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

AMBITION, VISION & ROADMAP
SMART MOBILITY TALLINN

D6.4 Final city report

18 August 2017

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ROADMAPS FOR ENERGY®

AMBITION, VISION & ROADMAP SMART MOBILITY TALLINN

D6.4 Final city report

Leader: TU/e LightHouse

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Abstract

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

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

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 MOBILITY

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

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

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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

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EINDHOVEN
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ISTANBUL METROPOLITAN MUNICIPALITY — public transport, traffic mgt

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

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ROADMAPS FOR ENERGY®

Version 4 September 2015

R4E - ROADMAPS FOR ENERGY

SMART MOBILITY

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.

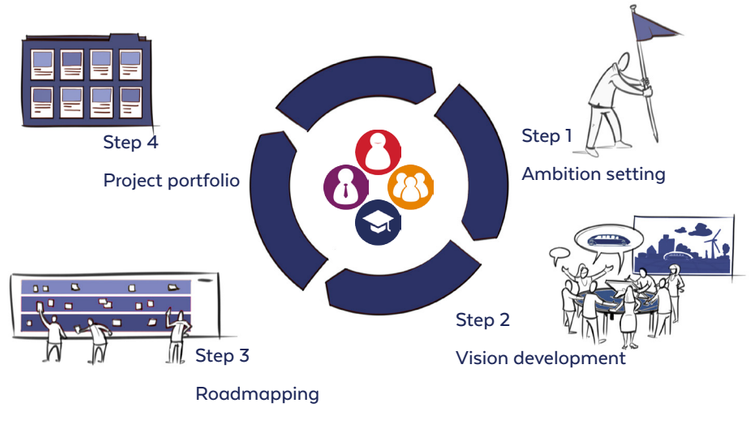
2. The SECOND step is to develop desired city scenarios for the selected focus areas.

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


Café

AMBITION SETTING

SMART MOBILITY

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.

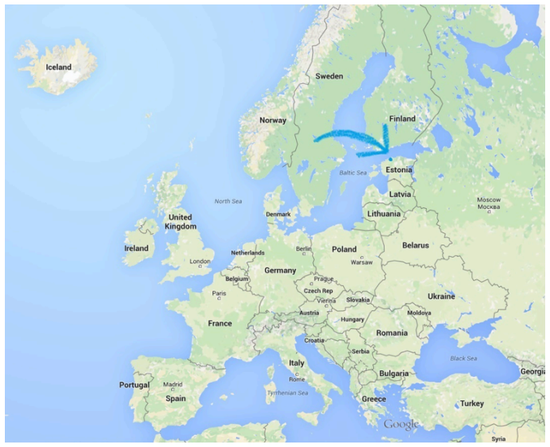
Morning Finalising Step 1	Presentation of the cities ambitions · Each city presents their ambition for the focus areas
	Learning from each other's ambitions · In-depth discussion on common and specific ambitions
Afternoon Preparing for Step 2	Presentation of the Drivers for Change · Sharing of results 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

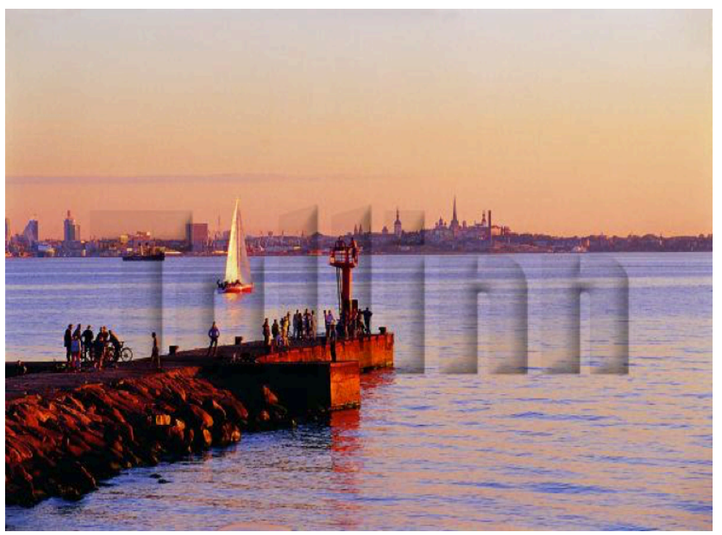
Introduction to Tallinn

Introduction to the city

Tallinn is the capital and largest city of Estonia. Approximately 33% of Estonia's total population lives in Tallinn. Tallinn never fails to amaze visitors with its historic charm. At its heart is the Medieval Old Town, an area of cobblestone streets, gabled houses, churches and squares that developed here from the 13th to the 15th centuries when Tallinn was a booming Hanseatic commercial hub. The Old Town has long been the main draw for visitors – in fact it is so unique that UNESCO added it to its World Heritage List in 1997. Other areas of the city reflect different ages, from the romantic, Tsarist-era Kadriorg Park to the unforgettable, early-20th-century wooden house district of Kalamaja. A modern shopping and business district in the city centre completes the city scene and blends the old and new faces of Tallinn. Tallinn is a small, relatively quiet city with 40 km^2 of parks and forests and a beautiful 2 km sand beach bordering its bay providing fresh air and relaxation.



Visitors can stroll along well-developed seaside pathways, explore the natural, suburban bog trails, take sailing trips to nearby islands or use a neighbouring golf course. Tallinn is widely recognised as one of the world's most technology-oriented cities, offering a range of solutions ranging from e-government to mobile parking. Free Wi-Fi is available almost everywhere. The city also hosts a dynamic business community, in which technology plays a major part. The city is home to the world development headquarters of the Internet telephony company Skype.



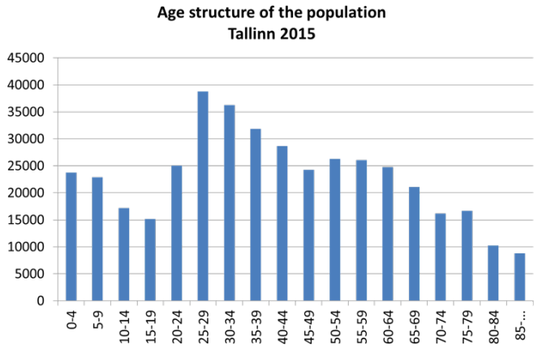
Tallinn has selected two focus areas for the R4E project:

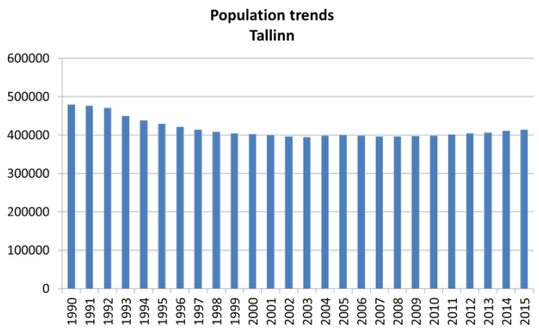
SMART BUILDINGS

SMART MOBILITY

Demographical aspects

- Size in km2 159,2 km²
- Number of inhabitants 438 569 (October 2015)





