SMART URBAN SPACES
GENERAL ROADMAP

D5.2 Report — Timelines for the topics in Smart Urban Spaces

28 August 2017
Torsten MASSECK, UPC
Elke DEN OUDEN & Rianne VALKENBURG, TU/e LightHouse
SMART URBAN SPACES GENERAL ROADMAP

D5.2 Report — Timelines for the topics in Smart Urban Spaces

Work Package title: WP5, Roadmap Smart Urban Spaces
Task: 5.3, Roadmap interviews, and 5.4, Creating timelines per topic
WP coordinator: UPC
Submission due date: August 2017
Actual submission date: 28 August 2017

Abstract
This report (D5.2) contains the results of the roadmap interviews held with more than 20 European experts (representing industry, knowledge institutes and governmental organisations) in the field of sustainable energy for urban spaces. The aspects covered are technology, behaviour and organisation. The information collected from the desk study (D5.1) and the roadmap interviews was used in an expert meeting to identify the most relevant topics and to create a timeline for each topic, showing when relevant options become available on the path to meet the needs of the cities (as described in report D2.2). The timelines of Smart Buildings (D3.2), Smart Mobility (D4.2) and Smart Urban Spaces (D5.2) were then aligned in a cross-theme expert meeting to gain understanding of the interlinking areas and potential options across several focus areas. This report presents the resulting General Roadmap Smart Urban Spaces, together with accompanying information from the desk study and the interviews. The creation of the general roadmap is part of the WP5 Roadmap Smart Urban Spaces for the R4E project.

The R4E project received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 649397.

Disclaimer: This report presents the views of the authors, and do not necessarily reflect the official European Commission’s view on the subject.

Versions of this report:
15 November 2016 Concept for roadmap workshops in partner cities (limited distribution)
1 May 2017 Concept for internal use by R4E partners (limited distribution)
28 August 2017 Final version for public distribution
Contents

R4E - ROADMAPS FOR ENERGY..............................................................................................................................................................................................5
Roadmapping ...........................................................................................................................................................................................................7
The experts .............................................................................................................................................................................................................8
COMMON NEEDS IN THE DESIRED FUTURE SCENARIOS .................................................................................................................................................10
SMART URBAN SPACES GENERAL ROADMAP ..........................................................................................................................................................12
Roadmap topics Smart Urban Spaces......................................................................................................................................................................................13
Smart Urban Spaces general roadmap ...........................................................................................................................................................................14
Urban planning strategies ........................................................................................................................................................................................................16
Sustainable energy transition ....................................................................................................................................................................................................17
Climate resilience & biodiversity ..................................................................................................................................................................................................18
Circular systems ........................................................................................................................................................................................................19
Data, connectivity & management systems ........................................................................................................................................................................20
Values, motives & behavioural change ..............................................................................................................................................................................22
Participation & communities .........................................................................................................................................................................................23
Innovative business models ................................................................................................................................................................................................24
Policies & legislation ......................................................................................................................................................................................................25
WP7. Project management

WP8. Communication & dissemination

WP1. Ambition setting

3-day workshops in each city to define specific ambitions per focus area

WP2. Vision development

3-day workshops in each city to develop specific desired future scenarios per focus area

WP3, 4 & 5. Roadmapping

2-day training sessions for expert partners on methodology and way of working

WP6. Project portfolio

Current projects

Each city identifies projects that will contribute to the realization of the roadmap, as well as the topics for cross-city learning.

New projects

New projects to ensure timely realization of the roadmap ambitions.

Financing opportunities

Identifying different opportunities for financing of the city specific and joint projects.

Organising for learning

Organizing for continued cross-city learning.

Joint portfolio meeting

3-day joint meeting on projects and their supporting developments of common ambitions.

Joint project kick-off & SC

2-day workshop in Eindhoven with all partners to start project (WP7) and prepare for ambition workshops and future telling interviews (WP1).
R4E - ROADMAPS FOR ENERGY

Introduction

In the Roadmaps for Energy (R4E) project, the partners will work together to develop a new energy strategy, their Energy Roadmap. The difference between the regular energy strategies and action plans and these new Energy Roadmaps is the much earlier and more developed involvement of local stakeholders. These include not only those who will benefit from the new strategy, such as the citizens, but also relevant research and industry partners. They offer a much clearer view of the future potential of the city in terms of measures and technologies, as well as of the challenges presented by today’s situations in the cities. The aim is to create a shared vision, containing the desired, city-specific scenarios and the dedicated roadmaps to be embedded in each city’s specific context. These will take into account the diversity in the geography, ecology, climate, society and culture of the eight partner cities in the project: Eindhoven, Forlì, Istanbul, Newcastle, Murcia, Palermo, Sant Cugat and Tallinn.

The R4E project focuses on the vision creation and roadmapping capacities of the municipalities. This includes initiating joint activities to drive the development and implementation of innovative energy solutions in cities. In this way the partners in R4E will learn the process and the roadmap structure. And they will gain the skills they need to work independently on their future roadmaps.

The ultimate aim is to create a process that will allow the partners to work together in developing the Energy Roadmap to achieve their ‘Smart Cities’ ambition. But energy and Smart Cities are too broad to cover in one project, so R4E focuses on three key areas of sustainable energy. These are closely linked to the main responsibilities of the municipalities:

- **SMART URBAN SPACES**
- **SMART BUILDINGS**
- **SMART MOBILITY**

In The R4E project follows a 4-step approach:

1. Set the ambitions of the participating cities on sustainable energy and Smart Cities, as well as their choice of three Smart Energy Saving focus areas: 1. Smart Buildings; 2. Smart Mobility; and 3. Smart Urban Spaces.
2. Develop scenarios for the selected focus areas.
3. Create the roadmap. Identify existing and future technologies and other developments – these will enable the desired future scenarios. Plot the opportunities and developments on a time-line to show the route and milestones towards the desired scenarios. The roadmaps contain common parts for all the partner cities, as well as specific parts for the individual cities.
4. Create a portfolio of new projects and initiatives to achieve the ambitions, visions and roadmaps of the cities. This portfolio shows the shared and individual projects, and includes a cross-city learning plan and a financial plan.

This report describes the Smart Urban Spaces General Roadmap, and contains all the relevant information from the Roadmapping research. It starts with an introduction to the Roadmapping research, and the approach to create the general roadmap. Then the experts are introduced, with short descriptions of their contexts, backgrounds and relevant expertise areas for the research. The main part of this report starts with the Smart Urban Spaces joint ambitions of the cities and their shared Smart Urban Spaces needs. The general roadmap is then presented, followed by a more detailed description of the nine topics and their timelines.

