EPAITD: Innovation and Digital Transition Action Plan	MCR2030: Making Cities Resilient 2030
EPBD: Energy Performance of Buildings Directive	mHealth: Mobile Health



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MSTN: Milestone	REC: Renewable Energy Communities
MW: Megawatt	RES: Renewable Energy Sources
NDR: Not Directly Reported	RNC20250: Roadmap for Carbon Neutrality 2050
NZEB: Nearly Zero-Energy Building	RRP: Recovery and Resilience Plan
ÖPNV: Öffentlicher Personennahverkehr (Public Local Transportation)	SBF: Správa bytového fondu (Czech Public Housing Company)
PAES: Plano de Ação para a Energia Sustentável (Sustainable Energy Action Plan)	SDGs: Sustainable Development Goals
PDM: Plano Diretor Municipal (Municipal Master Plan)	SDS: Sustainable Development Strategy
PED: Positive Energy District	SECAP: Sustainable Energy and Climate Action Plan
PEDD: Plano Estratégico de Desenvolvimento Desportivo (Sport Development Strategic Plan)	SECO: Secretariat for Economic Affairs of the Swiss Confederation
PEDT: Tourism Strategic Plan (Plano Estratégico de Desenvolvimento Turístico)	SME: Small Medium Enterprise
PJF: Presidentes de Junta de Freguesia (Parishes Representatives)	SMR: Small Modular Reactors
PMAAC: Plano Municipal de Adaptação às Alterações Climáticas (Climate Adaptation Action Plan)	SORPA: the community association of waste collection/processing of Iceland
PMJ: Plano Municipal de Juventude (Youth Municipal Plan)	SP: Strategic Plan
PMS: Plano Municipal de Saúde (Health Municipal Plan)	SUMP: Sustainable Urban Mobility Plan
PMUS: Sustainable Mobility Action Plan	SVJ: Společenství vlastníků jednotek (Association of Unit Owners)
PPP: Public Private Partnership	SW: Software
PR: Public Relations	USK: Division of Environment and Planning
PT: Public Transport	UTM: The Urban Transitions Mission
PV: fotovoltaic	V2G: Vehicle-to-Grid
PVP: Photovoltaic Panel	VRU: Vulnerable Road Users
QAT: Quality Assessment Template	VS: Vision Statements
R&D: Research and Development	WEE: Westsächsische Erneuerbare Energien (West Saxon Renewable Energies Company)
	WP: Work Package
	WS#: Working Session
	WS: Workshop
	WTP: Water Treatment Plant



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List of abbreviations

Partners	
Teknologian Tutkimuskeskus VTT OY	VTT
Espoon Kaupunki	ESP
Stadt Leipzig	LPZ
Camara Municipal da Maia	CMM
Reykjavikurborg	RVK
Statutarni Mesto Kladno	KLD
Municipality of Kifissia	KFS
Lviv City Council	LVIV
Adven	ADV
Fraunhofer Gesellschaft Zur Forderung der Angewandten Forschung E.V	FHG
BABLE UG	BABLE
Stadtwerke Leipzig GMBH	LSW
University of Leipzig	ULEI
Sociedade Portuguesa de Inovação consultadoria empresarial e fomento da inovação S.A	SPI
NEW - Centre for New Energy Technologies S.A	NEW
Orkuveita Reykjavíkur SF	OR
Ceske Vysoke Uceni Technicke V Praze	CVUT
Suite5 Data Intelligence Solutions Limited	SUITE5
ELIN VERD S.A	VERD
National Ecological Centre of Ukraine	NECU
LCE Lvivavtodor	LCE
CiviESCo	CiviESCo
Gopa Com	GOPA
ADEPORTO - Agência de Energia do Porto	AdEPorto



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7. APPENDICES

Appendix 1 – Resources for the roadmapping process and workshops

A. Guidelines for the Roadmapping process & Workshop

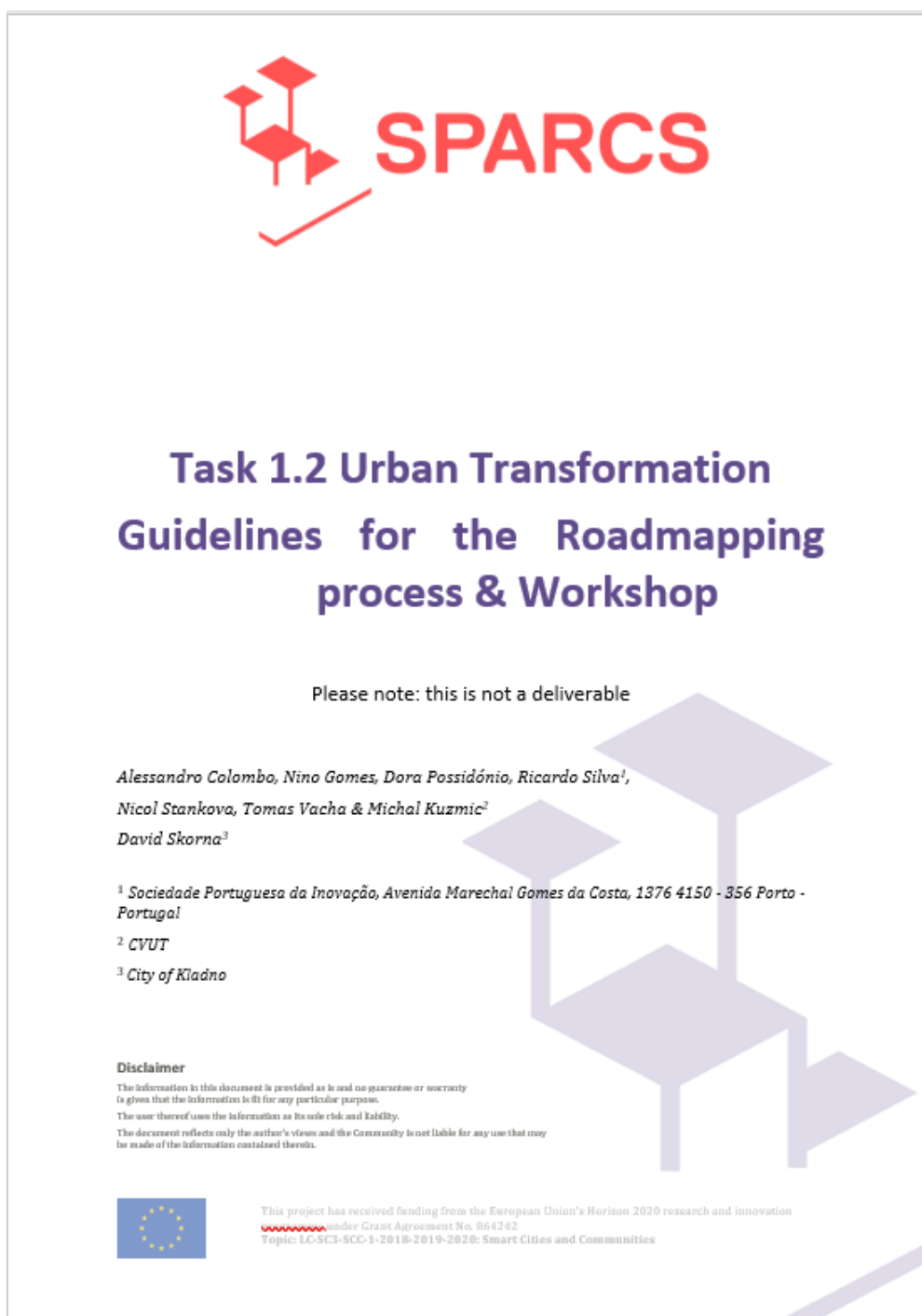


Figure 14. Guidelines for the cities' roadmapping process and workshops



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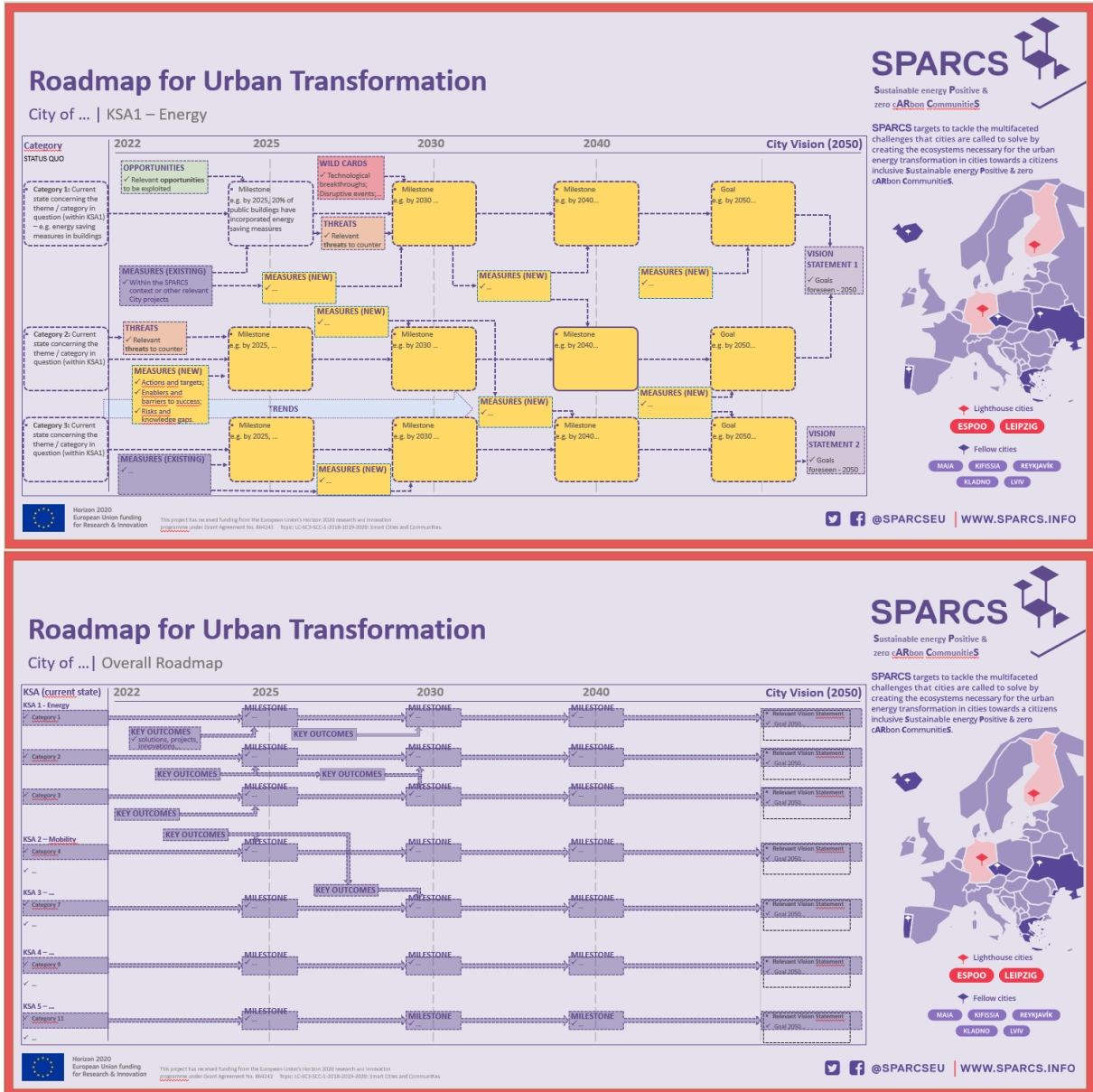


Figure 19. Poster – roadmap template for a specific KSA and for the overall results



Figure 20. Wild Cards, Key outcomes, and status quo cards



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Figure 21. Poster – Trend Gallery (used in the City Vision workshop); “Difficulties and suggestions” table

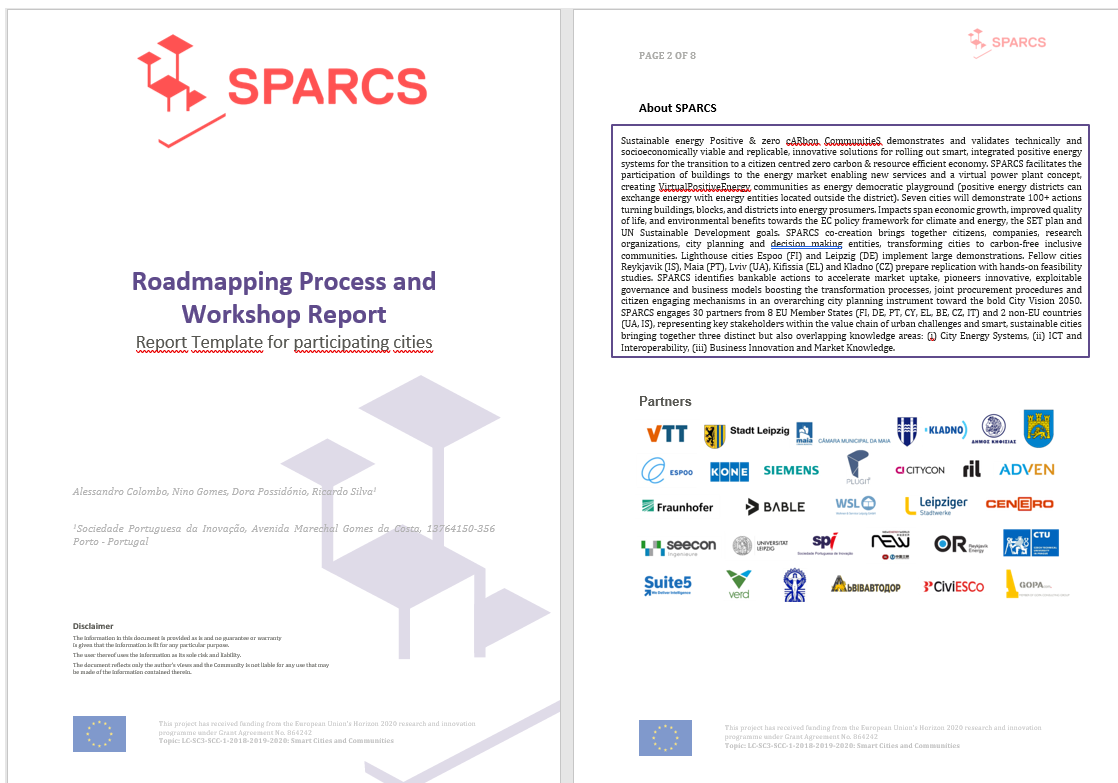


Figure 22. Roadmapping process and workshop report template



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Appendix 2 – Complementary outputs of Espoo’s roadmapping process

A. Espoo’s milestones tables per KSA

Table 21: Espoo’s Milestones for KSA1 - Sustainable and smart urban energy

Key strategic area #1: Sustainable and smart urban energy				
Categories / Theme	Current state (2023)	Intermediate milestones 2030	Intermediate milestones 2040	Future Scenario / Milestones 2050
1.1 Increase in local RES production	<p>Increase of local RES production.</p> <p>Increase of interest towards prosumer roles.</p> <p>Developments in carbon-free decentralized systems in electricity sector for system resiliency.</p>	<p>Identification of RES potential locally, supportive zoning practices and plot reservations.</p> <p>Solidification of energy communities as operational models.</p> <p>Development of small-scale PED areas.</p>		<p>The local energy system is carbon free.</p> <p>Providing financial support for new energy solutions.</p>
1.2 Increase in energy efficiency	<p>Increase of energy efficiency measures in building and mobility sectors.</p>	<p>Tackling energy poverty, increase of energy counselling.</p> <p>Locally shared ‘carbon-free summer’ type short-term goals.</p>	<p>Utilization of new building materials for energy efficiency.</p>	<p>Adapting measures to decrease energy poverty.</p> <p>Lowering overall energy consumption.</p>
1.3. Development of circular economy solutions in energy		<p>Removing regulatory and legal barriers for circular economy.</p>	<p>Developing solutions based on circular economy.</p>	<p>Adapting comprehensive circular economy perspectives.</p>
<i>Key technologies / concepts:</i>	<p><i>Demand response solutions.</i></p> <p><i>Bi-directional district heating solutions.</i></p>	<p><i>Consumer participation in demand response.</i></p> <p><i>Energy storages.</i></p> <p><i>Smart home solutions.</i></p>	<p><i>Digital solutions for energy savings.</i></p> <p><i>Electricity storages.</i></p>	<p><i>Energy consumption monitoring and counselling in residential buildings.</i></p> <p><i>Carbon capture and storage solutions.</i></p> <p><i>Utilizing demand response in residential buildings.</i></p>
2.1 Increase of energy citizenship	<p>Increase of national energy information and counselling.</p> <p>Energy price as a major influencer on behaviour.</p> <p>Early prosumers.</p>	<p>Supporting local RES production, including energy guidance.</p> <p>Energy citizenship as a topic in basic education.</p>		<p>People are energy conscious and participate actively in the energy system.</p> <p>Energy citizenship is ubiquitous.</p> <p>Energy training and information sharing.</p>



Key strategic area #1: Sustainable and smart urban energy				
Categories / Theme	Current state (2023)	Intermediate milestones 2030	Intermediate milestones 2040	Future Scenario / Milestones 2050
				Understanding motivational factors for energy transition.
2.2 Increase of energy communities	<p>Increase of technologies that enable local RES production.</p> <p>Increase of district level energy solutions.</p>	<p>Enabling energy communities, considering legal and regulatory frameworks.</p> <p>Incentives for demand response participation.</p> <p>Increase of energy-as-a-service and automated solutions.</p> <p>Financial support for households, focus on low-income homes.</p> <p>Adapting new policies, e.g., in land use agreements.</p> <p>Support for tests and pilots for new energy solutions.</p>		<p>Adapting supportive policy frameworks.</p> <p>Supporting the development of automated and energy-as-a-service solutions.</p> <p>'Test beds' and 'living labs', scaling up effective solutions.</p>
2.3 Increase of circular solutions in energy development	Adaptation of circular economy solutions in construction processes.		<p>Organization of the recycling of RES infrastructure in the end of its lifecycle.</p> <p>Adapting actions supporting biodiversity in local RES solutions (systemic approach).</p>	
<i>Key technologies / concepts:</i>			<i>Small modular reactors.</i>	
3.1 Increased recycling and sharing of energy	<p>Integrated autonomous and smart urban energy systems, including demand response, are actively researched, tested and piloted.</p> <p>Increase of smart and low-emission technologies.</p>		Energy regulation that enables 'platform' based business models.	<p>Energy is stored, recycled and shared, and is affordable.</p> <p>Increase of user participation, enabling prosumers.</p> <p>Advancement of sector integration.</p> <p>'Platform' based business models</p>



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Key strategic area #1: Sustainable and smart urban energy				
Categories / Theme	Current state (2023)	Intermediate milestones 2030	Intermediate milestones 2040	Future Scenario / Milestones 2050
	Circular solutions in energy, e.g., excess heat utilization.			supporting smart systems.
3.2 Increased 'system level' planning to ensure efficient energy use		Drafting a 'big picture' of energy for urban planning and zoning regulation.	Drafting plans for how to integrate old built environment energy infrastructure into new solutions.	System level integration of solutions, optimization of different solutions' effects. Advancement of sector integration.
3.3 Increased utilization of energy storage solutions	Increase of smart and low-emission technologies.	Utilization of new energy sources and energy storing solutions based on circular economy, ensuring transparency in green energy production for the end user.		Advancement of sector integration.
3.4 Increased affordability of energy	Adaptation to energy market prices.	Adapting new energy solution pricing models for different types of needs. Adapting measures to prevent inequality, energy citizenship and energy community participation made possible for all.		Increase of user participation, enabling prosumers.
<i>Key technologies / concepts:</i>		<i>New automated and easy-to use solutions, incl. demand response.</i> <i>Enabling virtual energy communities.</i>	<i>Automated solutions for sector integration and demand response.</i> <i>Energy storages as 'cloud services'.</i>	<i>Automated smart grid, infrastructure and technology solutions.</i>
4.1 Increased local RES production	Active promotion of RES production. Pilots for sustainable energy, energy efficiency and demand response.		Setting targets for locally produced energy utilization.	Many urban districts and areas are self-sufficient energy-wise.
4.2 Increased energy efficiency	Pilots for sustainable energy, energy efficiency and demand response.	Decrease of overall energy use.	Decrease of overall energy use.	



Key strategic area #1: Sustainable and smart urban energy				
Categories / Theme	Current state (2023)	Intermediate milestones 2030	Intermediate milestones 2040	Future Scenario / Milestones 2050
4.3 Increased energy guidance and local knowledge		Energy citizenship and information sharing, also focus on attitude transformation.		Increasing awareness on energy topics and solutions.
4.4 Increased utilization of strategies, and city planning solutions	Collaboration in different zoning practices.	Local area-level sustainable energy strategies, identification of local potentials, coordination of development.		Assessing grid development from PED perspective. Accepting the increasing visibility of energy infrastructure in the built environment, developing related design practices for aesthetical integration.
4.5 Increased collaboration towards sustainable solutions	Strategic collaboration, public-private partnership, and development projects.	Development of ecosystems and local sense of community for development, noting differences between different types of areas.		Supporting active collaboration between stakeholders.
<i>Key technologies / concepts:</i>	<i>Virtual power plant projects.</i>	<i>Increasing the pace of energy efficiency building renovations.</i> <i>Identification of large-scale locations for demand response utilization.</i> <i>Targets for hydrogen use and infrastructure.</i> <i>Utilizing smart readiness indicators in building construction phase.</i>	<i>Increase of hydrogen utilization and infrastructure.</i>	<i>Energy storages considered in zoning processes, considering the proximity to production and usage.</i> <i>Energy management and demand response solutions.</i>

Table 22: Espoo's Milestones for KSA2 - Sustainable and smart urban mobility

Key strategic area #2: Sustainable and smart urban mobility				
Categories / Theme	Current state (2023)	Intermediate milestones 2030	Intermediate milestones 2040	Future Scenario / Milestones 2050
5.1 Increase in modal share of sustainable mobility modes	Local public transportation service development taking place alongside	Development of the attractiveness of public transportation,	Increased awareness and behaviour change related to mobility related emissions.	Increase of awareness of mobility choices and their effects.



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Key strategic area #2: Sustainable and smart urban mobility				
Categories / Theme	Current state (2023)	Intermediate milestones 2030	Intermediate milestones 2040	Future Scenario / Milestones 2050
	emerging mobility services. Remote working practices post-COVID-19 affect local travel behaviour. General social pressure for sustainable mobility is increasing. Active development of (local) rail-networks ongoing.	and its status and brand. Shift in focus from personal car use to walking and bicycle use in behaviour; design of sustainable travel chains (also Park&Ride concepts).		Identification of different mobility needs in planning and securing access to related services. Development of the attractiveness of sustainable mobility modes (e.g., price).
5.2 Improvement of the sustainable mobility infrastructure	Development of biking and public transportation facilities and station areas. EV charging infrastructure is increasing rapidly.	Access to sustainable mobility options ensured.	Solutions for public transportation actively developed.	Reduction of unnecessary travel, e.g., through automated logistics services.
5.3 Support for MaaS development	Increasing number of operators for new mobility services.	Development of city centre areas that host diverse mobility services. Support for the transition from vehicle ownership to usership.	Support for the transition from vehicle ownership towards sharing and usership. Development of local urban air mobility framework.	Availability of year-round mobility services ensured, services usable across municipal boards.
<i>Key technologies / concepts:</i>	<i>Green electricity and decrease of e-car prices drives emission reduction, but currently a shortage of components.</i>	<i>Increase of local public city bike system area coverage.</i> <i>Personal emission budgets.</i>	<i>Digital platforms that combine all mobility services.</i> <i>Utilization of new energy sources in mobility.</i>	<i>Digital platforms that combine all mobility services.</i>
6.1 Increase in accessibility of services	Active development of the service network. Autonomous mobility solutions in active development.	Identification of different mobility needs of different kind of users, e.g. through service design processes.		Repurpose of street space for sustainable mobility and social use Prioritization of walking and bicycling as mobility modes. Inclusivity and design for all as core ideals in development.
6.2 Development of street space	New zoning practices, including traffic management, e.g.	Pilots on street re-organization and new mobility solutions,	Removing barriers from regulatory perspective.	Ensuring safety of different types of users of the street.



Key strategic area #2: Sustainable and smart urban mobility				
Categories / Theme	Current state (2023)	Intermediate milestones 2030	Intermediate milestones 2040	Future Scenario / Milestones 2050
for sustainable mobility	lowering of speed limits. New practices for area reservations in zoning for shared mobility services, possible need for renewed practices.	including citizen engagement. Development of walking, bicycling conditions and infrastructure.	Changes in national planning guidelines to support new public space models.	Co-creating streets, including street art and accessibility. Collaboration with local businesses, e.g. shops and restaurants.
6.3 Increase in awareness on sustainable mobility	Biodiversity and inclusivity as major topics also in mobility.	Communication about sustainable mobility for different stakeholders.		
<i>Key technologies / concepts:</i>		<i>Sustainable mobility in school education curriculums.</i>		<i>Events to support the creation of local sense of community.</i>
7.1 Increase of local e-mobility solutions	Electrification of local bus traffic. EV charging infrastructure development.	Local targets for e-mobility vehicle uptake. Procurement practices that direct towards emission reduction during the whole lifecycle.	Charging network developed on the basis of identified needs.	All mobility modes are fossil-free. Increase of charging services and accessibility. Public procurement guidelines to support emission reduction in transportation. Understanding effects of charging solutions and behaviour in zoning practices.
7.2 Increase of other zero-carbon mobility solutions locally	Active development of hydrogen technologies. Development of biogas as part of fossil free transportation.			New innovative solutions for fossil free fuels, enabling their use locally.
7.3 Increase of awareness of transportation related emissions	Organization level sustainability targets utilized.	Developing automated monitoring data of vehicles on carbon emissions. Using carbon neutrality as a target in large-scale transportation development projects. Service design processes for	Triggering an attitude change towards sustainable mobility mode usage. Decrease excessive private car use.	Identification of different mobility needs and respective solutions.



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Key strategic area #2: Sustainable and smart urban mobility				
Categories / Theme	Current state (2023)	Intermediate milestones 2030	Intermediate milestones 2040	Future Scenario / Milestones 2050
		understanding new mobility behaviours.		
7.4 Local support for zero-carbon mobility modes through infrastructure and policy			Roadmap for autonomous vehicles locally and beyond. Effects of densification and urbanization on public transportation profitability.	Utilization of autonomous vehicles. Improving walking and bicycling conditions and environments. Decrease of unnecessary travel, e.g. placement of services in the urban structure.
<i>Key technologies / concepts:</i>		<i>15 -minutes city - solutions, decreasing mobility need.</i> <i>New parking spaces fitted with chargers.</i> <i>Co2 capture and utilization.</i> <i>Transformation of current vehicles to utilize fossil free fuels.</i>		<i>Vehicle-to-grid and smart charging solutions.</i>
8.1 Autonomous transport development	Logistics are leading the development on autonomous mobility ahead of passenger transportation.	Pilots and co-creation of new service models. Sharing of data between stakeholders. Increase of shared mobility services. Behavioural change towards shared transportation. Security and monitoring solution development for autonomous vehicles.	Decreasing regulatory barriers. Optimization of local services selection and use.	Autonomous solutions used actively in human transportation and logistics Availability of shared mobility services. Behavioural change towards shared and autonomous mobility services, both in passenger transport and logistics. Autonomous public transportation. Decrease of private car use. Development of services linking different sectors, e.g. housing and mobility.
8.2 Development of built environment and		Utilizing urban space for new types of autonomous solutions.	Urban structure that supports autonomous transportation use	Winter maintenance for year-round autonomous mobility services.



