This project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649397

AMBITION, VISION & ROADMAP
SMART URBAN SPACES EINDHOVEN

D6.4 Final city report

18 August 2017

Luuk POSTMES, Gemeente Eindhoven
Elke DEN OUDEN & Rianne VALKENBURG, TU/e LightHouse

R4E ROADMAPS FOR ENERGY®

EINDHOVEN

AMBITION, VISION & ROADMAP
SMART URBAN SPACES EINDHOVEN

D6.4 Final city report

Leader: TU/e LightHouse

Submission due date: February 2018

Actual submission date: t.b.d.

Abstract

This report (D6.4) is the final deliverable of the R4E project and contains all relevant project results for smart urban spaces in the city of Eindhoven.

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:

18 August 2017	Concept for internal check by R4E partners (limited distribution)
xx Month 2017	Final version for public distribution

SMART URBAN SPACES

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R4E ROADMAPS FOR ENERGY®

WP7. Project management

Project coordination
quality management, project coordination, financial & administrative activities

SC Sant Cugat | SC Palermo | SC Istanbul | SC Tallinn | SC Newcastle | SC Forli | SC Murcia

Joint project kick-off & SC
2-day workshop in Eindhoven with all partners to sart project (WP7) and to prepare for ambition workshops and future telling interviews (WP1)

WP1. Ambition setting

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

EINDHOVEN
ISTANBUL METROPOLITAN MUNICIPALITY — public transport, traffic mgt
Newcastle City Council — domestic, non-domestic
Ajuntament de SantCugat
Murcia

Ambition sharing & selecting drivers for change
1-day meeting in Palermo to share the results of the ambition workshops and future telling and to select the drivers for change for WP2

Future Telling
20 interviews with experts on the future of energy in the city in general and especially w.r.t. buildings, mobility and urban spaces, and analysis of the results to define the most important drivers for change

Scenario preparation
defining generic elements for future scenario's as preparation for the workshops with cities to develop specific desired future scenario's

WP2. Vision development

Scenario workshops
3-day workshop in each city to develop specific desired future scenario's per focus area

EINDHOVEN
Murcia
Newcastle City Council — domestic, non-domestic
Ajuntament de SantCugat
Tallinn
ISTANBUL METROPOLITAN MUNICIPALITY — public transport, traffic mgt

Scenario sharing & selecting topics for roadmaps
2-day meeting in Istanbul to share the desired future scenario's of all cities with all partners and to select the topics for the roadmaps (covering sustainable technologies, behaviour and organisation)

WP3, 4 & 5. Roadmapping

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

Desk study
analysis of the available information on the selected topics for the roadmaps and to identify relevant experts

Roadmap interviews
collecting expert insights with 20 experts for each focus area

SMART BUILDINGS
- Sustainable technologies
- Sustainable behaviour
- Sustainable organisation

SMART MOBILITY
- Sustainable technologies
- Sustainable behaviour
- Sustainable organisation

SMART URBAN SPACES
- Sustainable technologies
- Sustainable behaviour
- Sustainable organisation

Creation of timelines
making timelines for each topic to indicate when relevant options become available on the path towards the desired future

Expert meeting
cross team expert meetings to share and align timelines for the focus areas and prepare roadmap workshops with cities

Roadmap workshops
2-day workshops in each city to develop specific timelines for the realisation of the desired future scenario's

EINDHOVEN
Tallinn
Murcia
Newcastle City Council — domestic, non-domestic
Ajuntament de SantCugat
ISTANBUL METROPOLITAN MUNICIPALITY — public transport, traffic mgt

WP6. Project portfolio

Current projects
each city identifies projects it has running that will contribute to the realisation of the roadmap, as well as the topics for cross-city learning

Roadmap sharing & cross learning objectives
2-day meeting in Newcastle to share the roadmaps of the different cities, as well as the current projects, and to identify cross-learning objectives

New projects
each city identifies the desired new projects to ensure the timely realisation of its roadmap ambition

EINDHOVEN
ISTANBUL METROPOLITAN MUNICIPALITY — public transport, traffic mgt
Newcastle City Council — domestic, non-domestic
Murcia
Ajuntament de SantCugat
Tallinn

Joint portfolio meeting
3-day meeting in Forlì to share the portfolios of the different cities, as well as to prepare for joint projects that support the achievement of common ambitions

Financing opportunities
identifying different opportunities for financing of the city specific and the joint projects

Organising for learning
organising for continued cross city learning

WP8. Communication & dissemination

Strategy & visuals
developing a communication & dissemination strategy, logo's and graphic charter

Event Palermo

Regular communication activities
electronic project newsletters, other newsletters and information services, project and partner websites, press releases and other media releases, social media

Event Tallinn

Regular communication activities

Final event
conference in Murcia

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649397

ROADMAPS FOR ENERGY®

Version 4 September 2015

R4E - ROADMAPS FOR ENERGY

SMART URBAN SPACES

Introduction

In the Roadmaps for Energy (R4E) project, the partners 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 benefit from the new strategy, such as the citizens themselves, 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 result is a shared vision, containing the desired, city-specific scenarios and the dedicated roadmaps embedded in each city's specific context. These roadmaps take into account the diversity in the geographies, ecologies, climates, societies and cultures of the eight partner cities in the project: Eindhoven, Forli, Istanbul, Newcastle, Murcia, Palermo, Sant Cugat and Tallinn.

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

The ultimate result is a process that allows the partners to work together in developing the Energy Roadmap to achieve their 'Smart Cities' ambition. Since energy and Smart Cities are too broad to cover in a single project, R4E focuses on three key areas of sustainable energy. These are closely linked to the main responsibilities of the municipalities:

SMART BUILDINGS

SMART MOBILITY

SMART URBAN SPACES

The three focus areas of R4E

Approach

The R4E project follows a 4-step approach:

1. The FIRST step sets the ambitions for the project. The ambitions of the participating cities on sustainable energy and Smart Cities in general are set, as well as the partner cities' choice of two (out of three) focus areas within Smart Energy Savings: Smart Buildings, Smart Mobility or Smart Urban Spaces.

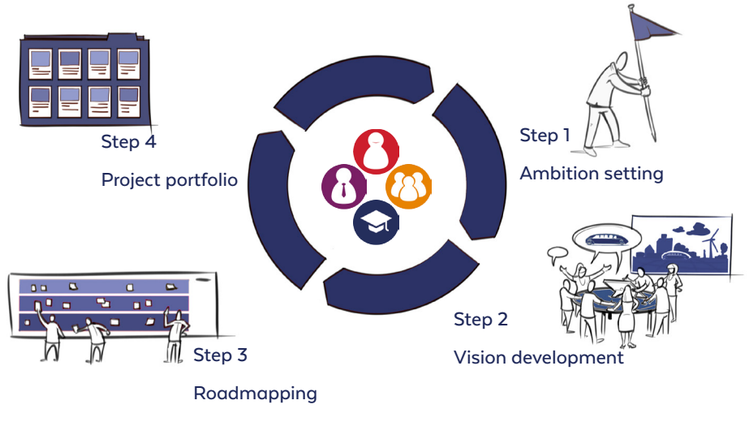
2. The SECOND step is to develop desired city scenarios for the selected focus areas.

3. In the THIRD step, the roadmap is created. This involves identifying existing and future technologies and other developments that will enable the desired future scenarios. The opportunities and developments are plotted on a timeline to show the route and milestones towards the favoured scenarios. The roadmaps contain common parts for all the partner cities, as well as specific parts for the individual cities.

4. In the FOURTH and final step, a project portfolio is generated with new projects and initiatives to reach the ambitions, visions and roadmaps of the cities. This portfolio provides an overview of individual and joint projects, and includes cross-city learning and financial plans.

The approach is characterised by four main elements:

- Backwards planning – the project starts with the development of a shared vision as a starting point for the creation of a well developed path to achieve it.
- Inclusive workshops in the cities – a cooperative process to engage key stakeholders (companies, citizens, public and private organisations and knowledge institutes) within the region in co-creating a clear and well designed implementation plan with a stronger commitment to the joint effort in the realisation phase.
- Expert knowledge is sourced in a practical and usable form during the vision development and roadmapping.
- A visual language is used to easily connect people and share main insights.



Four step approach of R4E

The R4E partner cities

EINDHOVEN

Gemeente Eindhoven, the Netherlands

- Population: 220,000
- Area: 90 km²

SMART MOBILITY · SMART URBAN SPACES

Newcastle City Council

Newcastle City Council, United Kingdom

- Population: 282,000
- Area: 114 km²

SMART BUILDINGS
- Domestic buildings
- Non-domestic buildings

Comune di Forlì, Italy

- Population: 120,000
- Area: 228 km²

SMART BUILDINGS · SMART URBAN SPACES

Comune di Palermo, Italy

- Population: 885,000
- Area: 160 km²

SMART BUILDINGS · SMART MOBILITY

ISTANBUL METROPOLITAN MUNICIPALITY

Istanbul Metropolitan Municipality, Turkey

- Population: 14,100,000
- Area: 1.830 km²

SMART MOBILITY
- Public transport
- Traffic management

Ajuntament de SantCugat

Ajuntamient de Sant Cugat del Vallès, Spain

- Population: 86,000
- Area: 50 km²

SMART BUILDINGS · SMART URBAN SPACES

Murcia

Ayuntamiento de Murcia, Spain

- Population: 440,000
- Area: 885 km²

SMART BUILDINGS · SMART MOBILITY

TALLINN

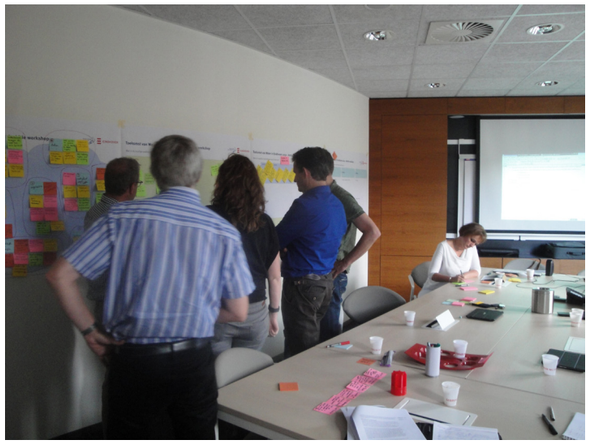
Tallinna Keskkonnaamet, Estonia

- Population: 430,000
- Area: 160 km²

SMART BUILDINGS · SMART MOBILITY

The eight partner cities of R4E

EINDHOVEN



AMBITION SETTING

SMART URBAN SPACES

Ambition Setting

The aim of Step 1 is to set the ambitions for the project. An ambition expresses what a city wants to achieve in the future. For this purpose the ambitions of the participating cities on sustainable energy in general are defined and refined in a process of co-creation, using existing policy documents as a basis for workshops with the individual cities. Each city selects two focus areas for which specific city ambitions are defined.

Today's reality

During the kick-off meeting the cities present the current status of their energy policy in general and their selected focus areas in particular. This chapter starts with a summary of this information.

Ambition Workshops

The strategic ambitions for energy-related themes in general and for the selected focus areas in particular are assessed in a series of workshops in each of the partner cities.

The Ambition Workshops consists of 3-day visits to the individual cities, during which several workshops with policy-makers and stakeholders are held to gain a deep understanding of the ambitions and specific contexts of the cities. Through the networks in the cities the local stakeholders (companies, citizens, public and private organisations and knowledge institutes) are invited to participate in the workshops. Together, the participants interactively contribute to the strategic ambitions. See also the pictures of the workshops on the previous page. The results of the Ambition Workshops are reported in similar formats for each of the cities to enable cross learning between the cities.

Day 1	Day 2	Day 3
Interview with policy makers	Workshop with stakeholders focus area 1	Project team working session to establish scope
Workshop with strategy department	Workshop with stakeholders focus area 2	Preparing main content of concept report

Programme of the Ambition Workshops in the cities

Joint Ambition Workshop

In a joint meeting in Palermo, the cities shared their ambitions and held in-depth discussions to understand the common and specific aspects of their ambitions. The main aim of the Joint Ambition Workshop is to enable cross-city learning. In this way the cities gain a deeper understanding of the Ambition Setting process, and can improve their own ambition with inspiration from others.

The Joint Ambition Workshop is a 1-day workshop that finalises the activities of Step 1 and prepares for Step 2.

Morning Finalising Step 1	Presentation of the cities ambitions · Each city presents their ambition for the focus areas
	Learning from each other's ambitions · In-depth discussion on common and specific ambitions
Afternoon Preparing for Step 2	Presentation of the Drivers for Change · Sharing of results of Future Telling research
	Understanding the Drivers for Change · Exploring the relevance for the focus area and selection of drivers for scenario workshops

Programme of the Joint Ambition Workshop

Introduction to Eindhoven

Introduction to the city

Eindhoven is located in the province of North Brabant in the south of the Netherlands, originally at the confluence of the Dommel and Gender streams. The Gender was dammed short of the city centre in the 1950s, but the Dommel still runs through the city. The population was 221,402 in 2014, making it the fifth-largest city in the Netherlands and the largest in North Brabant.

Neighbouring towns and cities include Son en Breugel, Nuenen, Geldrop-Mierlo, Heeze-Leende, Waalre, Veldhoven, Eersel, Oirschot and Best. The agglomeration has a population of 337,487. The population of the metropolitan area is 419,045. The city region has a population of 749,841. Also, Eindhoven is part of Brabant Stad, a combined metropolitan area with a population of more than 2 million inhabitants.

Eindhoven has grown from a small town in 1232 to one of the biggest cities in the Netherlands. After the independence of the Netherlands in 1815, Eindhoven was a small village of some 1250 people in an economically backward and mostly agricultural area. Cheap land, cheap labour and the existence of pre-industrial home-sourcing made Eindhoven an attractive area for industry. During the 19th century Eindhoven grew into an industrial town with factories for textiles, cigars and matches. Most of these industries disappeared after World War II. In 1891 the brothers Gerard and Anton Philips founded the small light bulb factory that would grow into one of the world's largest electronic companies. Philips' presence was probably the largest single contributing factor to the major growth of Eindhoven in the 20th century. It attracted and spun off many high-tech companies, making Eindhoven into today's major 'Brainport' technology and industrial hub. In 2005, a full third of the total spending on research in the Netherlands was in or around Eindhoven. A quarter of the jobs in the region are in technology and ICT, with companies such as FEI Company, NXP Semiconductors, ASML, Simac, Newways, Philips and DAF.

Eindhoven has long been a centre of cooperation between research and industry. This tradition started with Philips, and has since expanded to large cooperative networks. Eindhoven University of Technology (TU/e) hosts an incubator for technology start-ups (the Twinning Centre). and the Philips Research (formerly the 'NatLab') has developed into the High Tech Campus Eindhoven.

Map of Eindhoven

Source: Google

Due to its high-tech environment, Eindhoven is part of several initiatives to develop and promote the knowledge economy in the region. Some examples are:

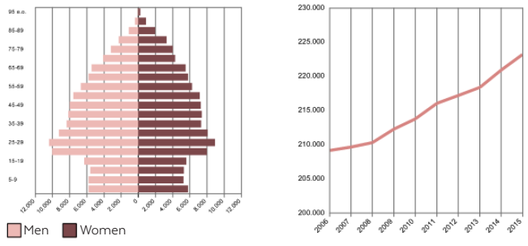
- Brainport: a cooperative initiative by local government, industry and Eindhoven University of Technology to develop the local knowledge economy in the Eindhoven region.
- MRE (Metropolitan Region Eindhoven): a cooperative agreement among the municipalities in the Eindhoven metropolitan area.
- ELAt (Eindhoven-Louvain-Aachen triangle): an extensive cooperation agreement between the universities and surrounding regions of Eindhoven, Louvain (Belgium) and Aachen (Germany).
- Within the Eindhoven region (and particularly Helmond), several parties are working together in the automotive sector. In particular in the Automotive Campus — a testing facility on a European scale — for testing and European certification of vehicles. This cooperation involves the Eindhoven University of Technology, TNO Automotive and a number of automotive companies in and around Helmond and Eindhoven.

As a result of these efforts, the Intelligent Community Forum named the Eindhoven metropolitan region as Intelligent Community of the Year in 2011.