**Approach**

**Step Three: Roadmapping**

This report is part of Step 3 of the R4E approach, and describes the second part of Work Package 5 (WP5). The aim of WP5 is to develop the General Roadmap for Smart Urban Spaces. The roadmaps explore the options to achieve the cities’ desired future scenarios. To do this, the first step was a desk study to collect the available information on the technology options (see D5.1 - Report Future Options). The desk study was also used to identify all the relevant topics and the most important experts on Smart Urban Spaces.

**Roadmapping**

The results of the desk study and the extensive networks of the R4E partners are used to select international experts and companies from different parts of Europe to collect all the required information. More than 20 experts from industry, knowledge institutes and government were invited to interviews and workshops to share their views on future opportunities. The interviews covered the roles of sustainable technologies, sustainable behaviour and sustainable organisation in achieving the ambitions of the cities as they make the transition to sustainable energy for urban spaces. The results of the interviews were used to create a draft roadmap for Smart Urban Spaces. This draft roadmap was aligned with those for Smart Buildings and Smart Mobility to ensure that related topics are well addressed. The resulting Smart Urban Spaces General Roadmap is presented in this report.

The general roadmaps will be used in the next step: co-creating city-specific roadmaps in workshops in the R4E partner cities together with local stakeholders.

**How to read this report**

This report describes the Smart Urban Spaces General Roadmap, and contains all the relevant information from the Roadmapping research. It starts with an introduction to the Roadmapping research, and the approach to create the general roadmap. Then the experts are introduced, with short descriptions of their contexts, backgrounds and relevant expertise areas for the research. The main part of this report starts with the Smart Urban Spaces joint ambitions of the cities and their shared Smart Urban Spaces needs. The general roadmap is then presented, followed by a more detailed description of the nine topics and their timelines.
Clustering all interview results to create the concept general roadmap

Interlinking and aligning the concept general roadmaps for Smart Buildings, Smart Mobility, and Smart Urban Spaces
**Roadmap research**

A (technology) roadmap is a plan that matches the short-term and long-term goals with specific technology solutions to help meet those goals. Developing a roadmap has three major uses:

- It helps to reach a consensus on a set of needs and the technologies required to meet them;
- It provides a mechanism to help predict technology developments;
- It provides a framework to help plan and coordinate innovation and the implementation of innovative solutions.

Roadmapping represents a powerful technique to manage and plan supporting technology, especially to explore and communicate the dynamic links between technological resources, organisational goals and the changing environment.

The most common format for a roadmap is a time-based chart, with a number of layers that typically include both the business and technological perspectives. The roadmap facilitates and supports the evolution of the markets, products and technologies to be explored, together with the links and gaps between the various perspectives. The Roadmapping technique also draws together the key themes from the technology strategy and transitions literature, by the use of its layered structure together with the time dimension.

In the R4E project, the Roadmapping research method is used to develop timelines for relevant topics in sustainable solutions for Smart Buildings, Smart Mobility and Smart Urban Spaces.

**Roadmapping template**

The Roadmapping method uses a format with multiple layers covering different aspects, such as technologies, products and markets. The roadmap allows the evolution within each layer to be explored, together with the interlayer dependencies, facilitating the integration of technologies into products, services and systems.

The roadmaps cover different elements of sustainability that need to go hand-in-hand to achieve the desired future scenarios:

- **I. Sustainable technologies**
- **II. Sustainable behaviour**
- **III. Sustainable organisation**

The roadmaps plot a timeline showing the different steps that are needed and possible to achieve the desired scenarios in 2050.

**The approach**

This research involved 25 interviews with experts holding different views on smart and sustainable energy in cities, covering technological, behavioural and organisational aspects.

**Experts**

The results of the desk study and the extensive networks of the R4E partners are used to select international experts and companies from different parts of Europe to cover a broad range of perspectives. More than 20 experts from industry, knowledge institutes, consultancies and government were invited to interviews and workshops to share their views on future opportunities. These experts are introduced on the following pages.

**Structured interviews**

The Roadmap interviews were held with a poster showing a timeline starting in 2016 and running until 2050. The common needs of the R4E partner cities were shown at the end of the timeline. The interviewees were asked to identify relevant future options, and to indicate on the timeline when they thought these options would regularly be available. They were also invited to create a storyline showing the expected developments over time, to gain understanding of the prerequisites for specific developments to take place.

For these interviews, the requested expertise areas of the experts were not specifically their own innovation strategies, but rather their knowledge of important developments in their own fields. The Roadmapping method inspired the experts to use their knowledge to indicate the available options in the shorter and longer term, and to describe the potential developments over time.

**Creating the general roadmap**

The collected information from the desk study (DS1) and the roadmap interviews was used in an expert meeting to identify the most relevant topics and to create a timeline for each of them showing when relevant options would become available on the path to meet the cities’ needs. All the results of the interviews were used to make a rich summary of the steps on the timeline. A maximum of 15 relevant future options was described for each topic, together with a short title and explanation and where possible including an example.

**Aligning the general roadmaps of the three focus areas**

In a cross-theme expert meeting the timelines for Smart Buildings, Smart Mobility and Smart Urban Spaces were aligned to gain understanding of the interlinking areas and potential options across several focus areas.

**How to read the general roadmap**

The resulting Smart Urban Spaces General Roadmap is presented in this report, together with accompanying information of the desk study and interviews. The roadmap contains four important elements:

- The time axis from now (2016) to the visions for 2050 as described in the desired future scenarios of the cities (see D2.2 — Report Vision Development for the full set of desired future scenarios).
- The eight common needs in the desired future scenarios as described by the cities in the Joint Vision Workshop (see also D2.2) are indicated at the end of the timeline in 2050 as the goal of the roadmap.
- The relevant topics for Smart Urban Spaces on which developments are required to achieve the desired future scenarios. These topics cover sustainable technologies, sustainable behaviour and sustainable organisation.
- The options that will become available in the shorter or longer term for each of the topics. Each topic has a timeline showing the developments that are relevant to that topic.

The image below shows the elements of the general roadmap for Smart Urban Spaces.

---

**Note:** the general roadmap contains the options that were identified in the desk study and the roadmap interviews. However, there will also be future developments; these are not included in the roadmap. The roadmap is not a ‘blueprint’ towards the desired future scenario – its purpose is to indicate relevant possible future developments that should be taken into account in the development of projects to ensure sufficient flexibility for future-proof cities.