Key strategic area #2: Sustainable and smart urban mobility				
Categories / Theme	Current state (2023)	Intermediate milestones 2030	Intermediate milestones 2040	Future Scenario / Milestones 2050
autonomous transportation linkages		<p>Identification mobility needs of different user groups, including changes in travel behaviour post-COVID-19.</p> <p>Ease of use and availability of information about the local availability of services.</p>	and services, e.g. dedicated lanes.	
8.3 Urban air mobility development	Development of urban air mobility.		Urban air mobility considerations in development of the built environment.	Utilization of drones in logistics, consideration in zoning practices and traffic management.
<i>Key technologies / concepts:</i>	<p><i>Autonomous work machinery and construction machinery.</i></p> <p><i>Autonomous delivery robots.</i></p>			



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B. Espoo's detailed graphic roadmaps

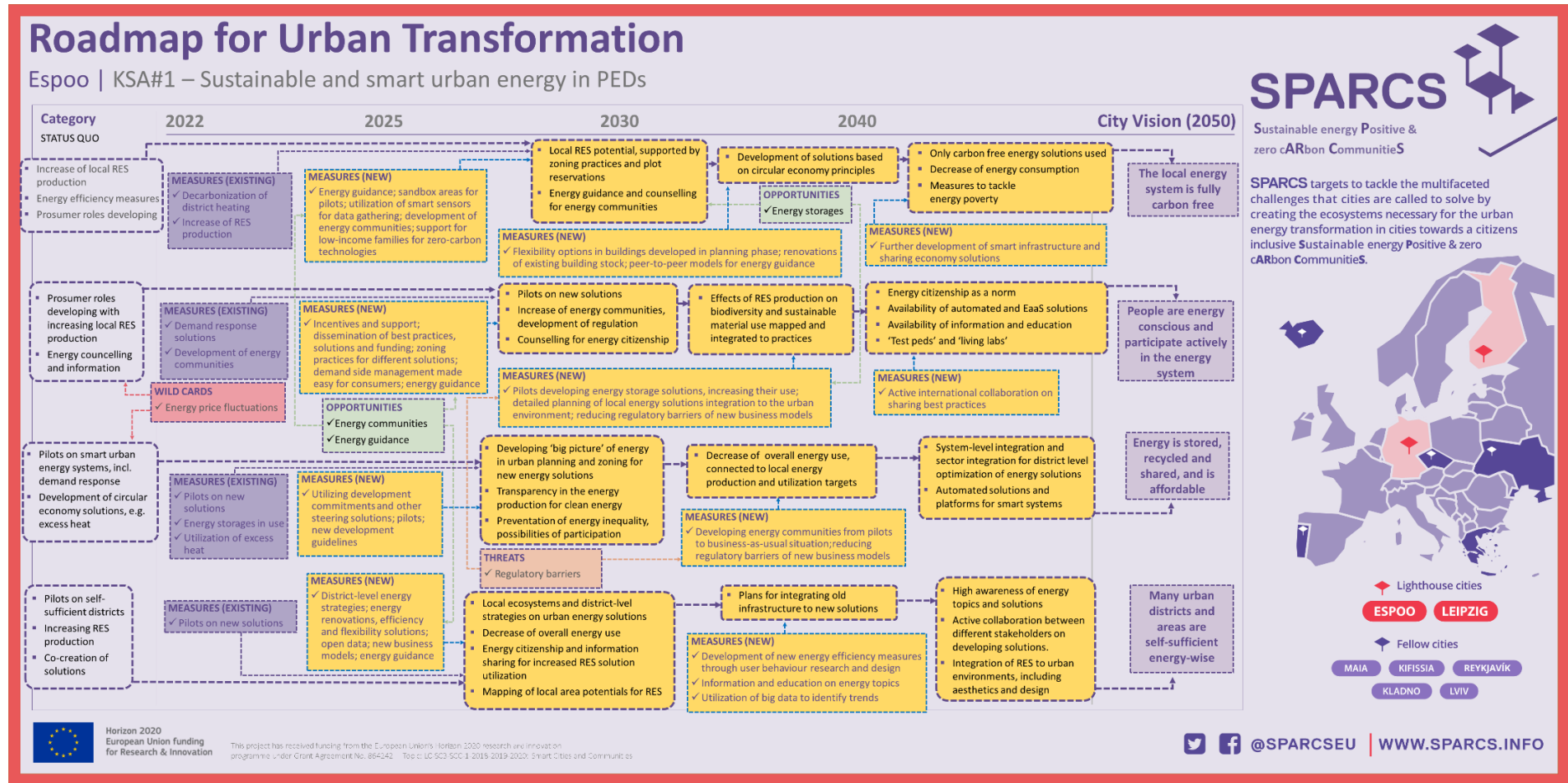


Figure 23. Espoo's Graphic Roadmap for KSA1 - Sustainable and smart urban energy



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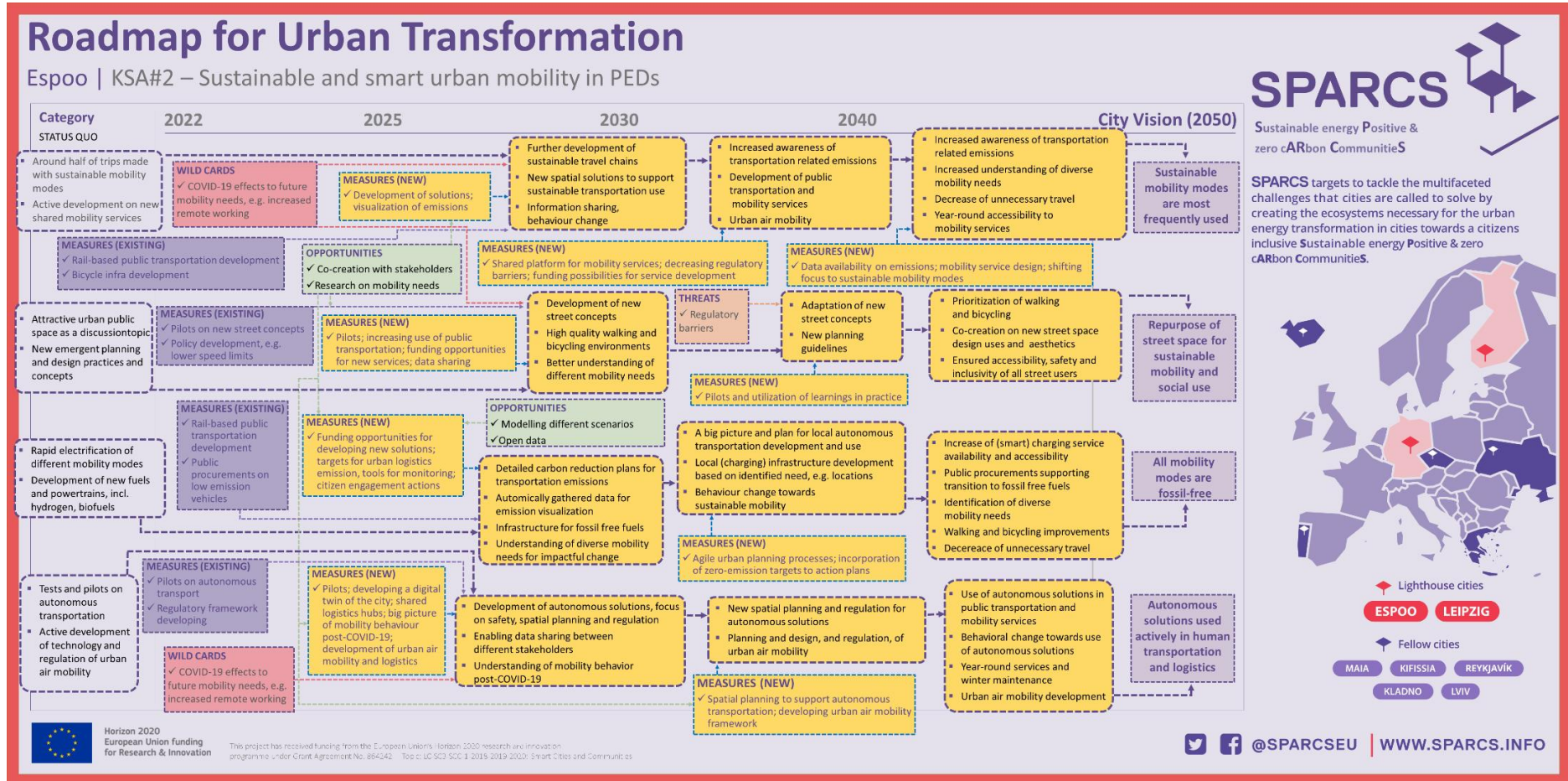


Figure 24. Espoo's Graphic Roadmap for KSA2 - Sustainable and smart urban mobility



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C. Dissemination Plan

DISSEMINATION PLAN

SPARCS ROADMAPPING 2050 WORKSHOPS AND RESULTS

The SPARCS Roadmapping workshop process examines possible local positive energy district (PED) development pathways and futures, especially from the perspective of sustainable and smart urban energy and mobility solutions. PEDs are areas that essentially would produce more energy than consume it, and thus provide one possible approach towards zero-carbon and human-centric urban development and local energy and mobility solutions. The Roadmapping report, drafted on the basis of two workshops organized for the SPARCS Work Package 3 project partner organizations in January 2023 by the city of Espoo project team, presents possible pathways for developing PED areas in the future. The workshops highlight the complexity of PED topic, and the need for co-creation and collaboration to realize any of the identified measures or future scenarios, including the citizens. The work is part of the project's larger City Vision 2050 process in which the project partner cities draft future scenarios for desirable and contextualized PED development. The process in Espoo provides a view into a specific North European geographical and climatical, and Nordic cultural and societal context, in which PED development can take place. The process is done in collaboration with the project partner organizations, examining the possible futures from a multi-voiced perspective.

In terms of sustainable development, PED thinking, and the Roadmapping and City Vision 2050 reports (draft done in 2020, to be updated in 2024), can provide insight, knowledge and leads to follow for future development. The workshop processes – that act as the basis of all the related reports – provide multistakeholder views to PED development and in more general terms to sustainable development.

In Espoo, the insights are communicated especially amongst the Centre of excellence for sustainable development and the Sustainable Espoo development Programme (2021-2025). The Centre is responsible of leading the work on the development of Climate Roadmap for 2030 – in accordance with the city's carbon neutrality 2030 target. The Centre is also responsible of Espoo's participation to the EU Mission for 100 Climate-neutral and Smart Cities, to which Espoo was selected as one of the Pilot cities. Additionally, the insights of the reports can be disseminated to other city departments, including urban development, which is currently drafting a Master Plan of the city for 2060. The results of the workshops and the contents of the reports, are also in the use of the SPARCS partner organizations for future leads on sustainable development.



Appendix 3 – Complementary outputs of Leipzig’s roadmapping process

A. Leipzig’s milestones tables per KSA

Table 23: Leipzig’s Milestones for KSA1 - Sustainable Mobility

KSA1- Sustainable mobility				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
1.1 Framework for climate neutrality in the mobility sector	<ul style="list-style-type: none"> ● Mobility strategy 2030 ● Environmentally sensitive traffic control: development of concept, clarification of data provision, integration of data in the traffic management system 	<ul style="list-style-type: none"> ● Foundations for climate-friendly mobility have been laid and act as guiding principles for implementation ● Introduction of an environmentally sensitive traffic control system 		x
1.2 Pedestrian traffic	<p>Structural improvements to foster pedestrian traffic (increase accessibility and safety)</p> <ul style="list-style-type: none"> ● Crosswalk Program: Improvement of the crossability of busy roads ● City Square Program: Upgrading of public spaces into city squares with a high recreational function ● Structural improvements at junctions and crossing areas for pedestrian traffic (increase accessibility and safety). 	<p>Implementation of the pedestrian traffic strategy (goal: 24% pedestrian traffic).</p> <ul style="list-style-type: none"> ● Creation and repair of sidewalks (sidewalk renovation program) ● Implementation of Environmentally friendly path structure along open space and water bodies (cycling and pedestrian traffic) 	<p>Further expansion and improvement of pedestrian paths</p>	Promote walking as part of the environmental alliance of walking, cycling and public transport.
1.3 Cycling traffic	<p>Development and initiation of the Municipal cycling development plan 2030+</p> <ul style="list-style-type: none"> ● Piloting of cargo bike rental as part of the TINK initiative (until 2023) ● Designation of further bicycle lanes ● Cargo bike promotion for SMEs 	<p>Expansion of bicycle lanes and public parking capacities (goal: 23% cycling traffic)</p> <ul style="list-style-type: none"> ● Implementation of the Municipal cycling development plan 2030+: Increasing bicycle traffic by improving infrastructures ● Realization of high-speed cycling connections 	<p>Further expansion and improvement of bicycle paths</p>	Promote cycling as part of the environmental alliance of walking, cycling and public transport.



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KSA1- Sustainable mobility				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
		<ul style="list-style-type: none"> Expanding the capacity of bicycle parking facilities in public spaces (incl. cargo bikes) 		
1.4 Public transport, intermodal mobility and motorized private mobility	<p>Network extension tramway</p> <ul style="list-style-type: none"> Network extension tramway: Feasibility study for the city district of Thekla Structural improvements at tram and bus stops to increase accessibility and safety <p>Procurement of new vehicles for public transport: Acquisition of 17 articulated electric buses</p> <p>District-related mobility concepts: Guidelines for mobility concepts incl. evaluation matrix</p> <ul style="list-style-type: none"> Deployment of app for multi- and intermodal mobility (LeipzigMOVE) Load-controlled fleet management for the car fleet of the Leipzig Stadtwerke (goal: dynamization of electricity consumption and protection of the distribution network) 	<p>Expansion of lines, structural improvements at tram/bus, acceleration</p> <ul style="list-style-type: none"> Infrastructure development for the use of trams ("main axes") Network extension tramway: feasibility studies and planning Expansion of local public transport: new tram lines and on-demand busses (project "Netz24") Acceleration of public transport <p>Electrification of bus fleet</p> <ul style="list-style-type: none"> Procurement of new vehicles for bus, streetcar and commuter rail transport (wider streetcars, e-buses, hydrogen-powered buses) <p>New construction and expansion of at least 400 mobility stations (intermodal mobility)</p> <ul style="list-style-type: none"> Capacity expansion of Park&Ride and Bike&Ride stations Expansion of areas with residential area parking <p>30 km/h pilot project, expansion of e-charging stations</p>	<p>Further expansion and improvement of public transportation, promotion of intermodal mobility (including in the delivery sector), expansion of e-charging stations</p>	Promote public transport as part of the environmental alliance of walking, cycling and public transport.



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KSA1- Sustainable mobility				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
	<ul style="list-style-type: none"> Expansion of e-charging infrastructure Introduction of Urban Hubs for Last Mile Delivery 			

Table 24: Leipzig's Milestones for KSA2 - Energy and Heat Supply

KSA2 Energy and heat supply				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
2.1 Framework for climate neutrality in the energy and heat sector	<ul style="list-style-type: none"> Development of a concept for municipal energy/heat supply Development of a Municipal heat plan Modelling of a climate-neutral district heating system: scenarios for the total costs of heat generation and design of the technology options 	Foundations for climate-neutrality in the energy and heat sector have been laid and act as guiding principles for implementation.		x
2.2 Expansion of the production of renewable energies (heat)	<p>Expansion of regenerative heat supply</p> <p>Specific implementation measure:</p> <ul style="list-style-type: none"> Construction of a solar-thermal plant in Leipzig Lausen <p>Complementary measures:</p> <ul style="list-style-type: none"> Hydrothermics: making potentials visible and preparing pilot applications 	<p>Implementation of a decarbonized municipal heating: Expansion of district heating network</p> <p>Complementary measures:</p> <ul style="list-style-type: none"> Waste heat pipeline from the Leuna industrial site to Leipzig (with potential co-construction of a hydrogen pipeline) Construction of a central data center for bundling resources and utilizing waste heat for local heat supply 	Continued expansion of district heating network	Decarbonization of municipal heat supply
2.3 Expansion of the production of	Expansion of renewable energy supply	Expansion of renewable energies: construction of at least	Continued expansion of renewable energies (PV, wind)	Decarbonization of municipal



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KSA2 Energy and heat supply				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
renewable energies	<p>Specific implementation measures:</p> <ul style="list-style-type: none"> • Construction of the PV plant Seehausen Energy Mountain (photovoltaic system) • Development and piloting of virtual power plant for demand-driven energy supply <p>Complementary measures:</p> <ul style="list-style-type: none"> • Development of an area concept for renewable energies • Development of Energy Atlas Leipzig to accelerate the expansion of renewable energies • Photovoltaic systems and electricity storage in the quarter "Dunckerviertel" and the "Baumwollspinnerei" in the SPARCS pilot project • Piloting smart charging and discharging of electric cars and bidirectional charging for grid stabilization. 	<p>400 MW of electrical generation capacity</p> <ul style="list-style-type: none"> • Updating the solar and green roof cadaster • Identification and utilization of area potentials for the generation of electricity/heat by means of regenerative energies • Installation of PV systems on roofs of municipal buildings • Promotion of private (balcony) PV systems • Expansion of virtual power plants for demand-driven energy supply 		energy supply
2.4 Expansion of storage capacities for renewable energies	<p>Expansion of storage capacities for renewable energies</p> <ul style="list-style-type: none"> • Construction of a heat storage facility in Leipzig-West 	Expansion of energy storage capacities for a secure and ecological energy supply	Continued expansion of storage capacities for renewable energies (PV, wind)	Leipzig has sufficient and stable storage capacities for a decarbonized renewable energy supply
2.5 Development of the regional hydrogen supply		<p>Conceptual design of the regional hydrogen supply</p> <ul style="list-style-type: none"> • Study "Hydrogen City Leipzig", formation of a 	Leipzig is a "hydrogen city"	Leipzig is an established "hydrogen city"



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KSA2 Energy and heat supply				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
		strategic monitoring committee, development of an action plan <ul style="list-style-type: none"> • Development of the hydrogen infrastructure 		
2.6 Smart energy monitoring systems	<ul style="list-style-type: none"> • Smart City Challenge - Digital meter reading, monitoring and low-threshold information for users of public buildings • Piloting the use of smart sockets in private homes • Intelligent heating control: collection of real-time data on heat consumption and visualization for tenants • Piloting user awareness through the use of an app ("SPARCS app") • Piloting of an energy monitoring system at the "Baumwollspinnerei" site • Piloting of an energy and load management system at the "Baumwollspinnerei" site 	Upscaling of SPARCS measures in the field of smart energy monitoring systems	Further dissemination and implementation of smart meters	Widespread efficient energy utilization through smart meters

Table 25: Leipzig's Milestones for KSA3 - Sustainable land-use

KSA3 Sustainable land-use				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
3.1 Implementation of a sustainable and climate-friendly land-use	Identification and utilization of area potentials e.g. for the generation of renewable electricity/heat,	Continuous evaluation of the (dis-)advantages of competing land-use potentials	Climate protection in urban development and urban planning	Resolution of the intensifying land competition between



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KSA3 Sustainable land-use				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
	mobility/transport, blue-green infrastructure	<ul style="list-style-type: none"> Climate protection in urban development and urban planning Identification and utilization of area potentials for the generation of electricity/heat by means of regenerative energies Implementation of an overall water management concept 		renewable energy expansion, residential, commercial and transport areas through integrated planning

Table 26: Leipzig's Milestones for KSA4 - Climate-friendly green-blue infrastructure

KSA4 Climate-friendly green-blue infrastructure				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
4.1 Infrastructure measures	<p>Infrastructure and organizational measures to strengthen the green-blue infrastructure</p> <ul style="list-style-type: none"> Development of a digital green space management system for further development and maintenance of green infrastructure Implementation redesign Parkbogen Ost Model project "Leipzig BlauGrün II: Blue-Green District Development in Leipzig" (funded by BMBF) <p>Establishment of steering network for water-sensitive urban development</p>	<p>Expansion/Strengthen biotope network in Leipzig</p> <ul style="list-style-type: none"> Preservation and enhancement of the forest as a CO₂ reservoir Concept for the Elster-Pleisse-Luppe Aue (floodplain, biotope) Evaluation of the potential of "Senken" (e.g. moor, marsh, etc.) to reduce greenhouse gases 	Expansion/Strengthen biotope network in Leipzig	Leipzig expanded its green spaces and water bodies for the preservation of livelihood



KSA4 Climate-friendly green-blue infrastructure				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
		Implementation of an overall water management concept		
4.2 Protection an expansion of tree population and green areas	<ul style="list-style-type: none"> • Success Monitoring of Tree Protection: Digital inventory of trees and woody vegetation and enforcement of tree protection regulations • Success Monitoring of Compensation Measures and Green Infrastructure Measures reg. impacts on nature caused by construction activities • Sustainable park management - maintenance concepts Clara-Zetkin-Park and Johannapark • Evaluation of the role of private allotment and community gardens to the ecosystem • Funding program for the promotion of measures for the ecological upgrading of (inner) courtyards and front gardens 	Expansion of street tree population and forest areas	Expansion of street tree population and forest areas	Leipzig's tree population and green areas have been expanded and necessary protection measures have been implemented.

Table 27: Leipzig's Milestones for KSA5 - Climate-friendly urban district development

KSA5 Climate-friendly urban district development				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
5.1 Framework for a climate-friendly urban district development	<p>Development of principles and approaches for climate-friendly urban district.</p> <ul style="list-style-type: none"> • Development of a standard model for climate-friendly neighbourhood 	<p>Climate protection in urban development and urban planning:</p> <p>Systematic integration of climate-friendly urban development principles into urban planning processes and their implementation</p>	Climate-friendly redevelopment of urban quarters	Leipzig integrated climate protection and adaptation measures into sustainable , energy-efficient,



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KSA5 Climate-friendly urban district development				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
	development (SPARCS project)			and climate-smart urban district development.
5.2 Digital Tools to support the urban district development	<ul style="list-style-type: none"> • Urban Data Platform and Digital Twin for Climate-friendly urban development • Urban Climate Analysis • Introduction of an ICT platform and open and standardized sensors and systems • Pilot project on the use of satellite data as a basis for planning urban climate adaptation measures (UrbanGreenEye project) 	Establishment of these digital tools in urban planning	Further development and establishment of digital tools in urban planning	Digital tools support urban planning processes by making data available and visualizing it.
5.3 Pilot projects for climate-friendly urban district development	<ul style="list-style-type: none"> • Model project "Leipzig BlauGrün II: Blue-Green District Development in Leipzig" (funded by BMBF) <p><u>SPARCS-projects:</u></p> <p>Virtual Power Plant</p> <ul style="list-style-type: none"> • Energy- and Load Management • Integrated Resource Planning and Optimization Energy System Model <p>Replication District: LWB-Stock</p> <ul style="list-style-type: none"> • Energy-Management for constant optimization of the heating systems • Constant expansion of PV-Installation and development of a social model for sale • Citizen engagement 	<ul style="list-style-type: none"> • Implementation of energy-efficient and environmentally friendly urban lighting • Realization of new residential areas with low car-use • Development of smarte products for energy-efficient PEDs 	Implementation of further pilot projects for a climate-friendly urban district development	Implementation of pilot projects for climate-friendly urban district development



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Table 28: Leipzig's Milestones for KSA6 - Climate-neutral city administration

KSA6 Climate-neutral city administration				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
6.1 Strategies for a climate-neutral city administration	<ul style="list-style-type: none"> • Concept "Climate-neutral City Administration 2035" • Development of the climate city contract as part of the EU Cities Mission "100 climate-neutral and smart cities". 	Foundations for climate neutrality within the city administration have been laid and act as guiding principles for implementation.	Foundations for climate neutrality within the city administration act as guiding principles for implementation	Sustainability as the top priority goal is reflected in the regulatory framework, for example, in laws and strategies.
6.2 GHG accounting	<ul style="list-style-type: none"> • Climate-neutral budget: GHG accounting of the annual overall municipal task fulfilment • Climate footprint assessment of cultural institutions and (cultural) events 	<p>GHG accounting for the city administration for a higher transparency regarding emission sources and thus GHG saving potentials has been introduced</p> <ul style="list-style-type: none"> • Introduction of greenhouse gas accounting in procurement • Transparent climate protection works through continuous climate monitoring 	Continued use of GHG accounting within the city administration	GHG accounting makes emissions and fields of action visible
6.3 Energetic refurbishment and energy saving measures in municipal buildings and production of renewable energy	<p>Energy refurbishment of the municipal building stock in accordance with the Leipzig Energy policy and increase the annual refurbishment rate to 3.3%. - Phase 1</p> <ul style="list-style-type: none"> • Energetic refurbishment of existing municipal buildings <p>Balancing the "gray energy" for municipal construction projects</p>	<p>Energy refurbishment of the municipal building stock in accordance with the Leipzig Energy policy and increase the annual refurbishment rate to 3.3%. - Phase 2</p> <ul style="list-style-type: none"> • Energetic refurbishment of existing municipal buildings • Pilot project for the construction of sustainable municipal buildings (e.g. school building) <p>Energy saving measures:</p>	Fully decarbonized municipal building stock	Leipzig's municipal building stock is fully decarbonized



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KSA6 Climate-neutral city administration				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
	<p>Energy saving measures:</p> <ul style="list-style-type: none"> • Use of energy-saving lighting in municipal buildings • Automation of energy consumption data collection and evaluation <p>Renewable energy production:</p> <ul style="list-style-type: none"> • Installation of PV systems on roofs of municipal buildings 	<ul style="list-style-type: none"> • Use of energy-saving lighting in municipal buildings • Automation of energy consumption data collection and evaluation <p>Renewable energy production:</p> <ul style="list-style-type: none"> • Installation of PV systems on roofs of municipal buildings <p>Sustainable administrative accommodation 2030</p>		
6.4 Climate-friendly mobility	<p>Reduction and electrification of the vehicle fleet, expansion of climate-friendly mobility offers for employees of the city administration. – Phase 1</p> <ul style="list-style-type: none"> • Expansion of bike-sharing for employees of the city administration for private use • Reduction and electrification of the vehicle fleet of the city administration as well as promotion of car sharing • Promote cargo bike transportation and mobility within the city administration • Expansion of climate-friendly mobility offers for employees of the city administration (job bike, job ticket) 	<p>Reduction and electrification of the vehicle fleet, expansion of climate-friendly mobility offers for employees of the city administration. – Phase 2</p>	<p>Climate-friendly mobility (70% environmental alliance)</p>	<p>The municipality is taking a pioneering role in the shift to a sustainable mobility within the city. 70% of all mobility is realized by the environmental alliance of walking, cycling and public transport.</p>
6.5 Awareness rising and capacity building	<p>Enable all 9,000 employees of the Leipzig city administration to make climate-conscious decisions and act as role</p>	<p>Enable all 9,000 employees of the Leipzig city administration to make climate-conscious decisions and act as role</p>	<p>Continued efforts in awareness rising and capacity building</p>	<p>Employees of the city administration are empowered</p>



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KSA6 Climate-neutral city administration				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
	<p>models in the transition process. - Phase 1</p> <ul style="list-style-type: none"> • Collaboration and engagement formats within the Digital Campus to promote a digital-savvy leadership and professional staff for supporting the transition process to a carbon-neutral city • Smart City Challenge: work-related carbon footprint calculator for city employees • Raising awareness of sustainable action and climate protection among employees of the city administration • Promotion and expansion of further training for sustainable and climate-friendly actions for employees of the city administration • Training of janitors in building technology and energy efficiency • Raising user awareness in public schools and daycare centers (trainings, projects) • Piloting sustainable working environments for resource-efficient use of space within the city administration • Resource efficiency network for culture 	<p>models in the transition process. - Phase 2</p>		<p>d to take their role as role models in the transition to a carbon-neutral city.</p>
6.6 Circular economy	<ul style="list-style-type: none"> • Establishment of zero waste management in the cultural sector • Introduction of optimized life cycles for ICT 	<p>Introduction of zero-waste management throughout the city administration</p> <p>Introduction of circular economy principles</p>	<p>Continued implementation of circular economy principles within the city administration</p>	<p>The principles of regional circular economy are implemented in the city</p>



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KSA6 Climate-neutral city administration				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
		within the city administration <ul style="list-style-type: none"> • Conversion to Green IT within the city administration 		administration.