Source: Wikipedia

Demographical aspects (2015)

- Size in km2 88,87 km2
- Number of inhabitants 223.220
- Population trends: growing (see graph below)



Social aspects

- Level of education of citizens 18% low standard of education
- Share of population with energy poverty none ??
- Percentage of people that require special care/needs:
  - 21% suffers from prolonged illness
  - 13% has poor health conditions
  - 4% is hampered at home
  - 6% is severely hampered in spare time
- Percentage of people from foreign origin (see also table below):
  - 70% of the inhabitants of Eindhoven is Dutch
  - 17% is of non-western origin
  - 13% is of western origin

Immigrant populations	No in 1995	No in 2013
Turkish Dutch	6590	10305
Indonesian Dutch	7111	6236
Moroccan Dutch	3183	5743
Surinam Dutch	3227	3714
Chinese Dutch	958	3129

Economical aspects

- Income per head in comparison to the national average income Eindhoven €30.600,-- (€13.400,-- per inhabitant)
- Level of infrastructure maintenance Basic
- Maintenance costs (green areas, roads, infrastructure) Approxmately 45 million (inclusive big repairs)

Environmental aspects

- Total m2 public green area within the urbanised area 1168 ha. and outside 366 ha
- Climate conditions: average temperature 10,3 degree C, rainfall 750 mm per year)
- Impact of climate change & measures taken to handle climate change. Most important, at this moment is heavier rainfall events
- Renewable energy production in the city: Biomass energy plant
- Air quality & noise data for the last 2 years online measuring of air quality: http://www.eindhoven.nl/artikelen/Meetwaarden-luchtkwaliteit.htm
- Water consumption per head 120 lit/day; 100% of underground water sources
- Supply and distribution of water: water company: Brabant Water
- Type of waste collection underground containers and small containers
- Biological sewage plant

Energy usage

- Energy performance of buildings in the city: average energy index: 1,82 (2014, source: klimaatmonitor databank)
- Residential Energy consumption (for houses): 5363 kWh/pp/yr (2012, source: monitoring report)
- Total energy consumption: 4722222 MWh/yr (2012, source monitoring report)
- Total CO2 emission per head: 6346 kg/pp/yr (2012, source monitoring report)
- Total energy consumption in the local industry: 2450000 MWh/yr (2012, source monitoring report)
- Municipal buildings energy consumption: 1,53 kW/m2 (2014, source: klimaatmonitor databank)
- Renewable energy production in the city: 122222 MWh/yr biomass (2012, source monitoring report).

Decision making process

- Organisation of responsibilities: municipality, no 'outsourcing' to company
- Process of decision making regarding energy and sustainability: The college van burgemeester en wethouders (abbreviated as college van B&W or simply B&W) is the executive board of a municipality in the Netherlands. This local government body plays a central role in municipal politics in the Netherlands. It consists of the mayor (burgemeester) and the members of the municipal executive (wethouders).
- Extensive involvement of stakeholders
- Extensive participation of citizens

SMART URBAN SPACES

Recent projects

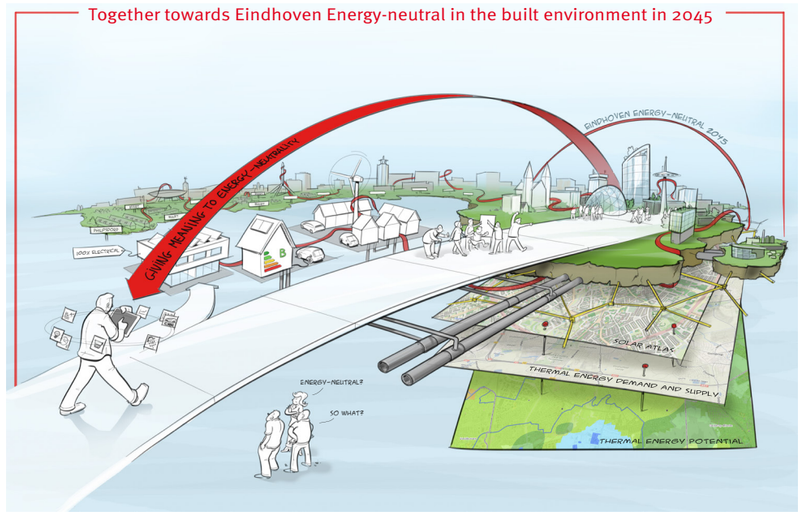
- Vision and roadmap urban lighting in Eindhoven 2030

Eindhoven started the process of creating visions and roadmaps in 2012 when the city was wondering how it would handle the transition to LED technology for urban lighting. Where many cities where replacing traditional lighting systems with LED technology to save energy, the municipality of Eindhoven was seeing an opportunity to use the urban lighting grid also as an opportunity to realise the smart city ambition. The city was not sure about the exact vision and route to achieve the vision and asked TU/e LightHouse to facilitate the creation of such a vision and roadmap for urban lighting in 2030 as a co-creation process.

The project resulted in a shared vision for the future of urban lighting in Eindhoven, and a roadmap that indicates possible technologies in the field of lighting and smart cities to achieve the desired future.

The vision and roadmap urban lighting Eindhoven 2030 has been established as the official policy for the municipality in November 2012. Currently the municipality is working on the implementing the vision and roadmap by executing a first tender for an innovation relation to develop, implement and continuously innovate the smart lighting grid. As the tendering process requires different approach than the more traditional 'product based' procurement processes, the municipality decided to have dialogue rounds with different consortia.
More information on the tender can be found on the site of the municipality: http://www.eindhoven.nl/smartlight

In parallel to the tendering process the city is experimenting with living labs for smart urban lighting solutions, such as on Stratumseind. This living lab was visited during the kick-off meeting of the R4E project. For more information:
https://nl-nl.facebook.com/LivingLabStratumseind

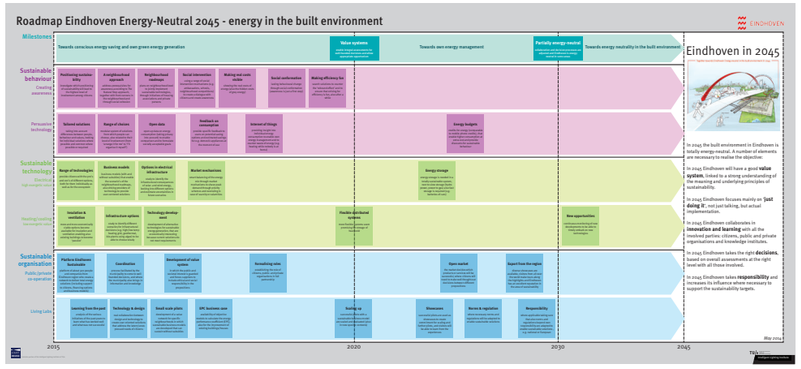


- Vision and roadmap Eindhoven energy-neutral 2045

Eindhoven set itself the ambition to become energy-neutral by 2045. Ensuring that this goal is actually achieved in practice will require cooperation between government, business and industry, research institutes and the citizens of Eindhoven. A series of short-term activities with a long-term focus will have to be defined. To make the goal achievable, Eindhoven will need a shared vision and roadmap. Because of the interrelationships between the different Smart City related roadmaps, LightHouse has been asked to support the process of the creation of a vision and roadmap for Eindhoven Energy-neutral in 2045. In the project the focus is put on energy in the built environment. The project was done in co-creation with the housing association Woonbedrijf, various companies and knowledge institutes. Together a vision was made of the desired future scenario of energy in the built environment.

With the vision a roadmap was developed that indicated possibilities in technology and organisational set-up to achieve the desired future scenario.

Currently a more in-depth study is done in the required infrastructure in Eindhoven to become energy neutral by 2045.



The experience to co-create visions and roadmaps in collaboration with industry, knowledge institutes and citizens has encouraged Eindhoven to develop more roadmaps for smart city related themes.

Moreover, as Eindhoven has now experienced that collaboration with other cities also improves with having roadmaps. Therefore it embarked on the opportunity to develop a proposal for the EE7 call in the Horizon 2020 program to collaborate with other cities to develop visions and roadmaps for sustainable energy.

Eindhoven has selected two focus areas for the R4E project:

SMART MOBILITY

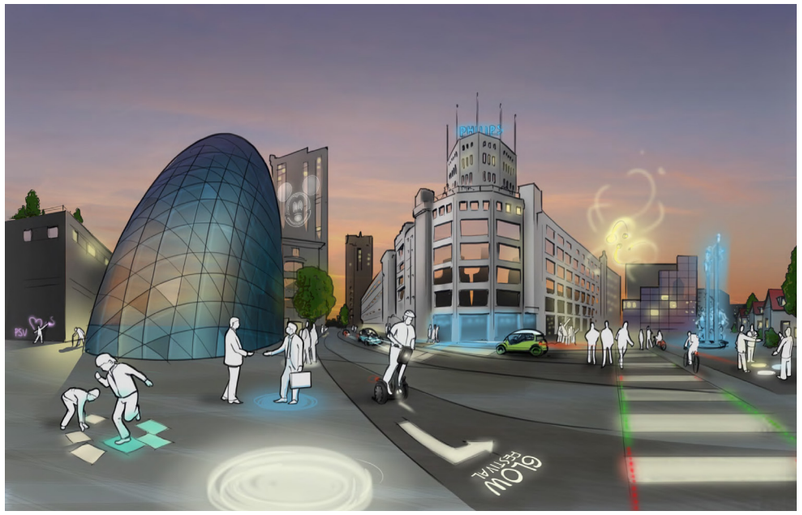
SMART URBAN SPACES

15 December 2015
Jan-Willem HOMMES & Luuk POSTMES, Gemeente Eindhoven

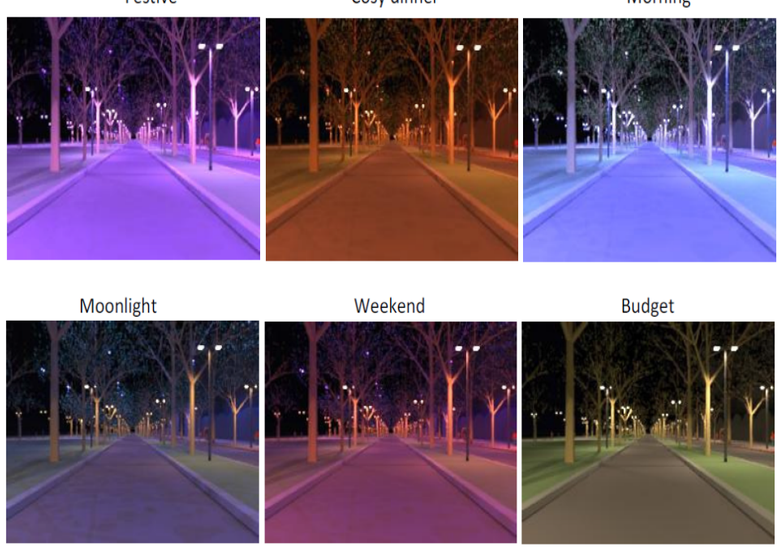
R4E ROADMAPS FOR ENERGY

Today's reality: Smart urban spaces

Roadmap light: light and data:



First implementations of smart lighting available, e.g. Strijp-S:

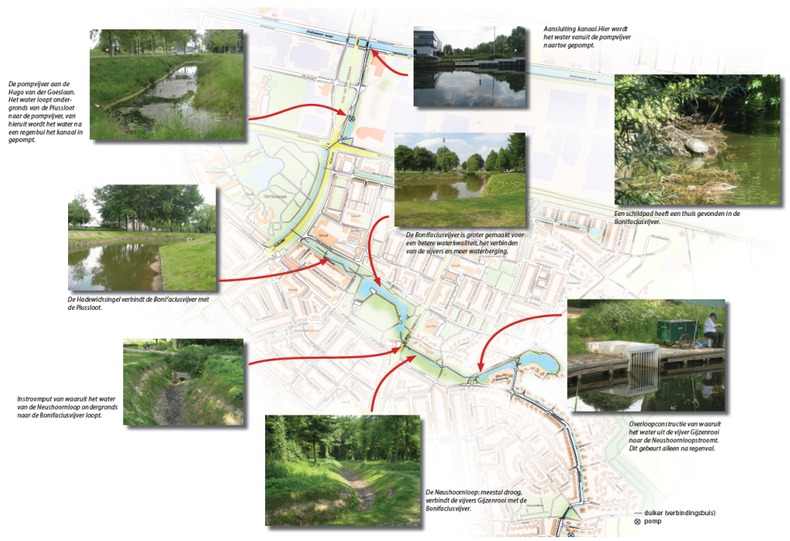


- Roadmap "Light" resulted in: **1st Prize Auroralia Award 2014**!

Eindhoven goes Greener

- Eindhoven is creating a greener environment: 'Eindhoven goes Greener' -> Garden city

- Traffic plan which includes more space for pedestrians and cyclists
- Reconstruction of watercourses and creation of more 'green and blue' spaces
- Vision on green space and its functions in Eindhoven
- We're working on a plan for a more liveable, healthier and sustainable city



Current satisfaction level of citizens regarding urban spaces: 6,6 (on a scale from 1 to 10).

15 December 2015

Luuk POSTMES, Gemeente Eindhoven

Ambition: ‘Green and blue’ spaces in Eindhoven 2050

SMART URBAN SPACES

1

Appreciation for nature in the living space

In 2050, people value a good, healthy and sustainable living environment with green and blue spaces. They are aware of the effects of climate change. That’s why people highly appreciate the interplay between city and nature. That in itself encourages a healthy lifestyle and behaviour.

A higher quality of life in Eindhoven is achieved by making room for green and blue spaces. Today, all the necessary fundamentals are in place. Perhaps they are even too well organised – people are freed from problems, and may no longer be aware of the importance of water in the living space. We aim to create value through a healthy, liveable urban environment. And we want to create awareness and appreciation of nature, driving behaviour change towards healthy lifestyles.

Strategic ambitions

- In 2050 citizens are water aware and appreciate the water and green spaces in their habitat (the garden city).
- In 2050 our society properly handles and anticipates changes (e.g. climate change).
- In 2050 citizens or companies experience no mortality, damage or nuisance by water.
- In 2050 water consumption is limited to the first necessity of life (other needs are used from different wells)

2

Working together in the value chain

In 2050, partners in the public space value chain appreciate the entire ecosystem. All (infrastructural) aspects of the urban environment and their interdependencies are clear, and the public space is designed right from the start as a healthy environment.

A higher quality of life in Eindhoven is achieved by integrated, physical city planning. Different disciplines support each other, contributing to a healthy city. The municipality, the water board (‘Waterschap De Dommel’) and other partners already work together on joint innovations. We aim for an integrated value chain covering blue (water), green (flora), grey (pavement) and red (buildings) elements. And we aim for an even better cooperation and sharing of responsibility in a Quadruple Helix model (partnerships between government, industry, academia and civil participants).

Strategic ambitions

- In 2050 the high quality of the (swimming) water and green spaces attracts people to Eindhoven and to spend more time outside.
- In 2050 city planning is done in new, democratic public private partnerships and the public space is designed in a way that it supports all it’s ambitions.
- In 2050 public space is planned with water and green spaces in a way that contributes to a healthy city (e.g. biodiversity and nature).
- In 2050 the public sector is a ‘value-ment’ (‘waardeschap’); this new governance (‘tussenheid’) is situated in the midst of society to maximise meaning for and with citizens.

3

Towards a circular water region

In 2050, the municipality of Eindhoven and the water board (‘Waterschap De Dommel’) value sustainability. That means a circular water region in Eindhoven, drinking water usage, waste water, the mining of raw materials, and energy from waste water.

To reach this aim, we need a deep understanding of new technology for water treatment, water usage, circular water systems and re-use of raw materials. Investments in new technologies are high, and we aim to optimise their use in the circular water region Eindhoven. At the same time, we want to make sure our investments in new technologies are future-proof.

Strategic ambitions

- In 2050 all meaningful elements from waste water will be reused (energy and raw materials).
- In 2050 the mining of raw materials and energy from waste water will be optimised.

Creating the visual of the desired future scenarios

VISION DEVELOPMENT

SMART URBAN SPACES

Vision development

The aim of Step 2 is to develop visions for the cities on the selected focus areas. A vision is based on a long-term perspective on the world — in this case we are focusing on 2050. Two main activities take place in this step: Future Telling research and the development of the desired future scenarios in the cities.

Future Telling

The first part of the vision development activity is to identify Drivers for Change that influence the future of Smart Cities in general, as well as of Smart Buildings, Smart Mobility and Smart Urban Spaces in particular. The Future Telling research method develops context-related possible future scenarios in a creative and imaginative way and leads to Drivers for Change for liveable Smart Cities in 2050.