The general roadmaps will be used in the R4E partner cities to co-create city-specific roadmaps together with local stakeholders.
The experts were selected for their expertise and knowledge on future options. The interviewees work across Europe as members of knowledge institutes, companies, consultancies and profit or non-profit organisations. Their expertise varies from technology oriented to human or social oriented. They are introduced through their expertise and the main criteria for selecting them for the R4E Roadmapping research.

Daniel Colatayou is an architect and urban planner and professor and researcher at BarcelonaTech (UPC). He is a recognised expert in holistic understanding of sustainability in architecture and urban planning with more than 20 years experience in the field. We invited him especially for his experience in energetic refurbishment projects within European research programmes, as well as his outstanding knowledge of the relationships between social, economic and environmental aspects of sustainability, for example in the field of fuel poverty.

Ursula Eicker is full professor at Stuttgart Technology University of Applied Sciences (HFT). As Research Director of the Zafh.net (Centre for Sustainable Energy Technology), the Netherlands, and currently chair of the Information Systems group in the Department of the Built Environment. We invited him especially for his broad experience in nature based transformations of urban environments into green urban landscapes, with circular on-site water management, improved human health and reduced carbon- and water footprint of the city, for example through the project of OliSquare Roof-Park at Sloterdijk Train Station in Amsterdam.

Bill Dunster is a widely recognised ecological architect based in London. As an expert in Sustainable Architecture he founded the architecture practice Zedfactory in 1999, specialising in the field of zero-carbon design and development. Zedfactory’s most notable project is bedZED, winner of the 2003 Royal Institute of British Architects (RIBA) Sustainability Award. We invited Mr. Dunster especially for his visionary contributions in the field of sustainable, low-carbon architecture.

Flavio Tejada is Associate Director at Arup, responsible for master planning & urban practice in Europe. His work focuses on the design of strategic urban projects that allow cities to face 21st century socio-economic and environmental challenges. He has led some strategic urban interventions such as Santander Waterfront and the Castellana Norte Masterplan in Madrid. We invited him especially for his experience in the fields of urban regeneration and retrofit development.

The experts

Daniel Colatayou

Ursula Eicker

Bill Dunster

Lucienne Krosse is Innovation Officer at KIC InnoEnergy in Eindhoven. With a background in chemical engineering, she gained her Master’s degree at the University of Twente in the Netherlands. She worked on her PhD entitled ‘Compact thermochemical storage’ at Delft University of Technology. We invited her especially for her current position as thematic leader on ‘Intelligent Energy Efficient Buildings and Cities’ at KIC InnoEnergy. This gives her a holistic, research-based focus as well as a company- and market-based vision on energy efficiency at both building and city levels.

Albert Cuch is an architect and professor in the Department of Architectural Technology at BarcelonaTech (UPC). He is a founding member of the Architecture and Sustainability group of the Association of Architects of Catalonia and the Sustainable Building Association GBCe – Green Building Council Spain. We invited prof. Cuch especially for his experience as an advisor for sustainability issues in the building sector for various institutes, including the Government of Catalonia, the Spanish Government Ministries, the Urban Ecology Agency of Barcelona and the Consortium of the City of Santiago de Compostela.

Salvador Rueda is founder and director of the Urban Ecology Agency of Barcelona. He has an academic background in biology, psychology and environmental sciences, and formerly held managerial positions in the Planning Department of the Government of Catalonia. We invited him especially for his clear experience in sustainable urban transformation strategies, for example the superblock concept and the sustainable urban mobility plan for Barcelona.

Karsten Voss is full professor of Building Physics at the University of Wuppertal and is a renowned expert on Energy Efficiency in Buildings and Cities. Before that he was responsible for German national research programmes such as ENOB (Energy Optimised Buildings), and has special knowledge in the field of Nearly Zero-Energy Buildings, Energetic Refreshment and Energy Efficiency strategies for buildings and cities. We invited him for his wide experience in these fields, forming part of the Solar Decathlon Community and European Energy Endeavour Secretariat.

Michael Kundt is Executive Director of the Collaborating Centre on Sustainable Consumption and Production (CSCP) in Wuppertal, Germany. We invited him especially for the centre’s contributions in the fields of Sustainable Consumption and Production (SCP) and climate change, policy assessment, sustainable business models, SCP indicators, technology assessment, triple bottom line innovation management, sustainable and strategic consumption and lifestyle patterns, as well as scenario building for sustainable living in the future.

Karsten Voss

Michael Kundt

Carlos Verdaguer is architect and urban planner and senior partner in the environmental consultant agency Geo21, Madrid. He is associate professor of Urban Planning in the Department of Urban and Territorial Planning at ETSAV (UPM) and lecturer in several postgraduate and Master’s courses. We invited him for his expertise in the design, implementation and evaluation of Integrated Urban Sustainability Projects, Governance and Citizen Participation and the implementation and development of Community Planning Methodologies.

Joris Voeten is Senior Engineer for Urban Green Spaces at Urban Roofscapes, Amsterdam. He is an expert on blue-green roofs, urban greening and related technological solutions. Before that he was Concept Manager and Urban Green Space Engineer at SHFT. We invited him especially for his rich experience in nature based transformations of urban environments into green urban landscapes, with circular on-site water management, improved human health and reduced carbon- and water footprint of the city, for example through the project of OliSquare Roof-Park at Sloterdijk Train Station in Amsterdam.

Joris Voeten

Joris Voeten

Joris Voeten

Lucienne Krosse

Christa Liedtke is Director of the ‘Sustainable Production and Consumption’ Research Group at the Wuppertal Institute and professor of Sustainability Research in Design/Industrial Design at the Folkwang University of the Arts, Essen, where she leads national and international research projects. We invited her especially for her expertise in the fields of resource efficiency, value chains, behavioural and systemic patterns of production and consumption, as well as user-integrated product-service development.

Ursula Eicker

Michael Kundt

Carlos Verdaguer

Christa Liedtke

Carlos Verdaguer

Carlos Verdaguer

Michael Kundt

Christa Liedtke

Bill Dunster

Bill Dunster

Bill Dunster

Bill Dunster
Roadmapping

Peter Loeffler is Head of Innovation and Industry Affairs at Siemens Building Technologies in Zug, Switzerland. The company is involved in many front-runner smart buildings and smart city projects such as the Crystal in London. We especially invited him because of his view on the possibilities that future information technologies will provide to buildings and cities.