Table 29: Leipzig’s Milestones for KSA7 - Regional circular economy

KSA7 Regional circular economy				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
7.1 Zero Waste Management	Development of a municipal Zero Waste Strategy <ul style="list-style-type: none"> • City of Leipzig joins the Zero Waste Europe Network • Digital participation by promoting hardware-based circular economy (Hardware4Future project) • Opening of the Municipal Second Life Store • Promotion of reusable tableware in the gastronomy sector • Establishment of zero waste management in the cultural sector („Analysis of Zero Waste Practices in Cultural Institutions“ project) 	Implementation of zero waste management in the city	Zero Waste City certificate	Leipzig has closed regional economic and material cycles for lower transport and transaction costs with value creation on site
7.2 Circular economy	Drafting and initiating of Business consulting on climate protection and resource efficiency	Continued Business consulting on resource efficiency and circular economy	Establishment of closed material cycles for specific key materials (e.g. glass, metals, plastics) to minimize the use of primary resources Integration of circular economy principles into urban planning and infrastructure projects to ensure	Leipzig has closed regional economic and material cycles for lower transport and transaction costs with value creation on site



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			sustainable development	
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Table 30: Leipzig's Milestones for KSA8 - Sustainable nutrition

KSA8 Sustainable Nutrition				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
8.1 Municipal nutrition strategy	<p>Initiating the shift in regional food supply towards ecological, seasonal, and local sourcing including the producer and consumer side</p> <ul style="list-style-type: none"> • Development of a municipal nutrition strategy • Recommendations and guidelines for Leipzig's food system • Promote exchange between actors from the agricultural and food sector 	<p>Foundations for climate-neutrality in local nutrition have been laid and act as guiding principles for implementation</p> <p>Diverse projects and activities for implementing the nutrition strategy</p>	Ongoing activities to support the transition of the local food system	<p>Sustainable realignment of the urban food landscape for food and climate justice</p> <p>Improved framework conditions and support for sustainable food production</p>
8.2 Sustainable nutrition in city administration and associated companies	<ul style="list-style-type: none"> • Adaptation of procurement rules for sustainable food for canteens of city administration and associated companies 	<p>Procurements rules are adapted and canteens are supplied with regional, seasonal and organic foods</p> <p>City administration and affiliated companies act as pioneers and influence other private businesses and institutions</p>		<p>The transition to the use of sustainable food influenced other businesses to also switch to regional, seasonal, and ecological catering in their canteens.</p>
8.3 Awareness-rising and capacity building	<p>Awareness-rising and capacity building. - Phase 1</p> <ul style="list-style-type: none"> • Information and education campaign for raising awareness of climate-friendly nutrition • Awareness-raising and information measures on conscious consumption and food waste 	<p>Awareness-rising and capacity building. - Phase 2</p>	<p>Awareness-rising and capacity building. - Phase 3</p>	<p>Transition of catering in local businesses and institutions has been completed. Private households predominantly source</p>



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	<ul style="list-style-type: none"> Urban orchards and vegetable beds: Establishment of care, communication and participation structures 			sustainable food.
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Table 31: Leipzig’s Milestones for KSA9 - Climate education

KSA9 Climate education				
Category	Current state and Milestones 2024	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
9.1 Climate education	<p>Climate education campaign: Information and awareness-raising services, events, campaigns, and advice for businesses and private households. – Phase 1</p> <ul style="list-style-type: none"> Foundations for awareness rising and capacity building for reaching climate neutrality have been laid and act as guiding principles for implementation (climate neutrality strategy) Implementation of the European Mobility Week 2023 Information events for citizens in the Dünkerviertel to increase acceptance of climate protection measures (SPARCS project) 	<p>Climate education campaign: Information and awareness-raising services, events, campaigns, and advice for businesses and private households. – Phase 2</p> <p>Raise awareness for effective climate protection</p> <ul style="list-style-type: none"> Implementation of European Mobility Week and an annual Car Free Day. 	<p>Climate education campaign: Information and awareness-raising services, events, campaigns, and advice for businesses and private households. – Phase 3</p>	<p>Climate action is the overriding common objective in Leipzig’s urban society.</p> <p>Climate-friendly behaviour is the new normal.</p>

Table 32: Leipzig’s Milestones for KSA10 - Climate protection initiative

KSA10 Climate protection initiative				
Category	Current state and Milestones 2025	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
10.1 Networking and encouraging climate action	<p>Networking and encouraging climate action</p> <ul style="list-style-type: none"> Introduction of the KlimaHub as a networking space for start-up accelerators in the field of climate and environment 	<p>Foundations for engaging the economy and civil society in achieving climate neutrality have been laid and act as guiding principles for implementation</p>		<p>Leipzig’s urban society is supported in implementing concrete climate protection measures</p>



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KSA10 Climate protection initiative				
Category	Current state and Milestones 2025	Goals and Milestones 2030	Goals and Milestones 2035	Goals 2040
	<ul style="list-style-type: none"> Leipzig (Green) Business Summit to make innovative projects and business models visible and promote new cooperations Resource efficiency network for culture <p>Development of the Climate City Contract as part of the EU Cities Mission "100 climate-neutral and smart cities"</p>	<ul style="list-style-type: none"> Promotion and initiation of climate protection projects and measures by companies and civil society <p>Implementation and update of Climate City Contract</p> <p>Marketing Leipzig as a sustainable city destination</p>		and networking for even more collaborative Climate Action
10.2 Supporting SMEs activities	<p>Initiation of new funding and supporting programs for SMEs</p> <ul style="list-style-type: none"> Cargo bike promotion for SMEs Promotion of private energy efficiency measures Drafting and initiating of SME support program "Regional value chains in the food and agriculture sector" Drafting and initiating of Support program for private companies in the construction of facilities for the generation, use and storage of renewable energies for Leipzig's economy Drafting and initiating of Business consulting on climate protection and resource efficiency Drafting and initiating of SME support program "Load Testing for Solar Roofs and Roof Greening" Drafting and initiating of SME support program "Measures for sustainable growth" 	<p>Initiation of new funding and supporting programs for SMEs and other private companies</p> <ul style="list-style-type: none"> Support programs have been successfully implemented and SMEs and other private companies have been supported through specific financial grants and consultations 		SMEs and other private companies are supported on their way to becoming climate-neutral companies.

B. Leipzig's Comprehensive roadmap

See: <https://miro.com/app/board/uXjVMKcTu5I=/>



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Appendix 4 – Complementary outputs of Kifissia’s roadmapping process

A. Kifissia’s milestones tables per KSA

Table 33: Kifissia’s Milestones for KSA1 - Mobility

KSA1- MOBILITY				
Categories / Themes	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050 (City Vision / Vision statement)
1. Mobility strategic framework	P1.1 SUMP approved Framework for the city’s sustainable mobility set in place			All KS1 Vision Statements
2. Public transportation	P1.2. Implementation of a municipal bus fleet <ul style="list-style-type: none"> No municipal busses 	<ul style="list-style-type: none"> Introducing municipal busses 	<ul style="list-style-type: none"> E municipal busses covers all city 	VS1 <ul style="list-style-type: none"> Public and municipal E-busses and rail transport are mostly used minimizing the use of private cars and non-renewable energy sources VS2 <ul style="list-style-type: none"> Improvements in ticketing system facilitates citizen and visitors’ daily movements
	P1.3. Extension of the urban rail network <ul style="list-style-type: none"> Extension to the north (N. Erythrea) (project in study phase from the Urban Rail Transports) 	<ul style="list-style-type: none"> Extension of urban rail to the north (N. Erythrea) completed (this project is managed by the Urban Rail transports) 		
	P1.4. Optimizing municipal ticketing system <ul style="list-style-type: none"> Project study will start in relevance with the introduction of municipal busses 		<ul style="list-style-type: none"> Single ticket for all means of transportation implemented 	
	P1.5. / P4.5. Implementation of Park and ride system and Mobility hubs <ul style="list-style-type: none"> Project in proposal phase 	<ul style="list-style-type: none"> Park and ride system completed Mobility hubs partly implemented 	<ul style="list-style-type: none"> Mobility hubs completed 	
3. Micromobility and e-mobility	P1.6. Fostering improvements in cycling mobility	<ul style="list-style-type: none"> Extension of bike routes Connection of bike route to the larger bike ‘paths’ 	<ul style="list-style-type: none"> Bicycling change rooms in municipal building and 	VS3 <ul style="list-style-type: none"> The city is fully accessible to bikes, scooters,



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KSA1- MOBILITY				
Categories / Themes	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050 (City Vision / Vision statement)
	<ul style="list-style-type: none"> E-bike sharing system –under implementation 	according to Athens regulatory plan <ul style="list-style-type: none"> E bike sharing system around the city 	private offices for employees	pedestrians and disables <ul style="list-style-type: none"> Sustainable mobility
	P1.7. Fostering EV infrastructure Municipal e-vehicle charging plan is approved <ul style="list-style-type: none"> Insufficient e-vehicle charges Chargers for common use exists in shopping centres and supermarkets 	<ul style="list-style-type: none"> E-vehicle chargers around the city facilitates the use of e-cars 	Most private cars are e-cars	
4. Traffic management and parking	P1.8. Traffic management system (to be added to central smart city control room <ul style="list-style-type: none"> Project in proposal phase Traffic congestion, especially in the two commercial centres of the municipality is currently a problem 	<ul style="list-style-type: none"> The smart parking system, traffic control, municipal busses and bike sharing system are minimizing traffic 		VS4 <ul style="list-style-type: none"> Traffic control with smart monitoring system
	P1.9. / P5.6 Smart parking system in the commercial centre of Kifissia <ul style="list-style-type: none"> Project in proposal phase Illegal parking is currently a problem.			VS5 <ul style="list-style-type: none"> Smart parking system in the city



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Table 34: Kifissia's Milestones for KSA2 - Energy consumption of buildings

KSA2 - Energy consumption of buildings				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
1. Existing building stock	P2.1. ΦΕΚ3424 /2022 “Measures to improve energy efficiency and save energy in public buildings and facilities <ul style="list-style-type: none"> • National framework energy efficiency of public buildings 	<ul style="list-style-type: none"> • 30% reduction of CO2 emission (SEAP ref. year 2015) 		VS1 Municipal and private buildings are energy efficient
	P2.2. Energy upgrade renovation work for municipal buildings <ul style="list-style-type: none"> • Ongoing project in some municipal buildings • Existing buildings are not energy efficient (Prior to building energy performance regulation) 	<ul style="list-style-type: none"> • Municipal buildings are A+ • Use of new building materials (and recycled) 	<ul style="list-style-type: none"> • Private buildings are A+ 	
	P2.3. New regulation for building's energy performance <ul style="list-style-type: none"> • Proposal-existing regulations is national 			
2. Heating & cooling energy	P2.4. PV panels for heating and cooling on the terrace of		<ul style="list-style-type: none"> • RES parks construction with PPP model 	VS2 All heating and cooling systems



KSA2 - Energy consumption of buildings				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
	municipal buildings <ul style="list-style-type: none"> • Project under development for some municipal school buildings • Heating energy currently is mainly heating oil and natural gas 			of the buildings is now climate neutral
	P2.5. Increase use of wind power <ul style="list-style-type: none"> • Proposal 			VS3 100% of energy demand is from RES
	P2.6. Increase prosumers <ul style="list-style-type: none"> • A pilot creation of energy community is under development 		<ul style="list-style-type: none"> • PV installation in municipal and private buildings • 70% of energy demand is from RES 	
3. Automation and energy management systems	P2.7. Energy management systems for Municipal buildings	<ul style="list-style-type: none"> • Energy management systems in municipal buildings 	<ul style="list-style-type: none"> • Energy management systems in private buildings 	VS4 Energy control & storage systems in municipal and private buildings
4. User behavior	P2.8. Digital building logbook <ul style="list-style-type: none"> • On going for two municipal buildings. The project is funded from EU 			VS5 Citizens have environmentally friendly and sustainable behaviour



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KSA2 - Energy consumption of buildings				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
	Lack of energy management systems			
	P2.9. / P6.1. Municipal office for sustainability/information to the citizens <ul style="list-style-type: none"> • Project proposal • Bad habits lead to more energy consumption 	<ul style="list-style-type: none"> • Smart communication policy for energy awareness • Promote energy communities (prosumers) 		

Table 35: Kifissia's Milestones for KSA3 Green Energy

KSA 3 - Green energy				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
1. Energy from RES	P3.1. PV park through energy communities Pilot creation of an energy community is under development <ul style="list-style-type: none"> • Currently there are no RES parks in the city 	<ul style="list-style-type: none"> • Installation of PV park for the needs of energy communities 	<ul style="list-style-type: none"> • PV in the roof tops of all municipal buildings 	VS1 100% energy demand is from RES
	P3.2. Small hydroelectric plant <ul style="list-style-type: none"> • Project is a proposal 	<ul style="list-style-type: none"> • Small hydroelectric plant 		
		P3.3. use of PV and solar panels	<ul style="list-style-type: none"> • Solar panels for street lighting 	
2. Storage systems	P3.4. Storage and smart energy management		<ul style="list-style-type: none"> • Storage system and energy management for 	VS3



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KSA 3 - Green energy				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
	for municipal needs		all municipal needs	Energy autonomy for Kifissia
3. Municipal waste	P3.5. Use of garden waste <ul style="list-style-type: none"> • Proposal -Waste treatment is not done in municipal level according to local regulations • Large amount of unusable garden waste. 		<ul style="list-style-type: none"> • Exploiting garden waste for energy (biomass) 	

Table 36: Kifissia's Milestones for KSA4 Urban Planning

KSA4 - Urban planning				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
1. Pedestrian accessibility and Micromobility	P4.1. Widen existing and create new sidewalks <ul style="list-style-type: none"> • Proposal • Insufficient width of sidewalks 	<ul style="list-style-type: none"> • Wide sidewalks free of obstacles 		VS1 City fully accessible for pedestrian, bikes and disabled. Network of pedestrian and bike streets
	P4.2. Pedestrianisation of Kifissia and N. Erythrea centres <ul style="list-style-type: none"> • Proposal 		<ul style="list-style-type: none"> • Commercial centre of Kifissia and N. Erythrea is accessible on foot 	VS2 Main traffic streets are underground
	P4.3. Extension of bike routes Proposal-partly already under study			



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KSA4 - Urban planning				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
2. General planning options / Green areas/use of public spaces	<p>P4.4. Improve public areas & parks</p> <ul style="list-style-type: none"> • Ongoing for some parks /proposal 	<ul style="list-style-type: none"> • Use of bioclimatic materials, add sitting areas, more trees for shadow, playing area according to safety regulations • Revival of local streams with NBS in combination of historical interest routes 	<ul style="list-style-type: none"> • Creation of Superblocks model 	<p>VS3</p> <p>large number of public spaces</p>
	<p>P4.5. / P1.5 Implementation of Park and ride system and Mobility hubs</p> <ul style="list-style-type: none"> • Proposal 			<p>VS4</p> <p>Mobility hubs completed-single ticket for all mean of transportation facilitates citizen and visitors' daily movements</p>
	<p>P4.6. City planning</p> <ul style="list-style-type: none"> • Proposal 		<ul style="list-style-type: none"> • Improve municipal sports facilities /build adequate underground parking space • Transform industrial area into technological park- due to its vicinity to the residential area 	<p>All VS</p>

Table 37. Kifissia Milestones table for KSA5 – Digital city

KSA 5 - Digital city				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
1. City sensors	<p>P5.1. Air quality sensors and fire prevention (pilot)</p>	<ul style="list-style-type: none"> • Fire prevention system covers all forest and 		<p>VS1</p> <p>Smart city control room for</p>



KSA 5 - Digital city				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
	(SPARCS project) • Installed	green areas in the city		all systems city is 100% digital
	P5.2. smart irrigation system (SPARCS Project) • In two parks within 2023	• Smart irrigation system in 50% of green areas of the city saves energy and water.	Smart irrigation system in 100% of green areas of the city saves energy and water.	
2. Building sensors	P5.3. Energy measurement & management sensors in municipal buildings • Already installed the electricity measurement sensors in one municipal building	• Heating and cooling management system in 50% of municipal buildings • smart lighting management system in municipal buildings		VS2 Heating and cooling management system in all municipal buildings
3. Traffic regulation & mobility	P5.4. Traffic management system • Proposal • No traffic lights management	Cameras for traffic management	Intelligent transportation system – telematics	VS3 Extensive use of new technologies
	P5.5. E-vehicle chargers Municipal e-vehicle charging plan is approved	E-vehicle chargers around the city covers all demand		
	P5.6. / P1.9 Smart parking system • Proposal			
	P5.7. Smart bus stations • Under implementation			



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KSA 5 - Digital city				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
4. Municipal services	P5.8. Digitization of public services		100% Digitization of public services	

Table 38. Kifissia Milestones table for KSA6 – Citizen engagement

KSA 6 - Citizen engagement				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
1. Energy saving	<p>P6.1. / P2.9 Municipal office for sustainability/information to the citizens</p> <ul style="list-style-type: none"> • Project proposal <p>Bad habits lead to more energy consumption</p> <ul style="list-style-type: none"> • Insufficient knowledge of the citizens for proper use of heating and cooling systems • Building of political credibility 	<ul style="list-style-type: none"> • New marketing procedures for proper awareness and engagement • New lessons for sustainability and innovation introduced in schools 	<ul style="list-style-type: none"> • Sustainable behaviour 	<p>VS1</p> <p>Citizens have environmentally friendly and sustainable behaviour</p>
2. Alternative ways of transportation	<p>P6.2. Micromobility</p> <p>Collaboration with private companies for Micromobility and shared transportation systems</p> <ul style="list-style-type: none"> • Private cars are mainly used for transportation 	<ul style="list-style-type: none"> • Continuous promoting Micromobility and public transportation 		



KSA 6 - Citizen engagement				
Category	Current state	Intermediate milestones 2030	Intermediate milestones 2040	Goal 2050
3. Energy communities	<p>P6.3 Creation of an energy community (SPARCS Project)</p> <ul style="list-style-type: none"> • Project under development • No energy communities within the city 	<ul style="list-style-type: none"> • Collaboration with private companies for building PV parks 	<ul style="list-style-type: none"> • Energy communities between citizens and local stakeholders 	<p>VS2</p> <p>New PPP models for RES implementation</p>
4. Circular economy	<p>P6.4. Environmental educational park</p> <ul style="list-style-type: none"> • Proposal 			<p>VS3</p> <p>Total recycling</p>
	<p>P6.5. Differential separation of waste at the point of their production</p> <ul style="list-style-type: none"> • In early stage/waste treatment is allowed in regional level (not municipal) 		<ul style="list-style-type: none"> • Waste treatment can be done in municipal level 	



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Appendix 5 – Complementary outputs of Kladno’s roadmapping process

A. Kladno’s milestones tables per KSA

Table 39: Kladno’s Milestones for KSA1 - Energy

KSA1- ENERGY				
Sub-area 1.1: Heating				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
1.1.1 Local combined heat and power to substitute decentralized gas boilers	There are no CHPs in the city.	The CHPs replace gas consumed in boilers (32 % for municipal buildings, 24 % for tertiary sector, 36 % in housing)	Share maintained or increased.	Gas completely crowded out from the mix.
1.1.2 Change in energy mix for both central source and in the district heating distribution	Kladno reversed from 20 % biomass (2017) to 100 % coal again (2020). Waste2energy is considered along with some heat pumps.	Feasibility study for Waste2energy plant finished and investment decision taken. Pyrolysis considered as alternative. PVs to run DH infrastructure in place.	Min 20 % of the heat demand covered by waste2energy.	More sustainable elements in the mix dominate (hydrogen, biomass). Trends in nuclear energy are observed.
1.1.3 Expansion and optimization of the district heating (DH)	New areas are foreseen to be connected.	Physical expansion to new areas, central heating is competitive against decentralized gas, new complementary services introduced by DH operator.	Consolidation of dominant DH share of heat delivered in the city.	Up to 90 % of buildings are connected.
1.1.4 Use of mine water for seasonal heat accumulation	Neither technical nor economic feasibility of mine water energy use was verified.	Mine water energy use feasibility study carried out.	Investment decision on mine water utilization taken (energy use or other).	Mine water utilization implemented.
1.1.5 Utilization of hydrogen, esp. green hydrogen	Hydrogen mentioned as a potential in SECAP.	Feasibility study carried out, business model suggested, and investment decision taken (H2 burning/only mobility utilization, vis-a-vis waste2energy etc.).	Hydrogen used for heating.	Hydrogen used for heating.



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KSA1- ENERGY				
Sub-area 1.1: Heating				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
1.1.6 Connecting water treatment plant with DH	No connection of the WTP with the DH.	Feasibility study carried out.	Investment decision taken.	For feasible scenarios, wastewater heat or sludge used.
1.1.7 Energy system robustness, ensuring the security of supply	Contingency plans are in place for current infrastructure.	The infrastructure is bolstered against blackouts.	The infrastructure is bolstered against blackouts.	
1.1.8 Central cooling distribution	No central solution in place.	Continuous assessment of central cooling potential carried out.	Foundations of central cooling in place.	Existing network of central cooling.

KSA1- ENERGY				
Sub-area 1.2: Buildings				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
1.2.1 Energy savings in the public buildings	<p>Some renovation is ongoing (schools, etc).</p> <p>Preparation of Phase I of energy saving projects (EPC); 22 buildings.</p> <p>Contract with National development bank (ELENA programme).</p> <p>Preparation of the application to EU funds.</p> <p>Energy management has developed incl. data tools.</p>	<p>Phase I submitted and implemented incl. achievement of NZEB.</p> <p>ISO 5000:2019 has already been in place for years.</p> <p>Significant reduction of the energy losses, lower emissions.</p> <p>Interconnection with the smart metering system.</p> <p>Connection to the clean energy production (PVs).</p> <p>Phase II of the energy savings projects has just started.</p> <p>Directive implementation (EPBD 4, Energy</p>	<p>Phase II and Phase III of the energy savings projects were done.</p> <p>Significant energy losses were reduced; clean energy was produced in a considerable amount.</p> <p>Smart metering in on all buildings, flexibility management is in place.</p> <p>Circular materials are an integral part of the reconstruction.</p> <p>EU and Czech legislation mechanism in place (boilers, RES, energy</p>	<p>NZEBs are achieved in all buildings where it is possible.</p> <p>A significant amount of energy losses, and emissions were decreased.</p> <p>All standards such as energy flexibility, demand response, green energy purchases, and use of circular materials in renovations are considered as a principle while renovation or construction of</p>



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KSA1- ENERGY				
Sub-area 1.2: Buildings				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
	ISO 5000:2019 energy management system preparation. NZEB in the testing phase.	performance of buildings). NZEB done in a several buildings.	performance, waste).	the buildings is taking place.
1.2.2 Energy savings in other buildings	Some renovations on the buildings (as a protected monument) are being prepared. Renovation of other buildings (other public, private sector) is taking place. Family and apartment houses are continuously reconstructed. A complex project for supporting the housing and private sector (= One-stop-shop) is designed for submission to the EU funds.	Significant energy losses and emissions were reduced due to the renovation of the: - heritage-protected buildings, - other public buildings (hospitals, high schools, etc.), - private sector, - family houses, - apartment houses. It is also due to support from the city administration since One-stop-shop services are in place, energy communities are supported, negotiation of the heat prices and decentralized models are solved, NZEB concepts are supported, etc.	Significant energy losses and emissions were reduced due to several activities. An effective system of cooperation with dozen partners bring benefits to users and vulnerable groups. The energy flexibility market is in place. Energy communities are basic tools for decreasing the consumption and prices of energy. Maximum use of alternative energy (from RES, waste heat, the testing of the nuclear modules, hydrogen use).	Th energy consumption is at the lowest level possible. NZEB is a basic approach of the other partners. The circular solutions are part of the construction and renovation of buildings. Energy flexibility is used on a daily basis. Macro-energy policy ensures the basic energy supply, security, and resilience. SECAP targets are achieved, climate neutrality is the main driven force.
1.2.3 RES installation in the buildings	Completion of PV feasibility study (new city business model for clean energy production). The process of licencing (city company) has started; technical	City company implements its business model (installation of the PVs, maintenance) and saves energy and finance city. City company offers the installation and operation of the PVs	Continuous installation of the PVs, carports, battery storage, and related technologies). New places were tested and evaluated (agriculture spots, bus roofs, etc.) Different business and cooperation	Maximum use of the buildings and other space for RES installation. Inclusion of the RES generated in the heating system as a balancing aspect. RES installation as a service (offered by city



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KSA1- ENERGY				
Sub-area 1.2: Buildings				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
	<p>documentation is under development.</p> <p>The use of the carports for the installation and battery storage – under design phase.</p> <p>Innovative installation on the roof of the Winter-stadium is prepared.</p> <p>No green energy is used by the housing sector (more by private due to the ESG requirements).</p>	<p>for third entities (upon a contracts).</p> <p>ECs is supported by offering a surplus from the production (could be used also for the eCars charging).</p> <p>Using the green electricity certificate mechanisms.</p> <p>Several carports (incl. battery storage) are installed and operated by the city company/other entities.</p> <p>Pilot installations on the ground (brownfields or any other non-development area).</p>	<p>models were tested incl. Involvement of the city company.</p> <p>PVS and other RES installation owned by city company is always fully connected with the city EM system and/or flexibility market if possible.</p>	<p>company or/and consortium of the public and private vehicle).</p>
1.2.4 Energy communities	<p>No Energy communities (ECs) are in place; the pilot project is planned by the city; EU project for the EC testing was submitted.</p>	<p>Legislation is in place; several EC are already implemented; the city is providing services for the EC establishment and moderating discussion among the partners; the city is testing its business model.</p>	<p>Establishment of the EC is a basic option for any entity; the city is providing wide services and is a member of several EC (connected also to a business plan with clean energy).</p>	<p>Increasing of the self-sufficiency as a main target EC is part of the PED scheme; ECs are linked to functioning energy flexibility and real-time demand response.</p>
1.2.5 Smart metering	<p>Smart metering is not in place; only a pilot was conducted on selected buildings.</p>	<p>More than 50% of public buildings are equipped with remote consumption smart meters; all is connected with the energy management system.</p>	<p>Smart metering is included almost in all new/old buildings; there is a contract with the distributor to provide the data.</p>	<p>Smart metering and AI are basic elements in energy management; it is connected with other data / dashboards.</p>



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KSA1- ENERGY				
Sub-area 1.2: Buildings				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
1.2.6 Other measures	<p>Green roofs and facades - there are no building requirements or standards; no buildings with such measures are in place.</p> <p>Smart building Pilot in the preparation – environmental centre.</p> <p>Tool for the assessment of the construction projects (only the basic principles for development are set out).</p>	<p>Green roofs and facades - established binding city requirements for the implementation of green roofs in new construction (e.g. combination of the PVs and bio-solar roof).</p> <p>The Pilot Smart building (environmental centre) is successfully functioning and providing good examples.</p> <p>Preparation of a toolkit: building-energy concepts for construction; higher savings standards.</p>	<p>Green roofs and facades – principles and city/regulation requirements are in place; pressure on savings and climate measures is increasing. Combination with the greenery and PVs is the basic issue.</p> <p>Smart buildings are regular and more/less compulsory forms of construction.</p> <p>Toolkit for the energy concepts and regulatory aspect is a basic procedural step.</p>	<p>All measures are in place.</p> <p>The city has a flexible mechanism and capacity to adapt new tools, standards, legal conditions / trends / innovation.</p>

Table 40: Kladno's Milestones for KSA2 - Mobility (individual mobility)

KSA2: Mobility (individual mobility)				
Sub-area 2.1: Charging system, Cars, parking				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
2.1.1 Charging stations infrastructure	<p>Limited number of public and private charging stations.</p> <p>Limited volume of eCars in use.</p> <p>Existing detailed study of the relevance, economics, connectivity,</p>	<p>Functioning system of the concession model between the city and private operators (building and operation of the charging system).</p> <p>Increasing number of public charging stations; also private one.</p> <p>City support clean mobility by other activities (funds,</p>	<p>The network of charging stations is sufficiently dense (need to think of street capacity in terms of space)</p> <p>Several hydrogen filling stations.</p> <p>Reduction in equivalent CO2 emissions from passenger transport</p>	<p>Established network of charging and filling stations.</p> <p>Smart connection to transport sharing, public transport.</p> <p>Innovative solution in the specific areas.</p>



KSA2: Mobility (individual mobility)				
Sub-area 2.1: Charging system, Cars, parking				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
	<p>etc. of the charging station system.</p> <p>Missing detailed business model for the operation.</p>	<p>awareness, sharing the data).</p> <p>Innovative concept/pilots of the charging system in high-density old apartment house areas (charging, battery storage, PVs, carport, reservation system).</p> <p>The existence of building standards for building construction and renovation.</p>	<p>reaches the SECAP predicted level.</p> <p>More complex solutions for the high-density old apartment house areas (charging system, car/bike/bus sharing systems).</p>	
2.1.2 City fleet	<p>The number of cars with alternative-fuel cars is minimal, no eCar, no hydrogen cars.</p> <p>Missing charging stations.</p> <p>Missing carports.</p>	<p>Share of EVs is min. 50 %.</p> <p>50 % reduction in road transport CO2 emissions.</p> <p>Digitalization of the city fleet.</p> <p>Sufficient network of the charging point for the city cars.</p> <p>Innovative projects for carports in the particular places.</p>	<p>100 % cars are zero-emission.</p> <p>Dozens of hydrogen-powered cars in the city.</p> <p>Full coverage of the charging system in the city (used also by citizens and other users).</p> <p>Extended storage points in the city (powered also by energy from the city PVs system).</p>	<p>Carbon neutral while increasing resilience to climate change.</p> <p>Innovative services within the public sector, but also offered to citizens.</p>

KSA2: Mobility (individual mobility)				
Sub-area 2.2: Links to the network and parking system				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
2.2.1 Network reinforcement and security	<p>Existing charging plan with a link to future real-estate development</p>	<p>Sufficient network capacity for charging.</p> <p>New (electric) substations.</p> <p>Existing sites with interconnection to</p>	<p>Full compatibility of charging infrastructure (and other plans in the city) with the distribution network.</p>	<p>Functioning system of the charging and filling stations and grid capacity</p>



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KSA2: Mobility (individual mobility)				
Sub-area 2.2: Links to the network and parking system				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
	and energy grid capacity. Metropolitan data network owned by the city.	generate EE, e.g. from PV or other sources. Data network reinforcement. Full connection of the data network to the stations. Integrated and user-friendly payment systems is in place.	New (sub)local distribution networks to accommodate increased charging demand. Several vehicle2grid solutions.	
2.2.2 Parking	Unclear parking strategy. Absence of parking houses.	Building parking spaces including charging EVs. New parking houses and hubs. Use of private parking lots as well (e.g. supermarkets).	Expensive parking fees / reducing capacity in the city. Charging in the built environment - the aim is to differentiate between cars that do and do not belong there.	Fewer cars and more public space. Car/bike/bus sharing system and services. Charging and filling networks.