The method is briefly described on the following pages and more elaborate in the Future Telling 2050 D2.1 Report — Drivers for Change.

Developing desired future scenario's

Of the 18 Drivers for Change for Smart and Sustainable Cities, the cities chose four Drivers for Change for each focus area that relate best to their specific contexts and ambitions.

Together with the ambitions of step 1, these are used to develop the desired future scenarios for the focus areas.

Scenario Workshops

The desired future scenarios for the selected focus areas of the cities are created in a series of workshops held in each of the partner cities. These Scenario Workshops consist of a 3-day programme in each city, and include sessions with policy-makers and stakeholders to develop a rich, contextual scenario for the city. Local stakeholders (companies, citizens, public and private organisations and knowledge institutes) are invited to take part in the workshops through the networks in the cities. The results of the Scenario Workshops are reported in the same format for each city to facilitate cross-learning between the cities.

Two sessions are held for each focus area. In the morning session the outline for the vision and the desired future scenario is developed. The main stakeholders work with the set ambition for the focus area and the selected Drivers for Change to understand their impact on the city in 2050. Together, the participants define the main elements of the vision. Then, in the afternoon session, a broad spectrum of stakeholders are invited to enrich the desired future scenario by making specific additions. Based on the outlined vision, they carry out a further in-depth exploration of the main elements of the vision. In all the sessions, the participants interactively build a visualisation of the desired future scenario. See also the pictures of the workshops on the previous page.

The result of the vision development step is a visualisation of the desired future scenario in an A0-format poster. The poster shows the visual together with a brief explanatory text. A common visual language is used to make sharing easier and to facilitate discussion among the cities on common and specific aspects of the visions.

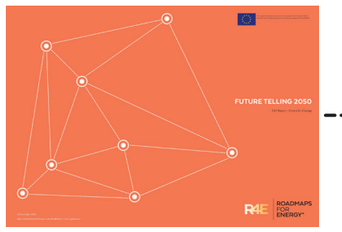
Joint Vision Workshop

In a joint meeting in Istanbul the cities presented their desired future scenarios to each other, and held in-depth discussions to understand the common and specific needs in their visions.

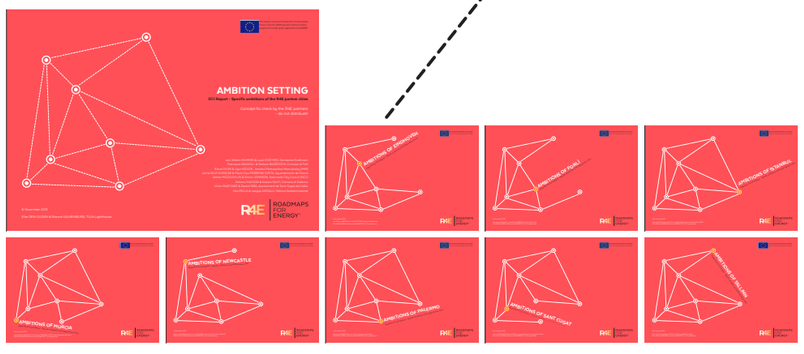
This Joint Vision Workshop served two purposes:

- To enable cross-city learning. The cities gain a deeper understanding of the vision development process, enabling them to improve their own vision with inspiration from others.
- To describe the needs as input for the roadmapping step.

The Joint Vision Workshop finalised the activities of Step 2 and prepared for Step 3.



Future Telling 2050 - D2.1 report - Drivers for Change



Ambition Setting - D1.1 report - Specific ambitions of the R4E partner cities

City scenario workshops

Day 1 - Focus area 1	Day 2 - Focus area 2	Day 3 - Reporting
Outlining the vision • Exploring the drivers for change in relation to the future of the city • Selecting the main elements of the vision	**Outlining the vision** • Exploring the drivers for change in relation to the future of the city • Selecting the main elements of the vision	Project team working session to prepare the report of the Scenario Workshop
Enriching the desired future scenario • Exploring the future the city and the main elements of the vision • Enriching the vision with specific additions	**Enriching the desired future scenario** • Exploring the future of the city and the main elements of the vision • Enriching the vision with specific additions	

Programme of the scenario workshops in the cities

Day 1 Finalising Step 2	**Poster exhibition of the city visions** • The cities share their desired future scenarios for the focus areas
	Learning from each other's visions • In-depth discussion on common and specific needs described in the visions
Day 2 Preparing for Step 3	**Presentation of the Roadmapping process** • Sharing of interim results of the roadmapping desk study
	Identifying topics and experts for the roadmap interviews • Selecting topics for the roadmapping interviews and making a list of suggested experts using the networks of all partners

Programme of the Joint Vision Workshop

R4E ROADMAPS FOR ENERGY

Governments are increasingly withdrawing their control. Citizens are taking more responsibility and initiatives; both now innovate together.
39
Each individual is provided with personal space to develop uniquely and is suitably challenged in both their study and professional lives.
32
33
34
36
In the expanding on and off-line social networks, people search for authenticity, economy of scale and a sense of security.
35
People are living longer.
Medical knowledge is a commodity where
professionals are
control over its use
DO

Future Telling & selection drivers for change

SMART URBAN SPACES

Future Telling research

The future is unpredictable and elusive. Recent changes in technology, ecology, economics and society have already led to significant changes.

The expectation is that the complexity that people and organisations experience will only increase further in the years ahead. A number of current Drivers for Change will lead to radical changes in the future. For example, new developments in information technology will create opportunities that we cannot imagine today. These will undoubtedly change our lives significantly, including the way we shop, travel, move, communicate and work. Another example is the increasing level of social connectivity, which will drastically affect the relationships between organisations and their strategies. Even today, disruptive developments in many areas are challenging us to redesign our world.

This constant process of change has also become more complex: developments are so rapid that the future is unpredictable, based on our knowledge and models of the past and present. Predictions based on analysis appear pointless. The new complexity is characterised by simultaneous developments with far-reaching effects. We need a new way to visualise the future, with all the opportunities and challenges that it will bring – an approach that is creative, imaginative and research-oriented. Even though we can't predict the future, we can create a range of possible context-related future scenarios. These desired scenarios will direct our decision-making, from short-term actions to long-term consequences.

In the R4E project, the Future Telling research method is used to develop possible, context-related future scenarios in a creative, imaginative way. This implies a structured method to map the expertise and ideas of the thought leaders. The process focuses on Smart Cities, in particular using analysis to gain insight into the Drivers for Change for cities in 2050.

Thought leaders

Finding suitable Drivers for Change requires both broad and specialist views. The research involves 25 interviews with thought leaders holding different views on smart and sustainable energy in cities. A broad spectrum of experts with a visionary scope was chosen from knowledge institutes, companies, consultancies and profit or non profit organisations. Their expertise was both general on (smart) cities, and specific on mobility, buildings and urban spaces.

To overcome possible cultural bias, the experts were drawn from all over Europe, and even included thought leaders from the USA. These thought leaders are introduced on the following pages. For the interviews, the requested expertise of the thought leaders was not specifically their future vision, but their knowledge of important influences in their own fields. The Future Telling method inspired them to use their knowledge to visualise future trends and to describe possible future scenarios in rich stories. In fact, the richness of those stories makes them fertile input for the R4E project.

Future Telling card set

The Future Telling method uses a set of 52 cards showing general future trends derived from an extensive research project by The Hague University of Applied Sciences. The cards are shown on the previous page. They are used to trigger ideas by the research participants, and to inspire them to tell rich stories about how they think these trends will influence the future.

Structured interviews

The Future Telling card set is used in the interview. The interviewees are asked to identify relevant future trends and to tell stories about how they imagine these trends could develop.

The card set with a broad collection of general trends helps in the interviews with specialists by making them consider all the relevant directions (social, technological, economic, ecological, political and demographic), and at the same time to consider more distant future scenarios. The trends that are presented on the cards trigger their thinking, and inspires them to give rich descriptions of how they see the future developing in relation to energy in cities in 2050.

The interviews contain three main questions:

1. Sort the 52 trends on the cards into three categories:
   - Not relevant in the context of smart and sustainable energy in cities
   - Already relevant now
   - Relevant in the future

2. Take the selected cards in the category 'relevant in the future' and pick the 10 cards that in your opinion will have the greatest impact on quality of life (or lack of it) in cities in the context of smart and sustainable energy. (The interviewees can also add missing trends which they regard as important.)

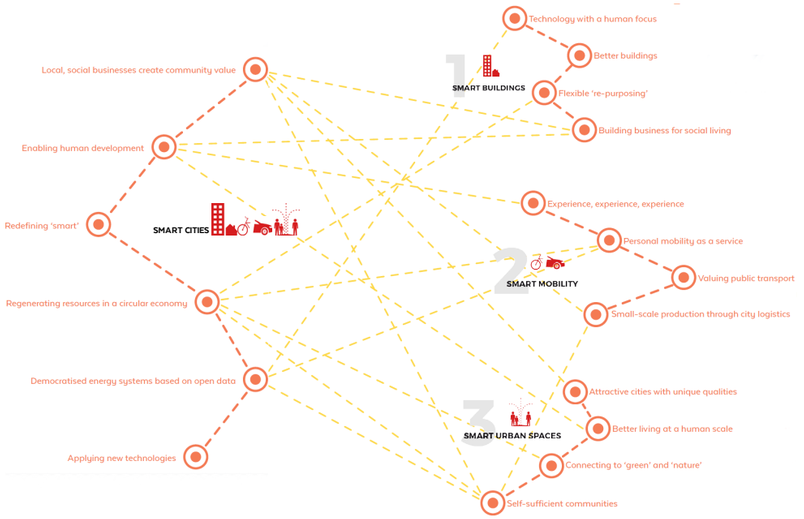
3. Tell stories about how you imagine these 10 trends will develop and what the future in cities will look like.

Drivers for Change

A limited yet representative number of Drivers for Change are distilled from the large volume of expert material. In this phase, the data from the interviews is analysed by means of clustering, selecting and comparing the quotes by the thought leaders. The clustering is based on both commonalities and contradictions in the statements by the experts on the specific topics.

A Driver for Change needs to address the topic of a cluster, as well as to point in the directions that the future might take. So for each cluster, a short title and a description are given to capture the richness of that cluster. The quotes by the though leaders serve as an inspiration to paint richer stories of the possible new future scenarios.

The analysis led to 18 Drivers for Change for the future of sustainable and liveable cities in 2050. We identified Drivers for Change at the general and smart city levels, as well as more specific Drivers for Change for the future of buildings, mobility and urban spaces.



18 Drivers for Change resulted from the Future Telling research

For an complete description, please refer to the complete report on Future Telling 2050 - D2.1 report Drivers for Change.

Selection of Drivers for Change

For the focus area Smart Urban Spaces, the city of Eindhoven selected four Drivers for Change:

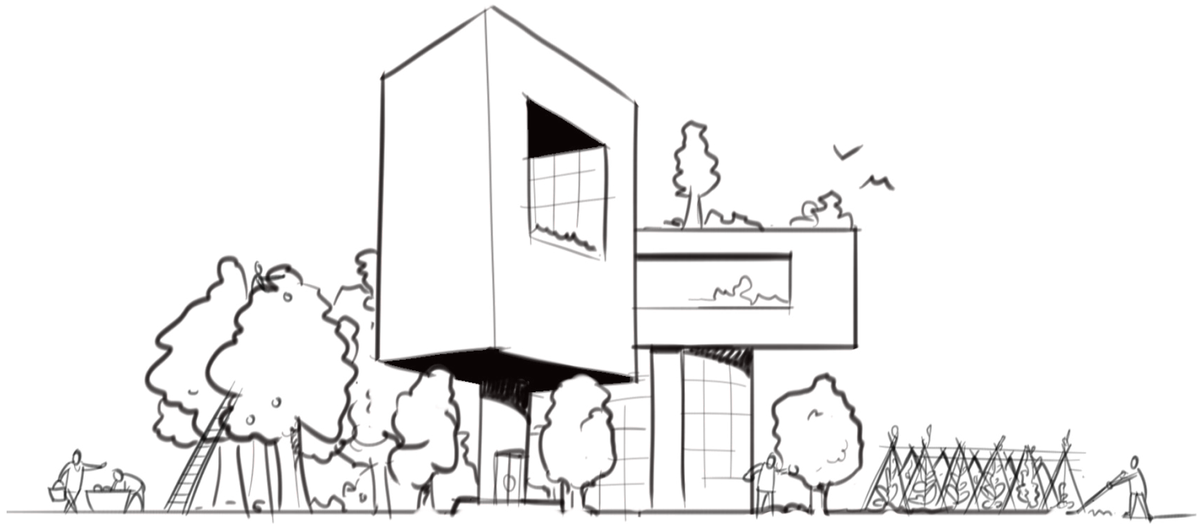
- Connecting to 'green' and 'nature'
- Better living at a human scale
- Regenerating resources in a circular economy
- Applying new technologies

The following pages give brief descriptions of the chosen Drivers for Change, stating the essence of the changes. These are supported by a few quotes from the experts.

EINDHOVEN

Connecting to ‘green’ and ‘nature’

In 2050, people’s need for ‘green’ and ‘nature’ is met by well-connected green spaces and landscapes all over the city. Soft birdsong and other nature sounds add an intangible quality and sense of well-being. Urban farming increases regeneration of resources, creating fresh, healthy foods, reconnecting with nature and mobilising local communities. People are aware of the effect of their living environment on health and well-being, and push for cleaner technologies. Advanced systems allow control of micro-climates, contributing to more resilient cities.



This Driver for Change represents the following clusters of quotes of the thought leaders:

a. Caring for nature
b. Urban farming to enable healthy and happy living
c. Improving the environment

FT8.10. … I do think that regardless about how we think about national boundaries or local boundaries, regardless about how technology is improving our day to day life and the access to energy and food and etcetera, I think that at the end of the day humans are animals. That there is something that we deeply need, that is met by green space, that is met by quiet sound and birds dripping, there is this very intangible effect that that kind of peacefulness has on peoples well being, physical and mental.

FT23.16. … – if you read Pope Francis papal encyclical, it starts with “the global eco reconciliation”. It is fantastic. Because the ecology has a big consequence in social impact in agricultures and politics. And it is said by the Pope, who would have thought about this? … Now is the time of reconciliation, because people want to live in cities together with nature, and not just buildings. So maybe smaller cities have now a great opportunity, because agriculture is inside the cities. .. So there lies an opportunity to optimise the relation between buildings and nature, and that may help with our energy problems and social problems. Maybe it is as simple as that. We should not make it more complicated. It can be this simple. …

FT15.07. The other big change we will see is around the urban farming concepts. By 2020 80% of the world population lives in an urban environment. It will become more and more important to grow the food close to where it is going to be consumed. …

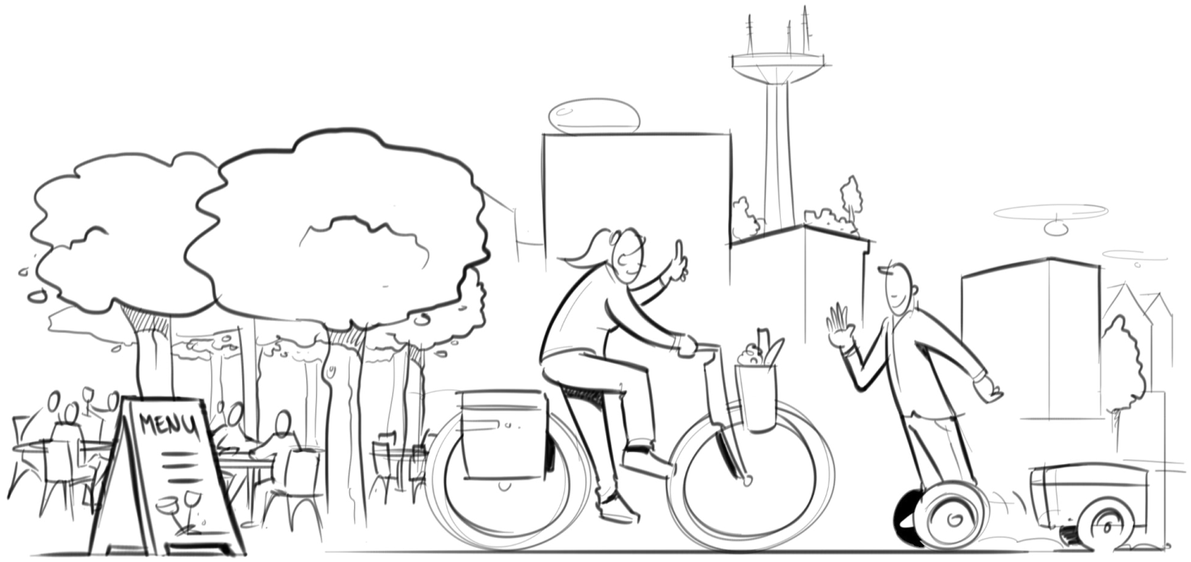
FT15.18. It will increasingly become very important for people that live in an urban environment to feel that they are actually consuming a freshly produced food. The urban farming concept with the growing vegetables and the fish is almost circular, since the fish help grow the vegetables and they can eat the waste vegetable products again. So you grow fish to feed them, to grow the vegetables, and you feed the waste vegetable back in to the fish. And then you sell the fish with the vegetables. You capture the CO2 in the building and feed that into the greenhouse because it needs CO2 to grow. …

FT6.02. For example if you look at a healthy city, from e.g. minimising the risk of industrial and traffic emissions, better technology will lead to clean vehicles, clean industry. With respect to air pollution, noise pollution, etcetera, emissions will greatly decrease and therefore increase the quality of living in an urban area. That will not happen automatically, we have a quite strong technocratic steering principle in that classical environmental hygiene type of policy. So there is quite a lot of technology in that area.