Social aspects

- Level of education of citizens
  46,4% of citizens in Tallinn (ages 15-75) have a Tertiary Education attainment. Population with secondary education level: 89,6% (2014, Statistics Estonia)
- Connectivity level: Percentage of households with broadband internet in Tallinn 88.2%. Percentage of households with a computer in Tallinn 88.6%. Smart Phone Usage in Estonia: 60% (2014, TNS Emor)
- Unemployment rate: In Tallinn the unemployment rate is 3.5%, which is slightly lower than in Estonia 4.8% (30.04.15, Eesti Töötukassa – "Estonian Unemployment Insurance Fund")
- Share of population with energy poverty: Estonia has not introduced the concept of energy poverty in its legislation, thus there is no statistics on population living in energy poverty.
- Percentage of people that require special care/needs: In 2014 ca 7% of the population in Tallinn had a disability that prevented them from working. 4%of city residents received disability pension (2014, Statistical Yearbook of Tallinn)
- Inclusive accessibility policies / indicators (e.g. related to access to public transport): 56% of the fleet are low-floor vehicles, making them accessible for people in wheelchairs or with baby strollers.
- Satisfaction level of citizens regarding buildings, mobility, urban spaces): In Tallinn, 89% of the respondents were satisfied to be living in Tallinn. The residents' satisfaction with their city's infrastructure and facilities is based on eight categories: public transport (59% satisfied), health care services (53%), sports facilities (55%), cultural facilities, the state of the streets (52%) and buildings in the neighbourhood, public spaces (68%), availability of retail shops and schools and other educational facilities. In all of these categories, a positive answer was given by more than a half of the surveyed residents of Tallinn. The residents of Tallinn gave a positive answer to four of five questions about the environment.

They are the most satisfied with green spaces (81%). About 60% of Tallinn's residents are satisfied with the quality of the air, cleanliness and noise level.

Economical aspects

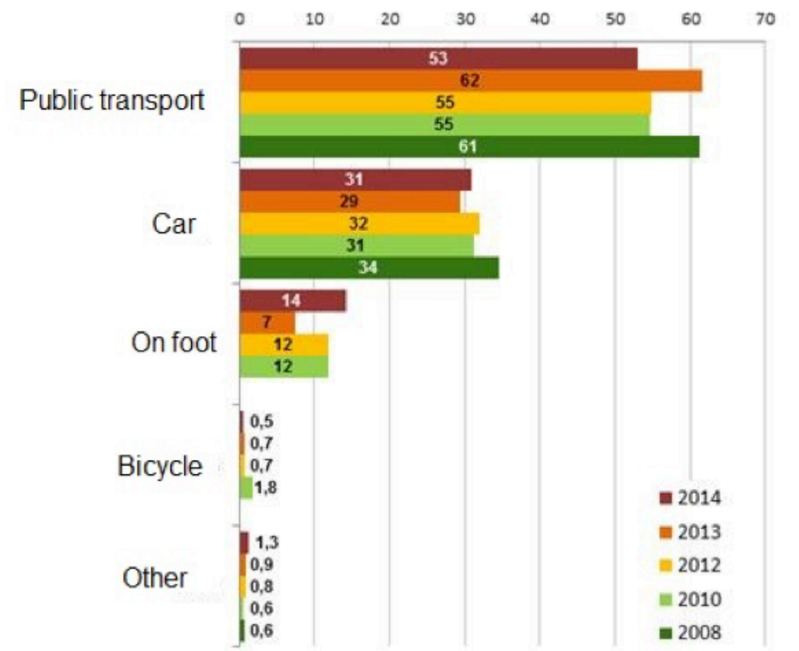
Income per head in comparison to the national average income:2013: Estonia 949€ monthly and Tallinn 1090€ monthly (2013, Statistics Estonia)

Tallinn is the financial and business capital of Estonia. The city benefits from the high level of economic freedom, liberal economic policy and has a highly diversified economy with particular strengths in information technology, tourism and logistics. Currently, over half of the Estonian GDP is created in Tallinn. 75% of residents are employed in the tertiary sector and 24% in the secondary sector (2013, Statistics Estonia). 78,9% of GDP is generated in the Services sector, 20,6% is generated in the Industry and construction sector (2012, Statistics Estonia).

In 2012 there were 21 787 buildings in Tallinn. Dwelling completions by type of building (number of buildings):

- 2009: 1 591
- 2010: 1 266
- 2011: 1 021
- 2012: 908
- 2013: 713

(2014, Statistical Yearbook of Tallinn)



Mobility modal share: see graph. Decline in the use of public transport in 2014 was due to large-scale tram network renovations, thus the share of moving by car and on foot increased.

34,9% of the budget of investment projects in 2014 was allocated to building and reconstructing of roads and streets.

Expenditures on public transport forms 14,6 % of the city budget.

Area	Percentage (%)	Expenses in 2013 (million €)
Education	37,7	159,17
Public Transport	14,6	61,52
Social Welfare	9,6	40,53
Administration	7,3	30,72
Roads and streets	6,5	27,48
Culture	5,9	24,9
Water supply and sewage systems	3,4	14,5
Housing	3,3	13,83
Open Space Maintenance	1,7	7,40
Public Safety	0,86	3,63
City Planning	0,7	2,98
Environmental protection	0,4	1,73

Environmental aspects

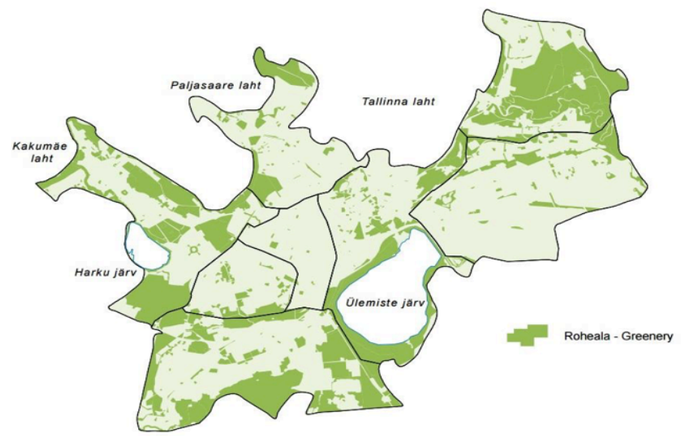
Green areas: 38 946 677 m2 , that is 24,4%, of Tallinn area.

Estonia lies in the northern part of the temperate climate zone. The climate in Tallinn is characterized by a fairly cold winter, a cool spring with little precipitation, a moderately warm summer and a long and rainy autumn. However, some summers have weeks at a stretch of temperatures around +30°C, and a warm, sunny summer can keep autumn at bay until mid-October. Average temperature in July +16,7°C. Average temperature in February -4°C. Tallinn receives 618 millimetres (24.3 in) of precipitation annually which is evenly distributed throughout the year although March and April are the driest months, averaging about 30 millimetres (1.2 in) while July and August are the wettest months with 74 millimetres (2.9 in) of precipitation. The highest recorded temperature in Estonia was +35,6°C in 1992 and the lowest temperature -43,5°C in 1940.