KSA2: Mobility (individual mobility)				
Sub-area 2.3: Links to the public transport, car sharing				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
2.3.1 Connections to train, bus, pedestrian, cycling	Bus station – project renovation (preparation). New rail route to the airport and Prague - under construction.	Improving the standard of interchanges. Collection service - within the city on public transport. New pedestrian and cycle paths. Short distance city. Rail route to the airport and Prague. Sharing of the existing car/bike fleet.	Ideally using means of transport other than cars. Creation of public transport infrastructure in connection with the connection to the airport. All public transport nodes are connected, access routes are short, logical and barrier-free.	Whole city system is interconnected (with high effectiveness, low time losses, low/zero emissions approach).
2.3.2	Minimum number of cars to be shared.	Both, in the city and out of the city (airport,	Moving physical infrastructure to online environment	System of the public transport and individual



KSA2: Mobility (individual mobility)				
Sub-area 2.3: Links to the public transport, car sharing				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
Car, bike and scooter sharing	The city provides eBikes sharing system.	Prague, other cities around): HUBs for electric cars/bikes/scooters. Areas for e-carsharing, community carsharing. Services for the users (incl. apps with information, reservation, news).	- parking stands -> mobile apps. Integration of urban transport with shared transport. Long-term existing sharing system (to airport, Prague and other cities).	mobility is effectively connected with the services for vehicles sharing.
2.3.3 Business and city services	Senior taxi for elderly people. No other services provided by public bodies.	Airport: favour taxis with alternative propulsion or full occupancy. Green behaviour with "individual allowances" and sanction non-environmental mobility. Financial and tax support for using the clean energy.	Other new services to be provided (in health, sport, community, social sector). The public and semi-public fleet use for others (incl. Reservation system). Piloting of the green certificates.	Public and private collaboration systems of services for users (incl. economic, environmental and other aspects).

Table 41: Kladno's Milestones for KSA3-4 - Smart City (merged digital services and e-governance)

KSA3-4: Smart City (merged digital services and e-governance)				
Sub-area 3.1: Sensorics and metering				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
3.1.1 Waste & Recycling	Several bins with sensors in operation (smart underground chests) incl. sharing data with citizens.	Installation of above-ground containers Monitoring and information on waste pick-up, container capacity all over the city. Test dynamic pick-up system.	Full waste management strategy due to future law in operation Central control system, automated processes and data import.	New technologies and innovation in operation. Elimination of the waste production by human acting /



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KSA3-4: Smart City (merged digital services and e-governance)				
Sub-area 3.1: Sensorics and metering				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
		Costs reduction from the collection (via optimizing the no. of field journeys).	Smart small bins all over the city.	preventive system etc.
3.1.2 Transport - telematics, signposts, eBike system	<p>Monitoring of the entrance to the city (study underway)</p> <p>A parking strategy (study underway)</p> <p>eBike system in operation</p> <p>Smart bus stops.</p>	<p>Implementation of priority use cases: city navigation, junction preference, charging station network, ...</p> <p>Implementation of city entrance monitoring, parking monitoring.</p> <p>Integration with Integrated Rescue System (drones, cameras for parking, person recognition, traffic mapping)</p> <p>New parking places constructed.</p>	<p>Full and interactive smart navigation in the city.</p> <p>Smart parking strategy is fully in place.</p> <p>Car-sharing system in place using smart elements.</p> <p>Most of the eHubs in place incl. reservation system; some filling stations for the hydrogen in operation.</p>	Fully flexible system in place (also depends on mobility trends, legislation etc).
3.1.3 Environment and health	<p>Air quality sensors installed at strategic locations.</p> <p>Partial air quality monitoring in city buildings.</p> <p>Lack of the future plans and data use.</p>	<p>Revised and developed air monitoring.</p> <p>Comprehensive assessment of how monitoring can be applied in the city, identifying responsibilities for topics/use cases.</p>	<p>Implementation of priority use cases: envi monitoring sensor network, digital irrigation, CO2 alerts.</p> <p>Connection with the energy management system, data gathering and assessment in real-time.</p>	<p>AI processes in place.</p> <p>Virtual assessment of the air and other particulates (outside and inside).</p> <p>Real-time data at disposal.</p>
3.1.4 Energy management	<p>Energy management system in place incl. SW solution (at the level of monitoring and partial automation).</p>	<p>Smart metering, water/gas metering, PV dispatching.</p> <p>Energy flexibility testing.</p> <p>Monitoring of the street light consumption, remote control.</p>	<p>Interconnected energy/facility management and building management system (BMS).</p> <p>Real-time remote building management.</p>	<p>Real-time management of the energy.</p> <p>AI (assessment and prediction of the future consumption, production, purchases etc.)</p> <p>Energy flexibility as service.</p>



KSA3-4: Smart City (merged digital services and e-governance)				
Sub-area 3.2: Digital twin				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
3.2.1 Digital twin development	There is no digital twin implemented. Nor, the concept is not yet fully explored.	Coordinated needs analysis, pragmatically oriented, focusing on economy of scale, maximizing utility, involving high number of agendas; 2D data modules implemented.	3D model of the city, supporting construction processes.	Virtual reality is routinely applied.
3.2.2 Digital twin inputs collection	Systematic reposition of data in the geoportal and city data platform.	Use cases in operation: Green spaces modelling, impact of surfaces on rainwater, navigation, property management, 3D models of construction projects, dynamic PV production models, contingency management (e.g. drinking water).	Future use cases explored and implemented.	
3.2.3 Digital twin interoperability	No interoperability so far.	Established rules for acquiring and updating data, including specification of resources, interconnection with city apps, BIM models integrated into a digital twin (esp. for contingencies).	Interconnection with Metaverse.	

KSA3-4: Smart City (merged digital services and e-governance)				
Sub-area 3.3: Open governance and organisational learning				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
3.3.1 Open data and data-oriented services to citizens	Existing portals for citizens: (1) Citizen portal (2) Misys portal	Implemented strategy for data use and data mining. Existence of Kladno open data portal.	Automatic full open system for open data. City apps with current information and services offer. Participative services/programs/	Big data centre. Full on-line services. 1 integrated solution for the collection, sharing, publishing and



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KSA3-4: Smart City (merged digital services and e-governance)				
Sub-area 3.3: Open governance and organisational learning				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
	(3) Invipo Smart City (4) Smart City Compass (5) Kladno website	INVIPO extension incl. sharing the data with citizens Continuous evaluation and reporting of data (different layers).	citizens involvement. Most of the public services are on-line.	general use of the data.
3.3.2 Learning organisation (infrastructure and practice)	Regular training of the administrative employees, ad hoc trainings.	Full-fledged learning strategy for organisational learning, including operation mechanisms. Data management plan. Testing of new systems and their utility. Training materials available.	Self-learning system incl. data use management. Cross-learning practise (among cities and other partners) Automatic system of the good practise – procurement vehicle for the future projects.	“Super smart people and office” and maximum of the AI and electronic devices use.
3.3.3 Communication and sharing with partners	On-demand (direct, open meetings, participation).	Good practice repository. Stakeholder engagement strategy (incl. tools) Communication and participation strategy implemented. Collection and assessment of the citizens’ needs and ideas. Existing system for PPP (general collaboration, projects). Existing collaboration with SMEs and research organization.	Full use of the good practise repository and its extension. Regular training for stakeholder engagement ongoing. Existing ambassadors in the city for involvement of the particular groups. Real and frequent PPP projects under realization. Ongoing research and pre-application projects.	



Table 42: Kladno's Milestones for KSA5 - Positive Energy Districts (PEDs)

KSA5: Positive Energy Districts (PEDs)				
Category	Current state	Milestones 2030	Milestones 2040	Goal 2050
5.1.1 SPARCS PED realization	Pre-feasibility study for PED Sletiště finished (WP5) with two main alternatives.	Implementation of the PED Sletiště at least partially complete (some of the PED elements in place)	PED Sletiště conforming at least to one PED-relevant definition	PED Sletiště further expanded (up-scaled)
5.1.2 Several implemented PEDs (PED replication)	No implemented PEDs, see 5.1.1, private real estate company investigating potential on the second project	Selection of new sites for future PEDs confirmed	At least one district conforming to PED definition; work on other PED-relevant projects started	Kladno has several PEDs in operation
5.1.3 PED ecosystem partnership developed	A PED working group Sletiště is in place, however, interests are not fully aligned	PED ecosystem is aligned on the wider strategy and role of PEDs in fulfilling energy transition, link to New European Bauhaus is established	PED ecosystem is replicated in other parts of the city, creating larger community of practice	PED ecosystems are transformed into routine energy planning
5.1.4 Energy communities integration with PEDs	No energy communities have been implemented in the city	First residential housing-level energy communities are formed in the wider PED Sletiště area (see the boundaries in the Feasibility study)	Energy Communities integrated with PED Sletiště (and/or other PEDs) where possible	Energy Community as a standard for multiapartment buildings both in the PED areas and beyond
5.1.5 Non-energy aspects of PED	No urban development master plan developed	PED Sletiště used as testbed and showcase for IoT technologies to improve local services and safeguard the quality of the environment	PED "branded" areas are considered high standard of living or public services/places to be"	PED as a routine approach to all new developments

...



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B. Kladno's detailed graphic roadmaps

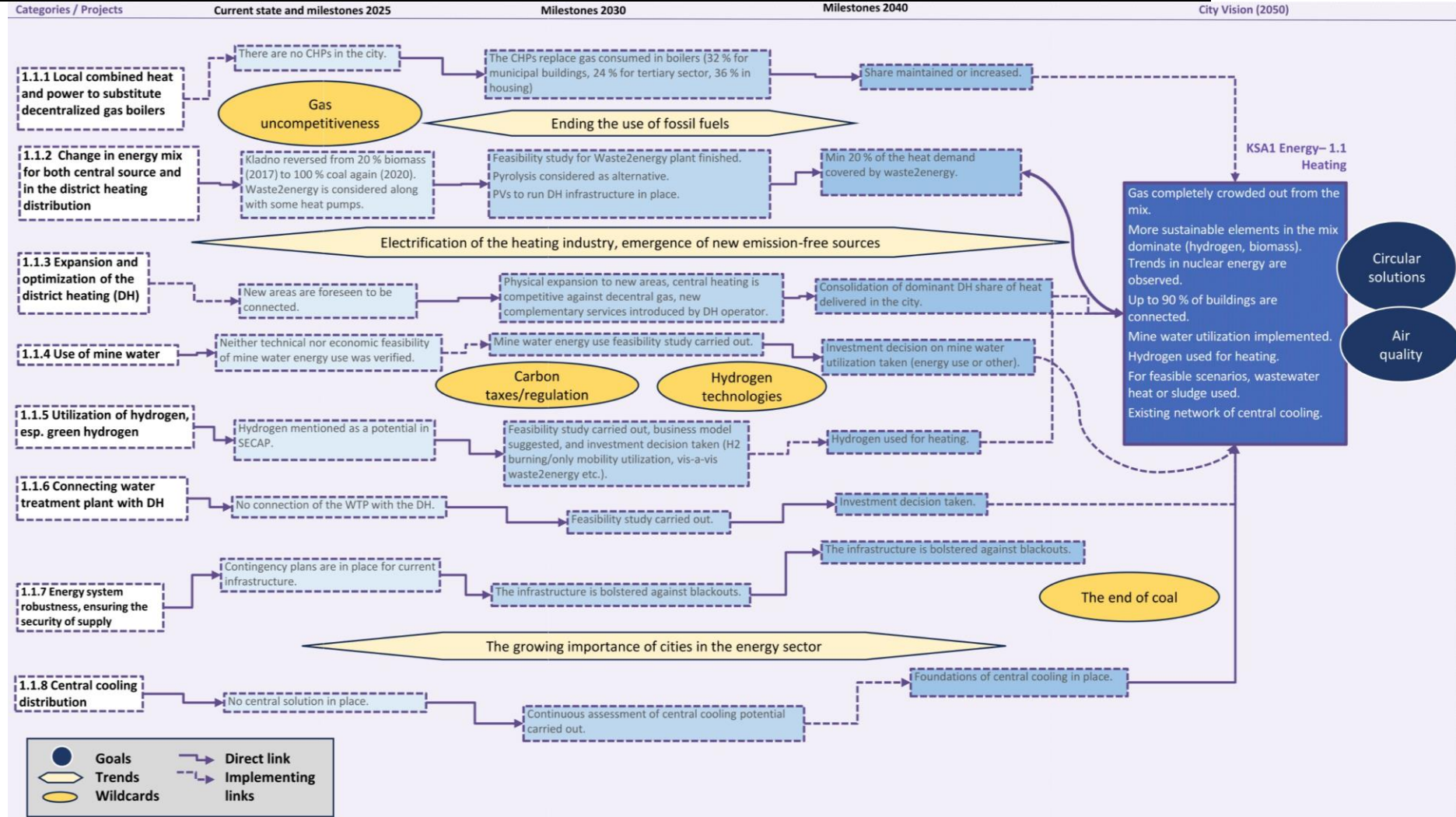


Figure 25. Kladno's Graphic Roadmap for KSA1 – Energy – 1.1 Heating



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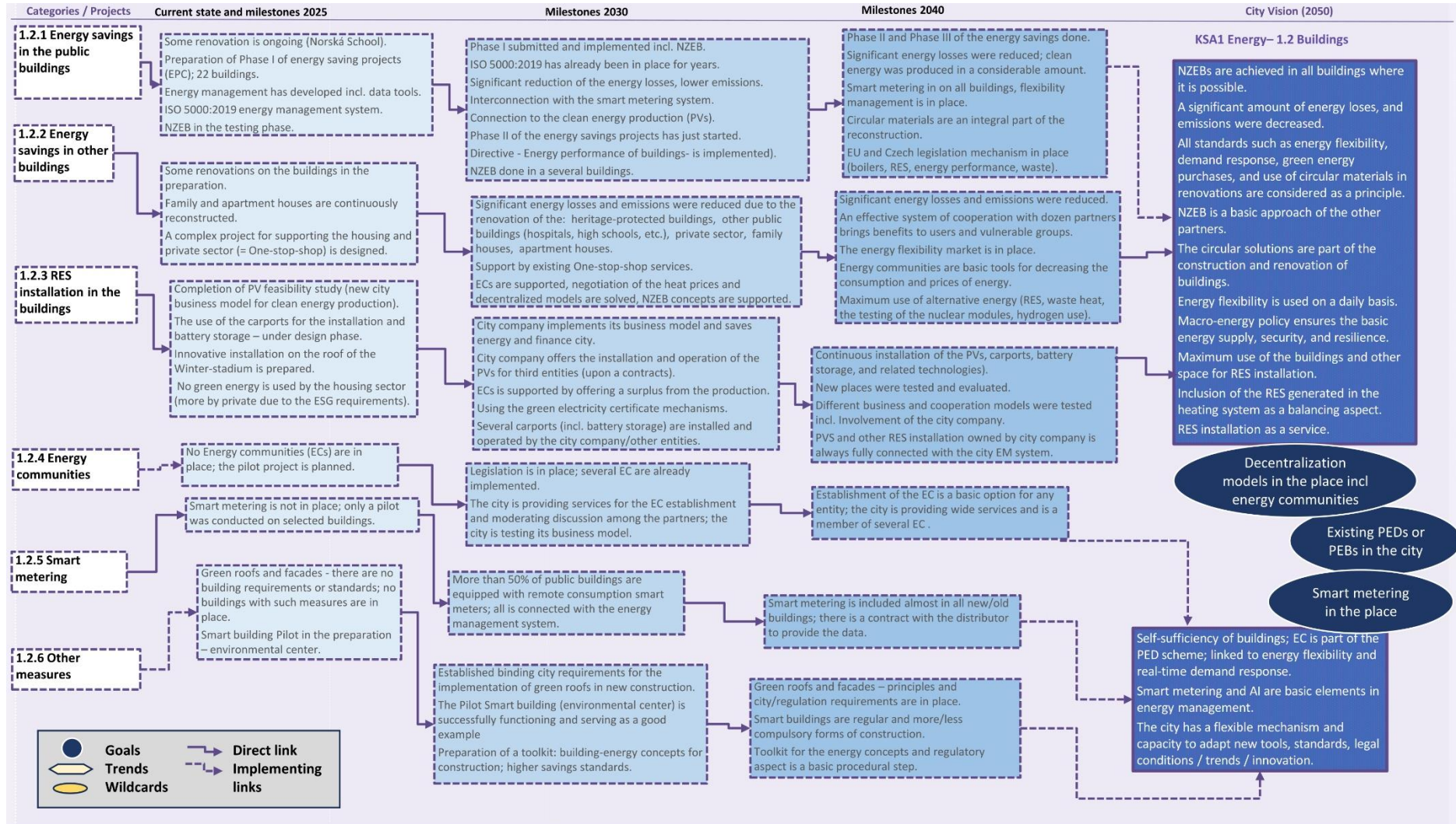


Figure 26. Kladno's Graphic Roadmap for KSA1 – Energy – 1.2 Buildings



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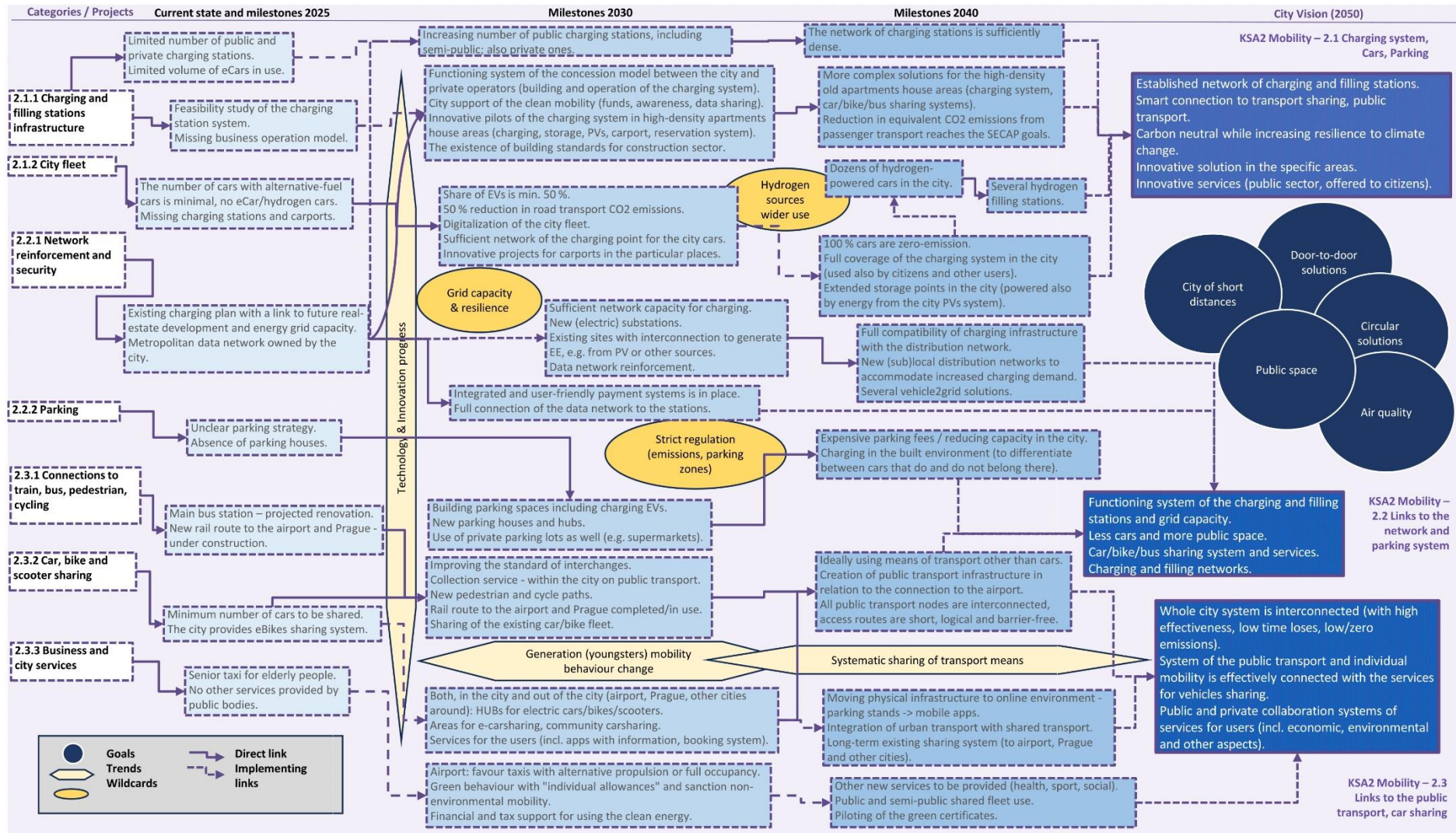


Figure 27. Kladno's Graphic Roadmap for KSA2 - Mobility (individual mobility)



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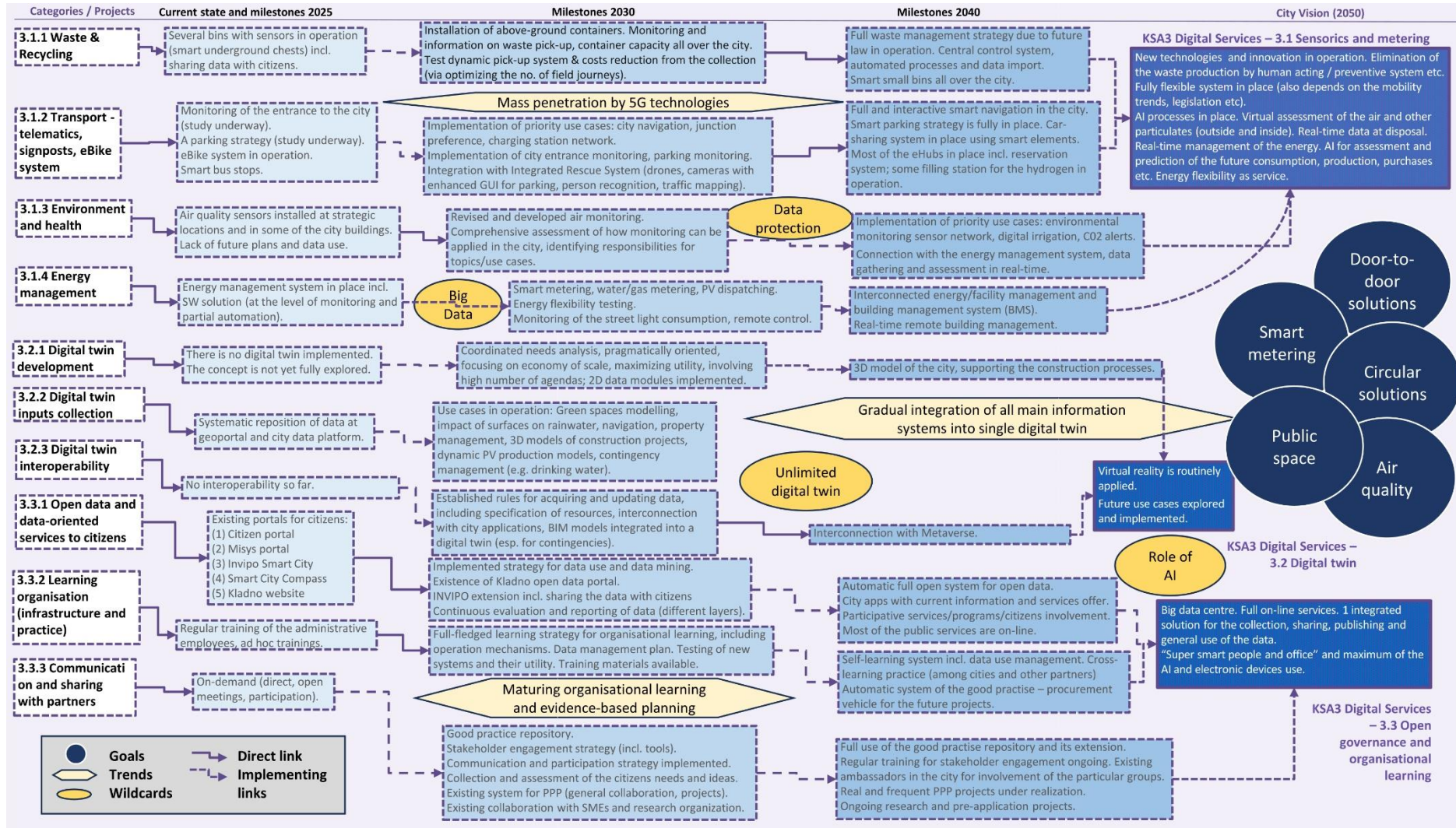


Figure 28. Kladno's Graphic Roadmap for KSA 3 - Digital services



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C. Kladno's Master document template

[Annex 13.1 Final KLD MasterDocumentTemplate](#)

D. Kladno's Roadmap workshop agenda

[Annex 13.2 – KLD RoadmappingWorkshopAgenda](#)



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Appendix 6 – Complementary outputs of Lviv’s roadmapping process

A. Lviv’s milestones tables per KSA

Table 43: Lviv Milestones table for KSA1- Energy infrastructure and Spatial Development, KSA2 Development of Mobility and Transport and KSA3 Climate-neutral city

KSA1 – Infrastructure, spatial development and energy efficiency; KSA2 – Mobility and transport; KSA3 - Climate-neutral city				
Category	Current state and Intermediate milestones 2025	Intermediate milestones 2030 - 35	Intermediate milestones 2040 - 45	Goal 2050 (City Vision / VS)
1. Normative framework and institutional solutions	<ul style="list-style-type: none"> • Setting up mobility department in the Lviv City Council • Implementation of the European Energy Award (P1.1); • Creation and realization of the SUMP (Sustainable urban mobility plan) – (P1.2 – SPARCS Project) • Preparation of an electromobility development plan for the city of Lviv (P1.3) 	<ul style="list-style-type: none"> • Creating a strategy for the future development of CHP in the city 	<ul style="list-style-type: none"> • Creation of a climate change control department 	85% of strategic documents have been implemented in the city
2. Improving public spaces	<ul style="list-style-type: none"> • "Street for all project" (P2.1) • Arranging public spaces and increasing the role of street landscaping; • Pedestrianization of relevant arteries in the city centre 	<ul style="list-style-type: none"> • Construction of a green line that connects remote parts of the city with the center: "Syhiv Center" (P2.2); 	In 2040 Svobody Avenue become a pedestrian street, also Doroshenka street is closed for car traffic;	Lviv was rated as the city with most comfortable public spaces in Ukraine



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KSA1 – Infrastructure, spatial development and energy efficiency; KSA2 – Mobility and transport; KSA3 - Climate-neutral city

Category	Current state and Intermediate milestones 2025	Intermediate milestones 2030 - 35	Intermediate milestones 2040 - 45	Goal 2050 (City Vision / VS)
3. Energy efficiency	<ul style="list-style-type: none"> • Development of Spatial Energy Plan (P3.1 - SPARCS Project) • Creating a district heating GIS for data collection, analysis and visualisation; • Development of the district heating scheme with feasibility studies for district heating development actions • Implementation of energy efficiency measures in Lviv neighbourhoods - ongoing projects (P3.2) • Replacement of existing heating networks with new pre-insulated pipes • Thermal and hydraulic adjustment of the heating network • Realising potential of solar energy 	<ul style="list-style-type: none"> • Reduction of energy resource consumption and of GHG emissions from the housing sector • Reconstruction and modernization of equipment on CHP-1 • Energy efficiency is promoted through information and awareness campaigns in each district on a regular quarterly basis; 	<ul style="list-style-type: none"> • in 2045 the new Thermal Power Station provides 60% of the city with biofuel; • - 50% of buildings in the city are energy positive; 	<ul style="list-style-type: none"> • - 80% of buildings in the city are energy positive; • Increase in the use of renewable energy sources by 40%
4. Improvements in public transport	<ul style="list-style-type: none"> • Upgrading trolleybus infrastructures, fleet, and services (P4.1) • Reconstructing tram depots and trolleybus contact networks, adding new city railway lines, a competition for a street with tram traffic, purchase and renewal of rolling 	<ul style="list-style-type: none"> • "Lvivelectrotrans" concluded an agreement for the next year on the use of electricity from renewable sources (100%); 	<ul style="list-style-type: none"> • According to the Urban electric mobility development plan is a ban on passenger buses with diesel and gasoline engines in Lviv, all buses are electric; • In 2045 "LeoKard" is implemented in the Lviv agglomeration; 	In 2050, all public transport in the Lviv community is electric;