FT5.09. Maybe the government will manage all the things from the space. For example right now the US implemented a laser gun and in my imagination after a while they will control everything from the space. We are able to control the weather and the rains. And this will be together with the global water supply.

Better living at a human scale

In 2050, urban systems and spaces are designed on a human scale. Everyday activities are within walking or cycling distance. Communal spaces strengthen social cohesion, giving people the freedom to follow the activities they value most. The city offers an excellent living environment in the European tradition, merging high-quality urban space with nature, culture, the economy and social coherence. Good living means enjoying time with friends, and social life is further supported by availability of public devices in communal space. These enable new forms of communicating, blending the virtual and real worlds in these areas.



This Driver for Change represents the following clusters of quotes of the thought leaders:

a. Respecting human scale in design of urban systems and spaces
b. Safeguarding the European quality of cities and living
c. Public devices

FT4.11. … On the one hand the world is a global village, we travel all over the world. And at the same time you see that young people try to reorganise their daily life smaller and smaller, because it enables them to have a better quality of life. Spatially it is a very interesting topic of how you can accommodate that by not just focussing on the region, the nation and international networks. The only ones that matter if you talk about mobility and quality of life and the attractiveness of location when you settle, but also this daily urban system and the human scale and the walk-ability and bike ability of it is increasingly important. And especially how the two connect to each other.

FT25.07. … the life cycles will change, so a childhood will not be what it is today. Much of this also depends on pubic space. If public space becomes safer, maybe because of automation and so forth, our children will be more autonomous and will be able to develop skills that we think will be important in the future: like empathy, taking responsibility and taking action, and becoming leaders.

FT10.07. There are studies about luxury, and how people perceive what is luxury in different countries. … also spending time in the most pleasant ways. And then you come to our hemispheres. … time with your friends, and having a good time. That could be related to travelling, and also to where you live and how you live. The area, or region or the surroundings is luxury. So you have pleasant and less pleasant surroundings.

FT4.02. … The relaxed quality of life that lots of foreign people see in the Netherlands has a lot to do with the special quality of the place, which is that it is much more urbanised landscape, fusing all kinds of qualities, not replacing one for another. …. In its aggregation of functions, in its aggregation of social networks, of economies, it is able to compete with a metropolis, but it has a fundamentally different quality in terms of place and life. In the sense that there is much more balance between the green and the red, between the old and new, between the big scale and the small scale, etcetera.

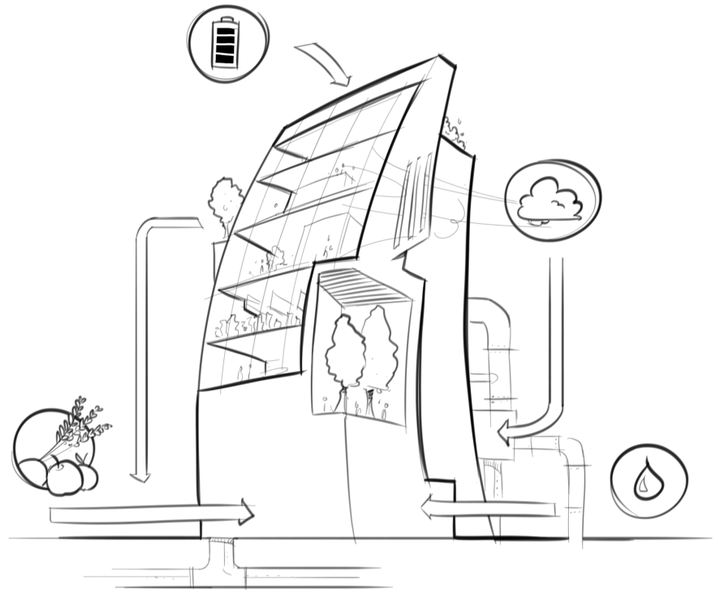
FT23.12. There is not one solution, not one green city. It is all about looking at the context, look at the resources and think about living in a better city. …

FT20.16. The relation between the virtual and the real world. In cities people are much more physical close that in other areas. … In my future scenario people will have emancipated themselves from their own iPhones and tablets. And I think the virtual world will be much more integrated in public spaces and in city spaces. That is not so much “bring your own device”, but it is “use the cities’ device”. … a new way of communicating in public space. I cannot tell what it will exactly be …

EINDHOVEN

Regenerating resources in a circular economy

In 2050, the circular economy ensures self-sufficiency of cities. Renewable energy is abundant, and this ensures a secure supply of vital resources for life (energy, water, food and clean air), although other resources may still be scarce. Cities have implemented circular systems to regenerate all the resources needed by their populations. These mechanisms are based on small-scale, local solutions, enabled by changed decision-making levels.



This Driver for Change represents the following clusters of quotes of the thought leaders:

a. Self-sufficiency based on an abundance of renewable sources and storage solutions
b. Regenerative cities with circular systems for all relevant resources
c. Securing supply of food, water & clean air

FT3.08. Abundance of energy is really foreseeable in the future, also of other resources, maybe even water. We will have energy producing houses, energy producing green houses, energy producing cars with solar rooftops etc. This will have a big impact.

FT16.13. I see the development of renewable energy too. Not only in generation, but also in biogas. We have made some analysis and we think if we can produce biogas from 100% of the green waste in a city being from homes, from schools, from restaurants, from city gardening, from supermarkets, we are able to produce enough biogas to feed all the buses and all the waste collecting trucks with that. It is still expenses, and now more expensive than filling them with fuel. So as long as we accept the emissions, nothing will change, but in the end we have to. ...

FT15.1. In the not too distant future, so by 2050 we'll have a scenario where there will probably be four commodities as we will see it. Nowadays we've got electricity, gas and water. I think air quality will become something we have to pay for. One of these days we will have to pay for clean air.

FT24.01 We do everything to bring renewable energy better into the grid, by using smart grid technology.... As soon as we have this abundance of energy – either renewable energy or nuclear fusion for example – then we still need a smart grid to put the energy to the grid, but we don't need to worry about saving energy by all means. ...

FT21.14. My vision for a city, for the 'ecopolis', or the regenerative city, is a city that basically has all mechanisms to regenerate the resources that are absorbed by the people who live in the city. Be it the materials, the food, be it the energy, the air that they breathe. And if this principle of regeneration becomes the guiding principle for designing cities, then we will come to this ecopolis. Where you have lots of green spaces to regenerate the air. Maybe some kind of urban farming places. Maybe we see skyscrapers that are not just for offices that remain empty, but that have some kind of food production, that host people, and that are some kind of a sustainable system in themselves, generating the energy. It is actually a very liveable place.

FT17.06. The new game-changing technologies will be more probably in the field of materials. It will totally change the way we make things, and the way we actually can reuse the material. ... It will be more like material engineering, things can be programmed, there is no trash, because you can reprogram the material and turn a computer into a car, just with new code. ...

FT21.4. Major issues, like food, production and water supply are regulated and organised on a global scale. That is already relevant now, but it is definitely one of the future trends. ...

FT21.19. For water I give a concrete example. It is about regenerating the resources. If you look how in some cities water and sewage is treated, ... Treating our sewage or water system in a way that regenerates the resources and nutrition makes a lot of sense to me. ... It is an important factor to start to separate those immediately to be in a position to much easier reuse it, than it gets all mixed up in what we call black water. I think that is still on a very low developed level unfortunately. We had somebody in our expert group, who has proposals for the separation of our sewage and regaining nutrition and bring them back to the agricultural system. That makes a lot of sense when it comes to regeneration. ...

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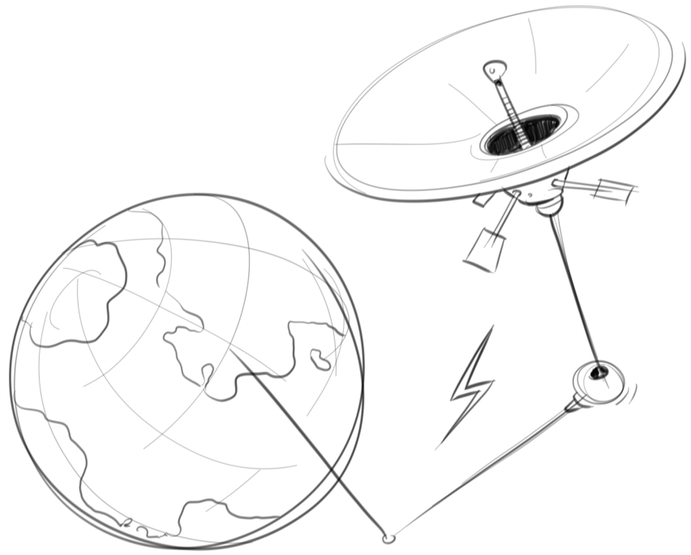
Applying new technologies

In 2050, a range of new technologies are available and affordable. Some of them are already in development, others are still unknown. Cities apply those technologies in new solutions that contribute to the quality of life, and in particular to the creation of smart buildings, smart mobility and smart urban spaces.



This Driver for Change represents the following cluster of quotes of the thought leaders:

a. Applying new technological solutions to increase quality of life in cities

FT7.17. There is another trend that is now not included: in 2050 humanity has moved into space. We will have much more activity in space, on the moon, on asteroids. ... When we succeed to harvest energy in space and beam it to earth it will be a revolution.

FT2.15. We will have our first test satellite up with solar power in 2017. We might be able to have the worlds first beaming of solar energy from space.

FT5.01. In 2050 I imagine that they are looking for the new world in space, out of our world. ...and maybe, if we will create a much better world than this one, there will be no-one left on this planet.

FT8.11. ...Technology will make diseases extinct. ... To be honest I do not know how feasible this is by 2050, surely aids, maybe not distinct, but under control. But if the key could be unlocked, for cancer for instance, I think this would have a huge impact on people's lives. Also because we will be getting older, so the more that you can cut out these kind of things would contribute to premature deaths, but also having an impact on the quality of live ...

FT10.13. ... I am not saying that by 2050 we will have an infinite amount of energy, but we will have so much that we can consider things like the 'beam-me-up-Scotty' type of stuff or space travelling.

FT5.07. ... Technology will enter all kinds of fields and disciplines, so this will happen everywhere.

FT2.12. Maybe the sweet spot is fabrication in the city, in vertical farms or whatever, 3D printing food. If I want a cup of coffee, I'll print the cup. The table will be a 3D printer, printing up my cup. One of the divisions in Carnegie University has a project on programmable matter. At the moment they are little units, but their idea is to have them at micrometre scale, where the particles are basically magnets, they change colour, they've got behavioural autonomy and swarm collective intelligence. It is basically very fine dust that can take form and shapes and lock into. It may sound as fantasy now, but this sort of thing will be there in 2050. ...

FT15.06. Today all buildings have an AC grid (alternating current), some today have a DC grid (direct current). By 2050 there will be DC grids. The majority of the assets in the buildings will be DC.

Creating the visual of the desired future scenarios

SMART URBAN SPACES

EINDHOVEN

SAFE AND PLEASANT LIVING IN EINDHOVEN 2050

In 2050, the city's 'green and blue' spaces provide a safe and pleasant living environment for the citizens of the Eindhoven region.

A high quality of life is achieved by integrated physical planning to create a resilient region by strengthening the interdependencies between 'blue' (water), 'green' (flora), 'grey' (pavement) and 'red' (buildings).

Citizens, public and private parties jointly take care of private and public spaces to create a safe, pleasant and healthy living environment. People are aware of the value of the interplay between the built environment and nature. They adopt healthy lifestyles and behaviour, through which they also contribute to their surroundings.

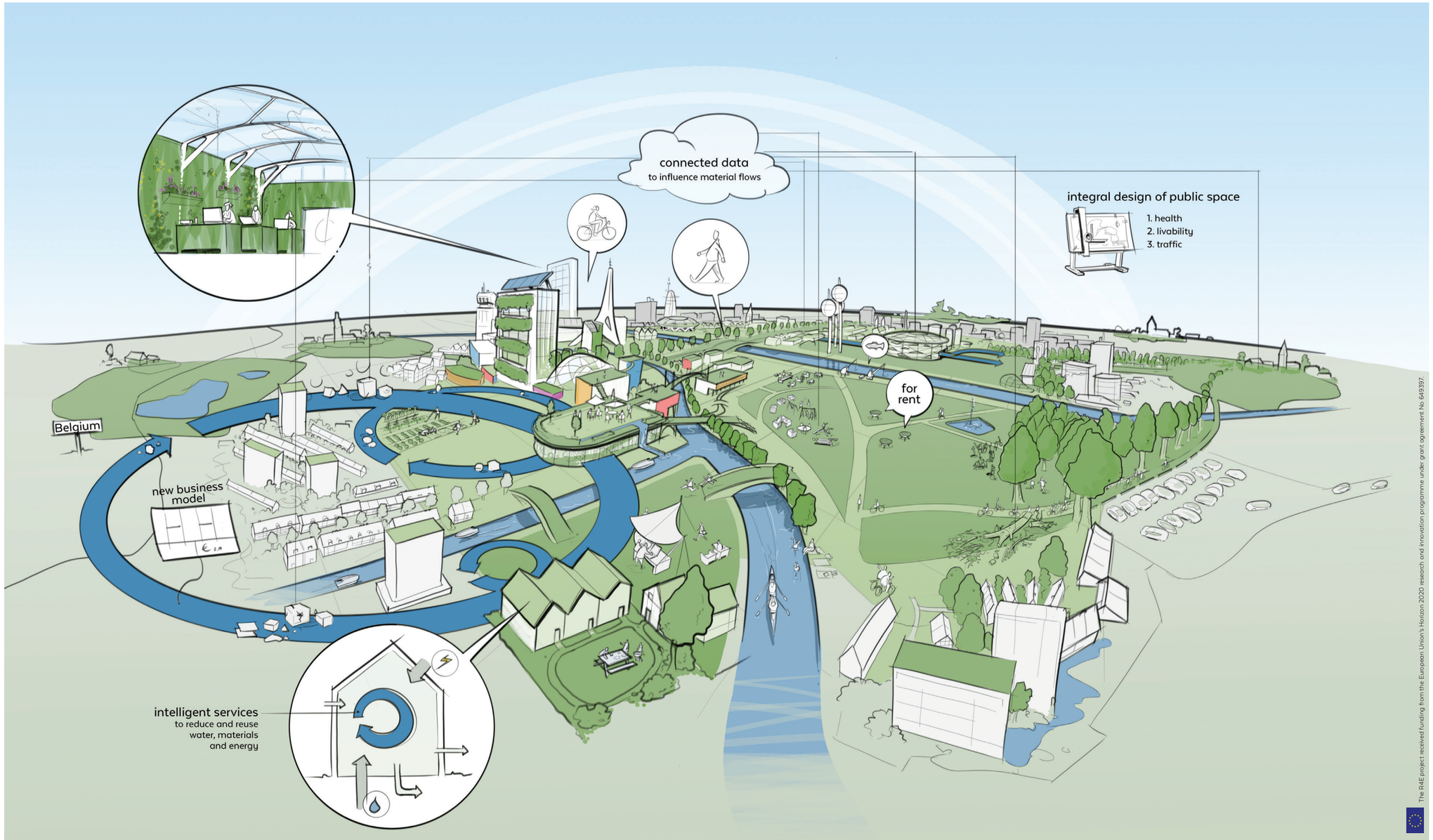
The region enjoys clean and safe water and green spaces that can be used actively for recreation (e.g. swimming, fishing) as well as to supply food (urban farming).