Josep Puig is Vice president and Head of the Spanish section of EUROSOLAR – European Association for Renewable Energies. He is consultant for energy and environment at Ecoserveis and professor for Energy at Autonomous University of Barcelona. We invited him especially for his wide experience in the field of renewable energy implementation, among others as the driving political force in the implementation of the Solar thermal energy law for buildings in Barcelona (Ordenanza Solar, 2001).

Christopher Trott is an Environmental Engineer who joined Foster + Partners in 2011 as part of the Creative Engineering team. He has 30 years’ experience in master planning, existing and new sustainable building design, low- and zero-carbon site-wide infrastructure design and sustainable building and policy consultancy. Before that he was director of Arup’s Sustainable Buildings Team, and has worked on numerous projects including the renewable energy studies and roof building physics at Beijing International Airport. We invited him for his broad experience as the Head of Sustainability at Foster + Partners in London.

Gallus Cardonau is Director of the Swiss Solar Energy Agency in Zurich. Since more than 25 years he has been an activist for the promotion and implementation of Solar Energy in Switzerland and beyond. He regularly organises corresponding national and European Solar prizes, for example the Norman Foster Plus Energy Buildings Award, and is active as consultant to policy-makers. We invited him especially for his experience of the political, legal and social transformation processes in relation to the renewable energy transition.

Jordi Segalàs is an associate professor at BarcelonaTech (UPC) and Director of the Research Institute of Sustainability Science and Technology, where he coordinates the Research Group on Sustainability Education and Technology. He gained his PhD in Sustainability Education in Engineering. We invited him especially for his expertise in curriculum greening policies, cross-disciplinary learning and social innovations for sustainability.

Werner Lang is Full Professor of Energy Efficient and Sustainable Planning and Design at the Technical University of Munich and has been Director of the Oskar von Miller Forum, Munich, since 2010. We invited him especially for his expertise in energy efficient and sustainable design and the use of renewable energy in buildings, as well as his experience in the development of building components and systems.

Nuria Pedrals is an Architect and President of AUS – Association Architects and Sustainability at the Architects’ Association of Catalonia (COAC), Barcelona. Before that she was General Director of Quality of Buildings and Refurbishment of Housing in the Department of Environment and Housing of the Catalan Government. We invited her especially for her rich experience in the field of legislation on energy efficiency and sustainability in housing.

A series of roadmap interviews and workshops was held in the city of Eindhoven (lead partner of the R4E project) as a pilot for the roadmapping sessions in R4E. The results were also incorporated in the Roadmap Smart Mobility. The sessions involved a number of experts from the municipality and from companies and knowledge institutes:

- John Dagevos, Telos, the Brabant Centre for Sustainable Development Tilburg University
- Robert Snep, Wageningen University, Environmental Research and Alterra
- Pieter van Wesemael, Eindhoven University of Technology
- Peter Glas, The Dutch Water Authorities
- Leendert van Bree, PBL Netherlands Environmental Assessment Agency
- Kees van Leeuwen, Watercycle Research Institute of Utrecht University
- Jeroen Langeveld, Research program Urban Drainage of Delft University of Technology

We would like to thank all participants for their contribution to the roadmap research.
At the Joint Vision Workshop on 24 and 25 May 2016 in Istanbul, the cities presented their desired future scenarios for Smart Urban Spaces to each other and held in-depth discussions to understand each other’s needs and contexts (WP2). Seven common needs were identified, as shown on the following page.

**COMMON NEEDS IN THE DESIRED FUTURE SCENARIOS**

At the Joint Ambition Workshop on 19 October in Palermo, the cities shared and discussed their ambitions for Smart Urban Spaces and identified the common aspects. The result was used for a description of the Smart Urban Spaces focus area.

The Smart Urban Spaces theme focuses on sustainable energy solutions for public spaces, where multiple functions and activities physically come together. The ambition of the cities is to create liveable urban spaces by engaged citizens and involvement of all stakeholders. Circular systems contribute to smart use of resources. Sustainable transportation solutions enable the achievement of a healthy living environment.
Flexible and attractive living environment

- Pleasant living environment for everyone
- Changing and updating, while preserving the identity of the city (history, culture)
- Ecological system connecting the ‘green’ and ‘blue’ areas
- Urban space is for people, not for private use (like parking cars)

Social interaction and healthy behaviour

- Active use of public spaces for sustainable lifestyles
- Well-connected and equipped green spaces enhance social life
- Healthy living environment with extensive ‘green’ and ‘blue’ areas to support social activities
- Open platforms to encourage citizens to initiate and participate in social events

Climate resilience

- Integrated physical planning to strengthen interdependencies between water, flora, pavement and buildings
- Green areas to help produce and store (renewable) energy, reduce heat stress and recover rainwater
- Private property should be climate resilient as well

Synergy between urban and rural areas

- Open territorial cooperation that encourages innovation and contributes to local economic development
- Reducing footprint by using circular systems
- Well-designed route network connecting urban and rural areas, responding to quality lifestyles and supported by smart technologies

Smart systems

- Real-time information to engage people in social activities
- Smart grid to connect public spaces and services
- Centralised ‘brain’ to enable information-sharing
- Secure system ensures privacy by understanding the boundary between public and private information
- Resilient system (optimising resources in line with conditions)

New business and financing models

- Providing an ideal environment for (local) entrepreneurs with sustainable and healthy services
- Accessible data to develop new apps and services
- Citizens and administration jointly invest in the living environment
- Public spaces are always freely accessible, but charges may be made for added-value services

Citizen taking the lead in co-creation

- People feel responsible for sustainability and are engaged in urban planning use and maintenance
- People create and take initiatives, supported by the administration
- Citizens use smart systems to monitor the quality of the environment and contribute to its improvement
- Citizens actively take part in decision-making to influence their living environment
SMART URBAN SPACES GENERAL ROADMAP
Roadmap topics Smart Urban Spaces

In the generic roadmap timelines are created for the topics that require developments to achieve the desired future scenario in 2050. The topics selected for the Roadmap Smart Urban Spaces are described briefly.

**Sustainable technologies**

The first element to achieve the sustainable energy ambitions is the availability of sustainable technologies. There is already a vast amount of sustainable technologies available, and in the meantime new technologies are being developed rapidly. Unfortunately there is not always a consensus on what is the best option for the future. The technology developments included in the Roadmap Smart Urban Spaces are:

**URBAN PLANNING STRATEGIES**

The Urban Planning Strategies topic refers to how urban space will be mapped, planned and programmed to allow urban transition. It includes aspects like resilience planning and a redefinition of the relationship with the territory as well as a reinforced human-centric approach through participatory mechanisms and new indicators.