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KSA1 – Infrastructure, spatial development and energy efficiency; KSA2 – Mobility and transport; KSA3 - Climate-neutral city

Category	Current state and Intermediate milestones 2025	Intermediate milestones 2030 - 35	Intermediate milestones 2040 - 45	Goal 2050 (City Vision / VS)
	stock (50 trolleybuses and 10 trams);		<ul style="list-style-type: none"> The first route with fully unmanned rolling stock was introduced into regular operation; 	
5. Electromobility and parking facilities	<ul style="list-style-type: none"> Implementation of the ShareP project - Shared parking and EV charging infrastructure as a smart, democratic and sustainable (P5.1) Increasing the number of parking spaces and ensuring control over the duration of parking, which led to a decrease in the number of cars in the central part of the city; Stimulation of electromobility, in particular, the development and approval of the procedure for the placement of electric charging stations; European Mobility Week initiatives (P5.2) 	<ul style="list-style-type: none"> All parking lots in the city are fully digitalized Introduction of electric vehicles in the urban transportation and taxi sectors, and development of charging hubs for private cars 	<ul style="list-style-type: none"> The number of interception parking lots increased to 7 in the city. Due to the continuing development of tram and trolleybus lines, you can easily get from point A to point B in Lviv by tram and trolleybus. 	<ul style="list-style-type: none"> Not a single car with an internal combustion engine is registered or re-registered, a ban on the using of vehicles with an internal combustion engine is introduced in the city; All parking spaces are equipped with wireless electric charging stations;
6. Pedestrian and cycling traffic	<ul style="list-style-type: none"> Development of the bicycle network - construction of bicycle infrastructure, arrangement of bicycle paths and bicycle lanes (P6.1); 	<ul style="list-style-type: none"> In 2035 at least 150 km of bicycle infrastructure are installed 	<ul style="list-style-type: none"> Most central streets of the city became accessible for pedestrians 	<ul style="list-style-type: none"> The 500th km of bicycle infrastructure is implemented in Lviv, the share of bicycle trips exceeded the share of car trips;



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KSA1 – Infrastructure, spatial development and energy efficiency; KSA2 – Mobility and transport; KSA3 - Climate-neutral city

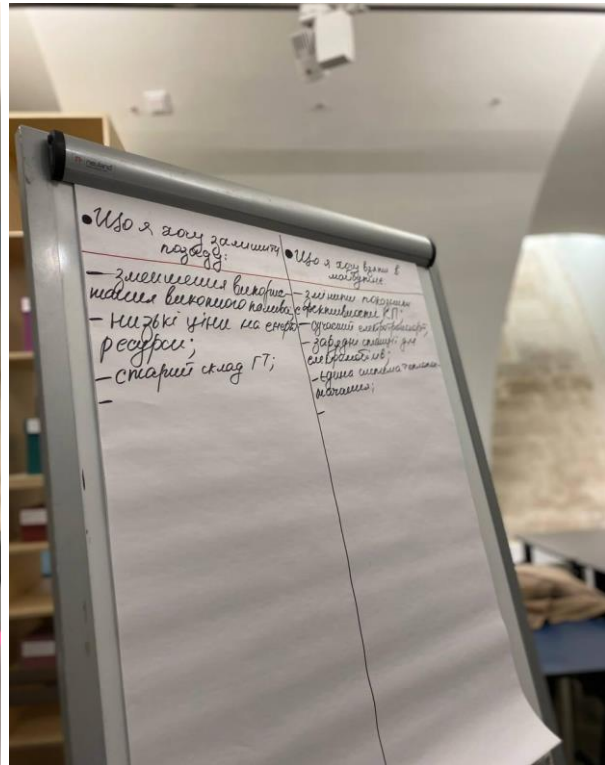
Category	Current state and Intermediate milestones 2025	Intermediate milestones 2030 - 35	Intermediate milestones 2040 - 45	Goal 2050 (City Vision / VS)
				<ul style="list-style-type: none"> • In 2050, the following structure of movement is recorded: <ul style="list-style-type: none"> - cars - 15% - bicycles - 20% - PT - 50% - pedestrians - 15%
7. Safety and traffic optimization	<ul style="list-style-type: none"> • Development of a Data-driven Sustainable Mobility Plan (P7.1 - SPARCS Project) - traffic modelling; calculating CO2 emissions • Implementation of measures to improve the safety of traffic through the KBDR, improving the conditions and safety of pedestrian traffic, and the safety of intersections; • Reconstruction of the street with an emphasis on reducing traffic and congestion; 	<ul style="list-style-type: none"> • Co-creation and implementation of sustainable mobility solutions (short and medium-term). • Introduction of a video surveillance system to reinforce safety in the streets 	<ul style="list-style-type: none"> • Co-creation and implementation of sustainable mobility solutions (medium and long-term). • 90% of crimes committed on the streets are solved thanks to the video surveillance system; 	<p>Zero mortality due to road accidents within the territorial community;</p> <p>100% of the territorial community is connected by public transport</p>
8. Climate neutrality 2050	<ul style="list-style-type: none"> • Implementation of ongoing projects on the scope of climate neutrality (P8.1) • Increasing shares of renewable energy sources by 20% • Starting development of a strategy to deal with heat islands in the city 	<ul style="list-style-type: none"> • Reduction of CO2 emissions by 35% • Atmospheric air quality monitoring posts have been established 	<ul style="list-style-type: none"> • the formation of heat islands has not been observed in Lviv for 5 years 	<ul style="list-style-type: none"> • Number of green roofs on buildings increased by 30% • Amount of CO2 emissions is reduced over 70%;



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B. Interactions and outputs of Lviv's Roadmapping workshops



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Appendix 7 – Complementary outputs of Maia’s roadmapping process

A. Maia’s milestones tables per KSA

Table 44: Maia Milestones table for KSA1 - Sustainable Urban Development

KSA1 – Sustainable urban development				
Project (Category)	¹⁹Current state and Intermediate milestones 2025	Intermediate milestone 2030	Intermediate milestones 2040	Goal 2050 (City Vision / VS)
SP 1.1 Collaborative housing projects in healthy ecological neighbourhoods (POPULATION AND SOCIAL CONDITIONS)	Identified needs: Rehabilitation/ construction of 800 social dwellings Phase 1 – pilot project Rehab / construction of social blocks (10%; Interventions in Sobreiro district) Testing community empowerment Promote regulation	Phase 2: Rehab / construction of social blocks (50%) Financing operative structures to support maintenance / management Promote intergenerational involvement of residents	Phase 3: Rehab / construction of social blocks (70%)	Project fully implemented VS1
SP 1.2 Platform for the Circularity of the Productive Sector (CIRCULAR ECONOMY IN BUILDINGS + BUILDING REFURBISHMENT / RETROFITTING)	Phase 1: Demonstration pilot project Promote municipal regulation (circularity)	Phase 2: To extend the scale; create incentives; regulate the obligation Promote municipal regulation: circularity, PEB/PED, nature-based solutions	NA²⁰	VS2 VS3
SP 1.3 Rehabilitation of the Building Stock in Maia (BUILDING REFURBISHMENT / RETROFITTING)	Phase 1: Survey/assessment of the conditions of the Buildings Stock in Maia for the implementation of solutions	Phase 2: 27% of listed buildings fully rehabilitated	Phase 3: 52 % of listed buildings fully rehabilitated	Phase 4: 100% of listed buildings fully rehabilitated VS3 VS4

¹⁹Current state might result from already existing solutions and/or specific KPI's.

²⁰Not Applicable.



KSA1 – Sustainable urban development				
Project (Category)	¹⁹Current state and Intermediate milestones 2025	Intermediate milestone 2030	Intermediate milestones 2040	Goal 2050 (City Vision / VS)
+ URBAN SUSTAINABLE DEVELOPMENT + COMMUNITY GARDENS)	Promote municipal regulation: (PEB/PED)			
SP 1.4 Organic farming, reforestation and carbon capture (LOCAL AGRICULTURE)	Promote municipal regulation: (PEB/PED)	170ha	NA	VS5

Table 45: Maia Milestones table for KSA2 – Energy Transition

KSA2 – Energy transition				
Project (Category)	²¹Current state and Intermediate milestones 2025	Intermediate milestone 2030	Intermediate milestones 2040	Goal 2050 (City Vision / VS)
SP 2.1 CSC - Collective self-consumption & REC - Renewable Energy Communities (DECENTRALISED RES PRODUCTION)	Installed power 34.930 kWp (2022)	160.679 kWp	513.475 kWp	873.256 kWp VS8 VS11
SP 2.2 Sustainable Buildings Program (SPARCS-IP) (ENERGY EFFICIENCY AND FLEXIBILITY IN BUILDINGS)	Phase 1: Baseline; energy certification of the entire municipal building stock	Phase 2: 27% of listed buildings fully rehabilitated	Phase 3: 52% of listed buildings fully rehabilitated	Phase 4: 100% of listed buildings fully rehabilitated VS9
SP 2.3 Waste Heat usage (HEAT AND COLD NETWORKS)	Phase 1: Heat and cold sources mapping and solution design	Phase 2: industrial and intersectoral symbiosis pilot	Phase 3: 2 business areas infrastructure	Phase 4: Fully infrastructured area VS10

²¹Current state might result from already existing solutions and/or specific KPI's.



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Table 46: Maia Milestones table for KSA3 – Mobility

KSA3 – Mobility				
Project²² (Category)	²³Current state and Intermediate milestones 2025	Intermediate milestone 2030	Intermediate milestones 2040	Goal 2050 (City Vision / VS)
SP 3.1 “15 Minutes Communities” (EASY ACCESSIBILITY)	Phase 1: Identification of territories/communities and respective weaknesses: equipment; services; commerce	Phase 2: 70% of the identified weaknesses addressed 25% On foot 10% Cycling	Phase 3: 90% of the identified weaknesses addressed	VS12 VS14
SP 3.2 Public Transport and Shared Mobility Services (SOFT MOBILITY + INTERMODALITY AND SHARING SYSTEMS)	Phase 1: Method definition + info gathering + Status Quo+ implementation/action plan 14% Public Transport usage	Phase 2: 40% implemented solutions 23% Public transport trips	Phase 3: 80% of implementation of recommended actions – on going monitoring	VS13 VS14
SP 3.3 Electrification of the Mobility System (GREEN MOBILITY)	6% electric vehicles	36% electric vehicles	80% electric vehicles	100% electric vehicles 100% charging stations available VS15

Table 47: Maia Milestones table for KSA4 – Smart City

KSA4 – Smart City				
Project (Category)	²⁴Current state and Intermediate milestones 2025	Intermediate milestone 2030	Intermediate milestones 2040	Goal 2050 (City Vision / VS)
SP 4.1 City Digital Transition CITY DATA INTEROPERABILITY	Phase 1: Dedicated Municipal Structure; Project prioritising the key strategic areas of territorial management to be interoperated (energy; waste;	Phase 2: 25% for all identified areas	Phase 3: 50% for all identified areas	Phase 4: 100% for all identified areas VS18

²² Mobility regular studies (every 5 years) must be implemented in order to properly monitor the solutions appointed by these projects.

²³Current state might result from already existing solutions and/or specific KPI's.

²⁴Current state might result from already existing solutions and/or specific KPI's.



KSA4 – Smart City				
Project (Category)	²⁴ Current state and Intermediate milestones 2025	Intermediate milestone 2030	Intermediate milestones 2040	Goal 2050 (City Vision / VS)
	mobility; water; etc.)			
SP 4.2 Digital Twin - Buildings and Infrastructure CITY DATA INTEROPERABILITY	Phase 1: Baseline/Diagnosis; energy certification of the entire building stock (One BIM – Building Information Modelling - modelled building (SmartLab))	Phase 2: aligned with SP 2.3	Phase 3: aligned with SP 2.3	Phase 4: aligned with SP 2.3 VS18
SP 4.3 Process Reengineering CITY DATA INTEROPERABILITY	Phase 1: 60% of digitalized municipal processes	Phase 2: 100% digitalized municipal processes (reengineering)	NA²⁵	VS18 VS21

Table 48: Maia Milestones table for KSA5 – Integrated & Inclusive City

KSA5 – Integrated & Inclusive City				
Project (Category)	²⁶ Current state and Intermediate milestones 2025	Intermediate milestone 2030	Intermediate milestones 2040	Goal 2050 (City Vision / VS)
SP 5.1 “Building Keeper” CITIZEN ENGAGEMENT	Regulation/implementation for all municipal buildings	NA²⁷	NA	VS22
SP 5.2 “Family architect” CITIZEN ENGAGEMENT	Regulation/implementation	NA	NA	VS22
SP 5.3²⁸ Environmental Literacy for Sustainability CITIZEN ENGAGEMENT	Phase 1: Project design and start off (Environmental Education Plan for Maia city)			Phase 4: 100% community involvement VS23

²⁵ Not Applicable.

²⁶Current state might result from already existing solutions and/or specific KPI's.

²⁷ Not Applicable.

²⁸ Intermediate/specific milestones to be defined after the project design is completed.



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KSA5 – Integrated & Inclusive City				
Project (Category)	²⁶Current state and Intermediate milestones 2025	Intermediate milestone 2030	Intermediate milestones 2040	Goal 2050 (City Vision / VS)
+ CITY STAKEHOLDERS ENGAGEMENT				
SP 5.4 Municipal Environmental and Urban Sustainability Fund CITIZEN ENGAGEMENT + CITY STAKEHOLDERS ENGAGEMENT	Phase 1: Regulation and Implementation	NA	NA	VS22 VS24 VS25

B. Milestones and Impact Assessment Key Performance Indicators (KPIs)

This document intends to record, in relation to each of the main indicators and targets set out in the Roadmap for Urban Transformation, the considerations taken by the team that led this process. This document is also a first approach to establishing a structured mechanism for systematic monitoring (strategic and operational) for assessing the impact of the main structural projects and measures towards the envisioned City Vision.

Table 49. Proposed KSA, Subcategories per KSA & Main Vision Statements for the Roadmap – Maia

KSA	SUBCATEGORY	MAIN VISION STATEMENTS (VS)
KSA1	Social Inclusion	VS1 - Maia embraces demographic dynamics by promoting access to housing and investing in multigenerational policies
	Circular Economy	VS2 -Maia actively promotes circularity in the economy of its productive sectors. 50% of them have already achieved this goal.
	Local Housing Buildings	VS3 - 90% of the building stock has been refurbished, allowing for thermal comfort without resorting to fossil fuels, and residually to other energy sources
	Public/Other Buildings	VS3 - 90% of the building stock has been refurbished, allowing for thermal comfort without resorting to fossil fuels, and residually to other energy sources
	Eco-neighbourhood	VS4 - Urban development takes place by valuing and upgrading the existing ecosystem and ensuring biodiversity, the urban water cycle and nature-based solutions



KSA	SUBCATEGORY	MAIN VISION STATEMENTS (VS)
	Green Areas	VS5 - Maia is one of Europe's leading Eco-Regions, ensuring wooded areas and urban agriculture, at different scales, for ecosystem services and the production and local consumption of vegetables
	Local Agriculture	VS5 - Maia is one of Europe's leading Eco-Regions, ensuring wooded areas and urban agriculture, at different scales, for ecosystem services and the production and local consumption of vegetables
KSA2	Decentralized RES Production	VS8 - 80% of urban areas in Maia are energy positive districts (PED).
	Heat and Cold Networks	VS8 - 80% of urban areas in Maia are energy positive districts (PED).
	Energy Efficiency and Flexibility in Buildings	VS9 - Maia's buildings are self-sufficient in energy and provide system flexibility.
KSA3	Public Transport	VS13 - 80% of journeys in Maia are made using soft modes and public transportation and/or MaaS - Mobility as a Service - with clear preference of soft modes
	Intermodality and Sharing Systems	VS14 - The Metropolitan Integral Mobility System includes, in addition to public transports, MaaS solutions and is entirely powered by renewable energy
	Green Mobility	VS15 - Over 70% of road traffic is fuelled by alternative fuels to the fossil fuel
KSA4	City Data Interoperability	VS18 - The Municipality's Integrated and Interactive Platform for urban data is systematically used to interact in real time with the municipality
	Innovation	VS21 - Maia's renewable energy R&D cluster consolidates its leading position in Europe
KSA5	Citizen & Stakeholders Engagement	VS22 - Maia is a territory of Active Citizenship through co-creation and participatory collaboration
	Social Inclusion	VS24 - Maia is a reference in the model of inclusion and autonomy from 3 to 103 years old
	Transparent Governance	VS25 - The city is based on a transparent, decentralized, integrated and collaborative model, acting predominantly through a Cross-Sectoral Advisory Board



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KSA1. Sustainable Urban Development – Social Inclusion

Monitoring the achievement of VS1 - Maia embraces demographic dynamics by promoting access to housing and investing in multigenerational policies, will be done by evaluating the KPI “Population living in affordable conditions”, and also with identified milestones for the implementation of social housing promotion projects. An example of it is the *58 Building* and the Sobreiro’s district blocks rehabilitation.

It is fundamental to consolidate the information about what is planned to be done (number of dwellings to be made available and, if possible, at what moment in time), with reference to the local housing strategy that will be anchored in the identified needs and in how/when it will be supplied.

Social Housing Buildings – The Local Housing Strategy

The municipality’s housing stock comprises 2.447 units, divided into 203 residential buildings, corresponding to 50 district units scattered throughout the territory (47 housing district units and 3 prefabricated district units).

The 2017 survey made to assess the precarity of social housing in Maia, which was submitted to IRUH, as part of the National Survey of Housing Needs, identifies the following:

- 400 degraded housing units.
- 841 dwellings needed to meet the needs of families residing in the municipality of Maia. Highest prevalence distributed as:
 - a. Águas Santas parish – 184 dwellings required
 - b. Pedrouços parish – 164 dwellings required
 - c. Moreira parish – 85 dwellings required

According to information recently gathered by the local company Espaço Municipal, this figure is already very close to 1,500 dwellings ²⁹

As a response to this pressing need, **757 new dwellings are to be allocated**, under the *1ª Direito Program* - Support Program for Access to Housing (included in the Recovery and Resilience Plan – RRP), representing an estimated 106 million euros investment, which will cover a total of **1,795 people who currently live in undignified conditions**.

In accordance to the identified housing needs, this amount will be distributed according to the following housing solutions:

- New construction on municipal land - 275 dwellings
- Land acquisition and construction - 322 dwellings
- Rehabilitation of existing social housing - 60 dwellings
- Acquisition and rehabilitation of urban buildings and dwellings - 20 dwellings
- Dwellings acquisition - 60 dwellings
- Lease housing solutions - 20 dwellings

²⁹ According to information recently collected by Espaço Municipal, the municipal housing company.



Aforementioned solutions will be gradually implemented and concluded by the end of year 2025/mid-2026.

Note:

The first operations are already underway, and it is expected that, for example, the rehabilitation of Blocks 41 to 47 may be completed by the end of year 2024 and the construction of the new Sobreiro Block 58 by mid-2025.

These values may be revised within the scope of the Municipality's Local Housing Strategy updating, which should start later this year.

KSA1. Sustainable Urban Development – Other Buildings

Urban Rehabilitation

Urban rehabilitation is represented in this roadmap in two structuring projects, the difference between which lies in the fact that SP2.2. *Sustainable Buildings Program* is aimed at the set of buildings owned by the municipality, or by the municipal ecosystem, including municipal services and municipal companies, the following indicators will be monitored: 1) % Rehabilitated Buildings; 2) % Certified Buildings; 3) % Class A and A+ Buildings.

The data source to be used will be the Energy Certification System for Buildings, managed by ADENE (Energy Agency).

These indicators will be analysed by individualising the results for buildings owned by the municipality (SP2.2. *Sustainable Buildings Program*) and for the total number of buildings located in the municipality (SP1.3. Rehabilitation of the Building Stock in Maia), and it is important to note the following considerations: despite the fact that it's an ongoing diagnosis, the building stock owned by the municipal ecosystem, in regard to energy certification, has a total of 129 services and commerce buildings, of which 74% of these still haven't yet been certificated. Nonetheless, the 33 buildings already duly certified are responsible for 75% of consumption in municipal buildings.

Below, Figure 29 demonstrates the reality of the Energy Certification of service and commercial buildings park owned by the municipal ecosystem, as well as the comparison with the existing service and commercial Buildings certified in Maia (data from [Sistema de Certificação Energética dos Edifícios](#)). To this day, more than half of municipal buildings only reach a class equivalent to C, with none having a class higher than B-. At the same time, existing commercial and service buildings in the territory of Maia follow a very similar trend, with a greater emphasis on the C class, however, with higher relevance on the upper classes.



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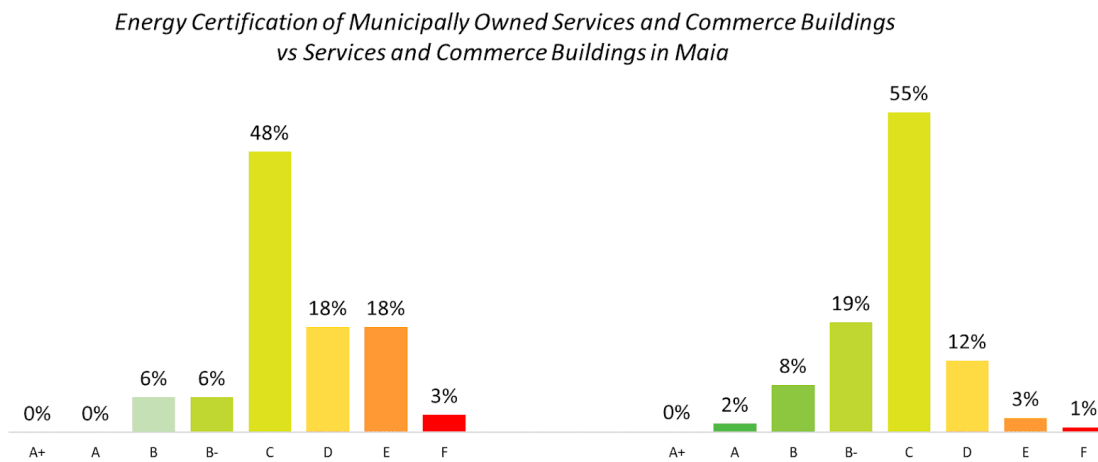


Figure 29. Energy certification of municipally owned services and commerce buildings (left) vs Services and commerce buildings in Maia (right) (Source: authors, using ADENE data)

Maia’s Municipality will seek to carry out a series of rehabilitations in its building stock. The results will allow to improve the energy performance, with a view to obtaining a class distribution that can be seen in the Image below (Figure 29), thus reaching an energy class C – to comply with the minimum regulated – or higher in all buildings.

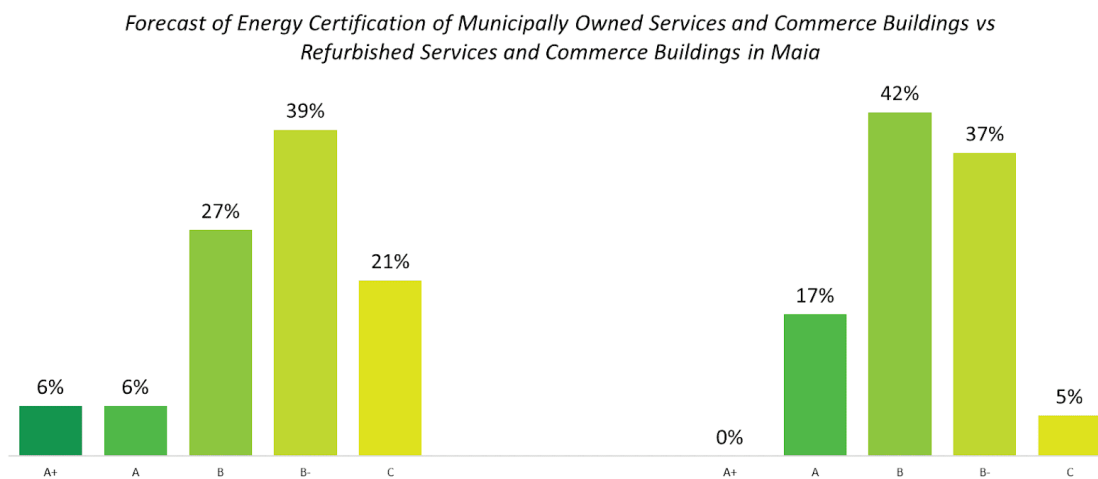


Figure 30. Forecast of energy certification of municipally owned services and commerce buildings (left) vs Refurbished services and commerce buildings in Maia (right) (Source: authors, using ADENE data)

The Long-Term Strategy for Building Renovation (ELPRE) sets goals for the percentage of renovated buildings for the 2030, 2040 and 2050 horizons, in comparison to the 2018 records, by reference to the entire national buildings stock. When comparing the ELPRE established targets with the objectives established during the Roadmap for Urban Transformation Workshop (Figure 31), it’s clear that this strategic document is more ambitious for achieving the 2050 horizon (100%). For that reason, the coordinating team decided, for SP1.3 *Rehabilitation of the Building Stock in Maia*, considering the integration



of energy efficiency, green roofs and/or vertical gardens, to consider ELPRE ambitions and use the same reference for SP2.2 *Sustainable Buildings Program*, while the conclusion of the diagnosis is not finalised and other goals are indicated.

Goals for Municipally Owned Service and Commerce Buildings interventions (ELPRE) vs Goals established in the Workshop

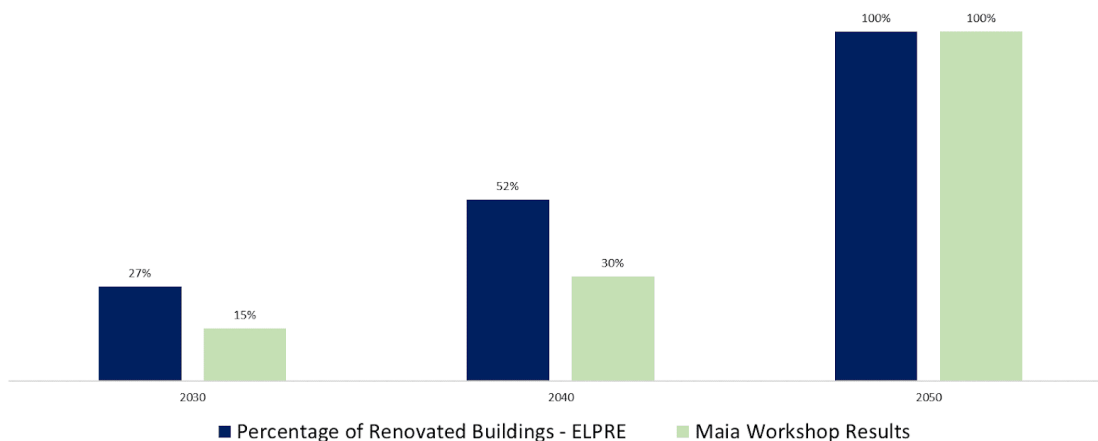


Figure 31. Goals for municipally owned service and commerce buildings interventions (ELPRE) vs Goals established in the Workshop (Source: authors, using ELPRE data)

KSA1 Sustainable Urban Development – Circular Economy

The RNC2050 states that increasing the circularity and efficiency of the economy will allow us to do more with fewer resources and reduce the consumption of raw materials, transforming a waste linear chain into a chain of new materials.

Having this in mind, and considering also the Portuguese Action Plan for Circular Economy, approved by the Resolution of the Council of Ministers n.º 190-A/2021, especially the KPIs list for assessing the impacts of the plan, the local team decided that the most appropriated KPI for evaluate the VS2 – Maia actively promotes circularity in the economy of its productive sectors. 50% of them have already achieved this goal should be the incorporation rate of waste materials into the economy.

After some bilateral contacts with LIPOR - Intermunicipal Waste Management Service of Greater Porto, and in order to enable an effective monitoring process, the selected KPI was the *Preparedness for Reuse and Recycling rate*.

The city of Maia has, in comparison to the stipulated national targets, very positive and promising results in this area of urban waste management and concomitantly the circular economy – see *Table 50*.