All meaningful resources are reused, thanks to circular systems on different scales.

The region values:

- **a safe living environment** that is resilient to the changing climate through the smart use of solutions on the appropriate scale;
- **a healthy living environment** with extensive 'green and blue' areas that support social activities and healthy lifestyles;
- **a circular water system** that provides sustainable re-use of water, materials and energy.

Elements of the desired future scenario are:



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

Active use of 'green and blue' spaces

People use public spaces actively for social interaction, working and leisure activities. Spaces are attractive in all seasons, and are accessible for all. The diversity of the spaces in the city and surrounding villages, and the flexibility in their use cater for different and changing needs and wishes. Smart use of spaces serves many different goals,with plenty of room for flora and fauna. Synergy between urban and rural areas is strong.

Human-scale design to promote sustainable living

People find everything they need for their daily living in their direct surroundings. The region is designed to encourage social interactions and sustainable lifestyles. People value the effects on their health and well-being, and spread the adoption of good lifestyles through social activities. The city and region provide an ideal environment for companies and start-ups with sustainable and healthy core-businesses.

Connected, integrated 'green and blue'

The region values well connected 'green and blue' spaces to strengthen climate resilience. The boundaries between public and private green areas are blurred, and people actively add green to roofs, gardens, squares and parks and make them accessible. Interconnected water systems reduce the risks of flooding and heat stress. Citizens' initiatives are valued, and are facilitated and encouraged by regulations.

Circular solutions on the right scale

The region uses circular systems at different levels to maximise re-use of water, materials and energy. Intelligent systems at the levels of homes, neighbourhoods, city and region are interconnected to balance demand and supply. Citizens use applications and sensors to monitor the quality of their water, food and environment, and contribute to its improvement. New technologies are used to make the systems intelligent.

New business and investment models

Public spaces are always freely accessible, and new business models are explored to provide added-value services. Decisions are based on an integrated view of value (economic, social, cultural and other) in both the short and long term. This 'Euro 2.0' approach enables new business with services in the public domain that create value for society at large as well as for individual citizens and enables investments in infrastructure.

Version 15 June 2016

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R4E ROADMAPS FOR ENERGY®

EINDHOVEN

ROADMAPPING

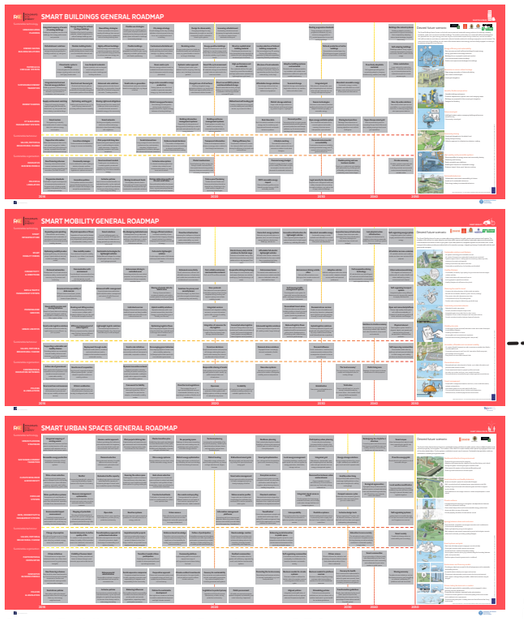
SMART URBAN SPACES

Roadmapping

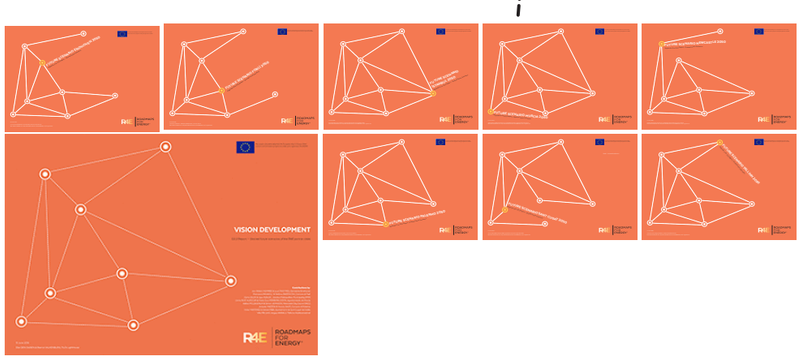
The aim of Step 3 is to develop specific roadmaps for the cities in the selected focus areas. A roadmap shows all existing and future technologies and other relevant developments that enable the achievement of the desired future scenarios by 2050. Two main activities take place in this step. Firstly, the roadmapping research to define the general roadmaps. Secondly, the definition of milestones for the years 2020 and 2030, and local solutions and research projects to create city-specific roadmaps.

General roadmaps

Desk studies and expert interviews are conducted to collect input for the roadmaps. The roadmaps explore the options to achieve the cities' desired future scenarios. The resulting General Roadmaps for Smart Buildings, Smart Mobility and Smart Urban Spaces provide input for the city-specific roadmaps.



Smart Buildings General Roadmap - D3.2 report,
Smart Mobility General Roadmap - D4.2 report,
Smart Urban Spaces General Roadmap - D5.2 report



Vision Development - D2.2 report - Desired future scenarios of the R4E partner cities

Roadmap Workshops

The city-specific roadmaps are created in a series of workshops held in each of the partner cities. These Roadmap Workshops consist of programmes with three sessions in each city.

In the first session, the policy-makers and city representatives select the topics from the general roadmaps as focus for the city-specific roadmap. This choice is based on their specific ambitions and context. They also define intermediate milestones for 2020 and 2030 on the path to their desired future scenarios.

Then, for each of the focus areas, local stakeholders (companies, citizens, public and private organisations and knowledge institutes) are invited to take part in the roadmapping sessions. With all the available knowledge of potential developments and the given focus of the city, the local stakeholders generate project proposals for (local) solutions and research proposals, as a first step towards the project portfolio. See also the pictures of the workshops on the previous page.

The results of the Roadmap Workshops are reported in the same format for each of the cities, facilitating cross-learning between the cities.

City roadmap workshops	Focus and milestones	Focus area 1	Focus area 2
	Making choices for the focus and intermediate milestones in the city specific roadmap to realise the Desired Future Scenarios for the two focus areas.	**Completing the roadmap** • Identifying (local) solutions and research projects needed to reach the city's desired future scenario • Reflecting on results and identifying missing solutions and research projects	**Completing the roadmap** • Identifying (local) solutions and research projects needed to reach the city's desired future scenario • Reflecting on results and identifying missing solutions and research projects

Programme of the roadmap workshops in the cities

Joint Roadmap Workshop

In a joint meeting in Newcastle, the cities presented their city-specific roadmap enriched with current projects and proposals for new projects, and held in-depth discussions to understand the common and specific learning objectives and opportunities for joint projects. The Joint Roadmap Workshop served two purposes:

- To enable cross-city learning. The cities gain a deeper understanding of the roadmapping process, and can improve their own roadmaps with inspiration from others.
- To describe the common learning ambitions as input for the Project Portfolio step.

The Joint Roadmap Workshop finalised the activities of Step 3 and prepared for Step 4, in which the project portfolio will be further developed.

Day 1 Finalising Step 3	Learning from each other • Presentation of current projects and proposals for new projects • Gaining understanding of the current strengths and challenges of the R4E partner cities
Day 2 Preparing for Step 4	Identifying cross-city learning objectives • Selecting common ambitions • Formulating cross-city learning objectives as input for the Project Portfolio step

Programme of the Joint Roadmap Workshop

R4E ROADMAPS FOR ENERGY

EINDHOVEN

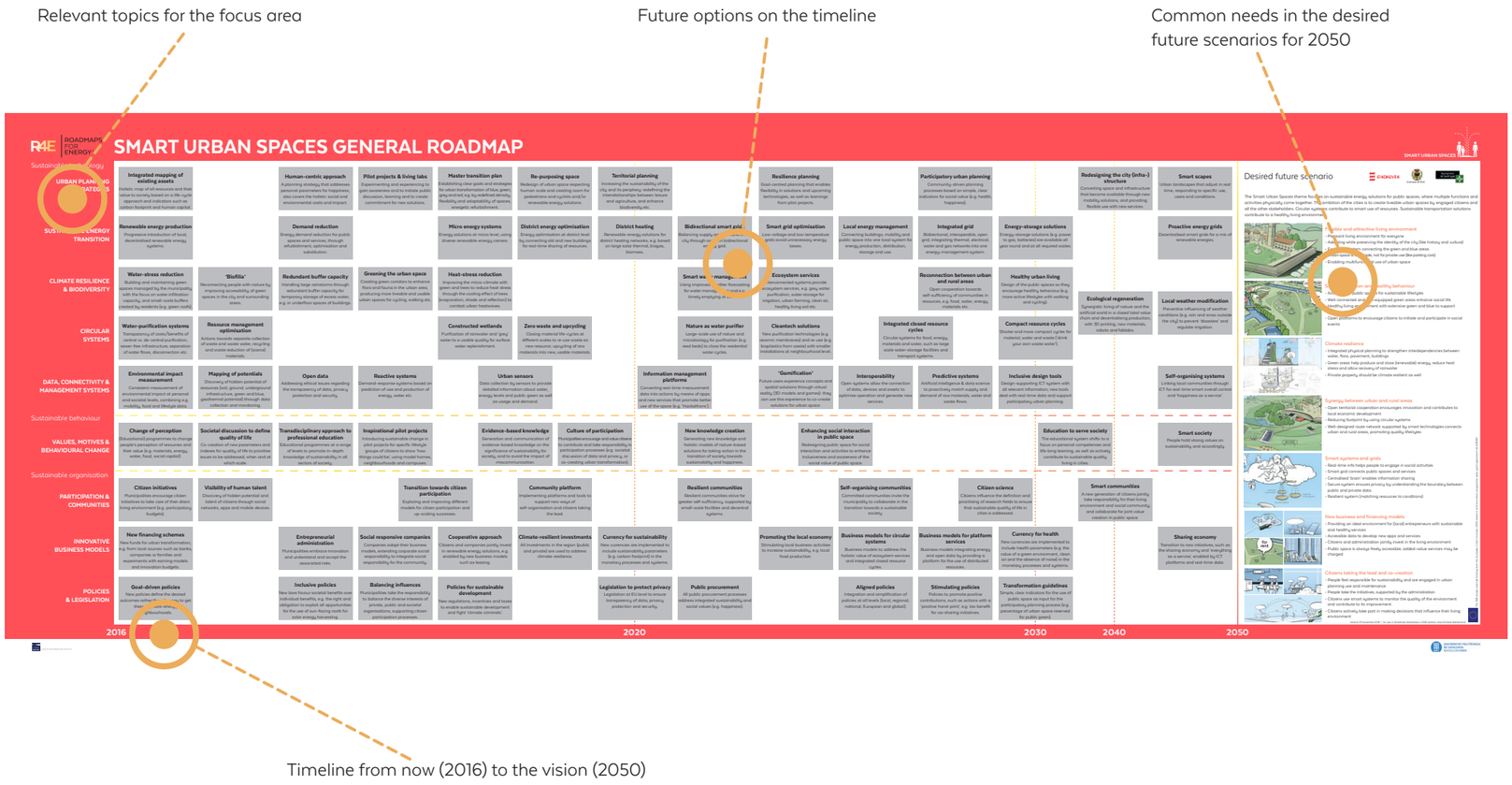
How to read the general roadmap

The resulting General Roadmap contains four important elements:

- The timeline 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 the focus area on which developments are required to achieve the desired future scenarios. These topics cover sustainable technologies, sustainable behaviour and sustainable organisations.
- The options that will become available in the short or longer term for each of the topics.

Each topic has a timeline showing the developments that are relevant to that topic.

The image shows the elements of the General Roadmap.



Elements of the Smart Urban Spaces General Roadmap

Relevant topics Smart Urban Spaces

SMART URBAN SPACES

The generic roadmap shows timelines for the topics requiring developments to achieve the desired future scenario in 2050. The selected topics for the Roadmap Smart Urban Spaces are described briefly here.

Sustainable technologies

The first element needed to achieve the sustainable energy ambitions is the availability of sustainable technologies. A wide range of sustainable technologies is already available, and new technologies are constantly being developed. But unfortunately there is not always a consensus on the best option for the future. The Roadmap Smart Urban Spaces technology includes the following developments:

URBAN PLANNING STRATEGIES

Urban Planning Strategies is about 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, ultimately resulting in proactive energy grids. The topic includes solutions at district and city levels through smart grids and developments towards integrated local energy systems on a range of scales.

CLIMATE RESILIENCE & BIODIVERSITY

Climate Resilience & Biodiversity is about how a holistic ecological regeneration of cities can be achieved in terms of green, water and microclimate, leading ultimately to healthier urban living. The topic refers to the necessary reconnection of people and nature, and how to reach healthier living environments. These will be achieved 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

Data, Connectivity & Management Systems 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, as well as sensor networks and information management, and interoperability of systems.

Sustainable behaviour

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

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 these can be modified and updated as necessary. The Roadmap Smart Urban Spaces includes the following organisational developments:

PARTICIPATION & COMMUNITIES

Participation & Communities is about how citizen participation will be organised to make them take joint responsibility for their living environment and 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

Policies & Legislation is about the role of policy in supporting transformation processes through clear guidelines and regulations. It includes regulations, incentives and taxation 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 city specific roadmap

The general roadmap describes the developments on a timeline, indicating when experts estimate that those development will be broadly available. For the cities to create their specific roadmaps, they were asked to focus on the topics that are most relevant for them to reach their own desired future scenarios. The cities create milestones for 2020 and 2030, describing what they will look like when their own developments and city projects have evolved. In this way each city can indicate the focus and pace that it will need to achieve. Projects can then be proposed on this basis to define (local) solutions or research leading to further realisation of the roadmap.

R4E ROADMAPS FOR ENERGY®

SMART URBAN SPACES GENERAL ROADMAP

Sustainable technology

URBAN PLANNING STRATEGIES

Integrated mapping of existing assets
Holistic map of all resources and their value to society based on a life-cycle approach and indicators such as carbon footprint and human capital.

Human-centric approach
A planning strategy that addresses personal parameters for happiness; also covers the holistic social and environmental costs and impact.

Pilot projects & living labs
Experimenting and experiencing to gain awareness and to initiate public discussion, learning and to create commitment for new solutions.

Master transition plan
Establishing clear goals and strategies for urban transformation of blue, green, grey and red, e.g. by redefined density, flexibility and adaptability of spaces, energetic refurbishment.

Re-purposing space
Redesign of urban space respecting human scale and creating room for pedestrians and cyclists and/or renewable energy solutions.

Territorial planning
Increasing the sustainability of the city and its periphery: redefining the interrelationships between leisure and agriculture, and enhance biodiversity etc.

SUSTAINABLE ENERGY TRANSITION

Renewable energy production
Progressive introduction of local, decentralised renewable energy systems.

Demand reduction
Energy demand reduction for public spaces and services, through refurbishment, optimisation and substitution.

Micro energy systems
Energy solutions at micro level, using diverse renewable-energy carriers.

District energy optimisation
Energy optimisation at district level by connecting old and new buildings for real-time sharing of resources.

District heating
Renewable-energy solutions for district heating networks, e.g. based on large solar thermal, biogas, biomass.

Bidirectional smart grids
Balancing supply and demand in the city through an open bidirectional energy grid.

CLIMATE RESILIENCE & BIODIVERSITY

Water-stress reduction
Building and maintaining green spaces managed by the municipality with the focus on water infiltration capacity, and small-scale buffers created by residents (e.g. green roofs).

'Biofilia'
Reconnecting people with nature by improving accessibility of green spaces in the city and surrounding areas.

Redundant buffer capacity
Handling large rainstorms through redundant buffer capacity for temporary storage of excess water, e.g. in underfloor spaces of buildings.

Greening the urban space
Creating green corridors to enhance flora and fauna in the urban area, producing more liveable and usable urban spaces for cycling, walking etc.

Heat-stress reduction
Improving the micro-climate with green and trees to reduce heat stress through the cooling effect of trees (evaporation, shade and reflection) to combat urban heatwaves.

Smart water management
Using improved weather forecasting for water management and e.g. timely emptying of buffers.