In its current cooperation with the state (Ministry of Environment) flood risk maps have been completed in Estonia, including Tallinn, showing the likely rise in the water level in 10, 50, 100 and 1000 years, and describing the potential adverse effects. Flood zones shall be construed as limitations in the comprehensive plans of city districts. These maps provide the basis of the recommendations by Tallinn City Planning Department for areas located in the flood areas during the process of planning and issuing building permits. In February 2009, Tallinn joined the Covenant of Mayors. Accordingly, the city has undertaken the duty to reduce its CO2 emissions by 20% by 2020 as a result of a 20% improvement in energy efficiency and a 20% share of renewable energy sources in the energy mix. Tallinn's present Action Plan for Energy Efficiency, which has been developed for the period 2011 to 2021, analyses energy-saving opportunities in Tallinn and sets out guidelines for the development of Tallinn's energy economy by the year 2021.

Type of urban space: 9 173 378 m² / 950 km of roads in Tallinn: 28,6 km of bus lanes, 940 stops for public transport, 377 321 m² city-owned parking lots, 252,5 km of bicycle paths.

Rohealad, 2014
Greeneries, 2014

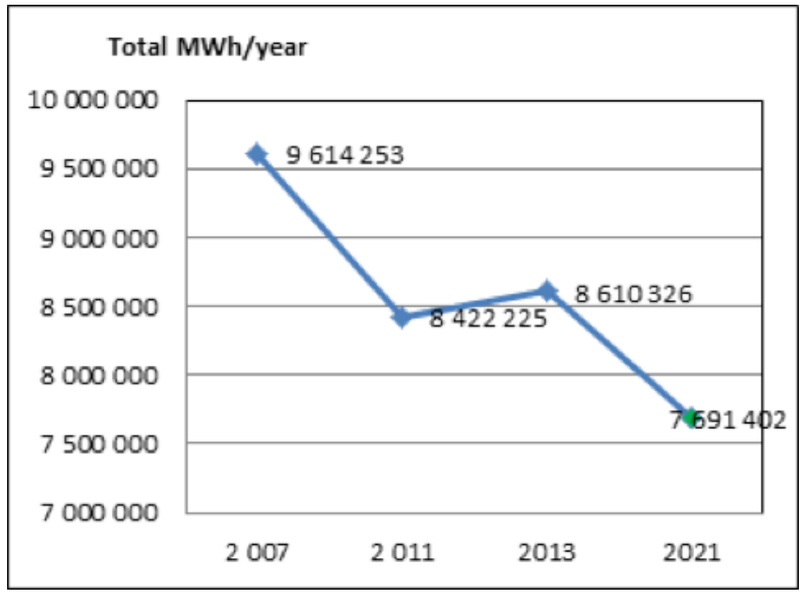


Allikas - Source: Tallinna Linnaplaneerimise Amet - Tallinn Urban Planning Department

In 2014 36,7% of land under Tallinn was private-owned, municipal land was 31,1%, state-owned 14,6%. 17,6% of land under the city is unreformed land.

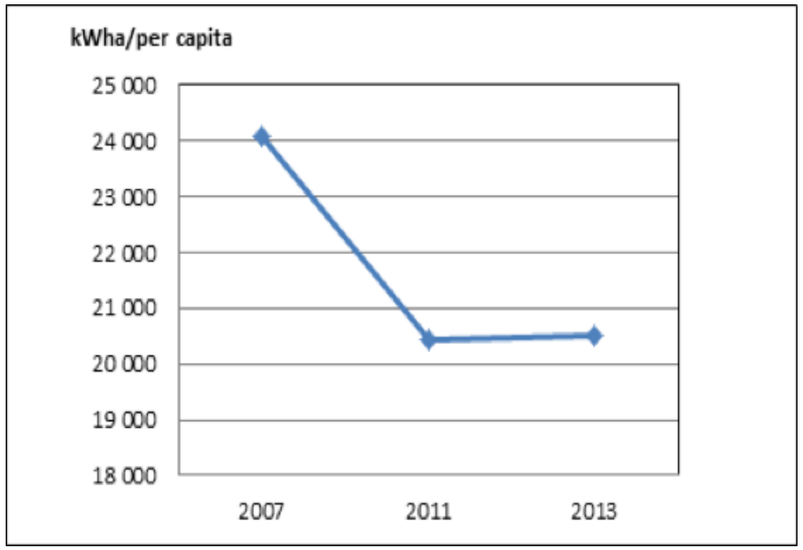
Buildings in the medieval old town are built mostly of limestone. Several residential districts of wooden houses built in the 19th and beginning of 20th century have been preserved. There are large districts of private houses in Nõmme, Pirita, Kristiine etc. In 1960s began the extensive construction of concrete slab apartment buildings in Mustamäe, Õismäe and Lasnamäe districts which lasted until the 1980s. In 2012 7.7% of residential houses were built before 1946; the share of houses built in 1946 - 1960 was 10.3%, in 1961 - 1970 26.4%; in 1971 - 1980 21.8% and in 1981 33.8%. 88.2% of households live in apartment buildings and 11.8% in private residences. The energy efficiency in houses built before 1991 is low: poor external wall insulation, only natural ventilation without heat recovery, no indoor temperature control. The energy consumption in unrenovated residential buildings is 180 – 250 kWh/(m2*year).

Total energy consumption:

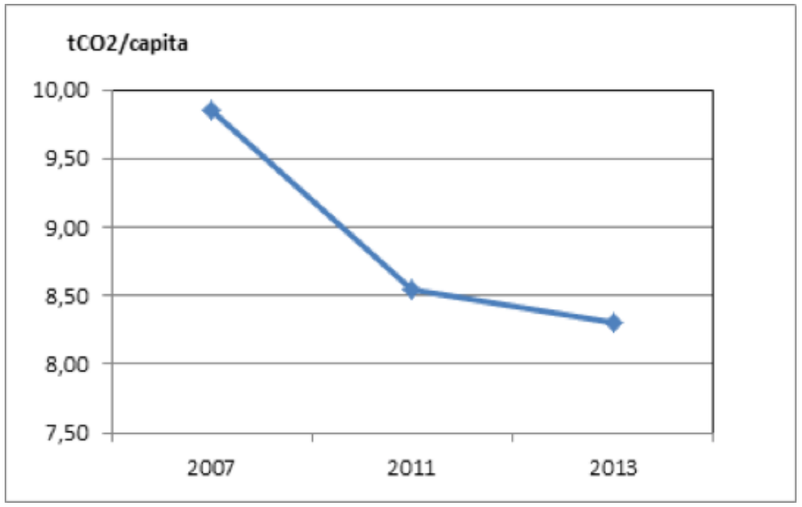


SMART MOBILITY

Energy consumption per resident:



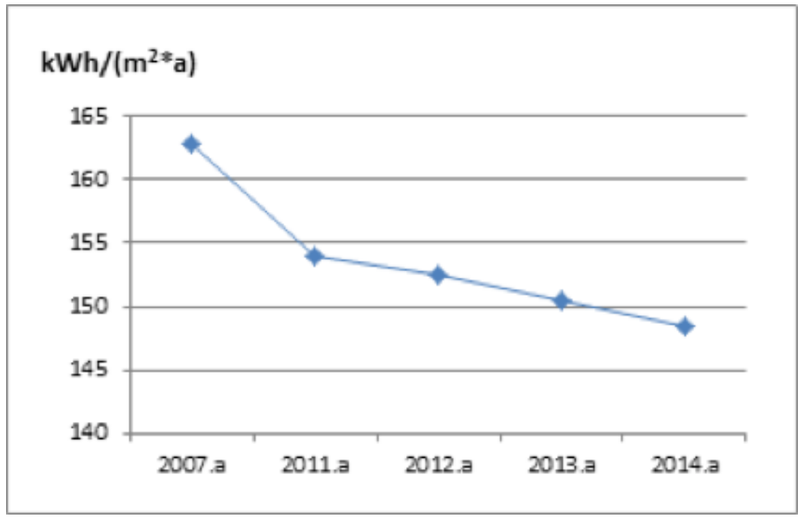
Total CO2 emission per head:



Total energy consumption in the local industry in 2011 was 1200 GWh.

The fleet of Tallinn public transport is mainly running on electricity (trams and trolleybuses) and diesel (buses). In 2015 24 new hybrid Diesel-electric buses will be procured.

Municipal buildings energy consumption:



Firewood is widely used for heating in private houses. CHP plant in Tallinn uses wood chips. In 2014 the share of wood chips used in district heating was 40%. In recent years a large number of different types of heat pumps have been introduced, to a lesser extent investments have been made in solar collectors and panels.

Annual average concentrations of air pollutants in Tallinn:

Pollutant	2013	2014
SO_2 µg/m³	1,03	1,07
NO_2 µg/m³	16,7	14,7
O_3 µg/m³	51,7	47,1
PM_{10} µg/m³	14,1	14,87
$PM_{2,5}$ µg/m³	8,2	8,4
CO mg/m³	0,25	0,227

Percentage of people in Tallinn (%), who are exposed to noise over 55 dB and 65 dB:

Noislevel L_{den} in dB	Car traffic	Railway	Industry	Aircraft	TOTAL:
≥ 55	66,6	1,48	2,11	0	**70,19**
≥ 65	22,52	0,02	0,12	0	**22,66**

Water consumption:

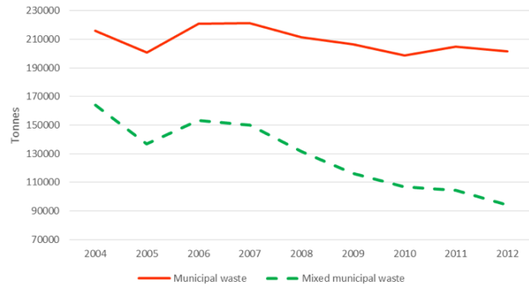
- Water supplied in 2013 in Tallinn: 21 167 000 m3
- Water supplied per resident: 93 l/24h

(Source: 2013, Tallinn Water)

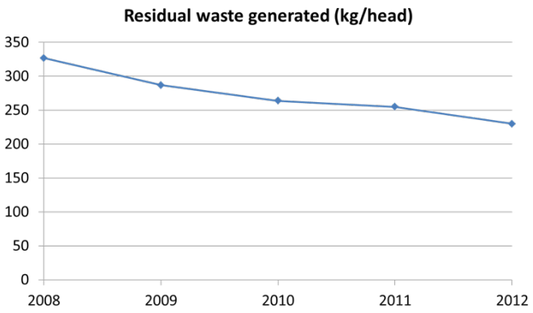
10% of consumers in Tallinn are supplied with groundwater

The water in Tallinn is mainly supplied by Tallinn Water (90% of the supply), the largest water utility in Estonia providing drinking water and wastewater disposal services to over 400 000 people in Tallinn and in several neighbouring municipalities of Tallinn. The potable water is produced from surface water at Lake Ülemiste. The company has two treatment plants Ülemiste Water Treatment Plant (WTP) and Paljassaare Wastewater Treatment Plant (WWTP). The public water supply system comprises almost 1,111 km of water networks, 17 water pumping stations and 64 ground water borehole pumping stations with a total of 93 boreholes throughout the entire service area. Source: Tallinn Water)

Residual waste:



In 2012 500kg municipal waste (household waste and similar mixed waste from various enterprises and activities) was generated per resident. In 2012 about 230 kg of residual waste (mixed municipal waste) was generated per resident.



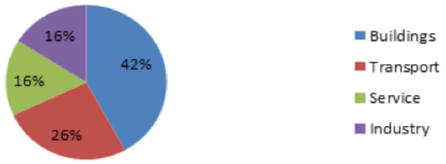
Type of waste collection: Organised Municipal Waste Collection Scheme.

Recycling rate (% of total waste):

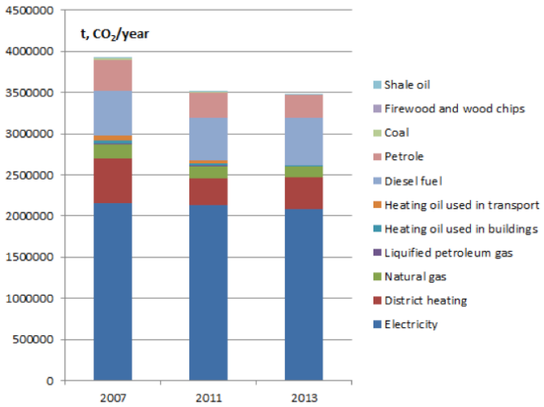
- 49% of household waste is recycled (2012)
- 57,8% of packaging is recycled (2013)

Tallinn Water Ltd. maintains the water supply and sewer systems. In Paljassaare Wastewater Treatment Plant mechanical treatment and biological and chemical treatment technologies are applied. Tallinn sewer system comprises of 21 sewer service areas covered by the separate sewer system and 7 areas covered by the combined sewer system. 35% of Tallinn is covered by the combined sewer system.

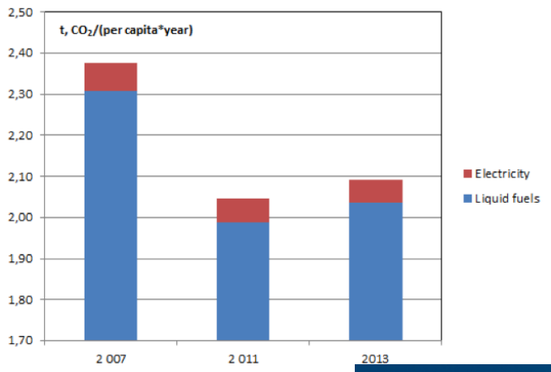
Final Energy Consumption in 2013



Total energy consumption by source:Total CO2 emission:



CO2 emissions in Tallinn transport sector:



Historical / cultural aspects

Area of Tallinn Old Town: 110 ha (1.1km), number of buildings 579.