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2022	MAIA	PORTUGAL
Reuse and Recycling Preparation	45%	32%

PERSU* 2030 - Reuse and Recycling Preparation	2025	2030	2035
Portugal	55%	60%	65%

*PERSU 2030 is the national strategic document for urban waste

Table 50. Reuse and Recycling Preparation data (source: LIPOR and PERSU 2030)

The municipality of Maia, wanting to be an example of good practices, is also concerned with the incorporation of recycled materials in building refurbishment/retrofitting operations, as they will be key in achieving the carbon reduction targets to which the municipality has committed itself.

Even though this is duly contemplated in the Portuguese law – Decreto-Lei n.73/2011, de 17 de junho – which translates into the mandatory use of, at least, 10% (in weight) of recycled materials or materials that incorporate recycled ones, in all construction and maintenance of infrastructure contracted under the Public Contracts Code, Maia is considering going beyond these targets.

In fact, the municipality has already safeguarded the incorporation of such materials, in a public tender for an installation under the BaZe pilot project, establishing a value of 30% for recycled materials or that incorporate recycled materials in the ToR. We must also emphasize that other examples will be taken into account for the monitoring process. Without prejudice to the appointed indicator, other practices and/or studies will be analysed in the future to improve this process.

KSA1 Sustainable Urban Development – Green Areas and Local Agriculture

Taking into account that emissions reductions can also be achieved through the role that forests and other land uses can play as carbon sinks, reforestation and having environmental care with the agricultural and forest practices are crucial. Having this in mind, for monitoring progress in this area, it was proposed to use the following indicators: 1) Green Area per 100.00 inhabitants; 2) Forest Area and 3) Burnt Area. Further analysis is needed to define the data sources or other specific indicators for this purpose.

KSA2 Energy Transition – Decentralized RES Production

The energy transition, also represented in indicators associated with urban rehabilitation, will be evaluated mainly by verifying Renewable Production in Self-Consumption and Energy Communities. In turn, urban rehabilitation, in accordance with the RNC2050³⁰, presents the opportunity to incorporate improvements in energy efficiency and reduce consumption, as well as to contribute to further increase of renewable energy sources.

³⁰ The RNC2050 is a national strategic document for carbon neutrality.

<https://descarbonizar2050.apambiente.pt/>



To this date doubts persist as to the best way to monitor production where there is no access to real data, namely for buildings that are not owned by the municipal ecosystem, so it was agreed to use, as a proxy variable, the installed PV power in Maia (kWp) as well as the number of installations for self-consumption by using the Open Data – E-Redes platform as a data source.

As to what was proposed for rehabilitation, a distinction will be made between the buildings owned by the municipal ecosystem and the total number of buildings located in the municipality. Next, some considerations about the process.

In order to frame the goals established during the workshop with the ones identified in strategic documents, an approach of photovoltaic power installed in residential, commercial, services and industry buildings in Maia was considered. Table 51 presents the estimated PV power based on the RNC2050 and on the workshop's results, to facilitate the comparison between both. By analysing the presented data, it is possible to conclude that the goals defined for renewable production during the workshop, although aligned with the national strategy for carbon neutrality in 2050, are even more ambitious. The goals chosen for the roadmap were thus aligned with the RNC2050.

	2022	2030	2040	2050
*Installed and foreseen PV power in Maia – RNC2050 [kWp]	34 930	160 679	513 475	873 256
**Foreseen PV power in Maia – Roadmap for Urban Transformation Workshop [kWp]	-	248 848	590 845	1 174 064
Deviation		35%	13%	26%

Table 51. Estimated PV power according to the RNC2050 and the Roadmap for Urban Transformation (Source: authors)

Calculation method:

*Consulting the Open Data – E-Redes platform (Figure 32 and Figure 33), it's possible to conclude that a total of 34.9 MW of photovoltaic power was installed in Maia (year 2022). Such was distributed among residential, service and industrial buildings. The RNC2050 data allows to observe the evolution (%) of the installed capacity of the electricity generator sector for decentralised Solar PV. From this analysis was possible to extrapolate the evolution of installed PV capacity in Maia, for 2030, 2040 and 2050 at the same growth rate as for the national territory.



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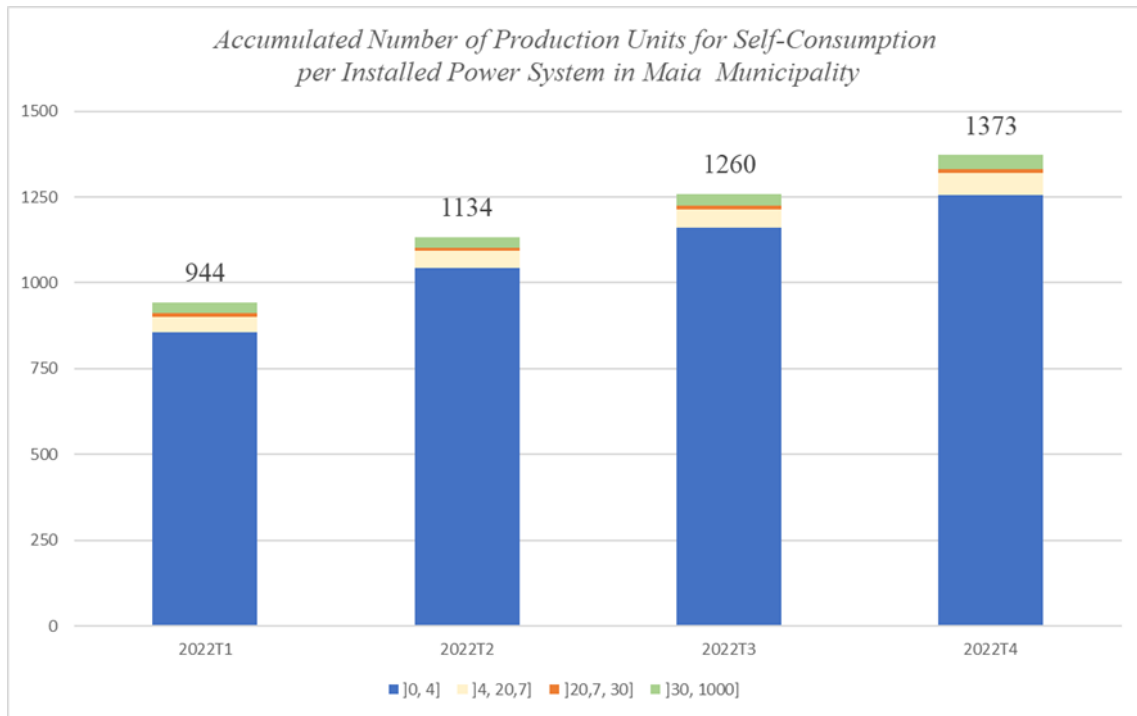


Figure 33. Accumulated Number of Production Units for Self-Consumption per Installed Power System in Maia Municipality (Source: Authors, adapted from E-Redes data)

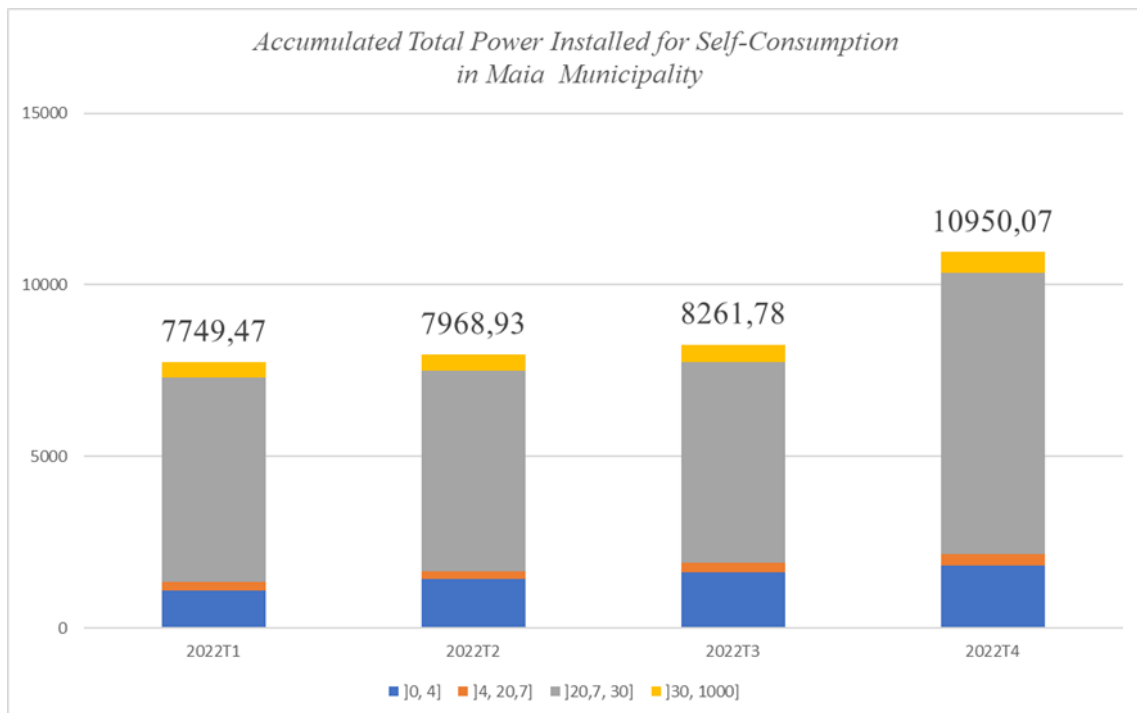


Figure 34. Accumulated Total Power Installed for Self-Consumption in Maia Municipality (Source: Authors, adapted from E-Redes data)



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**Taking into consideration the values presented in PAES for 2030³¹ for the evolution of electricity consumption, in regard to the residential, service and industrial buildings, an extrapolation was made for the 2040 and 2050 using the same proportion predicted by the RNC2050. Next, and based on the assumption that the percentage of buildings is proportional to the electricity consumption (25% buildings equals 25% of consumption), based on the percentages appointed at the Roadmap for Urban Transformation Workshop, the corresponding installed capacity of photovoltaic production was estimated for the different years in analysis.

For the buildings owned by the municipal ecosystem and since it will be possible to access production data, effective production and the number of installations will be monitored. At the present day, Maia's Municipality has 1.5% (NDR: 2/129) of the building stock under its management with photovoltaic solar systems. However, Maia is planning to install photovoltaic solutions in other 15 buildings in the next coming years. This will increase to 11.6% the percentage of buildings with renewable energy production systems. Such appointed values should be revised as soon as the diagnosis of the building stock owned by the municipal ecosystem is completed.

KSA2 Energy Transition - Heat and Cold Networks

As identified in the Maia 2030 Sustainable Energy Action Plan (PAES2030), the Industry sector has a weight of 50% for total municipal CO₂-eq emissions from the energy use, being the sector with higher contribution. This is the sector with the greatest potential for the use of thermal effluents, at different enthalpy levels.

The potential for using this resource was identified during the SPARCS Project and was reinforced during the Workshop. The necessary phases/tasks leading to a greater use of these resources are the following: i) to begin, mapping the availability of this resource; and ii) mapping its demand, resulting in pilot projects to better test the implementation of such solution and to provide the basis for a proper planning/launch of the territory's infrastructure.

Unlike central Europe countries, Portugal has no tradition in this type of solution, thus there's no infrastructure of such type. For that reason, the monitoring process should be made through an *in loco* verification of the implementation of a diagnosis, resulting in subsequent goals to consider.

Nonetheless, the local team has proposed an initial set of variables to be considered in studies and for subsequent follow-up:

- Annual amount of residual thermal energy available per effluent [GWh] and corresponding temperature [K] (supply);
- Annual amount of thermal energy needed per use [GWh] and corresponding temperature [K] (demand);
- % use of available residual thermal energy;

³¹ Maia 2030 Sustainable Energy Action Plan is a municipal strategic document.



- % thermal energy needs covered by the use of residual thermal effluents.

It is important to highlight that there is no public information available for this type of data, therefore its collection must be made through a close collaboration between industry/associations.

KSA3 Mobility – Soft Mobility

Mobility, alongside rehabilitation and decentralised energy production, is another of the main fields of intervention to ensure the transition to a carbon neutral society. Considering the SP3.1 15 Minutes Communities and SP3.2 Public Transport and Shared Mobility Services, we will be monitoring the evolution of the modal split.

For that, data from PMUS and its projection for 2030 were considered (Figure 32). Since there are no references beyond this time horizon, 2040 and 2050 milestones will be detailed in next steps.



Figure 32. Modal Partition Evolution 2001-2021 and 2030 milestones (Source: PMUS - internal non published document)

KSA3 Mobility – Green Mobility

Electric mobility and the use of alternative fuels to fossil fuels is also central to the achievement of the long-term goals towards carbon neutrality. The SP3.3 Electrification of the Mobility System, will be monitored through the evolution for the electric vehicle’s fleets (% in relation to the total number of vehicles), in terms of light and heavy vehicles. The goals to achieve will be the ones appointed in the Carbon Neutrality 2050 Roadmap. As for the data source, the Oporto Automobile Registry³² will be used.

In parallel, for the purposes of analysing the evolution of the charging infrastructure, the number of public charging stations and their location will be monitored, using Mobi.e platform as a source.

- % Electric vehicles fleets (light and heavy)
CRAPORTO data
36% by 2030 | 80% by 2040 | 100% by 2050
- Charging Stations/points

³² CRAPORTO



Mobility data

N.º charging stations/points

Location of charging stations/points

[Base2b \(cm-maia.pt\)](https://cm-maia.pt/Base2b)

KSA4 Smart City - City Data Interoperability

Progress towards Digital Transition will be assessed by milestones defined in the action plan that will be developed. The first milestones to be assessed are the implementation results of the pilot project Platform for Planning and Management Mobility Services and the creation of a dedicated city office to address these challenges.

KSA4 Smart City – Innovation

Innovation, decarbonization and digital transition are at the forefront of both national and European strategic guidelines. In line with this vision, Maia embraced innovative projects and measures, particularly the SPARCS project, and, more recently, other projects in the Horizon Europe context. This category of projects will be assessed by the accomplishment of the milestones of each initiative.

KSA5 Integrated and Inclusive City – Citizen and Stakeholders Engagement

Maia's developments towards fulfilling the KSA5 vision statements will be monitored mainly by the milestones defined in the Environmental Literacy for Sustainability project, as well as through the successful implementation of the other identified projects designed to support the active participation of citizens and stakeholders, with special emphasis on the Cross Sectoral Advisory Board.

C. Specialist presentations for the Roadmap for Urban Transformation Workshop

For the first session of the workshop – *Challenges and Opportunities for Urban Transformation* – specialists of the strategic areas of Mobility, Energy, and Digital Transition made their introductory interventions:

- For the first intervention, Maia's Sustainable Urban Mobility Plan revising coordinator, and Mobility expert, made some remarks on the main short/medium term issues that cities (in general) face in regard to urban mobility as one of the "great challenges" and a paradigm change that urges (Figure 33). Bringing the domains of management and spatial planning to a work of transforming urban design that aims to make "humanised cities" is an increasingly necessary change. Decarbonized, environmentally/citizen friendly cities should be considered in the design of such solutions.



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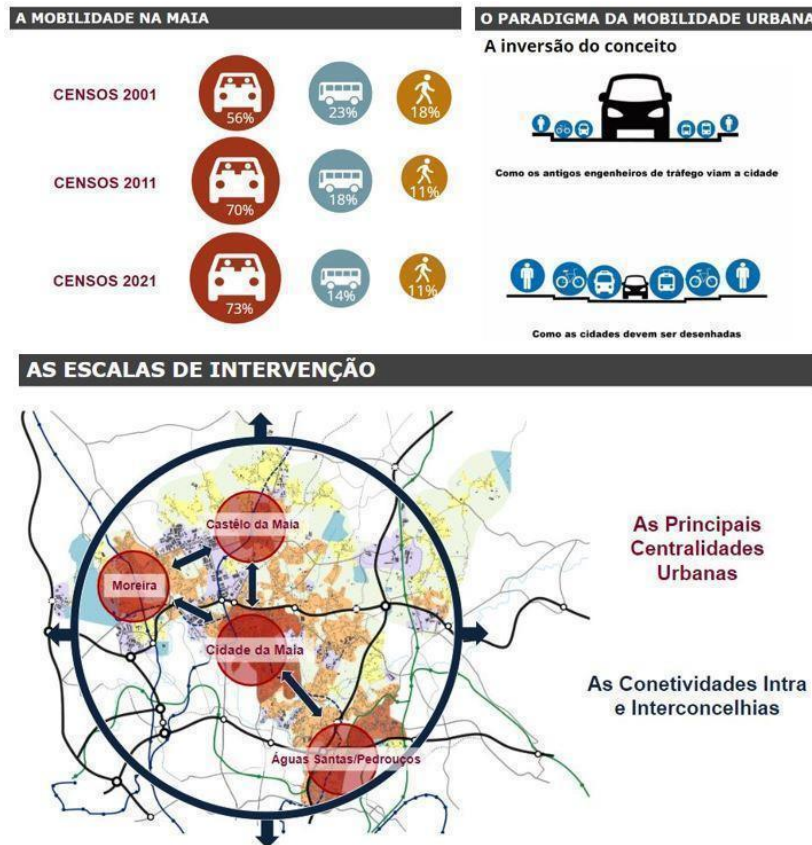


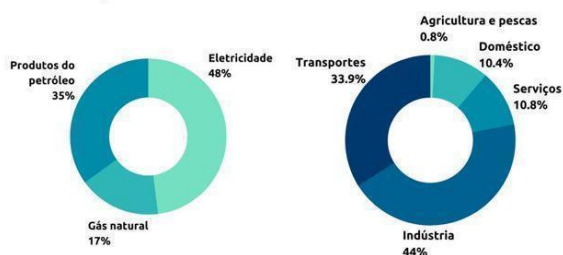
Figure 33. Mobility Expert Presentation

- The second intervention from the coordinator of the Sustainability and Mobility Division of the National Energy Agency (ADENE) reflected the challenges of the municipal energetic partition (Figure 34). Maia’s particularly robust industrial sector presents an “energy bill” of almost 50% for the Industry sector and over 30% for the Transports sector. With 21% of buildings duly certified, future challenges are to adopt measures that guarantee a performance based on the Energy Performance of Buildings Directive (EPBD). The CER - Renewable Energy Communities and the PED - Positive Energy Districts can contribute to it.



Município da Maia

Caracterização



EPBD

Energy performance of buildings: Neutralidade Climática até 2050

- Novos edifícios serão zero-emissões a partir de 2028
- Medidas para combater as alterações climáticas e diminuir faturas energéticas
- Medidas de apoio à pobreza energética
- Infraestruturas para a mobilidade elétrica
- Edifícios inteligentes

Nova revisão:

- Parques para bicicletas (proposta de 15% da capacidade máxima do edifícios)

Certificação Energética Edifícios de Habitação

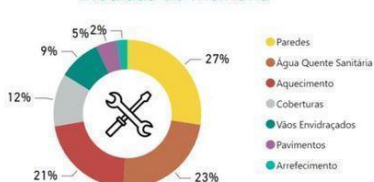
CEs Emitidos



14,050

12% do distrito de Porto

Medidas de melhoria



Mudanças Comportamentais



Figure 34. Energy Expert Presentation

- The last intervention under the theme of Urban Intelligence was held by the Urban Intelligence Management Centre coordinator from Lisbon Municipality (Figure 35). He spoke about the challenges that cities are facing regarding how they should handle the task of responding to citizens in requests, which need to be fast, efficient and proactive, if we they want to be considered truly intelligent and inclusive territories.

Urban Management greatest challenges are heavily focused on data sharing. Such data sharing is best represented in the chain value: 1) to monitor (real-time tracking and alarming); 2) describe (what happened?); 3) diagnosis (why did it happen that way?); 4) to predict (based on what we already know, what will happen next?); and 5) prescribe (the most evolved phase; how will we react?)



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Figure 35. Urban Intelligence Expert Presentation



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D. Internal Workshop Agenda (WS1)

Hora	Session	Contents
9h30	Boas-vindas	O Projeto SPARCS - Maia City Vision 2050
9h40	Introdução	Porquê um Roadmap para a Transformação Urbana
9h45	A Transição Energética na Maia - Status Quo e Tendências	A Transição Energética e Digital no município da Maia; principais indicadores de partida e principais tendências evolutivas. O papel do digital no processo de transição. Principais constrangimentos.
10h00	Distribuição Grupos Trabalho	Distribuição dos participantes por grupos e explicação do exercício colaborativo
10h15	A Transição Energética na Maia - Declarações de Visão 2050	Apresentação das declarações de visão da área chave Energia. Brainstorming e discussão sobre quais os projetos/medidas/ações que permitirão alcançar essa visão de futuro?
10h35	A Transição Energética na Maia - Projetos transformadores	Selecionados os projetos, brainstorming sobre Como? Com que recursos? Com que entidades? Que outros projetos ou ações serão necessárias? Quando serão atingidos resultados que permitirão alcançar essa visão de futuro.
10h55	Trabalho plenário Roadmap - Milestones	Discutidos os detalhes dos projetos, suas precedências e/ou interdependências e tempos de execução, brainstorming coletivo na construção do roadmap. Recolha dos contributos das mesas de trabalho e arrumação no quadro principal
12h25	Conclusão	Apresentação dos resultados



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E. Roadmap for Urban Transformation Workshop Agenda (WS2)

WORKSHOP
Roadmap para a Transformação Urbana

Início	Fim	Descrição
09:15	09:30	Receção dos participantes
		Abertura da Sessão
09:30	09:45	Marta Peneda Vereadora da Qualidade de Vida, Ambiente, Clima e Energia da CM da Maia
		Projeto SPARCS: Enquadramento e Objetivos
09:45	10:00	Fernando Gomes, Núcleo de Estratégia, Desenvolvimento e Inovação (NEDI) da CM da Maia
		Sessão 1: Desafios e Oportunidades para a Transformação Urbana
		Mobilidade Urbana Sustentável Paula Teles, Coordenadora da revisão do PMUS da CM da Maia
10:00	11:00	Transição Energética Hélder Rodrigues, Coordenador da Direção de Sustentabilidade e Mobilidade da Agência Nacional Energia (ADENE)
		Inteligência Urbana João Tremoceiro, Coordenador do Centro de Gestão de Inteligência Urbana da CM de Lisboa
11:00	11:15	Coffee break
		Sessão 2: Identificação de Projetos por Área Estratégica Chave
11:15	12:00	Trabalho colaborativo por mesas temáticas
		Sessão plenária de síntese: Apresentação de resultados por mesa e transferência para o painel colaborativo
12:00	12:30	
12:30	14:00	Almoço – Visita Quinta dos Cónegos
		Sessão 3: Implementação de Projetos por Área Chave
14:00	15:45	Trabalho colaborativo por mesas temáticas
15:45	16:00	Coffee break
16:00	17:00	Sessão 4: Apresentação dos resultados e co-criação do Roadmap Sessão plenária de síntese
		Encerramento Hernâni Ribeiro Vereador da Modernização, Eficiência Governativa e Digitalização do Território da CM da Maia



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Appendix 8 – Complementary outputs of Reykjavík’s roadmapping process

A. Reykjavík’s milestones tables per KSA

Table 52: Reykjavík’s Milestones for KSA1 – The Future of Mobility and Transport

KSA1 – The Future of Mobility and Transport				
Project	Current state and Milestones 2025	Goals and Milestones 2030	Goals and Milestones 2040	Goals 2050 (City Vision / Vision statement)
Category 1. Energy				
1.1.1 Public transport to be powered by renewable energy	<ul style="list-style-type: none"> 50% of the bus fleet powered by renewable energy 	<ul style="list-style-type: none"> 100% of the bus fleet powered by renewable energy 	<ul style="list-style-type: none"> All new public transport options use renewable energy sources 	Vision Statement 1 Transportation is powered solely by local sustainable energy sources.
1.1.2 Network of charging stations	<ul style="list-style-type: none"> Overnight charging hubs for rental cars ready Larson fast charging hubs widely available. AC-Charge hubs for tourists 			Vision Statement 1 Transportation is powered solely by local sustainable energy sources. Vision Statement 2 It is easy to plan a trip where different means of transport are used with comprehensive transport technology solutions.
1.1.3 Development of EV services (SPARCS project)	<ul style="list-style-type: none"> Implementation of time-of-use tariff demand response selection ready 			Vision Statement 1 Transportation is powered solely by local sustainable energy sources.
1.1.4 Renewable <i>synthetic</i> fuels	<ul style="list-style-type: none"> ON operates a hydrogen station, VON, that has proven the possibility to produce hydrogen in Iceland. Technology continues to develop 			Vision Statement 1 Transportation is powered solely by local sustainable energy sources.
Category 2. Transport				
1.2.1 Transport Agreement (Samgöngusáttmáli) - service level for public transport	<ul style="list-style-type: none"> Main Strætó bus routes - 10mins frequency during rush hour. Service hours from 6 a.m. to 1 a.m. on most routes 	<ul style="list-style-type: none"> Borgarlínan City Line routes -- 7mins frequency during rush hour. Other main routes 10mins frequency. Regular routes - never less than 20mins frequency during rush hour 		With improved service, number of users increase, hence frequency of the bus service increases. Vision Statement 2 It is easy to plan a trip where different means of transport



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KSA1 – The Future of Mobility and Transport				
Project	Current state and Milestones 2025	Goals and Milestones 2030	Goals and Milestones 2040	Goals 2050 (City Vision / Vision statement)
				are used with comprehensive transport technology solutions.
1.2.2 Re-routing of existing Strætó bus routes	<ul style="list-style-type: none"> Implementation started in small steps where possible in coordination with the Division of Environment and Planning (USK), The Icelandic Road and Coastal Administration (Vegagerðin) and Transport for the Capital Area (Betri Samgöngur) 	<ul style="list-style-type: none"> The new network mostly implemented 	<ul style="list-style-type: none"> The new network fully implemented 	Vision Statement 3 Transport in Reykjavik increases the quality of living in the city and the public health of citizens.
1.2.3 Ticketing and MaaS (Mobility as a Service) app KLAPP	<ul style="list-style-type: none"> Ferry and flights capping and e-scooter in app 	<ul style="list-style-type: none"> MaaS has been implemented for all types of mobility 		Vision Statement 2 It is easy to plan a trip where different means of transport are used with comprehensive transport technology solutions.
1.2.4 Optimization of Micro- and shared-mobility services	<ul style="list-style-type: none"> Expansion of micro- and shared-mobility service and service area. Increase popularity of micro-mobility Instability of business environment – current contract is renewed bi-annually Suggest for adoption of a legal framework guiding the use and rules for the services allows for greater stability and an integrated plan for expansion 			Vision Statement 3 Transport in Reykjavik increases the quality of living in the city and the public health of citizens.
1.2.5 Green connection between KEF Airport and Reykjavík	<ul style="list-style-type: none"> Identification and scope of project, such as stakeholders, routes and funding 	<ul style="list-style-type: none"> Design of system and changes in local / masterplans 	<ul style="list-style-type: none"> Implementation - Construction almost finished or opened 	Vision Statement 3 Transport in Reykjavik increases the quality of living in the city and the public health of citizens.
1.2.6 Borgarlínan City Line and Betri Samgöngur	<ul style="list-style-type: none"> In 2022, development planning was carried around the areas along the Borgarlínan city line Regional planning for individual sections of Borgarlínan. 	<ul style="list-style-type: none"> The first 4 phases are finished 	<ul style="list-style-type: none"> Connection to KEF airport. All phrases finished in Government-Municipality Transport Agreement (Samgöngusáttmáli) 	Light rail. Expansion of service area. Vision Statement 3 Transport in Reykjavik increases the quality of living in the city and the public health of citizens.