**SUSTAINABLE ENERGY TRANSITION**

Sustainable Energy Transition refers to the transition towards a decentralised renewable energy system resulting ultimately in proactive energy grids. The topic includes solutions at district and city levels through smart grids and developments towards integrated local energy systems at different scales.

**CLIMATE RESILIENCE & BIODIVERSITY**

Climate Resilience & Biodiversity is about how a holistic ecological regeneration of cities regarding green, water and microclimate, and ultimately healthier urban living, can be achieved. The topic refers to the necessary reconnection between people and nature, and how to reach healthier living environments. This will be reached through an integrated approach to urban ecosystem services, and by reconnecting urban and rural areas.

**CIRCULAR SYSTEMS**

Circular Systems refers to the need for increasingly closed resource cycles in cities. This topic is about optimised, nature-based solutions for water treatment, with a zero waste approach to generate integrated closed resource cycles for food, energy, materials and water in cities.

**DATA, CONNECTIVITY & MANAGEMENT SYSTEMS**

The Data, Connectivity & Management Systems topic refers to management systems. Based on available data these will evolve from reactive to predictive and increasingly self-organising systems. The topic includes environmental impact measurement and mapping of hidden potentials in cities, sensor networks and information management as well as interoperability between systems.

**Sustainable behaviour**

One of the crucial elements of a sustainable city is the behaviour of citizens. Awareness is required to make a collective turn towards more sustainable solutions and energy-saving alternatives. In many cases, available technologies are not sufficiently attractive to gain acceptance in mass markets. The behavioural developments included in the Roadmap Smart Urban Spaces are:

**VALUES, MOTIVES & BEHAVIOURAL CHANGE**

Values, Motives & Behavioural Change refers to the need for far-reaching cultural change of citizens to become part of a smart society. This topic includes aspects like the need for societal discussions on the definition of quality of life and a new culture of participation. Other aspects included are the need for evidence-based knowledge, pilot projects and a paradigm shift in education to create a deeper understanding of sustainability.

**Sustainable organisation**

Last but not least, the element of sustainable organisation is addressed. How can we organise the collaboration between relevant parties (public, private, citizens) to achieve the desired future scenarios? Because the technology is not yet mature, new business models are needed to enable learning processes, and that can be adapted when needed. The organisational developments included in the Roadmap Smart Urban Spaces are:

**PARTICIPATION & COMMUNITIES**

Participation & Communities is about how citizen participation will be organised to make them take joint responsibility for their living environment, as well as their social community. This topic includes how people will organise and interact through new platforms, making human talent visible and taking the lead in decision-making processes, all focused on collaborating in joint value creation.

**INNOVATIVE BUSINESS MODELS**

Innovative Business Models refers to different kinds of financial mechanisms and the changing role and organisation of players supporting and driving transformation processes. Specifically, this topic includes the social responsibility of companies, cooperative approaches between different stakeholders implementing local and closed resource cycles and the development towards a sharing economy, based on new values and even new currencies.

**POLICIES & LEGISLATION**

The Policies & Legislation topic is about the role of policy in supporting transformation processes through clear guidelines and regulations. It includes regulations, incentives and taxes at all levels covering important fields like data and privacy protection, public procurement and transformation of public space, all contributing holistically to sustainable city development.
The Smart Urban Spaces theme focuses on sustainable energy solutions for public spaces, where multiple functions and activities physically come together. The ambition of the cities is to create liveable urban spaces by engaged citizens and all the other stakeholders. Circular systems contribute to sustainable use of resources. Sustainable transportation solutions contribute to a healthy living environment.

- Flexible and attractive living environment
  - People enjoying quality of life and safety
    - Adapting while preserving the identity of the city (like history and culture)
    - Ecological system: connecting the green and blue areas
    - Urban space is for people, not for private use (like parking)
    - Enabling multifunctional use of urban space

- Social interaction and healthy behaviour
  - Active-use of public spaces for sustainable lifestyles
  - Well-connected and well-equipped green areas enhance social life
  - Healthy living environment with extensive green and blue to support social activities
  - Open platforms to encourage citizens to initiate and participate in social events

- Climate resilience
  - Integrated physical planning to strengthen interdependencies between water, forests, pavement, buildings
  - Green areas help produce and store (renewable) energy, reduce heat stress and allow recovery of nature
  - Private property should be climate resilient as well

- Synergy between urban and rural areas
  - Open territorial cooperation encourages innovation and contributes to local economic development
  - Reducing footprint by using circular systems
  - Well-designed route network supported by smart technologies connects urban and rural areas, promoting quality lifestyles

- Smart systems and grids
  - Real-time info helps people to engage in social activities
  - Smart grid connects public spaces and services
  - Centralised ‘brain’ enables information sharing
  - Secure system ensures privacy by understanding the boundary between public and private data
  - Resilient system (matching resources to conditions)

- New business and financing models
  - Providing an ideal environment for local entrepreneurs with sustainable and healthy services
  - Accessible data to develop new apps and services
  - Citizens and administration jointly invest in the living environment
  - Public space is always freely accessible, added-value services may be charged

- Citizens taking the lead and co-creation
  - People feel responsible for sustainability and are engaged in urban planning-use and maintenance
  - People take the initiatives, supported by the administration
  - Citizens use smart systems to monitor the quality of the environment and contribute to its improvement
  - Citizens actively take part in making decisions that influence their living environment

---

**Desired future scenario**

**Flexible and attractive living environment**

- People enjoying quality of life and safety
  - Adapting while preserving the identity of the city (like history and culture)
  - Ecological system: connecting the green and blue areas
  - Urban space is for people, not for private use (like parking)
  - Enabling multifunctional use of urban space

**Social interaction and healthy behaviour**

- Active-use of public spaces for sustainable lifestyles
  - Well-connected and well-equipped green areas enhance social life
  - Healthy living environment with extensive green and blue to support social activities
  - Open platforms to encourage citizens to initiate and participate in social events

**Climate resilience**

- Integrated physical planning to strengthen interdependencies between water, forests, pavement, buildings
  - Green areas help produce and store (renewable) energy, reduce heat stress and allow recovery of nature
  - Private property should be climate resilient as well