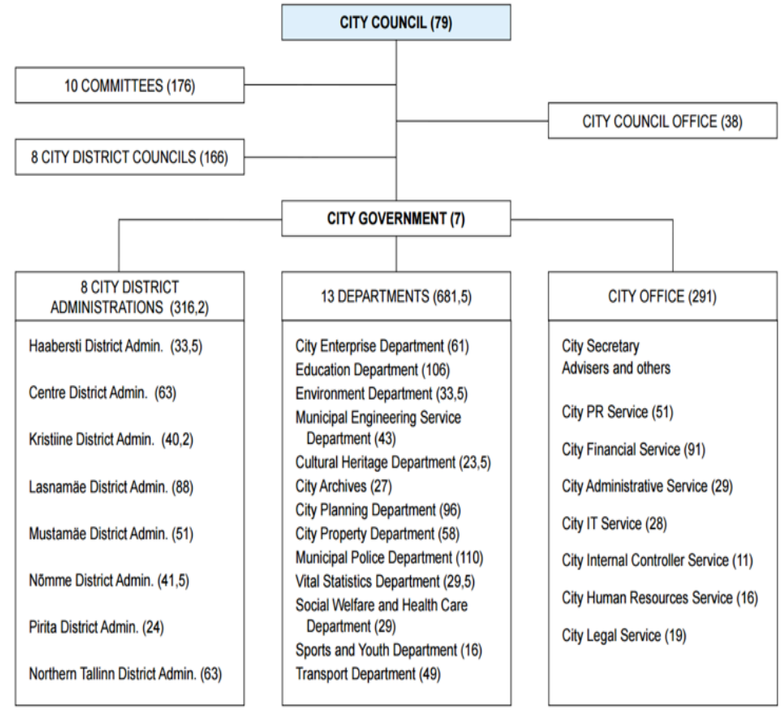
Tallinn is a multicultural city with people from over 100 nationalities calling it their home, The majority of the population comprises of Estonians, followed by Russians, Ukrainians, Belarusians, Finnish and others. 78% of Tallinn residents hold Estonian citizenship.

167553 passenger cars registered (2014, Statistical Yearbook of Tallinn)

91% of residents in Tallinn are homeowners

Number of associations :

- 58 museums
- 40 galleries
- 14 theatres
- 10 cinemas
- 18 libraries
- 18 concert halls
- 11 culture centres
- 10 hobby centres for elderly
- 7 youth recreational centres
- 247 private hobby schools
- 178 cultural associations
- 610 folk culture groups
- 42 houses of worship



SMART MOBILITY

Recent projects

- Tallinn participated in a 3-year project (2011-2014) called CASCADE of networking and mutual learning on local energy leadership. It supported cities in delivering the European Union 2020 targets for energy and climate change. Coordinated by EUROCITIES, the project involved 19 large European cities as partners, as well as thematic experts Koucky & Partners and Wuppertal Institute.
- Tallinn has also been involved in the EU project COMBAT from October 2009 until September 2011. The Covenant of Mayors in the Central Baltic Capitals (COMBAT) was an EU-funded project, spearheaded by Helsinki, Riga, Stockholm and Tallinn, with the objective of facilitating knowledge and experience-sharing on the development and implementation of Sustainable Energy Action Plans (SEAP). As part of the project, the four Baltic capitals pinpointed the key success factors and challenges encountered during the development process of their respective SEAP. In a second phase, the findings of the project were collected and outlined in a set of guidelines. These guidelines present how the four COMBAT cities prepared and developed their SEAP and identify critical factors that may be relevant to other municipalities.
- In February 2009, Tallinn signed the Covenant of Mayors. Accordingly, the city has undertaken the duty to reduce its CO2-emissions by 20% by 2020 as a result of a 20% improvement in energy efficiency and a 20% share of renewable energy sources in the energy mix. In 2011, Tallinn submitted the “Sustainable Energy Action Plan”.
- Civitas Mimosa (2008- 2013) CIVITAS MIMOSA is an innovative collaboration among the cities of Bologna (Italy), Funchal (Portugal), Gdansk (Poland), Tallinn (Estonia), and Utrecht (Netherlands). MIMOSA is short for motto of the project: “Making Innovation in MObility and Sustainable Actions”. The five MIMOSA cities joined forces to “learn how to move better, to live in better cities”, by collectively exploring new approaches to sustainable transport and demonstrating new solutions with guidance from scientific and support teams. Through the implementation and evaluation of different activities, the cities worked with their citizens towards a new and innovative concept of urban mobility. Tallinn introduced a new contactless ticketing system (Mifare card), real-time information system for public transport service, installed red-light enforcement cameras that can catch three categories of law breaking motorists: those who run red traffic lights, exceed the speed limit, or use the bus lanes and etc.
- Project Great (begins in September 2015) aims to exchange experiences and knowledge between cities on reducing traffic jams.
- R4R INTERREG IV C project which allowed local and regional authorities to make consistent comparisons thanks to a common method and exchange of transferable good practices related to local instruments in order to improve recycling performances.
- BECOSI – INTERREG IV A project with objective to map hazardous waste contaminated land sites in partner countries. (status – ongoing at the moment)
- IUWMM – INTERREG 3C CIP project with objective to make regional surveys and regional action plans for optimal integrated urban waste management. (duration was April 2005 – September 2007)
- SEECA- Interreg IV C
- POWER – Interreg IV C
- Tallinn is a signatory of the Baltic Sea Challenge, a network of over 200 friends of the Baltic Sea taking action for a better future of the sea. Tallinn also participated in the project Cities For a Healthier Sea in 2010-2012 aiming to increase awareness of the state of the sea and to implement water protection measures on a voluntary basis. Tallinn is a partner in the project CITYWATER (Benchmarking water protection in cities), which ends in September 2015.

In 2011, Estonia launched a program for electromobility called ELMO to support the introduction of energy-efficient and environmentally-friendly electric cars and plug in hybrids. An electric vehicle fast-charging network, consisting of 165 fast chargers around Estonia, was built. Since establishing the programme there are 28 fast-charging stations in Tallinn. Tallinn municipality uses 29 electric cars. The first fast-charging station in Estonia

was built in the city of Tallinn in 2009 at the Freedom Square underground car park. In total there are 252 electric vehicles, 85 of them belong to the public sector, 125 to legal entities and 42 to individuals.

In 2014 the city of Tallinn opened Tondiraba Ice Hall in the Lasnamäe district, which can be used for various sporting events and concerts. The heat supply system in the Ice Hall effectively uses residual heat from the operation of cold machinery producing ice for the building’s heating and hot water. If the residual heat is not enough, the system will use heat from the district heating network. The building was designed with heat recovery ventilation. The heating system in Tondiraba Ice Hall is a carefully designed solution containing various modern technology solutions with the aim of achieving high energy efficiency.