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KSA1 – The Future of Mobility and Transport				
Project	Current state and Milestones 2025	Goals and Milestones 2030	Goals and Milestones 2040	Goals 2050 (City Vision / Vision statement)
	Construction of Borgarlínan started.			
Category 3. Urban and infrastructure development				
1.3.1 Public health assessment for the first round of Borgarlínan development	<ul style="list-style-type: none"> Workshops have been conducted. Final report is completed with the assistance from economic partners and is published in early 2022. Public health assessment is a legal requirement 	<ul style="list-style-type: none"> Continued HIA on Borgarlínan on the next development phases (2,3 phases) 	<ul style="list-style-type: none"> Impact assessment on infrastructure and urban development around the City Line 	Re-evaluation and assessment on older neighbourhood Vision Statement 3 Transport in Reykjavik increases the quality of living in the city and the public health of citizens.
1.3.2 Hlemmur area development (SPARCS project)	<ul style="list-style-type: none"> In early 2022, reconstruction on Rauðarárstígur and Laugavegur began, entering the first phase of transforming Hlemmtorg and its surroundings Detailed design for Hlemmtorg is published 	<ul style="list-style-type: none"> Reconstruction of Hlemmtorg is completed (2027) 		Vision Statement 3 Transport in Reykjavik increases the quality of living in the city and the public health of citizens.
1.3.3 Cycling plan - A world-class cycling city	<ul style="list-style-type: none"> In 2022, following the newly approved cycling plan, construction began with the bicycle paths and safer parking spaces for bicycle and scooter were established at several elementary schools. 	<ul style="list-style-type: none"> Emphasis on bike paths within districts. The long-distance routes are mostly constructed. 	<ul style="list-style-type: none"> Bike sharing programs are easily available to residents in all districts. 	Comprehensive and integrated bike path network is a self-sufficient transport layer. Vision Statement 3 Transport in Reykjavik increases the quality of living in the city and the public health of citizens.
1.3.4 Development of mobility hub in Vatnsmýri - Planning competition for the development	<ul style="list-style-type: none"> Concept search for development in and around Miklubrautarstokk and Sæbrautarstokk the publication of the preliminary draft report ongoing implementation 	<ul style="list-style-type: none"> Mobility hub ready/ up and running. Integration of Borgarlínan route. Surrounding area at BSÍ in detail phase for building and public space 	<ul style="list-style-type: none"> Vatnsmýri built area 50% ready. New residential area with green approach in Skerjafjörður ready. 	Reykjavík domestic airport has been removed. Detailed planning for the area started. Vision Statement 3 Transport in Reykjavik increases the quality of living



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KSA1 – The Future of Mobility and Transport				
Project	Current state and Milestones 2025	Goals and Milestones 2030	Goals and Milestones 2040	Goals 2050 (City Vision / Vision statement)
	work at the location of Borgarlínan, direction become clearer			in the city and the public health of citizens.
Category 4. Research and innovation				
1.4.1 EC-funded Project AMIGOS, with focus on Hlemmtorg multi-modal mobility hub as a Safety Improvement Area	<ul style="list-style-type: none"> Project kick-off June 2023. Preparation work: data collection, data aggregates, stakeholder identification and recruitment. 	<ul style="list-style-type: none"> Project implementation completed (May 2027) Improvements built into completion of surface and service designs at Hlemmtorg for co-existing modes of transport and accessibility measures catered to Vulnerable Road Users (VRU). 		<p>Vision Statement 2 It is easy to plan a trip where different means of transport are used with comprehensive transport technology solutions.</p> <p>Vision Statement 3 Transport in Reykjavik increases the quality of living in the city and the public health of citizens.</p>
1.4.2 Climate Agreement - EU Mission: Climate-Neutral and Smart Cities	<ul style="list-style-type: none"> First version of Reykjavík's Climate Agreement in preparation 	<ul style="list-style-type: none"> 7th contract signed but still emissions are not zero. As stated in the Climate Action Plan, estimated emissions by 2030 will be around 170.000 co2 eq tonnes. 	<ul style="list-style-type: none"> Scope 1 climate neutral - more information on the emission goals by 2040 will be available before the first contract is drafted. Scope 3 still high GHG emissions - not enough data to estimate any % on Scope 3 emissions yet. 	<p>All scopes reached climate neutrality. Reykjavik reached full carbon neutrality</p> <p>Vision Statement 1 Transportation is powered solely by local sustainable energy sources.</p> <p>Vision Statement 2 It is easy to plan a trip where different means of transport are used with comprehensive transport technology solutions.</p> <p>Vision Statement 3 Transport in Reykjavik increases the quality of living in the city and the public health of citizens.</p>



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Table 53: Reykjavík's Milestones for KSA2 – Sustainable Ecosystem for the Built Environment

KSA2 – Sustainable Ecosystem for the Built Environment				
Project	Current state and Milestones 2025	Goals and Milestones 2030	Goals and Milestones 2040	Goals 2050 (City Vision / Vision statement)
Category 1. Energy				
2.1.1 Other renewable energy sources	<ul style="list-style-type: none"> Other renewable energy sources 	<ul style="list-style-type: none"> Permits for new energy production 		All scopes reached climate neutral
Category 2. Transport				
2.2.1 Green urban development along the Borgarlínan City Line	<ul style="list-style-type: none"> Development of Keldnaland and Keldnaholt - declaration of intent on co-operation is signed with Betri Samgöngur (CSO for better transport) Acceleration of the infrastructure development of two Borgarlínan routes. Development of Elliðaárvogur, Ártúnshöfði, Gufunes, Skerjafjörður and Keldur - planning work Development of Sæbraut and Miklubraut - pre-planning 	<ul style="list-style-type: none"> Stop building Sundabraut. City Line arrived. Keldur, Keldnaholt, Ártún, Skerjafjörður, Mjódd -- incentive to be offered for development on these plots. If the public agrees, private sector gets involved. 	<ul style="list-style-type: none"> Construction in these areas will be completed Halfway construction in Vatnsmýri 	<ul style="list-style-type: none"> Vatnsmýri construction completed. Renewal of the older neighbourhoods in Laugadalur, Grandi and Vesturbær. <p>Vision Statement 1 Reykjavík is a diverse and multicultural society</p>
Category 3. Urban and infrastructure development				
2.3.1 15-minute neighbourhood	<ul style="list-style-type: none"> Neighbourhood planning for Neðra-Breiðholt, Seljahverfi and Efra-Breiðholt Older district plans to be replaced. 	<ul style="list-style-type: none"> Borgarlínan phase two up and running. Plan for all 10 neighbourhoods ready. Implementation of infrastructure for micro-mobility. https://borgarlinan.is/leidanet 	<ul style="list-style-type: none"> Borgarlínan phase three completed. All high streets "borgargötur" ready in the neighbourhoods. Services like the Pikkoló grocery self-service pick-up accommodated for. 	<ul style="list-style-type: none"> Full implementation of 15-minute neighbourhood <p>Vision Statement 1 Reykjavík is a diverse and multicultural society</p>



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KSA2 – Sustainable Ecosystem for the Built Environment				
Project	Current state and Milestones 2025	Goals and Milestones 2030	Goals and Milestones 2040	Goals 2050 (City Vision / Vision statement)
2.3.2 Green Bond (Græn skuldabréf)	<ul style="list-style-type: none"> In the forecast estimation, the annual investments will be around ISK 25 billions. The City of Reykjavík's investment plan was updated in parallel with the preparation of 2023-2027 budget. 	<ul style="list-style-type: none"> A certain percentage of investments will fall under the Green Bond Framework 	<ul style="list-style-type: none"> 80% green & social bonds (sustainable) bonds 	No "grey bonds" available Vision Statement 1 Reykjavík is a diverse and multicultural society
2.3.3 Housing plan (Húsnæðisáætlun)	<ul style="list-style-type: none"> By July 2022, 532 new apartments had entered the housing market since Jan that year. Negotiations are currently underway with the Housing Department (HMS) and the Ministry of Infrastructure (Innviðaráðuneytið) regarding a 10-year contract for housing development. 	<ul style="list-style-type: none"> Around 14.000 new apartments have been built since 2023 -- 5% City-owned, 2% close to zero emission. 	<ul style="list-style-type: none"> 26.000 new apartments have been built since 2023. 35% affordable and 10% City-owned -- 40% close to zero emission. 	<ul style="list-style-type: none"> 40.000 new apartments built since 2023. 50% affordable + City-owned, over 50% close to zero emission Vision Statement 1 Reykjavík is a diverse and multicultural society
2.3.4 Green housing for the future (Grænt húsnæði framtíðar) (SPARCS project)	<ul style="list-style-type: none"> Proposals for green housing development on five plots were advertised. Winning teams of each site selected by jury panel individually. Site 1 contract completed, ongoing legal team for Site 2-5. Upscaling work for green neighbourhood begun for Site 5. Site 1 – Breiðholt – Arnarbakki 6	<ul style="list-style-type: none"> 50% of all green housing build. Second round of proposals for Grænt húsnæði framtíðar 	<ul style="list-style-type: none"> Site 4 and Site 5 ready. All detail plans finished. 	100% of all housing built green. Vision Statement 1 Reykjavík is a diverse and multicultural society



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KSA2 – Sustainable Ecosystem for the Built Environment				
Project	Current state and Milestones 2025	Goals and Milestones 2030	Goals and Milestones 2040	Goals 2050 (City Vision / Vision statement)
	Site 2 – Breiðholt – Völvufell 13-23 Site 3 – Breiðholt – Völvufell 43 Site 4 – Miðborg – Frakkastígur 1 Site 5 – Hlíðar – Veðurstofureitur <ul style="list-style-type: none"> Assisting to establish green construction guidelines with Green Building Council (Byggjum grænni byggð) 			
2.3.5 Affordable housing and first-time buyers	<ul style="list-style-type: none"> In 2022, Construction was underway in three areas out of nine. Plots allocated are Gufunes, Úlfarsárdalur, at Vatnsholt and Bryggjuhverfi. Next plot allocation will likely be in Bryggjuhverfi. 	<ul style="list-style-type: none"> By 2030, all nine areas will be built. Continued project, more areas in development. Governmental agreement established with other municipalities to ensure this type of housing to be available in the market 	<ul style="list-style-type: none"> All construction is built to last and in simple but classic design. 	Vision Statement 2 Reykjavík is a socially equal society based on a strong education and welfare and health system
2.3.6 Housing for people is vulnerable situations.	<ul style="list-style-type: none"> Division of Welfare, Division of Environment and Planning and Félagsbústaðir (social housing - non-profit City-owned company) – work completed on renovating apartments for disabled people. Extend the current plan from 2017 to 2028 with about 20 residential clusters with 120 apartments and two mobile housing teams 	<ul style="list-style-type: none"> Agreement between state and municipalities on revenues / costs has been made - waiting lists are gone 	<ul style="list-style-type: none"> no waiting lists 	<ul style="list-style-type: none"> focus on tailoring housing to individuals' needs - flexible solutions Vision Statement 2 Reykjavík is a socially equal society based on a strong education and welfare and health system



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KSA2 – Sustainable Ecosystem for the Built Environment				
Project	Current state and Milestones 2025	Goals and Milestones 2030	Goals and Milestones 2040	Goals 2050 (City Vision / Vision statement)
	<ul style="list-style-type: none"> a total of 168 apartments plus staff facilities. In 2022, Félagsbústaðir to select locations, define plot designs, and outsource for construction. 			
2.3.7 Waste management, recycling and GAJA	<ul style="list-style-type: none"> Landfill is ended. Gaja produces soil and methanol gas for fuel. The harmonised classification system (Samræmd flokkun) leading to reduction in waste classifications for general publics 	<ul style="list-style-type: none"> Circular Park in Álfsnes completed 	<ul style="list-style-type: none"> Stop demolition of existing buildings except if recycling building materials Goal is reached in minimising export in waste 	<ul style="list-style-type: none"> All waste is sorted and recycled <p>Vision Statement 3 There is a good supply of stores with environmentally friendly and unpackaged products.</p>
Category 4. Research and innovation				
2.4.1 Reinventing Cities (C40)	<ul style="list-style-type: none"> For Sævarhöfði plot, competition is completed and winning proposal has been selected. For Gufunesbryggja plot, a team is revising the proposal per feedback. For Lágmúli plot. the legal team is working on contracts with Veitur. For Malarhöfði plot near Ártún, negotiations have been completed for a project to be constructed there. 	<ul style="list-style-type: none"> Detail plans ready by 2030 for all C40 sites Two more sites have entered the competition 	<ul style="list-style-type: none"> Continuation of new detail plans for new C40 sites 	<ul style="list-style-type: none"> C40 buildings are up and running <p>Vision Statement 2 Reykjavík is a socially equal society based on a strong education and welfare and health system</p>
2.4.2 Climate Agreement - EU Mission: Climate-Neutral and Smart Cities	<ul style="list-style-type: none"> First version of Reykjavík's Climate Agreement in preparation 	<ul style="list-style-type: none"> 7th contract signed but still emissions are not zero. As stated in the Climate Action Plan, estimated 	<ul style="list-style-type: none"> Scope 1 climate neutral - more information on the emission goals by 2040 will be available before 	<ul style="list-style-type: none"> All scopes reached climate neutrality. Reykjavík reached full carbon neutrality



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KSA2 – Sustainable Ecosystem for the Built Environment				
Project	Current state and Milestones 2025	Goals and Milestones 2030	Goals and Milestones 2040	Goals 2050 (City Vision / Vision statement)
		emissions by 2030 will be around 170.000 tCO ₂ eq.	the first contract is drafted. <ul style="list-style-type: none"> • Scope 3 still high GHG emissions - not enough data to estimate any % on Scope 3 emissions yet. 	Vision Statement 1 Reykjavík is a diverse and multicultural society Vision Statement 2 Reykjavík is a socially equal society based on a strong education and welfare and health system Vision Statement 3 There is a good supply of stores with environmentally friendly and unpackaged products.

B. Supporting documents

An available [Master Spreadsheet](#) is the working document of workshop preparations, including the preparations of the vision statements and the measures identified from interviews and document reviews to frame workshop activities and interactions. The spreadsheet also catalogues the response input from workshop participants.

A report has been issued by the Reykjavík Energy Group (OR, Veitur Utilities and ON Power) – [LINK to published report \(PDF\)](#) – elaborating measures to achieve their stated 2050 goals, prioritising climate issues and the environment. The former set of priorities broadly concerns carbon-neutrality in energy production, more resilient/adaptable power/utility systems, capture and sequestration of CO₂ and finalising the transition of the transportation fleet. The set of environmental priorities is focusing on sustainable management of low/high temp geothermal resources, water protection, zero carbon footprint in operations of distribution/supply and outflow services, the restoration of ecosystems and biodiversity, green loans and funding.

C. List of participants

Name	Organisation	Position
Harpa Þorsteinsdóttir	City of Reykjavík – Office of the Mayor and CEO	Project Manager of Public Health
Hugrún Snorradóttir	Government of Iceland - Public Health Department, Directorate of Health	Project Manager of Public Health



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Name	Organisation	Position
Hulda Hallgrímsdóttir	City of Reykjavík – Office of the Mayor and CEO	Project Manager in Economic and Urban Development
Rebekka Guðmundsdóttir	City of Reykjavík – Division of Environment and Planning	Urban Designer
Bjarni Ingvarsson	City of Reykjavík – Office of Transport and Urban Design, Division of Environment and Planning	Interim Head of the Office of Transport
Þorsteinn Hermannsson	Better Transportation of Capital Region (Betri Samgöngur)	Director of Development
Hilmar Magnússon	City of Reykjavík – Office of the Mayor and CEO	Project Manager in Economic and Urban Development
Óli Örn Eiríksson	City of Reykjavík – Office of the Mayor and CEO	Head of Economic and Urban Development
Ívar Örn Ívarsson	City of Reykjavík – Office of the Mayor and CEO	Head of Legal
Kristrún Thorlacius Gunnarsdóttir	City of Reykjavík – Office of the Mayor and CEO	Senior Research Officer
Hrönn Hrafnisdóttir	City of Reykjavík – Division of Environment and Planning	Head of Climate Unit
Ragnheiður Einarsdóttir	Strætó bus company	Transport Planner
Sólrún Svava Skúladóttir	Strætó bus company	Transport Planner
Valgerður Gréta Benediktsdóttir	Strætó bus company	Transport Planner
Sólveig Björk Ingimarsdóttir	City of Reykjavík – Division of Environment and Planning	Project Manager (green buildings)
Sæunn Ósk Unnsteinsdóttir	HOPP scooter and shared mobility service provider	Managing Director
Hrafn Leó Guðjónsson	ON Power / Reykjavík Energy	Product Manager / Programme Manager



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D. Workshop photos



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E. Transposing the Reykjavík City Vision 2050

SPARCS – MEMO

Reykjavík, January 2023

Transposing the Reykjavík City Vision 2050

building task forces – developing roadmaps

This memorandum concerns the City Vision 2050 for Reykjavík ([SPARCS D1.11](#)) and how the vision is transposed onto Key Strategic Areas (KSA) in the roadmapping work to follow, turning visions to actions. In the late summer of 2022, the RVK team re-evaluated the outcomes of the early envisioning work and decided, as a way forward, to focus the KSAs on the **future of mobility and transport** in and around Reykjavík and a **sustainable ecosystem for the built environment**.

This choice aligns with the Implementation Plan for Reykjavík ([SPARCS D5.05](#)) which is also indicative of a minor shift from the City Vision 2050 document. Arguably, the aggregate of project ideas that later came forward broach the most serious challenges. They are constitutive of practices that produce by far the largest amount of GHG emissions in the capital region, while also being the most complicated in delivering social and cultural change. Inciting transformation is urgent, however, already embedded in the action plans of the City's administration. Hence, the focus on these two KSAs. Another reason is to argue that, while mobility as a KSA is uniquely addressed in the City Vision 2050 document (*Mobility Vision*), most of the other statements in the document either apply indirectly to mobility and transport or they apply to the wider aspects of the built environment — considering community/social aspects of green development, the common lifeworld, inclusivity, the full lifecycles of buildings and their surroundings, including choice of materials, on-site operations, energy performance, maintenance issues and waste management. Importantly, finding sustainable solutions for those practices ought to be transferable.

As we summarise in the Implementation Plan for Reykjavík, the overall City Vision 2050 describes a clean, green, smart and socially inclusive city, populated by environmentally conscious and conscientious inhabitants — a city by the sea where nature-based solutions are at the heart of policy and decision making.

- **Mobility Vision** describes a city completely transitioned from fossil fuels to electricity and other renewables in transport, and it describes multi-modal mobility combining foot traffic, car traffic, public transport, micro-flows of various electric-type vehicles and *Mobility as a Service* (MaaS).
- **Circular Economy Vision** describes the conservation of natural resources, minimised reliance on the international supply chain, and smart solutions advancing the material (re-)cycles. It describes environmentally friendly lifestyles, demanding sustainable business in production and services.



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Figure 1: transforming mobility and transport. (Image: Dagný Land Design and Mandaworks)

- **Societal Vision** describes a cultural diversity, respect for ecosystems and environmental awareness in the interactions between people, nature and the urban environment. It describes age-friendliness, active democracy, floating workplace culture, innovative education system, and dynamically adaptable ICT-driven services.

A host of statements further elaborate these KSAs, however, only the latter two (*Circular Economy* and *Society*) are the object of what we call *transposition* in RVK's roadmapping for SPARCS.

For example, a host of statements therein apply to material practice (recycling, recyclables, waste, local (micro) energy production and resource efficiency), green development (recovering wetland, a sharing economy, communal gardens to grow edibles, botany for pleasure), education about responsibilities and obligations in the interplay between society and nature, and 'active' democratic participation in planning and decision-making about the built environment. Altogether, these statements call on a strategic approach to a **sustainable ecosystem for the built environment**, indeed, to implement a circular economy and an environmentally conscientious lifeworld.



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Figure 2: transforming the ecosystem for the built environment (Image: Basalt Architects)



Figure 3: transforming the ecosystem for the built environment (Image: City of Reykjavík)

Another set of statements applies to inclusivity and a changing culture (flexible work, healthy ageing, *eHealth* and *mHealth* solutions and active recreational interests). They apply to matters of equal access (education, welfare, health services), public health and personal responsibility. Again, these vision statements broadly refer to a sustainable ecosystem for the built environment but, more importantly, they refer to smart mobility and transport, and novel ways of applying advanced ICTs in supporting opportunities and accessibility while reducing inactive lifestyles.

To sum up, the **future of mobility and transport** and a **sustainable ecosystem for the built environment** are the most pressing environmental, technical and cultural challenges for Reykjavík, hence, are KSAs for roadmapping as a contribution to SPARCS. Notably also, the domains of practice thereunder are already the object of internal consultations, cross-functional and strategic actions, bringing together technical research, citizen science, urban development projects and emerging economic opportunities, transforming the foundations on which the future city can flourish.

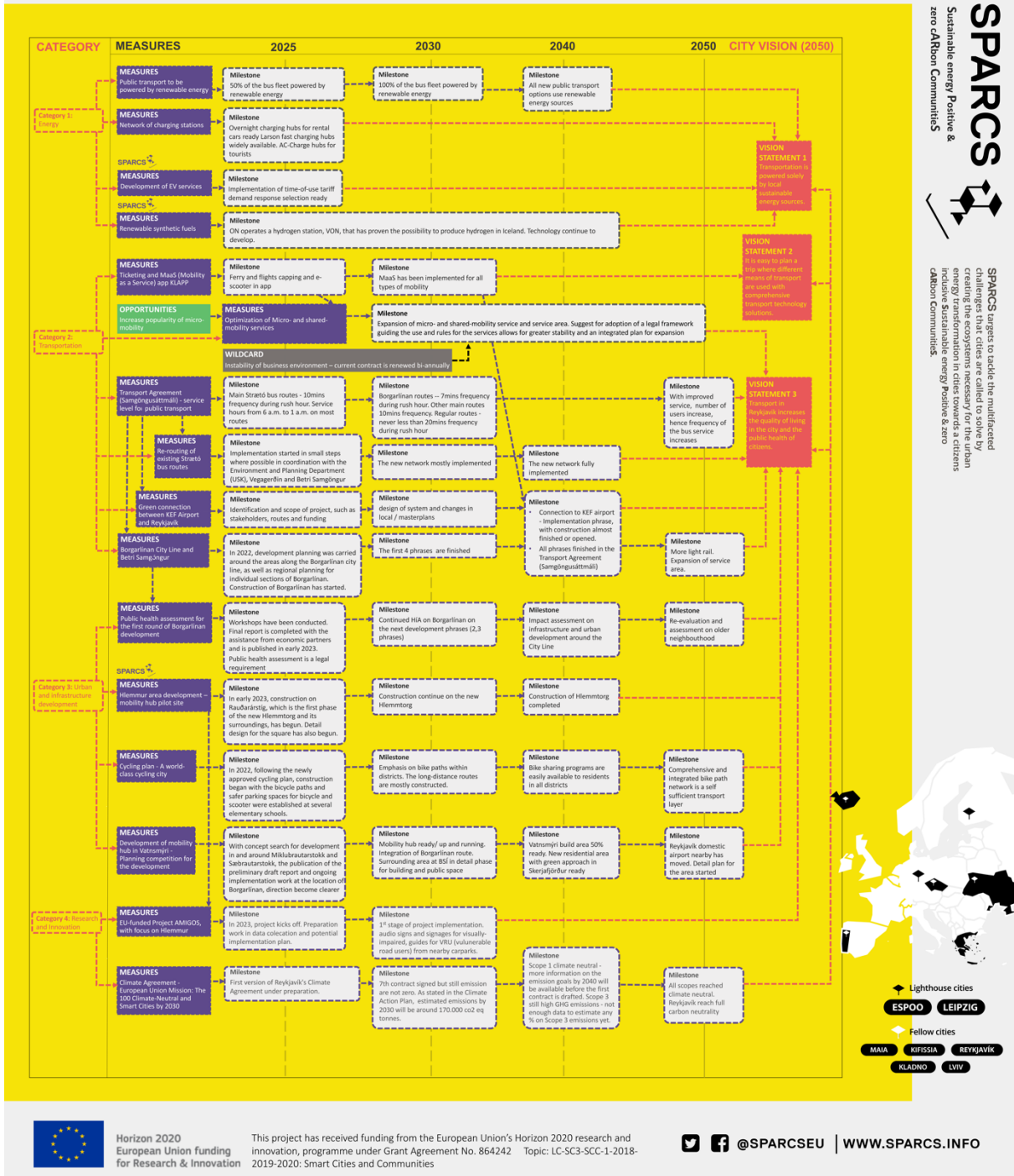


F. Diagram - Future of Mobility and Transport

City of Reykjavík | KSA1 – Future of Mobility and Transport

ROADMAP FOR URBAN TRANSFORMATION

- TRENDS**
- Increase the use of multi-modal shared mobility
 - Improved existing and new large-scale infrastructure development for greener mobility
 - greener municipal planning - urban densification and 15-minute neighbourhood
 - technological advancement in renewable energy production and carbon sequestration



SPARCS
Sustainable energy, Positive & zero Carbon Communities

SPARCS targets to tackle the multifaceted challenges that cities are called to solve by creating the ecosystems necessary for the urban energy transformation in cities towards a citizens inclusive Sustainable energy Positive & zero Carbon Communities.

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H. Presentation deck

Presentation deck used at the workshop. (order: left to right, top to bottom)



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<p>REYKJAVÍK 2050?</p> <p>Hallgrímskirkja Harpa Grandi</p> <p>AI-generated image of carbon-neutral Reykjavik 2050</p>	<p>REYKJAVÍK 2050?</p>
<p>REYKJAVÍK 2050?</p> <p><small>"The Road" - https://gaedwaco.com/future-transportation-medium-the-road-49935/</small></p>	<p>REYKJAVÍK 2050?</p>
<p>REYKJAVÍK 2050?</p> <p><small>© iStock (19984)</small></p>	<p>As envisioned in the Innovation Workshop in 2021</p>
<p>MOBILITY 2050</p>	<p>SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT 2050</p> <ol style="list-style-type: none"> 1. Transportation is powered solely by local sustainable energy sources. 2. In Reykjavik, less than 30% of trips are made by car. 3. It is easy to plan a trip where different means of transport are used with comprehensive transport technology solutions. 4. Transportation infrastructure is designed to promote communication and human life. 5. Reykjavik is a leader in changing the workplace culture with floating offices. 6. There is good access to a variety of sharing equipment that meets different needs for each trip. 7. Reykjavik is characterized by car-free areas. 8. People in Reykjavik are safe in traffic, serious traffic accidents are virtually unknown. 9. Reykjavik is a calm and relaxed city with improved mobility infrastructure. 10. Transport in Reykjavik increases the quality of living in the city and the public health of citizens. 11. Reykjavik residents are well informed about the cost of transport decisions. 12. Reykjavik has implemented an innovation-guided public education system. 13. Most of waste recycling takes place in Iceland. 14. Companies in the city use recycled products in their production. 15. Reykjavik is sustainable in growing vegetables that everyone can access. 16. There are sharing centres in all districts in the city. 17. Homes in Reykjavik produce energy and are sustainable. 18. There is a good supply of stores with environmentally friendly and unprocessed products. 19. Recovery of all wetland is finished, with some of them located in close proximity to urban spaces. 20. All resource streams are used to create value. 21. Reykjavik is a diverse and multicultural society. 22. Reykjavik is a socially equal society based on strong education and welfare and health system. 23. Reykjavik is an age-friendly city that offers a variety of opportunities for work and recreation and that offers user-controlled permeability. 24. All districts have botanical gardens in temperate houses. 25. Reykjavik has implemented innovation-guided public education system.