**Synergy between urban and rural areas**

- Open territorial cooperation encourages innovation and contributes to local economic development
  - Reducing footprint by using circular systems
  - Well-designed route network supported by smart technologies connects urban and rural areas, promoting quality lifestyles

**Smart systems and grids**

- Real-time info helps people to engage in social activities
  - Smart grid connects public spaces and services
  - Centralised ‘brain’ enables information sharing
  - Secure system ensures privacy by understanding the boundary between public and private data
  - Resilient system (matching resources to conditions)

**New business and financing models**

- Providing an ideal environment for local entrepreneurs with sustainable and healthy services
  - Accessible data to develop new apps and services
  - Citizens and administration jointly invest in the living environment
  - Public space is always freely accessible, added-value services may be charged

**Citizens taking the lead and co-creation**

- People feel responsible for sustainability and are engaged in urban planning-use and maintenance
  - People take the initiatives, supported by the administration
  - Citizens use smart systems to monitor the quality of the environment and contribute to its improvement
  - Citizens actively take part in making decisions that influence their living environment

---

**SMART URBAN SPACES**

**Roadmapping**

The R4E project received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 649397.
### Urban planning strategies

#### Short term developments
- In the short term, Urban Planning Strategies are based on detailed information about existing city assets through integrated mapping of resources and their value to society. This includes a life-cycle approach and specific indicators such as carbon footprint and human capital.
- Urban planning is more human-centric, taking into consideration a holistic social and environmental approach, for example including personal parameters for the happiness of citizens.
- Pilot projects and Living Labs contribute to raising citizens' awareness, allowing them to experience and engage with new solutions. This in turn allows them to take part in discussions and initiatives, and to be part of the overall transition process.
- All this contributes to the creation of an integrated Master Plan for urban transition with a strong commitment by citizens, including clear goals and strategies for urban density, flexibility, and adaptability of spaces or energetic refurbishment.
- Urban space is redesigned on a human scale, with the focus on the quality of life of citizens. The aims include creating more space for pedestrian and cyclist, as well as implementing renewable energy solutions or other systems and mechanisms that contribute to more sustainable city life.

#### Mid term developments
- In the mid-term, the relationship between cities and their surrounding areas is redefined through an integrated territorial planning approach, optimising resource flows, enhancing biodiversity, and redefining the interrelationship between leisure and agriculture.
- Urban planning shifts towards resilience planning, which allows flexibility in solutions, making planning processes open for upcoming technology changes and promoting continuous learning from pilot projects.
- Urban planning of cities is increasingly community-driven by strengthening participatory mechanisms and using simple and clear indicators for social value, for example in relation to the health and happiness of citizens.

#### Long term developments
- In the long term, public space and infrastructure that become available through new mobility solutions are designed and repurposed, providing new and flexible uses and services for citizens.
- Urban spaces are designed and used as smart urban landscapes or 'Smartscape', adjusting in real time to specific uses, users and conditions.
Sustainable energy transition

**Short term developments**
- In the short term, renewable energy production in cities increases substantially through the local and decentralised introduction of diverse renewable energy systems.
- To achieve a high rate of renewable energy use in cities, energy demand for public spaces and services is reduced through refurbishment actions, optimisation of processes and substitution of assets.
- Technology development allows micro-energy systems using different renewable energy carriers that can easily be integrated in buildings, public space and infrastructure.
- Energy production and consumption is optimised at district level, for example by connecting energy-generating and energy-consuming buildings. This allows real-time sharing of resources.

**Mid term developments**
- In the mid-term district heating networks evolve, integrating increasingly renewable energy solutions, for example large solar thermal installations, biogas and biomass.
- Smart grid solutions evolve towards bidirectional smart grids, which allow balancing supply and demand of energy in cities. Low-voltage, low-temperature grids allow undesired energy losses to be reduced.
- Local energy management systems connect buildings, mobility systems and public spaces into a single local system that allows optimised production, distribution, storage and use of energy at district level.
- Future grids will be increasingly integrated, interoperable and open, for example integrating thermal, electrical, water and gas networks into a single energy-management system.

**Long term developments**
- In the long term, district energy networks include energy storage solutions at all scales, for example power-to-gas solutions or advanced battery storage technologies. These evolve towards proactive energy grids, actively managing local resources based on a mix of renewable energy sources.

**Smart grid optimisation**
- Low-voltage and low-temperature grids avoid unnecessary energy losses.

**Local energy management**
- Connecting buildings, mobility and public space into one local system for energy production, distribution, storage and use.

**Integrated grid**
- Bidirectional, interoperable, open grid, integrating thermal, electrical, water and gas networks into one energy-management system.

**Energy-storage solutions**
- Energy-storage solutions (e.g. power to gas, batteries) are available all year round and at all required scales.

**Proactive energy grids**
- Decentralised smart grids for a mix of renewable energies.


**Climate resilience & biodiversity**

### Short term developments

- In the short term, cities increase their Climate Resilience & Biodiversity by implementing strategies to reduce water stress. This is achieved by increasing the water infiltration capacity of the ground and small-scale buffers such as green roofs in public and private buildings. Buffer capacity is increased by temporary storage of excess water so large rainstorms can be handled securely.

- Reconnecting people and nature is one of the main strategies adopted by cities, improving the accessibility to urban green spaces and creating connections between city and territory. Green corridors enhance flora and fauna in cities and offer more liveable and usable spaces, for example for cycling or walking.

- The urban microclimate benefits from increased urban greening, resulting in a reduction of heat stress through the cooling effects of vegetation, for example evaporation, shading and reflection by trees.

### Mid term developments

- In the mid-term, water management in cities is increasingly smart, using improved weather forecasting for intelligent management of storage capacity and water resources.

- Different urban systems are interconnected to provide optimised ecosystem services in cities. For water, this results in a systemic relationship between ‘grey’ water purification, water storage for irrigation, urban farming, clean air, healthy living soil and other services.

- For urban resilience, reconnecting urban and rural areas is key. New forms of open cooperation between cities and territory allow increasing self-sufficiency of communities in relation to food, water, energy and materials.

### Long term developments

- Healthy urban living is promoted by the design of public spaces that encourage healthy behaviour of citizens, for example more active lifestyles that include walking and cycling, sports and leisure activities in natural surroundings.