15 December 2015

Villu PELLA & Jaagup AINSALU, Tallinna Keskkonnaamet

Today's reality: Smart mobility

Tallinn is located between Lake Ülemiste and the Gulf of Finland, and the main bottleneck is in the middle of the city with width less than 2,4 km. The maximum distance from east to west is 13km. Approximately two-thirds of traffic passing through the city centre is inner transit between city districts. Urban sprawl has caused major problems as it generates additional mobility needs for people who live outside the administrative city area and commute to the city for work.

Since the beginning of the 1990s the amount of car users has grown very rapidly. This has created a lot of problems such as a lack of parking spaces, increased vehicular queuing in the city causing the average speed in rush hours to fall by 2 km/h per year. To avoid these problems, Tallinn has decided to promote public transport. The goal is to make public transport much more attractive than the use of private cars.

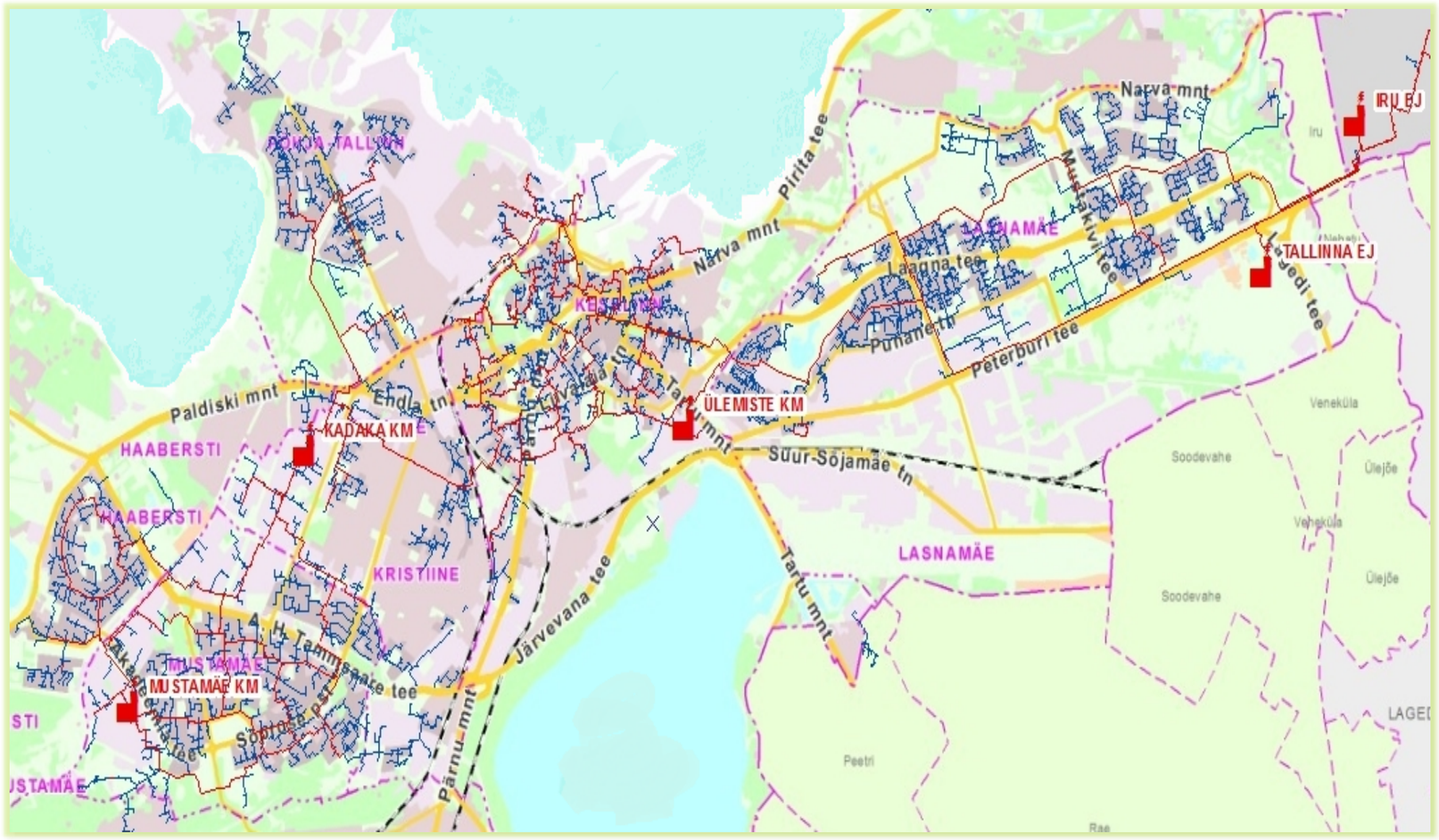
In Tallinn, active developing of public transport started at the beginning of 2005, when the city joined the CIVITAS SMILE project. Just a few examples of the improvements in the public transport systems are 24,2 km of bus lines, integrated ticket system in Tallinn and Harju County, creating public transport priority system, implementing real-time information system, purchasing new fleet, and offering discounts for different groups of public transport users. To promote a healthy lifestyle, 214 km of light traffic roads have been established in Tallinn.

The newly designed identity of Tallinn public transport was launched to the public in 2012, and was created to make public transport more attractive. A policy document and design standard was created to fully define any design-related decision in connection with Tallinn Transport. In 2012 the design management for Tallinn Transport won an award in the EU 'Design Management Europe' design competition.

In January 2013 free public transport was launched in Tallinn for registered city residents who have a contactless Mifare card ('green card'). Since 2013 free public transport has been expanded to trains travelling within the city borders. From 2016 Tallinn will start offering free public transport to residents of all the world's cities who join the network established on September 17, 2015 by a memorandum between Tallinn and Avesta (Sweden). Today, the first results of free public transport can be presented:

- traffic load has been reduced by 20% compared with the last months of 2012;
- the number of public transport users has increased by 6%.

Due to free public transport in Tallinn, the number of Tallinn residents has increased rapidly, which has had a positive impact to the city budget. The increased funds derived from the increase in Tallinn residents are allocated to improving the quality of public transport even further.



15 December 2015

Jaagup AINSALU, Tallinna Keskkonnaamet

Ambition: Smart mobility enables an enjoyable living environment in Tallinn 2050

SMART MOBILITY

1 Enjoyable living environment

In 2050, citizens of Tallinn enjoy an attractive, clean and quiet living environment that encourages them to behave sustainably. More and integrated green and blue areas, with an extensive network of cycle tracks and pedestrian-only areas enables people to commute conveniently by bike or on foot.

The cityscape is dense, so all services are within easy reach or are provided in the home. More public space is allocated to living, and less for motorised transport.

Strategic ambitions

- In 2050 Tallinn is a liveable city where citizens get their services in walking/biking distance or at home. The city is planned for humans: user friendly facilities and more green areas invite more sustainable behaviour. People choose to walk/bike to commute.
- In 2050 the city of Tallinn has a good urban space where people are invited to move differently (more sustainable) resulting in an attractive, clean and quiet environment and liveable streets. More public space is allocated to living, and less to motorized traffic. The green and blue areas in the city are well integrated.
- In 2050 the city scape is more dense, more functions are available within easy reach. More priority is given to pedestrians 'above the ground'. Space is freed up for buildings and places by putting transportation underground (e.g. parking). The city is build in a way that it enables to use foot, bike and public transport.
- In 2050 the bicycle routes in the city are connected. The number of streets in the city centre that are pedestrian-only is increased. Tram and bus provide good connections to the centre. Car use is discouraged through limitations in lanes and parking fees. There is more lively boat traffic and water taxis.