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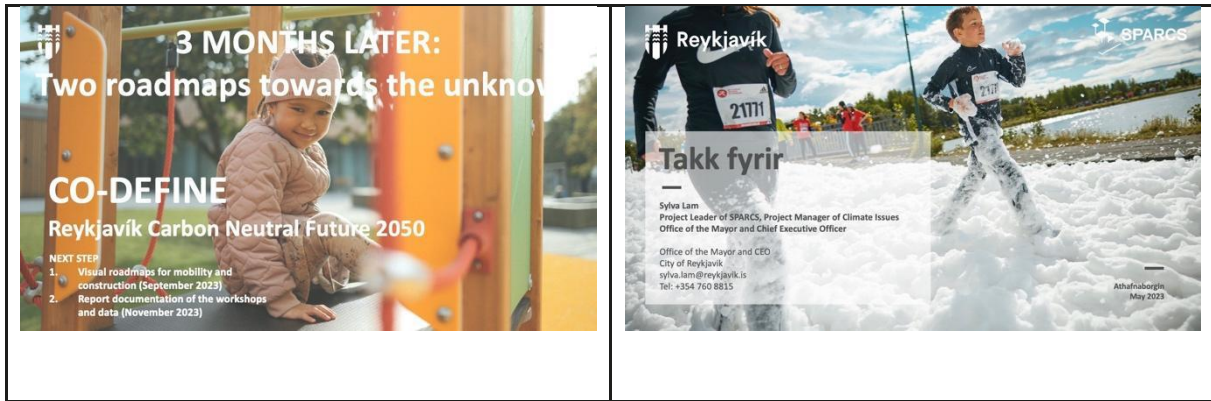
<p style="text-align: center;">YOU HAVE 15 mins TO DISCUSS THE FUTURE</p> <p style="text-align: center;">+ - feasibility, relevancy & realistically - 5 mins TO VOTE</p>	<p style="text-align: center;">WHICH 3 MOBILITY STATEMENTS CAN BECOME REALITY IN RVK? </p> <div style="border: 1px dashed black; padding: 10px; margin: 10px auto; width: 80%;"> <ol style="list-style-type: none"> 1. XXXXXXXXXXXX 2. XXXXXXXXXXXX 3. XXXXXXXXXXXX </div>
<p style="text-align: center;">WHICH 3 BUILD ENVIRONMENT STATEMENTS CAN BECOME REALITY IN RVK?</p> <div style="border: 1px dashed black; padding: 10px; margin: 10px auto; width: 80%;"> <ol style="list-style-type: none"> 1. XXXXXXXXXXXX 2. XXXXXXXXXXXX 3. XXXXXXXXXXXX </div>	<p style="text-align: center;">LET'S RIDE BACK TO 2020</p>
<p style="text-align: center;">NOW BACK TO THE PRESENT</p> <p style="text-align: center;">Divide into 2 thematic groups, feel free to mingle in-between</p>	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>MOBILITY </p> <p>HOW TO GET THERE?</p> <p style="font-size: small;">Projects and policies 2020</p> <ol style="list-style-type: none"> 1. Continue energy exchange in the transport sector - Strengthening of distribution network within the capital area 2. Continue energy exchange in the transport sector - Network of charging stations 3. Development of EV services 4. Helmerur area development 5. Re-routing of existing routes 6. Strætú - Ticketing and MaaS app RÍLAPPÍD 7. Micro-mobility - HOPP and ZOLO - Business plan to expand services 8. Continue energy exchange in the transport sector - Renewable synthetic fuels 9. Healthy modes of mobility: a world class cycling city 10. AMICUS - EU funded research project on mobility 11. Public health assessment for first round of Borgarinnan development 12. Climate Agreement - European Union Mission: The 100 Climate-Neutral and Smart Cities by 2030 13. Planning competition for development and mobility hub at Vatnsmýri 14. Roadmap for energy transition in mobility - Icelandic state 15. Climate issues and environment education are offered to students. Advice and training on climate issues and environment in school and leisure activities are offered to staff 16. Reducing carbon footprint - Implementation of green screens in primary schools (Græniskjál) </div> <div style="width: 45%;"> <p>SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <ol style="list-style-type: none"> 1. Eco-friendly build development - Þegsum granni framfarður, „Ágerðarskúli“ loftslagsáætlun 2. Walkable city - 15-minute neighbourhood 3. Walkable city - green urban development - new neighbourhoods along Borgarinnan 4. Investment plan - Green Bond 5. Housing plan 6. Green housing for the future (grænt húsnæð) 7. Affordable housing and first time buyer 8. Reinvesting Cities (C40) 9. Elderly housing – sustainable 10. Recycling and GABA 11. Housing for disabled residents 12. My Neighbourhood (Meinð mitt) 13. Reykjavík Energy - Actions to achieve future goals - Geothermal energy production 14. Reykjavík Energy - Actions to achieve future goals - Other renewable energy sources 15. Reykjavík Energy - Actions to achieve future goals - Safeguarding renewable heat supply 16. Reykjavík Energy - Actions to achieve future goals - Continue carbon sequestration 17. Energy exchange - charging equipment for electric cars at apartment buildings 18. Climate Agreement - European Union Mission: The 100 Climate-Neutral and Smart Cities by 2030 19. Climate issues and environment education are offered to students. Advice and training on climate issues and environment in school and leisure activities are offered to staff 20. Reducing carbon footprint - Implementation of green screens in primary schools (Græniskjál) (2020 - 7) </div> </div>
<p style="text-align: center;">15mins sort out the relevant projects write down the milestones</p> <p style="text-align: center;">-</p> <p style="text-align: center;">15mins ADD your relevant projects write down the milestones</p>	<p style="text-align: center;">15 min TO FIND THE PATHS TO THE FUTURE </p> <p style="text-align: center;">WILDCARDS + OBSTACLES + OPPORTUNITIES</p>



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I. Activity cards

Introduction

Vision Statements 2050 from previous Workshop – KSA 1

<div style="border: 1px solid black; padding: 5px; background-color: #fff9c4;"> <p style="font-size: small; margin: 0;">SPARCS IN REYKJAVÍK 2050 REYKJAVÍK - MOBILITY</p> <p>1. Transportation is powered solely by local sustainable energy sources.</p> <p style="font-size: x-small; margin: 0;">The use of fossil fuels on vehicles, whether traveling by road, ocean or air, has been discontinued. Instead, sustainable local energy sources are used, such as electricity, hydrogen, methane or other fuels that are produced, for example, by electrolysis or biomass.</p> </div>	<div style="border: 1px solid black; padding: 5px; background-color: #fff9c4;"> <p style="font-size: small; margin: 0;">SPARCS IN REYKJAVÍK 2050 REYKJAVÍK - MOBILITY</p> <p>2. In Reykjavík, less than 30% of trips are made by car.</p> <p style="font-size: x-small; margin: 0;">Most of the travel is by foot, by MaaS (mobility app), micro-flow of vehicles or by public transport.</p> </div>	<div style="border: 1px solid black; padding: 5px; background-color: #fff9c4;"> <p style="font-size: small; margin: 0;">SPARCS IN REYKJAVÍK 2050 REYKJAVÍK - MOBILITY</p> <p>3. It is easy to plan a trip where different means of transport are used with comprehensive transport technology solutions.</p> <p style="font-size: x-small; margin: 0;">Digital travel planners help individuals find the easiest route from A to B and switching costs are minimal between different modes of transport.</p> </div>
<div style="border: 1px solid black; padding: 5px; background-color: #fff9c4;"> <p style="font-size: small; margin: 0;">SPARCS IN REYKJAVÍK 2050 REYKJAVÍK - MOBILITY</p> <p>4. Transportation infrastructure is designed to promote communication and human life.</p> <p style="font-size: x-small; margin: 0;">Cycling and walking are organized as a priority.</p> </div>	<div style="border: 1px solid black; padding: 5px; background-color: #fff9c4;"> <p style="font-size: small; margin: 0;">SPARCS IN REYKJAVÍK 2050 REYKJAVÍK - MOBILITY</p> <p>5. Reykjavík is a leader in changing the workplace culture with floating offices.</p> <p style="font-size: x-small; margin: 0;">Floating location of offices is common, and their functionality is ensured by powerful information technology and high-speed internet connection. Staff of the City of Reykjavik are not required to travel a long way to get to the workplace, but can approach the nearest office and meet colleagues from different departments.</p> </div>	<div style="border: 1px solid black; padding: 5px; background-color: #fff9c4;"> <p style="font-size: small; margin: 0;">SPARCS IN REYKJAVÍK 2050 REYKJAVÍK - MOBILITY</p> <p>6. There is paid access to a variety of sharing equipment that meets different needs for each trip.</p> <p style="font-size: x-small; margin: 0;">Citizens have access to a variety of travel modes through a well-designed multi modal transport system including MaaS, micro- and sharing-solutions, pedestrian zones and fossil free public transport. Citizens either pay on demand or subscribe to travel options.</p> </div>
<div style="border: 1px solid black; padding: 5px; background-color: #fff9c4;"> <p style="font-size: small; margin: 0;">SPARCS IN REYKJAVÍK 2050 REYKJAVÍK - MOBILITY</p> <p>7. Reykjavík is characterized by car-free areas.</p> <p style="font-size: x-small; margin: 0;">Reykjavik is characterized by car-free areas. Car-free areas are a characteristic of Reykjavik. Car traffic is on the edge of the urban settlements. Attractive environments nourish the spirit.</p> </div>	<div style="border: 1px solid black; padding: 5px; background-color: #fff9c4;"> <p style="font-size: small; margin: 0;">SPARCS IN REYKJAVÍK 2050 REYKJAVÍK - MOBILITY</p> <p>8. People in Reykjavik are safe in traffic. serious traffic accidents are virtually unknown</p> <p style="font-size: x-small; margin: 0;">The safety requirements for cars are such that traffic accidents caused by cars are a thing of the past.</p> </div>	<div style="border: 1px solid black; padding: 5px; background-color: #fff9c4;"> <p style="font-size: small; margin: 0;">SPARCS IN REYKJAVÍK 2050 REYKJAVÍK - MOBILITY</p> <p>9. Reykjavik is a calm and relaxed city with improved mobility infrastructure.</p> <p style="font-size: x-small; margin: 0;">Reykjavik is calm even though people are on the move, slow traffic, quiet and relaxed.</p> </div>



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 <p>2050 REYKJAVÍK - MOBILITY</p> <p>10. Transport in Reykjavik increases the quality of living in the city and the public health of citizens.</p> <p>It is easy to travel around the city regardless of which mode of transport is used. There is plenty of space for human activity and for people who choose more active modes of transport.</p>	 <p>2050 REYKJAVÍK - MOBILITY</p> <p>11. Reykjavik residents are well informed about the cost of transport decisions.</p> <p>Reykjavik residents are well informed about the cost of transport decisions. Citizens are aware that each trip translates to costs for society, economically and environmentally and that these costs vary greatly depending on the mode of transportation.</p>	 <p>2050 REYKJAVÍK - MOBILITY</p> <p>12. Reykjavik has implemented an innovation guided public education system.</p> <p>The City of Reykjavik operates an innovative, individual growth-oriented education system that emphasizes the responsibilities and obligations of citizens in the interplay of society and nature. The education system emphasizes creating an understanding of the importance of the ecological footprint, sustainability, and circular economic thinking and it emphasizes understanding the impact of consumerism on the earth's ecosystem and the importance of social innovation as a guiding light for greener societies.</p>
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Vision Statements 2050 from previous Innovation Workshop – KSA 2

 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>1. Most of waste recycling takes place in Iceland.</p> <p>Recycling companies process all the waste that is possible to recycle in Iceland. Almost all recycling happens in Iceland and only specific materials are sent abroad.</p>	 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>2. Companies in the city use recycled products in their production.</p> <p>Manufacturers use recycled materials and smart solutions as much as possible in their production and manufacturing processes. By this, Reykjavik conserves natural resources, reducing the need for international transport and increasing the diversity of jobs within the city. There is increased collaboration between those who create waste and those who use waste in production.</p>	 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>3. Reykjavik is sustainable in growing vegetables that everyone can access</p> <p>Excess heat is used to heat community greenhouses in each district where people can grow their own vegetables but also buy vegetables and fruits that the city grows. Reduced carbon emissions because of less international transport.</p>
 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>4. There are sharing centres in all districts in the city.</p> <p>The City of Reykjavik operates sharing service centres in each district, where people can bring used things that others can buy, rent or borrow.</p>	 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>5. Homes in Reykjavik produce energy and are sustainable.</p> <p>In addition to the environmentally friendly energy production that Reykjavik residents enjoy from the geothermal and hydropower plants, there is also decentralized energy production in households and companies in the city, used to equalize the load on the distribution system and production. Sustainability and energy security are also created for residents and companies.</p>	 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>6. There is a good supply of stores with environmentally friendly and unpackaged products.</p> <p>A wide-ranging transformation of behaviours and demands regarding an environmentally friendly lifestyle means that stores see business opportunities in offering unpackaged products or systems for returning and replacing packaging.</p>
 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>7. Recovery of all wetland is finished, with some of them located in close proximity to urban spaces.</p> <p>Recovery of wetlands has been completed as a climate action priority in order to reduce emission and mitigate impact on climate due to the destruction of natural habitats.</p>	 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>8. All resource streams are used to create value.</p> <p>All resource streams generated by the production of electricity and hot water are used to create value, (e.g., heat, carbon and silicon). Resource streams from industry and companies within the city are also used for value creation.</p>	 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>9. Reykjavik is a diverse and multicultural society</p> <p>Reykjavik is a diverse and multicultural society based on values of mutual respect and human rights, respect for ecosystems and a vision of sustainability and environmental awareness as a guiding principle in the interaction of population, built urban environment and nature.</p>
 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>10. Reykjavik is a socially equal society based on strong education and welfare and health system</p> <p>Social equality is based on the participation of all citizens in society and should include increasing their awareness of rights and obligations, including participation in socially important issues and not least environmental issues. It is emphasized that all citizens have equal access to education, welfare and health services, and that if these immediate challenges are met, citizens will be better equipped to face the challenges of the future.</p>	 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>11. Reykjavik is an age-friendly city that offers a variety of opportunities for work and recreation and that offers user-controlled personalized healthcare (UCPH)</p> <p>Social equality is based on the participation of all citizens in society and should include increasing their awareness of rights and obligations, including participation in socially important issues and not least environmental issues. It is emphasized that all citizens have equal access to education, welfare and health services, and that if these immediate challenges are met, citizens will be better equipped to face the challenges of the future.</p>	 <p>2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT</p> <p>12. All districts have botanic gardens in temperate houses.</p> <p>Residents have access to temperate buildings housing botanic gardens in all districts of the city for their enjoyment and cultivation.</p>



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 864242

Topic: LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities

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2050 REYKJAVÍK – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT

13. Reykjavík has implemented an innovation-guided public education system

The City of Reykjavík operates an innovative, individual growth-oriented education system that emphasizes the responsibilities and obligations of citizens in the interplay of society and nature. The education system emphasizes creating an understanding of the importance of the ecological footprint, sustainability, and circular economic thinking and it emphasises understanding the impact of consumerism on the earth's ecosystem and the importance of social innovation as a guiding light for greener societies.

Identified policies from 2020 – KSA1

<div style="background-color: #003366; color: white; padding: 5px;"> <p>LET'S RIDE BACK TO 2020</p> </div>	<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Strengthening of distribution network within the capital area</p> <p>The Icelandic EV market is the second fastest growing EV market in the world. The market is the result of a long approval process initiated in 2017. The progress and development of the market will be a key factor in the development of the building, energy and the development of the environment in Iceland.</p> <p>To support the uptake of EVs in Reykjavík and encourage the market, the city has implemented different strategies to use different demand response strategies for EVs are being researched in the Smart Charging pilot project. The main strategy is the introduction of a new type of charging point, meaning that the grid load from EV charging can be lowered. This increases the utilization factor of the distribution grid and reduces infrastructure investment cost. Different types of demand response strategies are being considered. Smart charging through the smart EV charger as well as direct control of charging patterns of customers.</p> <table border="1"> <tr><td>2025</td><td>The government is in the process of developing a roadmap for the energy transition to hydrogen in Iceland until the year 2050. The first document is currently under review by the public.</td></tr> <tr><td>2030</td><td>The technology of EVs is constant development and advances from several different players with some starting to reach 100% of total vehicle production in 2030. The main strategy is the introduction of a new type of charging point, meaning that the grid load from EV charging can be lowered. This increases the utilization factor of the distribution grid and reduces infrastructure investment cost. Different types of demand response strategies are being considered. Smart charging through the smart EV charger as well as direct control of charging patterns of customers.</td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td>Even if demand response leads to higher utilization of the distribution network, and other demand and response strategies, it will not be enough to meet the demand of the transport sector, but it will still be a key element of the transport sector. A roadmap for the energy transition to hydrogen in Iceland until the year 2050.</td></tr> </table> </div>	2025	The government is in the process of developing a roadmap for the energy transition to hydrogen in Iceland until the year 2050. The first document is currently under review by the public.	2030	The technology of EVs is constant development and advances from several different players with some starting to reach 100% of total vehicle production in 2030. The main strategy is the introduction of a new type of charging point, meaning that the grid load from EV charging can be lowered. This increases the utilization factor of the distribution grid and reduces infrastructure investment cost. Different types of demand response strategies are being considered. Smart charging through the smart EV charger as well as direct control of charging patterns of customers.	2040		2050	Even if demand response leads to higher utilization of the distribution network, and other demand and response strategies, it will not be enough to meet the demand of the transport sector, but it will still be a key element of the transport sector. A roadmap for the energy transition to hydrogen in Iceland until the year 2050.	<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Network of charging stations</p> <p>ON envisions an increase in charging stations where there is demand and for users that cannot charge in their homes such as overnight charging for tourists. The network of fast-charging chargers will be strengthened with larger hubs with more connectors.</p> <p>Within the charging service market there are many different players, and the environment is developing fast. It can be forecasted that the transition to EVs will continue and answer to market demand. It is yet likely that there will be a consolidation within the service provider group and services better targeted to the EV user group.</p> <table border="1"> <tr><td>2025</td><td></td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025		2030		2040		2050									
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<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Development of EV services</p> <p>With the changing subscription model of ON power, the possibility of large-scale direct load control of charging stations is possible. This is a new type of demand response and has been researched within the Charging Better project (2018-2021).</p> <p>The biggest obstacle with this kind of demand response are the various types of charging stations on the market with different types of connectivity and support for control mechanisms. With a subscription model, the charging load of customers can be seen as controllable and therefore can be reduced if there are no customers' demand exceeds supply or infrastructure capabilities. The flexibility of the load is valuable to both DSOs and retail electricity providers.</p> <table border="1"> <tr><td>2025</td><td></td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025		2030		2040		2050		<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Renewable synthetic fuels</p> <p>Renewable synthetic fuels will play an important role in the energy transition for aviation and maritime transport sectors. ON operates a hydrogen station, VON, that has proven the possibility to produce hydrogen in Iceland. There are presently no plans to enlarge the station however the market is being closely monitored.</p> <table border="1"> <tr><td>2025</td><td></td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025		2030		2040		2050		<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Re-routing of existing bus routes</p> <p>Strato is working on adapting their routes in coordination with Borgarlínan. The new route network, which is currently under construction, is designed in such a way that both city line buses and other buses can drive out of the special space and travel part of the route in mixed traffic. This means greater flexibility and shorter journey times for passengers.</p> <table border="1"> <tr><td>2025</td><td></td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025		2030		2040		2050	
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<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Ticketing and MaaS app KLAPP</p> <p>Strato developed their new ticketing app, Klapp, and continue to implement new features to it, with the objective to become a multi-modal mobility platform (MaaS). Klapp is an account based ticketing system that gives access to Strato buses in the capital area. With the Klapp app, you can use your smartphone to buy single tickets or period cards for Strato in the capital area.</p> <table border="1"> <tr><td>2025</td><td></td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025		2030		2040		2050		<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Hlemmur area development</p> <p>Hlemmur and the surrounding streets will be improved and elevated in the coming years as private cars will be prohibited. The aim is to make the new square favourable for cycling and pedestrians.</p> <table border="1"> <tr><td>2025</td><td>In early 2025, construction on Hlemmur, which is the first phase of the new Hlemmur and its surroundings, for long-term change for the square for development.</td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025	In early 2025, construction on Hlemmur, which is the first phase of the new Hlemmur and its surroundings, for long-term change for the square for development.	2030		2040		2050		<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>A world-class cycling city</p> <p>The revised cycling plan aims to make Reykjavík a world-class cycling city. The objective is to boost the use of cycling in the journeys made within the city. Population in the capital area has increased rapidly. The number of trips in the city has also increased, with each resident making an average of four trips per day. Cycling is an economical, healthy and fun way to travel. A better cycling city increases the quality of life for all residents and visitors. Air quality will be better, residents will be healthier and car traffic delays will be reduced. Cycling is the happiest mode of travel.</p> <table border="1"> <tr><td>2025</td><td>In 2025, following the newly approved cycling plan, construction begins with the bicycle paths and safe parking spaces for bicycles and e-bikes are established at several strategic points.</td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025	In 2025, following the newly approved cycling plan, construction begins with the bicycle paths and safe parking spaces for bicycles and e-bikes are established at several strategic points.	2030		2040		2050	
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<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>EU-funded research project: AMIGOS for Hlemmur</p> <p>The City of Reykjavík and its partners recently received a four-year grant through the European Union's Horizon Europe Research program. The project is called AMIGOS and looks at improving the city's environment through different road cases around research hubs, transformation of Hlemmur and the surrounding area in the coming years will be the main objective of Reykjavík's contribution to the main objectives and implementation of AMIGOS will support the area objectives of the Smart City carbon neutrality, green transport, 15-minute neighbourhoods and focus on public health, inclusive society, democratic participation, digital level and smart services. It will also support the city's welfare and economic growth by making the area accessible, safer and more livable and enabling the accessibility issues, safety and health affairs, and will be financially based on the efforts of business partners in co-creation workshops.</p> <table border="1"> <tr><td>2025</td><td>In 2025, following the newly approved cycling plan, construction begins with the bicycle paths and safe parking spaces for bicycles and e-bikes are established at several strategic points.</td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025	In 2025, following the newly approved cycling plan, construction begins with the bicycle paths and safe parking spaces for bicycles and e-bikes are established at several strategic points.	2030		2040		2050		<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Micro-mobility</p> <p>Micro-mobility is the most popular mode of mobility in Reykjavík. The leading service providers, HOPP and 2020, are improving and expanding their services, including increase coverage areas in the capital region, expanding services to car rental, sharing, collaboration with private developers, etc.</p> <table border="1"> <tr><td>2025</td><td></td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025		2030		2040		2050		<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Borgarlínan City Line and Betri Samgöngur</p> <p>The city line is a high-quality public transport system for the entire capital area, together with Strato. It will provide good connections with the neighbouring municipalities. It will mostly run along in dedicated road with priority at intersections, which increases both reliability and efficiency.</p> <table border="1"> <tr><td>2025</td><td>In 2025, transportation planning was carried around the area along the Borgarlínan city line, as well as regional planning for regional municipalities.</td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025	In 2025, transportation planning was carried around the area along the Borgarlínan city line, as well as regional planning for regional municipalities.	2030		2040		2050	
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<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Public health assessment for the first round of Borgarlínan development</p> <p>Evaluation of the first round of the Borgarlínan City Line project within Reykjavík has been conducted. The project is carried out in collaboration with Betri Transport (Betri Samgöngur) with the objective to evaluate the impact of public health factors.</p> <table border="1"> <tr><td>2025</td><td>Workshops have been conducted. Final report is completed with the objective to assess the impact of public health factors.</td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025	Workshops have been conducted. Final report is completed with the objective to assess the impact of public health factors.	2030		2040		2050		<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Energy transition in mobility - Icelandic state</p> <p>A roadmap for energy transition in mobility in 6 categories is under development.</p> <table border="1"> <tr><td>2025</td><td></td></tr> <tr><td>2030</td><td></td></tr> <tr><td>2040</td><td></td></tr> <tr><td>2050</td><td></td></tr> </table> </div>	2025		2030		2040		2050		<div style="background-color: #ffff00; padding: 5px;"> <p>2020 - MOBILITY</p> <p>Transport for the Capital Area</p> </div>								
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Identified policies from 2020 – KSA1 and KSA2

2020 – MOBILITY + SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT		2020 – MOBILITY + SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT		2020 – MOBILITY + SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT	
Planning competition for the development and mobility hub at Vatnsmyri	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>	Climate issues and environment education are offered to students	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>	Reducing carbon footprint - Implementation of green screens in primary schools (grænskjáir)	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>
My Neighbourhood (Hverfið mitt)	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>	Climate Agreement - European Union Mission: The 100 Climate-Neutral and Smart Cities by 2030	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>		
2020 – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT		2020 – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT		2020 – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT	
Eco-friendly build development guideline	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>	Walkable city - 15-minute neighbourhood	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>	Green urban development	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>
Investment plan – Green Bond (Græn skuldabréf)	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>	Housing plan – sustainability goals	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>	Green housing for the future (grænt húsnæði)	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>
Affordable housing and first-time buyer – Sustainability goals	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>	Reinventing Cities (C40)	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>	Housing for disabled residents – sustainability goals	<p>2025</p> <p>2030</p> <p>2040</p> <p>2050</p>



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2020 – SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT

Recycling and GAJA

2025
2030
2040
2050

Identified policies from 2020 – do not fall into KSA1 and KSA2 but still brings huge impact to the ultimate goal of carbon neutrality 2050

2020 – ENERGY/UNCATEGORIZED

Geothermal energy production

2025
2030
2040
2050

2020 – ENERGY/UNCATEGORIZED

Other renewable energy sources

2025
2030
2040
2050

2020 – ENERGY/UNCATEGORIZED

Safeguarding renewable heat supply

2025
2030
2040
2050

2020 – ENERGY/UNCATEGORIZED

Continue carbon sequestration

2025
2030
2040
2050

Attendees fill in other relevant projects

Attendees fill in Wildcard, Challenge or Opportunity

2020

MOBILITY / SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT

(policy/project)

2025
2030
2040
2050

2050

MOBILITY / SUSTAINABLE ECOSYSTEM OF BUILD ENVIRONMENT

(wildcard/challenge/opportunity)

Estimated milestone: Short term / Medium term / Long term

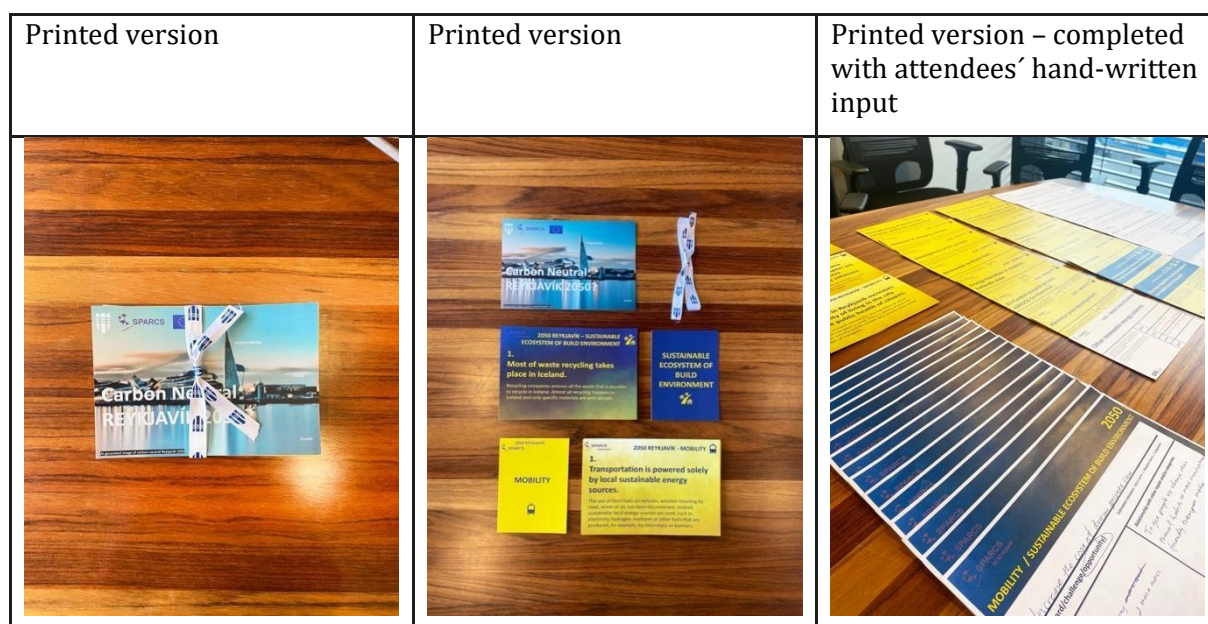
Description: _____

Relationship with other inputs and/or categories: _____



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Topic: LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities



J. The SPARCS Task Force

City: **City of Reykjavík**

Responsible person/Head of Task Force: **Sylva Lam**

Future of Mobility and Transport

First name	Surname	Organization	Field of expertise	Role/Task
Harpa	Þorsteinsdóttir	Office of the Mayor and CEO	Project Manager of Public Health	Public health assessment for Borgarlínan and other public projects
Hugrún	Snorradóttir	Public Health Department, Directorate of Health	Project Manager of Public Health	Public health assessment for Borgarlínan
Edda	Ívarsdóttir	Division of Environment and Planning	Urban Designer	Managed urban design projects
Rebekka	Guðmundsdóttir	Division of Environment and Planning	Urban Designer	Manages urban design projects
Atli Björn E	Levy	Division of Environment and Planning	Project Manager, Borgarlínan City Line Team	Manages Borgarlínan
Eva	Kristinsdóttir	Division of Environment and Planning	Manages planning coordination for Borgarlínan	Manages Borgarlínan



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First name	Surname	Organization	Field of expertise	Role/Task
Bjarni	Ingvarsson	Office of Transport and Urban Design, Division of Environment and Planning	Interim Head of the Office of Transport	Oversees transportation development projects
Þorsteinn	Hermannsson	Better Transportation (Betri Samgöngur)	Director of Development	Oversees Borgarlínan developments

Sustainable Ecosystem for the Built Development

First name	Surname	Organization	Field of expertise	Role/Task
Hulda	Hallgrímsdóttir	Office of the Mayor and CEO	Project Manager in Economic and Urban Development	Manages green housing project
Hilmar	Magnússon	Office of the Mayor and CEO	Project Manager in Economic and Urban Development	Manages international and housing affairs
Olí Örn	Eiríksson	Office of the Mayor and CEO	Head of Economic and Urban Development	Oversees Economic and Urban Development
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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 864242

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