- In the long term, this leads to an overall ecological regeneration in cities, creating synergies between nature and the built environment.
Circular systems

Short term developments

- In the short term, water is recognised as a highly valuable resource in cities. All related efforts to increase the efficiency of water cycles are based on transparent costs and benefits. This supports decision-making, for example on central vs. decentral water purification, sewer-free infrastructure, separation of water flows and even disconnection. Later, purification of rainwater and ‘grey’ water is done by constructed wetlands and similar natural systems, providing water of usable quality for surface water replenishment.

- To strengthen the circular approach to material flows in cities, resource management is optimised, for example by separate collection of different kinds of waste water, as well as reducing waste and increasing recycling. This leads to a zero-waste and even upcycling approach, allowing material life-cycles to be closed at different scales, and understanding waste as a resource.

Mid term developments

- In the mid-term, natural systems such as reed beds serve as water purifiers on a large scale, contributing to the closing of residential water cycles.

- This goes hand-in-hand with the use of new Cleantech solutions such as ceramic membranes for water purification. Other Cleantech solutions focus on creating bio-plastics from waste, and allow decentralised, small-scale installations at neighbourhood level.

- Resource cycles are increasingly closed and integrated, offering solutions for circular systems for food, energy, materials and water. These resource cycles become shorter and more compact, allowing efficient solutions at building, housing development and neighbourhood levels.

Long term developments

- In the long term, closed resource cycles contribute to the overall ecological regeneration of cities, creating synergies between nature and the built environment based on new materials and new, decentralised production methods, for example based on 3D printing and Fablabs.
Short term developments
- In the short term, ICT technologies and related data management systems allow the consistent measurement of the environmental impact at personal and societal levels, for example combining data from mobility, food and lifestyle data.
- The available data allows integrated mapping and monitoring of assets and potentials of city resources such as land, underground infrastructure, green and blue spaces and geothermal potential of different areas.
- Open data is an important factor in value creation, for example by new business models. This needs to address ethical issues in terms of transparency of data, privacy protection and security.
- Systems are reactive and demand-driven, for example by predicting the use and production of energy, demand and storage of water and other resources. Technology developments allow increasing use of urban sensors for data collection, providing detailed real-time information on demand and availability of different resources, or the performance and use of public green and public space.

Mid term developments
- In the mid-term, information management platforms convert real-time measurement data into actions by apps and new services that promote better use of spaces.
- User participation is an important paradigm in future urban developments, benefiting from ‘Gamification’ solutions. Future users will be able to experience new concepts and solutions through virtual reality, for example based on 3D models and games. These allow citizens to co-create solutions for urban spaces.
- Solutions for system interoperability are introduced in the mid-term, allowing the connection of data, devices and assets within an open system approach. This optimises system operation and generates new services based on new algorithms for the integration and use of data.
- Together with the use of artificial intelligence this allows systems to become predictive, proactively matching supply and demand of materials, water and energy.

Long term developments
- In the long term design tools are inclusive, based on design-supporting ICT systems with access to all the relevant information. New tools are based on the use of real-time data, allowing participatory urban planning through co-creation with multiple stakeholders.
- ICT systems are increasingly self-organising, allowing real-time smart, overall control of local communities as well as their interconnection. Quality of life and overall happiness of citizens play a major role, and will regarded as a service.
**SMART URBAN SPACES**

- **2030**
  - ‘Gamification’
  - Interoperability
  - Predictive systems
  - Inclusive design tools
  - Self-organising systems

- **2040**

- **2050**

Futurists use experience concepts and spatial solutions through virtual reality (VR models and games); they can use this experience to co-create solutions for urban spaces.

- **2030**
  - Interoperability
    - Open systems allow the connection of data, devices, and assets to optimize operation and generate new services.
  - Predictive systems
    - Artificial intelligence & data science to proactively match supply and demand of raw materials, water, and waste flows.
  - Inclusive design tools
    - Design-supporting ICT system with all relevant information; new tools deal with real-time data and support participatory urban planning.
  - Self-organising systems
    - Linking local communities through ICT for real-time smart overall control and ‘happens as a service’

- **2040**

- **2050**

- **Goal-centred planning that enables future users experience concepts and spatial solutions through virtual reality (VR models and games); they can use this experience to co-create solutions for urban spaces.**

- **2030**
  - Green areas help produce and store (renewable) energy, reduce heat
  - Citizens and administration jointly invest in the living environment
  - Accessible data to develop new apps and services
  - Reducing footprint by using circular systems
  - Open territorial cooperation encourages innovation and contributes to new services, such as leasing.

- **2040**

- **2050**

- **Ecosystem services**
  - Open systems allow the connection of data, devices, and assets to optimize operation and generate new services.

- **2030**

- **2040**

- **2050**

- **Transformation guidelines**
  - Prioritising of research fields to ensure sustainable quality of life in living in cities.

- **2030**

- **2040**

- **2050**

- **Ecosystem services**
  - Open systems allow the connection of data, devices, and assets to optimize operation and generate new services.

- **2030**

- **2040**

- **2050**

- **Ecosystem services**
  - Open systems allow the connection of data, devices, and assets to optimize operation and generate new services.

- **2030**

- **2040**

- **2050**

- **Ecosystem services**
  - Open systems allow the connection of data, devices, and assets to optimize operation and generate new services.
Values, motives & behavioural change

Short term developments

• In the short term, experts predict the need for profound cultural change of both citizens and society in relation to values, motives and behaviour. These changes are based on a better understanding of the value of resources (e.g. materials, energy, water, food, social capital).

• In relation to this change of perception, societal discussions contribute to a new definition of quality of life, based on new parameters and indices, which can be applied in different fields and at different scales.

• Education is a major area for transformation of society, preparing new generations of citizens with in-depth, transdisciplinary knowledge about sustainability across all sectors, for example in professional education.

• Transformational experiences are promoted in the mid-term through inspirational pilot projects. These allow citizens to experience new developments in areas like model homes, exemplary neighbourhoods and future campuses.

• Value and behavioural changes are based on the generation and communication of evidence-based knowledge on the significance of sustainability for society, avoiding possible adverse effects of miscommunication.

• Societal transformation is based on a new culture of participation by citizen taking responsibility, for example in societal discussions about data privacy or in the co-creation and co-design of urban transformation strategies and projects.

Mid term developments

• In the mid-term, new knowledge is generated on holistic models of nature based solutions. These enable society to take action on the transition towards higher levels of sustainability and happiness as important indicators of well-being.

• The redesign of public space promotes new social interactions and a new culture of participation, enhancing inclusiveness and awareness of its social value.