2 Smooth, seamless public transport

In 2050, the citizens of Tallinn all have access to smooth, seamless public transport that connects all the city areas. Smart planning is used to respond to the (dynamic) demand for the transport of people and goods. The transport and ticketing systems around the Baltic Sea are integrated in a way that is simple, comfortable, affordable (free), clean and fast.

Strategic ambitions

- In 2050 the connections in the city centre of Tallinn and to the neighbourhoods are very good, so all people can reach their destination fast with public transportation (in less time than cars).
- In 2050 the people of Tallinn experience smooth and seamless mobility that better connects all areas of the city by different transport modes (e.g. an extended tram network). The system responds to the demands of goods & people by smart planning to arrive at the desired destination (in the city and outside) reliably and safely.
- In 2050 the green card for free public transport is used widely, not only in Estonia, but also in Helsinki.
- In 2050 the public transportation system around the Baltic Sea is integrated in such a way that it is simple, comfortable, cheap/free, clean and fast.

3 Open, collaborative decision-making

In 2050, planning and decision-making processes are based on open collaboration that includes different views and knowledge sources. Tallinn is recognised as an front-runner in openness. Citizens are aware of their roles, and actively take part in making decisions that influence their living environment.

Strategic ambitions

- In 2050 the planning and decision making process in Tallinn is knowledge based. Administrative organisations and departments collaborate to have an integral view. The people are aware and take their responsibility by actively taking part in decisions that influence their living environment.

Creating the visual of the desired future scenarios

VISION DEVELOPMENT

SMART MOBILITY

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.

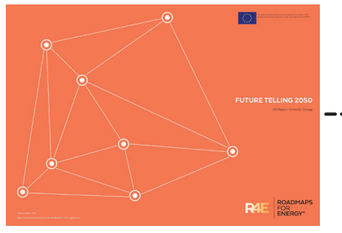
Joint Vision Workshop

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.

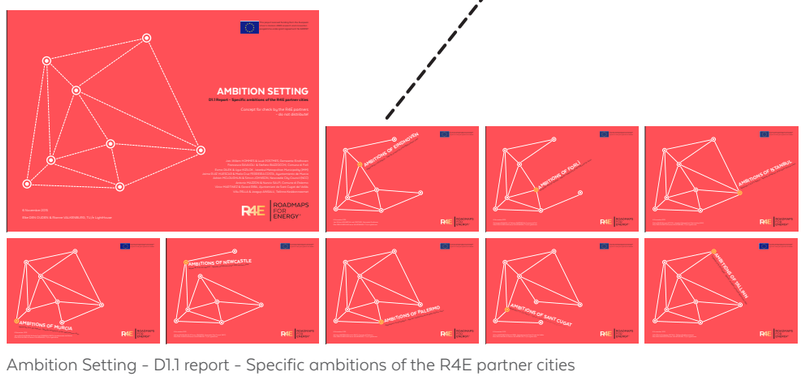
This Joint Vision Workshop served two purposes:

- 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


TODAY'S
A new game-changing technology is again on the horizon. The question is which one?
There is more room for small-scale, local services specifically tailored in the field of education and in product personali-
Intensive replaced that produ used for fo
Compan and acr skills, p input.
Exploitin manufac meat o now p
In the care-sector as we in education, welfare of the individual is a core concern.
The merging of bra with digital systems has now led to a physically and mentally different kind of
Each individual is provided with personal space to develop uniquely and is suitably challenged in both their studi and professional lives.
Governments are increasingly withdrawing their control. Citizens are taking more responsibility and initiatives; both now innovate together.
DO
People are increas looking for a meanin contribution to societ heightening their sens well-being and happi
conditions for the empowering them.
by informed citizens on a global scale who advise each other about consequences and risks.
People are living longer. arning, working, relaxing longer separated and ed: Learn-time, now span our d) active life.
In the expanding on and off-line social networks, people search for authenticity, economy of scale and a sense of security.
Medical knowledge is a commodity where me professionals are lo control over its use
Now that e design som have b
Traveler which ther per
Nationa longer pla in society d economies, te and cyber-crime stretch beyond na geographical bound
Solu People interest- money amo together in, h rare disease res
Soci the pe author large con
of an ow best to spend their time.
y and authentication vices for companies and individuals have become an increasingly important

Future Telling & selection drivers for change

SMART MOBILITY

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.)

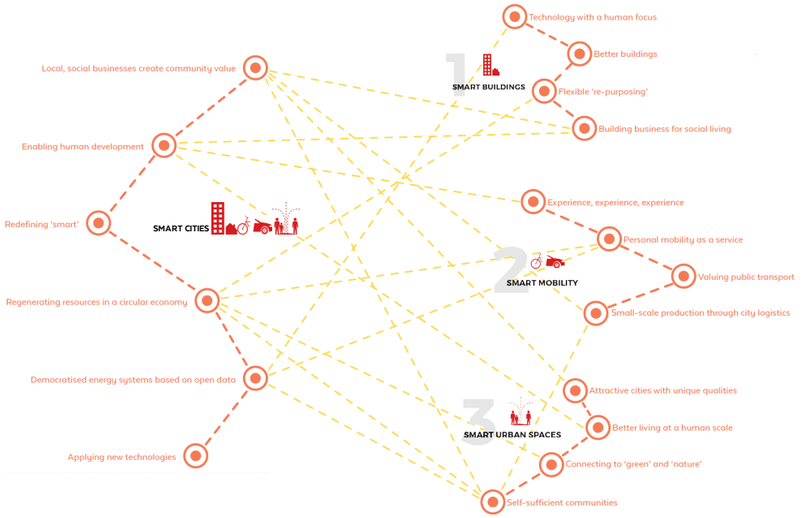
3. Tell stories about how you imagine these 10 trends will develop and what the future in cities will look like.