CIRCULAR SYSTEMS

Water-purification systems
Transparancy of costs/benefits of central vs. de-central purification, sewer-free infrastructure, separation of water flows, disconnection etc.

Resource management optimisation
Actions towards separate collection of waste and waste water, recycling and waste reduction of (scarce) materials.

Constructed wetlands
Purification of rainwater and 'grey' water to a usable quality for surface water replenishment.

Zero waste and upcycling
Closing material life-cycles at different scales to re-use waste as new resource; upcycling of raw materials into new, usable materials.

Nature as water purifier
Large-scale use of nature and microbiology for purification (e.g. reed beds) to close the residential water cycles.

DATA, CONNECTIVITY & MANAGEMENT SYSTEMS

Environmental impact measurement
Consistent measurement of environmental impact at personal and societal levels, combining e.g. mobility, food and lifestyle data.

Mapping of potentials
Discovery of hidden potential of resources (soil, ground, underground infrastructure, green and blue, geothermal potential) through data collection and monitoring.

Open data
Addressing ethical issues regarding the transparency of data, privacy protection and security.

Reactive systems
Demand-response systems based on prediction of use and production of energy, water etc.

Urban sensors
Data collection by sensors to provide detailed information about water, energy levels and public green as well as usage and demand.

Information management platforms
Converting real-time measurement data into actions by means of apps and new services that promote better use of the space (e.g. 'Hackathons').

Sustainable behaviour

VALUES, MOTIVES & BEHAVIOURAL CHANGE

Change of perception
(Educational) programmes to change people's perception of resources and their value (e.g. materials, energy, water, food, social capital).

Societal discussion to define quality of life
Co-creation of new parameters and indexes for quality of life to prioritise issues to be addressed, when and at which scale.

Transdisciplinary approach to professional education
Educational programmes at a range of levels to promote in-depth knowledge of sustainability in all sectors of society.

Inspirational pilot projects
Introducing sustainable change in pilot projects for specific lifestyle groups of citizens to show 'how things could be', using model homes, neighbourhoods and campuses.

Evidence-based knowledge
Generation and communication of evidence-based knowledge on the significance of sustainability for society, and to avoid the impact of miscommunication.

Culture of participation
Municipalities encourage and value citizens to contribute and take responsibility in participation processes (e.g. societal discussion of data and privacy, or co-creating urban transformation).

New knowledge creation
Generating new knowledge and holistic models of nature-based solutions for taking action in the transition of society towards sustainability and happiness.

Sustainable organisation

PARTICIPATION & COMMUNITIES

Citizen initiatives
Municipalities encourage citizen initiatives to take care of their direct living environment (e.g. participatory budgets).

Visibility of human talent
Discovery of hidden potential and talent of citizens through social networks, apps and mobile devices.

Transition towards citizen participation
Exploring and improving different models for citizen participation and up-scaling successes.

Community platform
Implementing platforms and tools to support new ways of self-organisation and citizens taking the lead.

Resilient communities
Resilient communities strive for greater self-sufficiency, supported by small-scale facilities and decentral systems.

INNOVATIVE BUSINESS MODELS

New financing schemes
New funds for urban transformation, e.g. from local sources such as banks, companies or families and experiments with earning models and innovation budgets.

Entrepreneurial administration
Municipalities embrace innovation and understand and accept the associated risks.

Social responsive companies
Companies adapt their business models, extending corporate social responsibility to integrate social responsibility for the community.

Cooperative approach
Citizens and companies jointly invest in renewable energy solutions, e.g. enabled by new business models such as leasing.

Climate-resilient investments
All investments in the region (public and private) are used to address climate-resilience.

Currency for sustainability
New currencies are implemented to include sustainability parameters (e.g. carbon footprint) in the monetary processes and systems.

POLICIES & LEGISLATION

Goal-driven policies
New policies define the desired outcomes rather than the way to get there, e.g. zero-energy neighbourhoods.

Inclusive policies
New laws favour societal benefits over individual benefits, e.g. the right and obligation to exploit all opportunities for the use of sun-facing roofs for solar energy harvesting.

Balancing influences
Municipalities take the responsibility to balance the diverse interests of private, public and societal organisations, supporting citizen participation processes.

Policies for sustainable development
New regulations, incentives and taxes to enable sustainable development and fight 'climate criminals'.

Legislation to protect privacy
Legislation at EU level to ensure transparency of data, privacy protection and security.

Public procurement
All public procurement processes address integrated sustainability and social values (e.g. happiness).

2016 — 2020

Resilience planning
Goal-centred planning that enables flexibility in solutions and upcoming technologies, as well as learnings from pilot projects.

Participatory urban planning
Community-driven planning processes based on simple, clear indicators for social value (e.g. health, happiness).

Redesigning the city (infra-) structure
Converting space and infrastructure that become available through new mobility solutions, and providing flexible use with new services.

Smart scapes
Urban landscapes that adjust in real time, responding to specific use, users and conditions.

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.

Ecosystem services
Interconnected systems provide ecosystem services, e.g. grey water purification, water storage for irrigation, urban farming, clean air, healthy living soil etc.

Reconnection between urban and rural areas
Open cooperation towards self-sufficiency of communities in resources, e.g. food, water, energy, materials etc.

Healthy urban living
Design of the public spaces so they encourage healthy behaviour (e.g. more active lifestyles with walking and cycling).

Cleantech solutions
New purification technologies (e.g. ceramic membranes) and re-use (e.g. bioplastics from waste) with smaller installations at neighbourhood level.

Integrated closed resource cycles
Circular systems for food, energy, materials and water, such as large scale water-storage facilities and transport systems.

Compact resource cycles
Shorter and more compact cycles for material, water and waste ('drink your own waste water').

Ecological regeneration
Synergistic living of nature and the artificial world in a closed total value chain and decentralising production, with 3D printing, new materials, robots and fablabs.

Local weather modification
Preventive influencing of weather conditions (e.g. rain and snow outside the city) to prevent 'disasters' and regulate irrigation.

'Gamification'
Future users experience concepts and spatial solutions through virtual reality (3D models and games): they can use this experience to co-create solutions for urban space.

Interoperability
Open systems allow the connection of data, devices and assets to optimise 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 'happiness as a service'.

Enhancing social interaction in public space
Redesigning public space for social interaction and activities to enhance inclusiveness and awareness of the social value of public space.

Education to serve society
The educational system shifts to a focus on personal competences and life-long learning, as well as actively contribute to sustainable quality living in cities.

Smart society
People hold strong values on sustainability and accordingly.

Self-organising communities
Committed communities invite the municipality to collaborate in the transition towards a sustainable society.

Citizen science
Citizens influence the definition and prioritising of research fields to ensure that sustainable quality of life in cities is addressed.

Smart communities
A new generation of citizens jointly take responsibility for their living environment and social community, and collaborate for joint value creation in public space.

Promoting the local economy
Stimulating local business activities to increase sustainability, e.g. local food production.

Business models for circular systems
Business models to address the holistic value of ecosystem services and integrated closed resource cycles.

Business models for platform services
Business models integrating energy and open data by providing a platform for the use of distributed resources.

Currency for health
New currencies are implemented to include health parameters (e.g. the value of a green environment, clean air and the absence of noise) in the monetary processes and systems.

Sharing economy
Transition to new initiatives, such as the sharing economy and 'everything as a service', enabled by ICT platforms and real-time data.

Aligned policies
Integration and simplification of policies at all levels (local, regional, national, European and global).

Stimulating policies
Policies to promote positive contributions, such as actions with a 'positive hand-print', e.g. tax benefit for car sharing initiatives.

Transformation guidelines
Simple, clear indicators for the use of public space as input for the participatory planning process (e.g. percentage of urban space reserved for public green).

2030 2040 2050

Desired future scenario

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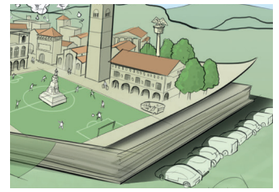
The Smart Urban Spaces theme focuses on sustainable energy solutions for public spaces, where multiple functions and activities physically come together. The ambition of the cities is to create liveable urban spaces by engaged citizens and all the other stakeholders. Circular systems contribute to smart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

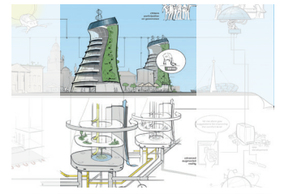


Flexible and attractive living environment

- Pleasant living environment for everyone
- 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 cars)
- Enabling multifunctional use of urban space

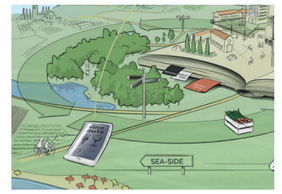
Social interaction and healthy behaviour

- 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



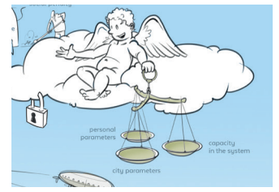
Climate resilience

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



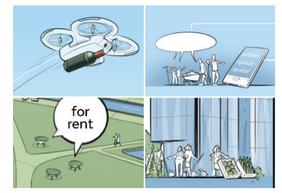
Synergy between urban and rural areas

- 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



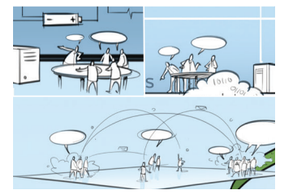
Smart systems and grids

- 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

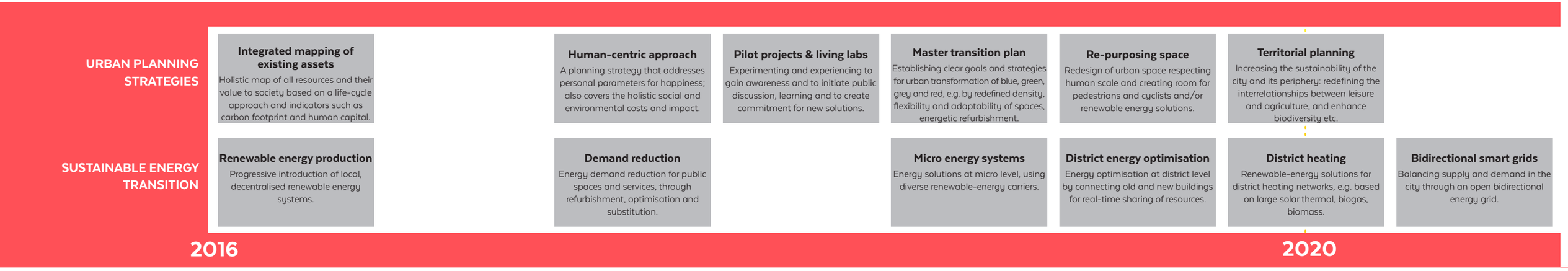
- Providing an ideal environment for (local) entrepreneurs with sustainable and healthy services
- Accessible data to develop new apps and services
- Citizens and administration jointly invest in the living environment
- Public space is always freely accessible; added-value services may be charged



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

The R4E project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 643937



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 in 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 experiment and experience 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 are 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.

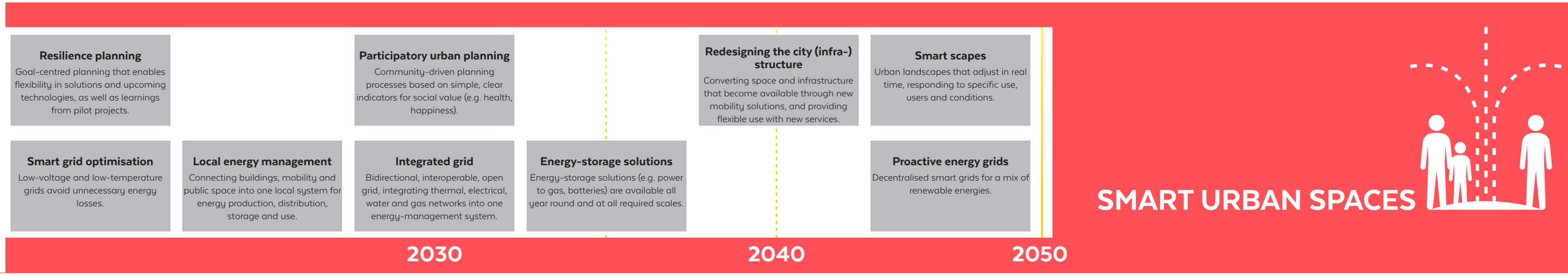
Mid term developments

- 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 a long term, public space and infrastructure that become available through new mobility solutions are redesigned and repurposed, providing new and flexible uses and services for citizens.
- Urban spaces are designed and used as smart urban landscapes or 'Smartscapes', adjusting in real time to specific uses, users and conditions.

SMART URBAN SPACES



Sustainable energy transition

Short term developments

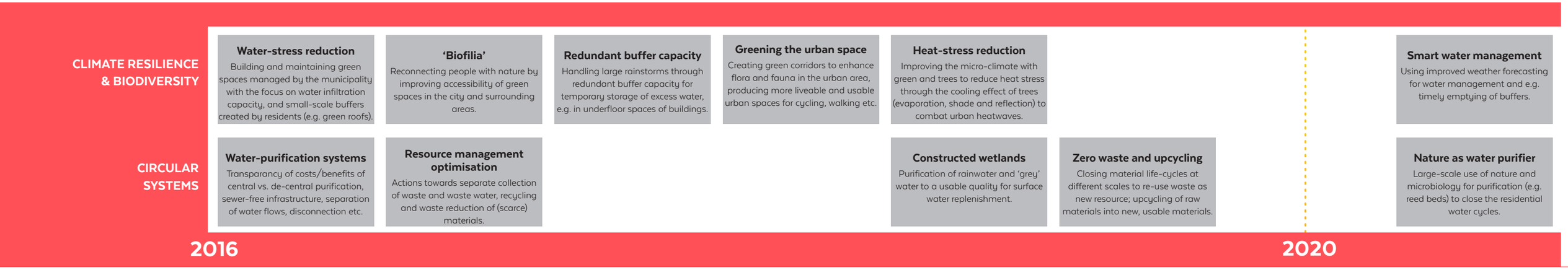
- In the short term, renewable energy production in cities increases substantially through the local and decentralised introduction of diverse renewable energy systems.
- To achieve a high rate of renewable energy use in cities, energy demand for public spaces and services is reduced through refurbishment 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.



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 handles 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.

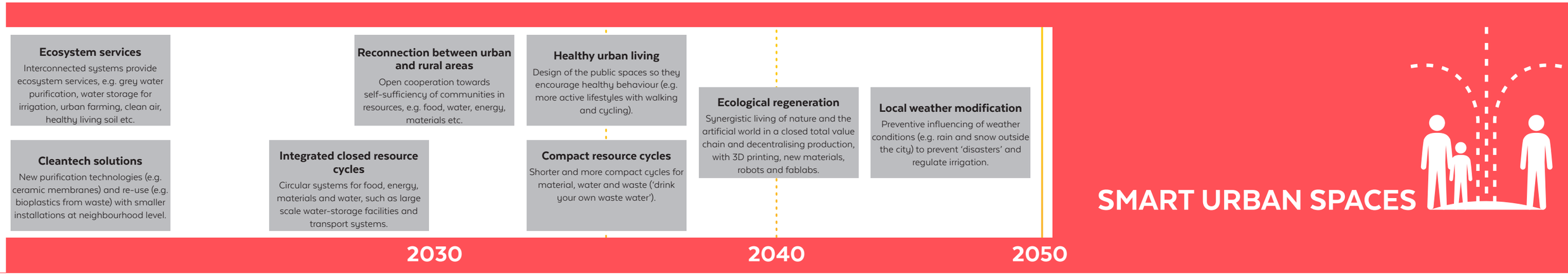
Mid term developments

- 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.

SMART URBAN SPACES



Circular systems

Short term developments

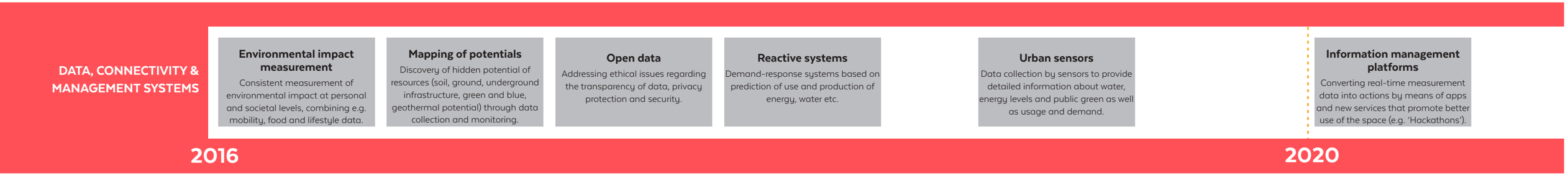
- In the short term, water is recognised as a highly valuable resource in cities. All related efforts to increase the efficiency of water cycles are based on transparent costs and benefits. This supports decision-making, for example on central vs. decentral water purification, sewer-free infrastructure, 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.