Long term developments

• In the long term, the educational system shifts to a focus on personal competences and lifelong learning. There is a strong emphasis on sustainability in all fields, and the contribution this makes to the quality of life in cities.

• As a result, towards 2050 people form part of an overall smart society, in which citizens have a deep understanding of sustainability. They hold corresponding strong values, resulting in coherent and sustainable behaviour.
Participation & communities

**Short term developments**
- In the short term, citizen initiatives are facilitated by municipalities, encouraging citizens to take responsibility for their own direct living environments, for example through participatory budgets. At the same time, citizen participation is optimised and up-scaled, exploring and improving different approaches, mechanisms and tools.
- Another important action regarding participation and communities is to highlight the human talent in society. This is done through social networks, apps and mobile devices, which help to create the required dynamics and platforms.
- Community platforms support these social dynamics, promoting self-organisation of citizens and allowing them to take the initiating and lead the way in collective actions.

**Mid term developments**
- In the mid-term communities become increasingly resilient, with a higher level of self-sufficiency in relation to resources like energy and food, supported by small-scale facilities and decentralised systems.
- Communities are self-organising and proactive in relation to the sustainable transition processes of society, inviting municipalities to participate in the associated projects and actions.
- Citizens even influence the definition and importance of research fields, prioritising research that contributes to the development of a higher quality of life in cities.

**Long term developments**
- In the long term, communities consist of a new generation of citizens with a strong sense of commitment. They jointly take responsibility for their living environment and their social communities, collaborating in joint value creation in relation to the public space.
Innovative business models

Short term developments
- In the short term new financial schemes evolve, generating new funding for urban transformation projects. For example these include local banks, companies and families, as well as experiments with new earning models and innovation budgets.
- A new entrepreneurial attitude develops in public administration, with municipalities embracing innovation and understanding and accepting the associated risks.
- In the private sector, companies develop an increasing sense of social responsibility, changing their business models and policies accordingly. Corporate social responsibility is extended to integrate social responsibility for the communities in which companies operate.
- This includes new cooperation models between companies and society. For example companies joint invest in renewable energy solutions, enabled by new business models such as leasing or similar approaches.
- All private and public investments in a region address climate-resilience.

Mid term developments
- In the mid-term new currencies are introduced, including sustainability parameters in the monetary processes and systems. These currencies could be based on parameters like the carbon footprint or other environmental indexes of products and services, to define their value or cost for society in relation to sustainability. Later a currency for health will be introduced, including health related parameters in the monetary processes and systems. This currency could value aspects such as the positive effects of a green environment, clean air and the absence of noise.
- Local economies are stimulated by specific business activities which increase the sustainability of society, for example local food production. This is in line with the focus of business models on integrated closed resource cycles, addressing the holistic value of ecosystem services based on circular systems.
- Business models are increasingly based on platform services, for example integrating energy and open data, providing a platform for the use of distributed resources.

Long term developments
- In the long term, experts predict a societal transition towards a sharing economy and new paradigms like ‘everything as a service’. These processes are enabled by ICT platforms and real-time data.
## Policies & legislation

### Short term developments
- In the short term policies are increasingly goal-driven, focusing on the definition of desired outcomes rather than how to achieve them. This allows a higher level of innovation, for example in the way to achieve zero-energy neighbourhoods.
- Policies are also more inclusive, favouring societal benefits over individual benefits to achieve collective goals for a sustainability transition of society. This could include not only rights but also obligations, for example for solar energy harvesting on suitable building surfaces.
- Another political responsibility of municipalities is to balance the differing interests of public, private and societal organisations, promoting an active role by citizens in the related participation processes.
- Specific policies are introduced for sustainable development of cities and communities, including regulations, incentives and taxes that allow financing positive transformation as well as fighting ‘climate criminals’.

### Mid term developments
- In the mid-term, legislation will be developed and introduced to protect privacy at EU level, ensuring transparency of data, privacy protection and security.
- All public procurement processes address integrated sustainability and social value including the happiness of citizens, and policies are aligned at local, regional, national, European and even global levels, based on a simplified, integrated approach.
- Policies are focused on promoting positive contributions to the social sustainability transition, for example actions with a ‘positive handprint’ such as car-sharing initiatives. These actions are promoted by tax incentives and other stimulating mechanisms.

### Long term developments
- In the long term, transformation guidelines facilitate the input needed for citizen-driven participatory planning processes using simple, clear indicators. The goal is to achieve sustainable transformation and to make maximum use of public spaces.
This project received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 649397

This report (D5.2) contains the results of the Roadmapping research conducted between January 2016 and August 2017. The first Roadmapping interviews were held to identify future options for sustainable energy in the area of Smart Urban Spaces. The interview results were analysed in an expert meeting to distil the most relevant topics and to create timelines with future options for those topics. The timeline for Smart Urban Spaces was aligned in a cross-expert meeting, together with the timelines for Smart Buildings (D3.2) and Smart Mobility (D4.2) to ensure that the links between the focus areas were also addressed. The general roadmaps were used in roadmapping sessions held in the R4E partner cities to create city-specific roadmaps (which are reported in D5.3).

The creation of the general roadmap is part of the WP5 Roadmap Smart Urban Spaces within the R4E project. The R4E partners work together to develop a new type of energy strategy through visions and roadmaps for the eight partners cities in co-creation with local stakeholders. The project supports the development of visioning and roadmapping capacities within the municipalities to drive future development and implementation of innovative energy solutions.

SMART URBAN SPACES GENERAL ROADMAP
D5.2 Report — Timelines for the topics in Smart Urban Spaces

This report (D5.2) contains the results of the Roadmapping research conducted between January 2016 and August 2017. The first Roadmapping interviews were held to identify future options for sustainable energy in the area of Smart Urban Spaces. The interview results were analysed in an expert meeting to distil the most relevant topics and to create timelines with future options for those topics. The timeline for Smart Urban Spaces was aligned in a cross-expert meeting, together with the timelines for Smart Buildings (D3.2) and Smart Mobility (D4.2) to ensure that the links between the focus areas were also addressed. The general roadmaps were used in roadmapping sessions held in the R4E partner cities to create city-specific roadmaps (which are reported in D5.3).

The creation of the general roadmap is part of the WP5 Roadmap Smart Urban Spaces within the R4E project. The R4E partners work together to develop a new type of energy strategy through visions and roadmaps for the eight partners cities in co-creation with local stakeholders. The project supports the development of visioning and roadmapping capacities within the municipalities to drive future development and implementation of innovative energy solutions.