Data, connectivity & management systems

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 to give a holistic picture of individual and group consumption patterns.
- 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 spatial 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

‘Gamification’
Future users experience concepts and spatial solutions through virtual reality (3D models and games): they can use this experience to co-create solutions for urban space.

Interoperability
Open systems allow the connection of data, devices and assets to optimise operation and generate new services.

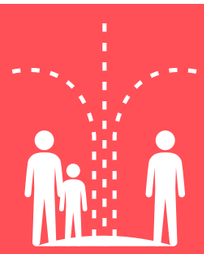
Predictive systems
Artificial intelligence & data science to proactively match supply and demand of raw materials, water and waste flows.

Inclusive design tools
Design-supporting ICT system with all relevant information; new tools deal with real-time data and support participatory urban planning.

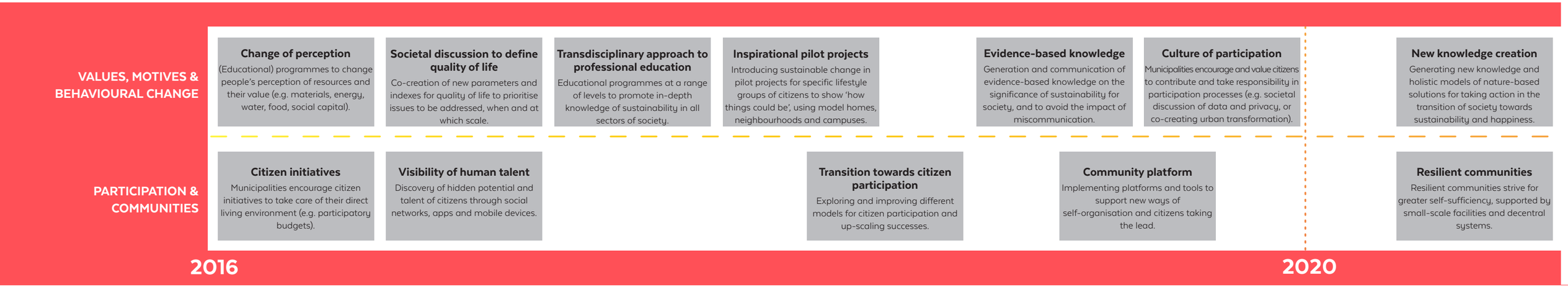
Self-organising systems
Linking local communities through ICT for real-time smart overall control and ‘happiness as a service’.

2030 2040 2050

SMART URBAN SPACES



EINDHOVEN



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 indexes, 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.

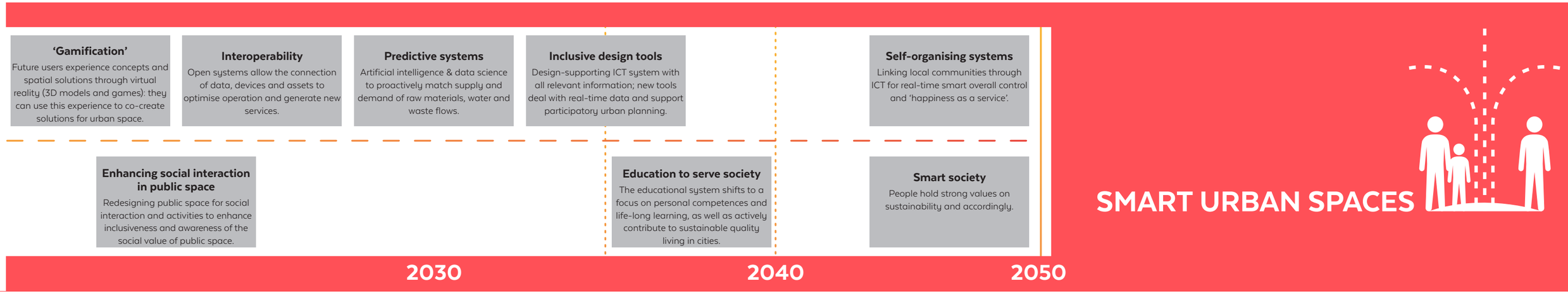
Mid term developments

- 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 life-long 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.

SMART URBAN SPACES



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.

EINDHOVEN

Innovative business models

Short term developments

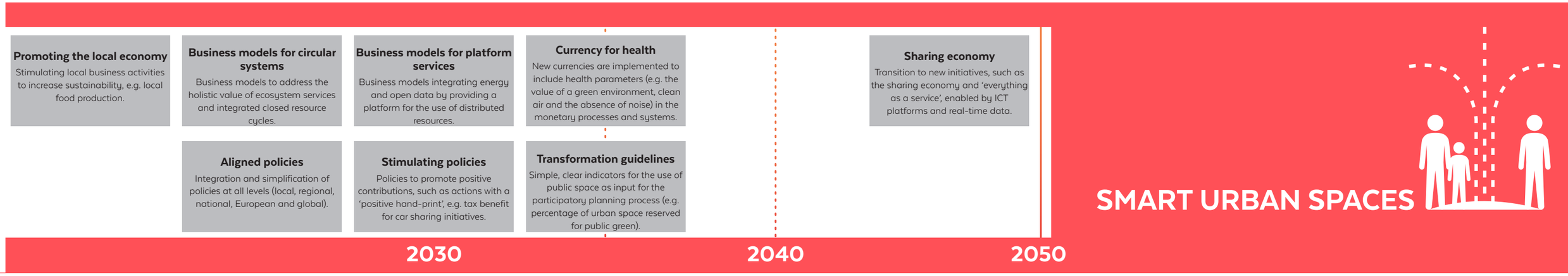
- In the short term new financial schemes evolve, generating new funding for urban transformation projects. For example these include local banks, companies and families, as well as experiments with new earning models and innovation budgets.
- A new entrepreneurial attitude develops in public administration, 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 politics 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.

R4E ROADMAPS FOR ENERGY®

SMART MOBILITY ROADMAP EINDHOVEN

Sustainable technology

SMART INFRASTRUCTURE

Expanding and exploiting
More efficient use of existing infrastructure and construction of new physical infrastructure (roads, hubs etc.) to accommodate growing mobility demand.

Physical separation of flows
Separation of lanes and (re-)design of infrastructure for flexible use over time, aligned with growing diversity of (sustainable) mobility modes.

Smart solutions
Increase intelligent assets, e.g. sensors, cameras, RFID tags and inductive loops for detection ans energy generating constructions e.g. 'solar roads'.

(Re-)designing dedicated areas
Creating areas for e.g. intermodal hubs, green corridors for cycling and walking, e-bike highways, e-vehicle charging systems and areas for autonomous vehicles.

Energy-efficient solutions
Increased availability of new solutions for fast charging of (mainly electric) vehicles (e.g. inductive charging) and increased local storage of energy.

Proactive infrastructure
Increasing the intelligence of physical infrastructure to proactively adapt to guide sustainability, e.g. smart charging and adaptive road marks.

SMART MOBILITY MODES

Optimising mobility modes
Increasing efficiency, drive trains (e.g. plug-in hybrid electrical vehicles), comfort and safety of mobility modes.

New mobility modes
New solutions for specific mobility demands, e.g. e-bikes, hover boards, e-scooters .

Sustainable technologies for lightweight vehicles
Sustainable technologies for a range of lightweight vehicles, e.g. electric and hydrogen powered.

Full-electric lightweight vehicles
A wide range of models of full-electric vehicles provide freedom of choice for users.

MILESTONE 2020
A number of city areas show improved urban quality and sustainable mobility when walking and cycling are promoted / encouraged. Alternative modes of travel to the city centre – also from the region – are attractive thanks to modern hubs. Fast, safe cycling routes are available throughout the region. Up-to-date information on travel possibilities and changes supports smart choices.

Electric heavy-duty vehicle solutions for limited range
Extension of available heavy-duty vehicle that provide clean and silent solutions for in-city transport ('last mile').

CONNECTIVITY & ROBOTISING

On-board automation
Development of on-board solutions to enhance safety, comfort and fuel economy, e.g. by sensors and monitoring.

Communication with environment
One-directional communication from vehicles to the environment for less critical purposes, e.g. with infrastructure, people and grids.

Autonomous driving in controlled areas
Connecting vehicles for more critical purposes, such as platooning and autonomous driving in separate, controlled zones.

Enhanced connectivity
Small, autonomous, efficient and affordable sensors in infrastructure and mobile devices enable the shift to bidirectional communication.

Fast, reliable and secure communication network
Roll-out of 5G and fibre networks.

Cooperative driving technology
Technologies to communicate, react and respond between new vehicles, enabling e.g. (truck) platooning in all areas.

DATA & TRAFFIC MANAGEMENT SYSTEMS

Occasional interoperability of data sources
Different data sources (open, private, traffic) are occasionally combined by means of open protocols.

Enhanced traffic management
Smart infrastructure enables fast (real-time) information management and control of traffic flows and crowds.

Sharing of private data for added value
Sharing of personal data is considered valuable, and enables market uptake for sharing initiatives towards Mobility as a Service (MaaS).

Solutions for privacy and security issues
New technologies, e.g. block chain and other encryption technologies, increase privacy and security.

New protocols
New protocols to connect systems and enable roaming of services (e.g. integrated billing, booking and dynamic pricing over multiple mobility modes).

PERSONALISED SERVICES

New mobility services and sharing initiatives
Based on (open) data and matching of supply and demand, enabling new, disruptive mobility services, e.g. Uber, mytaxi, car2go.

Booking and billing services
Integrated booking and billing services across multiple public transport solutions (e.g. one city card for all public transport services).

Individual services
Merging of diverse data sources (e.g. weather forecast and diary) enables more reliable user information and customised services.

Hybrid mobility solutions
Separation between public and private transport blurs due to the change in ownership (first signs of Mobility as a Service).

Integrated services
Connected and integrated mobility services in an open information system offer a range of mobility options.

URBAN LOGISTICS

Small-scale logistics solutions
Small-scale solutions to make city logistic streams more efficient, e.g. pick-up points.

Efficiency improvement of urban logistics
Efficiency improvement by means of cargo 'hitching' between different logistic service providers.

Lightweight logistic solutions
New technological solutions for lightweight logistics (e.g. drones and robot delivery of small packages).

Optimising logistics flows
Optimising physical logistics flows by using time slots (e.g. night deliveries) and usage rate of infrastructure (i.e. urban spaces).

Integration of resources for city logistics
Sharing of resources to integrate city logistics flows by sharing hubs, storage, data and transport.

Connected urban logistics
Internet of Things allows real-time monitoring of locations and status of goods, and connectivity between urban logistics among different (urban) logistics service providers.

Sustainable behaviour

VALUES, MOTIVES & BEHAVIOURAL CHANGE

Supporting sustainable and healthy choices
Promoting bottom-up movements towards healthy behaviour and awareness, e.g. through education and incentives.

Deployment through media
Traditional media (critical journalism) and social media are used to mediate in the transition towards a sustainable society.

Small-scale initiatives
Supporting initiatives by individuals, communities and local businesses for sustainable, cooperative solutions.

Encouraging green behaviour
Encouraging people to choose more active mobility options by (re-)designing the urban space with more attractive green areas.

Conscious decisions
People's travel reasons and purposes will change, reducing the urge to travel and increasing the choice to use alternative forms of travel.

Sustainable organisation

COOPERATION & INNOVATION NETWORKS

Active role of government
Public parties take the lead to ensure cooperation among all parties in the transition towards smart and sustainable mobility (e.g. in tendering procedures).

New forms of cooperation
New forms of cooperation between different parties (public - private - citizen) to speed innovations in mobility solutions.

Dynamic innovation network
Dynamic innovation networks (including all parties necessary for smart and sustainable mobility) to enable active response to suitable new mobility systems.

Responsible sharing of assets
Public parties ensure access by other (private) parties to public assets, e.g. public transport data and infrastructure.

POLICIES & LEGISLATIONS

New incentives and measures
Implementation of new incentives and measures to promote and scale-up new mobility solutions and services.

Ethical recalibration
Public parties take the lead in an ethical discussion of privacy and security to safeguard public interest.

Framework for liability
Insurance for new ownership(s) and sharing of assets (e.g. 'who is responsible?') to promote the adoption of sustainable mobility modes.

Proactive local regulations
Discouraging the use of high-emission (private) cars and unsustainable solutions, e.g. by regulating time slots or flexible use of infrastructure.

Openness
New frameworks for accessibility and openness of data systems and mobility systems, including coverage of national privacy issues.

Scalability
EU legislation to ensure scalability of innovative mobility solutions, e.g. scalable legislation for Uber.

2016 — 2020

Connected energy systems
Bidirectional grids and systems to generate, store, use and exchange of energy between infrastructure, buildings, vehicles etc.

Innovative infrastructure for lightweight vehicles
New engineering technologies to make infrastructure for light weight vehicles e.g. unfolding bike paths.

Abundant renewable energy
Sustainable energy is widely available and affordable as a result of large-scale solutions, e.g. wind and solar parks and alternatives.

Innovative heavy infrastructure
Cheaper, faster and sustainable technologies for heavy infrastructure (e.g. roads, railways) and constructions (e.g. tunnels and bridges) .

Less physical urban infrastructure
Less physical infrastructure for mobility in cities due to sustainable mobility solutions, enabling a greener living environment.

Self-organising energy system
Integrated system that matches supply and demand for sustainable energy.

Affordable full-electric lightweight vehicles
All kinds of full-electric vehicles are more affordable for the mass market than conventional polluting (combustion) engines.

MILESTONE 2030
Neighbourhoods have noticeably fewer parked cars, with more shared systems and services. There are small-scale cooperatives for mobility services, nice walking routes throughout the city, and extensive networks and hubs with endless facilities in the region. Integrated, personalised information makes it easy to choosing green, healthy mobility solutions.

All vehicles are zero-emission
All available vehicles and mobility modes are clean, zero-emission fit for purpose.

Autonomous buses
Connected, automated buses can drive autonomous outside controlled areas on dedicated routes with dedicated bus stops.

Autonomous driving outside cities
Safe and efficient autonomous driving on less complex routes such as highways.

Adaptive vehicles
Artificial intelligence within the vehicle for user comfort: adaptation based on user profile and personal preferences.

Full cooperative driving technology
All vehicles (old, new and all types), all road users and all infrastructure are interconnected for communication and cooperative driving.

Urban autonomous driving
Full integration of autonomous vehicles with all modes of traffic and urban artefacts (e.g. urban environment and citizens).

Self-learning traffic management system
One integrated smart system for intermodal transport (private and public, passengers and goods) based on different data sources.

Self-organising transport system
Integrated system using different data sources to dynamically respond to supply and demand.

Personalised travel advice
(F)actual advice across different modality platforms based on shared services creates a more efficient system (combining people and goods).

Demand-driven services
Flexible choices ofmodalities and services (e.g. based on widespread use of dynamic pricing) matching diversity in needs and lifestyles.

Open and connected platform
Diverse, high quality total system with sufficient availability of transport of people and goods for all needs, distances and lifestyles.

Intermodal logistics solutions
Combining transport of goods with all mobility modes ('cargo hitching').

Reduced logistics flows
Small-scale solutions (house and neighbourhood) for resources and waste, due to developments in 3D-printing, retail, urban farming and local goods storage.

Hybrid logistics solutions
Combining transport of goods and people with all modes ('hitching'), e.g. by using multifunctional drones, small (shared) vehicles or pipelines.

Solutions in circular economy
New solutions, e.g. up-cycling, aimed at ensuring constant high usability and value of products, components and materials.

Physical internet
Open logistics system based on physical, digital, and operational interconnectivity, through encapsulation, interfaces and protocols.

Demand-driven solutions
Engaged citizens increasingly demand sustainable, flexible solutions.

Personal influence
Social mechanisms, incentives and measures provide evidence of the consequences of people's choices and influences.

Self-improving communities
Communities create value by realising local and personal initiatives in which energy and mobility solutions are shared and exchanged.

New value systems
Attractive economic systems to enhance the creation of integrated mobility services and products.

The 'next economy'
The 'next economy' based on value models and integrated value for society at large.

Public living area
Redesign of urban areas to release infrastructure for other purposes.

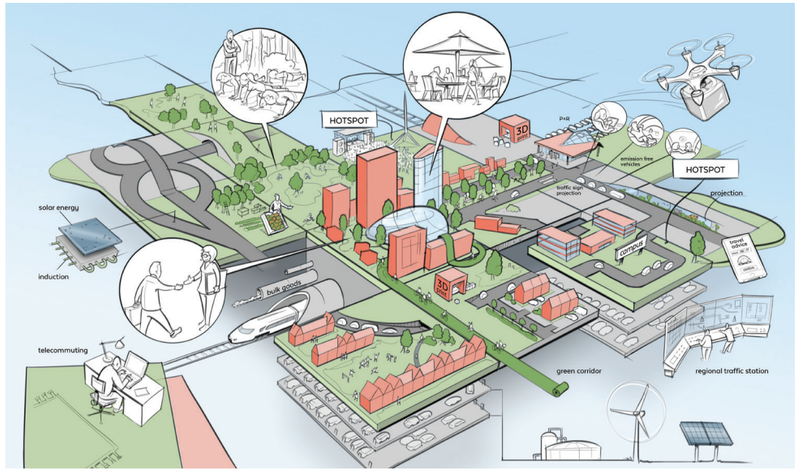
Globalisation
Data privacy and legislation at a global level.

Total value
Data is valued based on 'value for society' instead of purely by economic value — this creates a level playing field for sustainable solutions.

2030 2040 2050

Desired future scenario

EINDHOVEN



SMART, SUSTAINABLE MOBILITY IN EINDHOVEN 2050

In 2050, people in the Eindhoven region enjoy a clean and safe city with energy-neutral mobility solutions. Their personal mobility needs are met by seamless services provided as and when they are needed, at that specific moment and in line with their personal lifestyles. A wide range of sustainable options 'nudge' them towards more sustainable lifestyles, but always with full freedom of choices.

The spatial planning of the city and the region cherishes history and at the same time facilitates new dynamics. Solutions are chosen because of their flexibility to adapt to changing conditions and users' needs.

The region offers an attractive climate for business. It functions as a 'living lab' in which innovative solutions are developed and proven in practice. People can experience these innovations in their own living environment, and can adopt them if and when they wish to do so. The region is an economic hotspot for smart and sustainable mobility.

Elements of the desired future scenario are:

Attractive and clean city

The city of Eindhoven and its surroundings are clean and attractive. Widespread greenery in public spaces creates a healthy living environment and encourages people to choose healthy transport options such as walking and biking. Extensive and attractive walking and cycling routes throughout the region connect areas for living, working and leisure. Quality of the living environment is high, with air quality, low emissions and road safety are better than average.

Sustainable transportation

Mobility in the region is energy-neutral, using of entirely renewable resources and sustainable materials. The city centre is free of private cars. The region is well connected with sustainable mobility solutions that enable convenient access to all destinations in different ways. Smart traffic management provides efficient guidance based on real-time analysis and predictions of traffic flows, demand and transport availability.

A range of options

People can choose from a range of mobility options. Individual choices are facilitated by (f)actual information and seamless mobility products and services that meet their personal needs at that moment. People experience autonomy and freedom in their choices, although they understand that service availability and prices can be influenced by scarcity of resources at specific times. Smart apps help them to choose the best solution at that moment.

Local facilities

Facilities for people's daily living are within walking/cycling distance in all neighbourhoods. Shops and other facilities provide social meeting opportunities for citizens in their direct living environment. Local produce (food, but also innovative solutions like 3D printing) is available in the local convenience stores. Green squares, school yards, recreational grounds and public spaces facilitate healthy lifestyles and social activities.

Diversity in experience

People enjoy a variety of environments in the region. They can choose from different areas in the city or surrounding villages that provide different experiences, and offer a range of options for different needs and lifestyles. People are free to explore new things and try them for themselves (for example faster or more attractive routes, or innovative sustainable vehicles). This makes it easier to for them to choose and adopt sustainable solutions.

The R4E project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649375

TU/e Technische Universiteit Eindhoven University of Technology
Where innovation starts

EINDHOVEN

The cities plotted the presented current and future projects on a matrix, indicating when the result of the project would be visible in the city (horizontally) and the expected impact on the city, in terms of energy or emission (vertically).

The cities worked together on themes with a potential to become a programme of projects.

PROJECT PORTFOLIO

SMART URBAN SPACES

Project portfolio

The aim of Step 4 is to develop a portfolio of projects that the cities can work on – individually or jointly – and that help them to reach their desired future scenarios. The cities created an overview of running projects, and in a joint meeting they selected common ambitions that they all want to pursue. The new projects have to explore many new ways forward. This means that new project proposals are worked out in specific project plans, all relating to the learning opportunities between cities. The financial opportunities are also explored in this step.

Joint workshop

In a joint meeting in Newcastle the cities presented current projects and proposals for new projects based on their city-specific roadmaps. They held in-depth discussions to understand their shared and specific learning objectives and opportunities for joint projects.

First, the cities presented their projects and plotted them on a poster to show when the results will be visible in the city and how they will impact energy and emissions in the city. The picture at the left on the previous page shows the result of this first part of the workshop.

Secondly, a marketplace was held in which city representatives could put forward themes for further development into project portfolios. A theme is a challenge to become a smart city with the ability to grow into a project programme. The themes build on the running and new projects presented by the cities.

In the marketplace, each city took on the role of 'seller' of a theme and proposed it to 'buyers'. The buyers supported the themes, and were able to enrich them by 'negotiation' to include objectives which they considered important. If three cities 'bought' a theme, it was accepted. The marketplace resulted in 14 themes. Together it was decided to merge some of these themes. This left 10 themes for further elaboration in groups.

Thirdly, the cities worked in groups to elaborate the themes by describing their objectives, relevant projects and innovation opportunities. The resulting rich discussion combined the insights of all the experts, and built on the visions and roadmaps.

The groups then presented their proposals in a plenary session, after which all the cities described their learning objectives related to the themes.

Towards a project portfolio

The themes defined in the joint workshop will be further developed into project portfolios that contain local projects in the cities, but also joint projects, all forming part of the project portfolio. The project portfolios are not included in this report as they will not be made public.

Running Projects Smart Urban Spaces Eindhoven

EINDHOVEN

1 EINDHOVEN GREENER

EINDHOVEN

The goal is to reduce the amount of paved area in the city in favour of green. Now the project has extended to the private area. With several means the municipality is trying to convince private parties to get rid of as many pavement as possible.

ROADMAPS FOR ENERGY

SMART URBAN SPACES

2 BIOPOLUS

EINDHOVEN

Local wastewater treatment and recovering resources; exploring the possibilities of processing waste water and food left-overs in a locale wastewater treatment plant as a part of a circular economy.

ROADMAPS FOR ENERGY

SMART URBAN SPACES

LIGHT HOUSE

New Project Ambitions Smart Urban Spaces Eindhoven

SMART URBAN SPACES

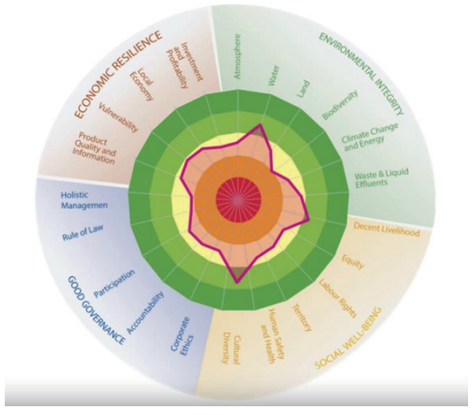
1 CLIMATE RESILIENT BUILDING

EINDHOVEN

A lot of the buildings built nowadays aren't climate resilient. The project is about motivating parties to start building resilient buildings.

2 CLIMATE RESILIENT TOOL

EINDHOVEN



Everyone is talking about climate resilient but when is a street or building climate resilient. The effort needed to become climate resilient depends on the locale conditi-ons. To test whether the effort is sufficient, a Climate resilient test will be developed in this project as well as a monitor. The monitor will be developed to show which buildings and streets are considered climate resilient.

3 CLIMATE RESILIENT KIT

EINDHOVEN

A kit containing tools to help inhabitants to become more adaptive to climate change and make the city more climate resilient.

4 STREET OF THE FUTURE

EINDHOVEN

A lot of thing are changing: mobility, we have to get rid of fossil energy, climate is chan-ging, we realise that our surrounding will influence our health. This project is about creating opportunities. While combining all changes take place, new possibilities will come up. Integrating expertise in adapting for future changes like climate change, smart mobility etc.

CONTRIBUTIONS

EINDHOVEN

The results in this project are co-created with many stakeholders in the cities. We would like to thank all participants for their valuable contributions.

Participants of the ambition workshops:

Hans Brouwhuis	NXP
Annemarie Buddemeijer	Philips Research
Joan van Dijk	SRE
Anouk Florentius	Stichting Natuur en Milieu
Jeroen van Gestel	Het Energiebureau
Luciën Groenhuijzen	Innovactory
Jelle Groot	Eindhoven Municipality
Arjen van Halem	Platform NOC
Eric Hendricks	The Waterboard - Waterschap de Dommel
Jan-Willem Hommes	Eindhoven Municipality
Lex Huijbers	The Waterboard - Waterschap de Dommel
Jarno de Jonge	The Waterboard - Waterschap de Dommel
Elly van der Kallen	Eindhoven Municipality
Nelleke Knipscheer	Gemert-Bakel Municipality
Henk van Lieshout	Helmond Municipality
Niek Luijten	Helmond Municipality
Rene Mens	Brabants-Zeeuwse Werkgeversvereniging (BZW)
Jan van Mourik	Brabants-Zeeuwse Werkgeversvereniging (BZW)
Ron Nohlmans	Eindhoven Municipality
Gerard Okhuijsen	Raadhuis Advies
Tineke Posno	Helmond Municipality
Luuk Postmes	Eindhoven Municipality
Ger Renkens	Eindhoven Municipality
Madelon Roest	Eindhoven Municipality
Ewit Roos	TU/e Strategic Area Smart Mobility
Ingeborg Schouten	Eindhoven Municipality
Ludger Schrauwen	Province of Noord-Brabant
Mary Ann Schreurs	Eindhoven Municipality
Jacques Splint	Eindhoven Municipality
Frank van Swol	Eindhoven Municipality
Eleftheria Vasileiadrou	TU/e Environmental Science
Roel Velstra	Raadhuis Advies
Yvonne van Velthoven	SRE
Nanette van der Ven	The Waterboard - Waterschap de Dommel
Hans Verhoeven	Eindhoven Municipality
Berry Verlijsdonk	Raadhuis Advies
Frans Vlemmix	Laarbeek Municipality
Jannie Visscher	Eindhoven Municipality
Michiel Visser	Brabantse Milieufederatie (BMF)
Gösta Weber	Eindhoven Municipality
Carlo van de Weijer	TU/e & TomTom

Participants of the scenario workshops:

Ronald Aben	Provincie Noord Brabant
Hanne Baudoin	Waterschap de Dommel
Dick Boland	Waterschap de Dommel
Inge van den Broek	GGD
Jean-Paul Close	Stad van morgen
Roel den Dikken	Gemeente Eindhoven
Lot van de Giessen	Gemeente Eindhoven
Antoinette Grips	Gemeente Eindhoven
Has van Helvoort	Omgevingsdienst ZO Brabant
Eric Hendrickx	Waterschap de Dommel
Magna Hofman	Trefpunt Groen Eindhoven
Jan-Willem Hommes	Gemeente Eindhoven
Lex Huijbers	Waterschap de Dommel
Berry de Jong	Metropoolregio Eindhoven
Jarno de Jonge	Waterschap de Dommel
Herman Kerkdijk	Gemeente Eindhoven
Nelleke Knipscheer	Gemeente Gemert-Bakel
Erik Kronenburg	Waterschap de Dommel
Delia Mitcan	Gemeente Eindhoven
Robbert de Mug	Gemeente Eindhoven
Ruud van Nieuwenhuijze	Brabant Water
Luuk Postmes	Gemeente Eindhoven
Ger Renkens	Gemeente Eindhoven
Jan Rots	Bosgroepen
Mary-Ann Schreurs	Gemeente Eindhoven
Vanessa Silvertand	Gemeente Eindhoven
Robbert Snep	Wageningen Universiteit/Alterra
Sandra van der Sterren	Gemeente Eindhoven
Frans van Strijp	Cure
Robert Teunissen	Gemeente Eindhoven
Nanette van der Ven	Waterschap de Dommel
Hans Verhoeven	Gemeente Eindhoven
Ron Wetzer	Provincie Noord Brabant
Jean van Zeeland	Gemeente Eindhoven

Participants of roadmap workshops:

Robert Arts	Mijn Thuis
Manus Barten	Studio Bereikbaar
Alwin Beernink	gemeente Eindhoven
Bernadette Bergsma	gemeente Eindhoven/Brussel
Leon van den Biggelaar	gemeente Eindhoven
Paul Bloemen	Mobility S
Arjan uit het Broek	gemeente Eindhoven
Hans Brouwhuis	NXP
Noortje Dekkers	Brabantwater
Léon Dielen	Heijmans
Marcel Duffhuis	gemeente Eindhoven
Frank van Ekert	gemeente Eindhoven
Rosalie Franssen	gemeente Eindhoven
Raymond Gense	PON
Lot van der Giessen	gemeente Eindhoven
Neelke Gooskens	Proeftuin 040
Mark de Greef	Eindhoven 365
Anja Hannema	gemeente Eindhoven
Frank Heger	gemeente Eindhoven
Francis Hendrikx	gemeente Eindhoven
Erwin van Herwijnen	TGS
Jan Willem Hommes	gemeente Eindhoven
Michael van Hulst	Eneco
Peter Janssens	Enexis
Mireille Jongen	Ennatuurlijk
Irmo Kaal	bereikbaarheidsagenda Zuidoost Brabant
Peter Kentie	Eindhoven356
Joop Ketelaers	gemeente Eindhoven
Pierre Kil	Open Remote
Ruud Kock	Waterschap de Dommel
Gertjan Koolen	provincie Noord-Brabant/ ITS Bureau
Andre Kools	Proeftuin 040
Tim Kouthoofd	Bygg
Arne Kramer	gemeente Eindhoven
Erik Kronenburg	Waterschap De Dommel
Lisanne Kusters	Rijkswaterstaat
Robert-Jan Marringa	Brainport Development
Bennie Meek	Gewildgroei
Delia Mitcan	gemeente Eindhoven
Maarten Neeskens	Beamrz
Steven Nelemans	Amber Mobility
Ruud van Nieuwenhuijze	Brabantwater
Ab Oosting	MRE
Leon Piepers	Enviroworks

SMART URBAN SPACES

Participants of roadmap workshops:

• Tineke Posno	gemeente Helmond
• Luuk Postmes	gemeente Eindhoven
• Ben Rutten	TU/e
• Ingeborg Schouten	gemeente Eindhoven
• Piotr Svczesniakl	Bygg
• L. Somers	TU/e
• Robert Teunissen	gemeente Eindhoven
• Fred Tilburgs	Hermes
• Alfredo Verboom	gemeente Eindhoven
• Roel Willemsen	KPN
• Ellen Wilms	Tauw
• Jeroen Ijff	gemeente Veldhoven
• Raimond Zegveld	Bubblepost
• Lucas Zoutendijk	studio 1op1
• Dirk Zuiderveld	Noorderberg

This project received funding from the European Union's Horizon 2020
research and innovation programma under grant agreement No 649397

AMBITION, VISION & ROADMAP

SMART URBAN SPACES EINDHOVEN

D6.4 Final city report

This report contains the results of the ambition setting, vision development and roadmapping activities for smart urban spaces in the city of Eindhoven. Workshops were conducted with policy makers, strategy departments, integral project managers, department managers and external stakeholders and strategic partners to define a shared ambition, create a desired future scenario, develop a city specific roadmap and identify initial (local) solutions and research projects to achieve the desired future in the specific context of the city. The participants will continue working on the project portfolio.

This report is the final public deliverable of the Roadmaps for Energy (R4E) project. The R4E partners work together to develop a new type of energy strategy through visions and roadmaps for the 8 partners cities, in co-creation with local stakeholders. The project supports the development of visioning and roadmapping capacities within the municipalities to spur future development and implementation of innovative energy solutions.

R4E | ROADMAPS FOR ENERGY®