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

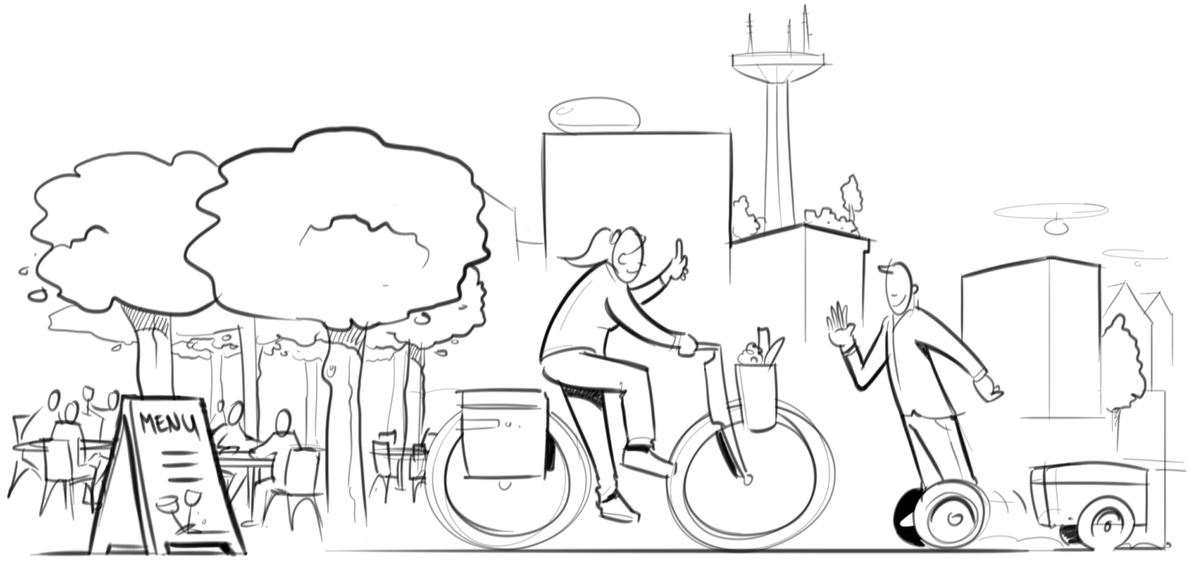
For the focus area Smart Mobility, the city of Tallinn selected four Drivers for Change:

- Better living at a human scale
- Experience, experience, experience
- Valuing public transport
- Regenerating resources in a circular economy

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.

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 …

Experience, experience, experience

In 2050, city residents travel because they like the experience. For short (hyper-local) distances by walking or cycling, to reach places on a daily human scale. And for longer (hyper global) distances, the whole planet can be reached within a few hours. Even space travel could be an option! There's a range of convenient, clean mobility options, making use of abundant renewable energy. Travel has never been easier – it provides seamless connections from where you are to where you want to go. Services focus on what people need, and not on the available systems.

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

a. Experience, experience, experience
b. Hyper local & hyper global
c. Space for mobility

FT11.07. It will be nice to see if that will increase mobility. If we get back to that: if this is all much easier, how much more will we move? Will we be on and off everywhere in the world? Or will we stay more in one place and are connected? So far it seems that we are much more 'out'. Even though we are connected, we still want to be somewhere else connected. I kind of think that it is human nature not to just want to sit around the house. More of us want to be somewhere else. It is about experience, experience, and experience. The virtual experience is not replacing that. We still want the real thing. People still go to concerts, although CD's are there, even in better sound quality, but there are more concerts than ever. There is not going to be a big change in that. They are all more accessible in that sense.

FT25.04..... That is a kind of habit that we have: we accept certain travel times. Commuting will be more like buildings. Mobility is already a commodity, but will be more of a commodity, in the sense that stepping into your mode of transport will be an extension of your living room. You will not drive yourself, but basically it will be like entering another room in your home. Mobility will be a stepping-stone it will not be an activity, so as a cost on life it will disappear – other than separating us from the ones we care about.

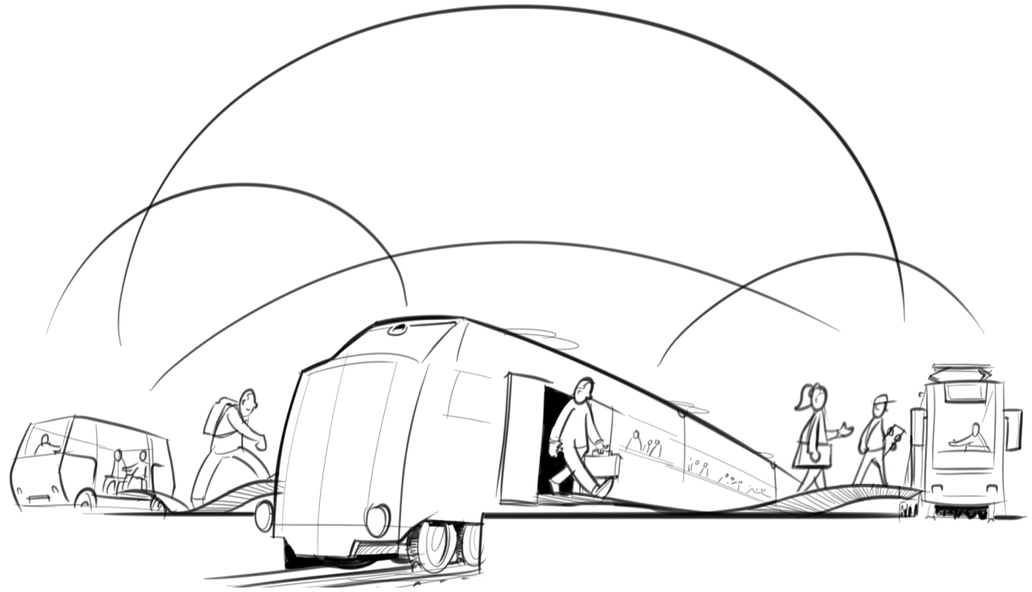
FT3.25. For cities there is also a question in public transport. Do you just want a high speed train to bring you in two hours over a long distance to central hubs, and then just a local network to connect the centre of the city to the surrounding areas? Or do you want local networks between cities? Or will it be local sharing services, with e.g. local cars and e-bikes, but not necessarily public transportation like tram or metro. The focus on more local communities means that we need less travelling on national scale. We may have international and local transportation needs, but much less in between.

FT13.21. If energy is cheap and available, that also means that you can travel far and long. So you need alternative mechanisms to reduce traffic volumes. Because the space is limited factor then. ...

FT13.22. How do you manage mobility? Space is an element to make people understand what traffic can and will do in the city. For instance when Groningen (in the Netherlands) started to plan its urban space, already in the 70s or begin 80s, when they started, it took them at least 25 years to become a very cycling oriented city. So 2050 is now 35 years ahead as well, if you want to accomplish something by now, you now have to start with urban space management. You can accomplish a lot, but it takes a lot of time and digital policies and modelling to support it. It is not that simple.

Valuing public transport

In 2050, cities offer attractive, seamless mobility options: these give everyone access to everywhere. New investment structures and revenue models ensure that the city values (such as inclusiveness) are ingrained in system design. Cities actively influence operators to ensure high levels of customer satisfaction and service quality.



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

a. Affordable, accessible, seamless and attractive

FT13.30. One other thought line we are starting to explore is the impact of door to door services, the concept of collaborative or shared mobility. … If you believe in this scenario to happen of the fully connected traveller, then probably the urbanite may opt out of the mass transport systems. He may no longer choose the bus or the metro. If you believe systems like Uber for instance, who promise door to door transport, and shared mobility services are more and more organised in a way that you do not have to bring back the car to where you got it and you can leave the bicycle close to your door, then you will be tempted away from mass transport. And if you look at the impact of such a scenario then that will be very big. … And would you then care about spatial structure when transport becomes available at all places at all times.

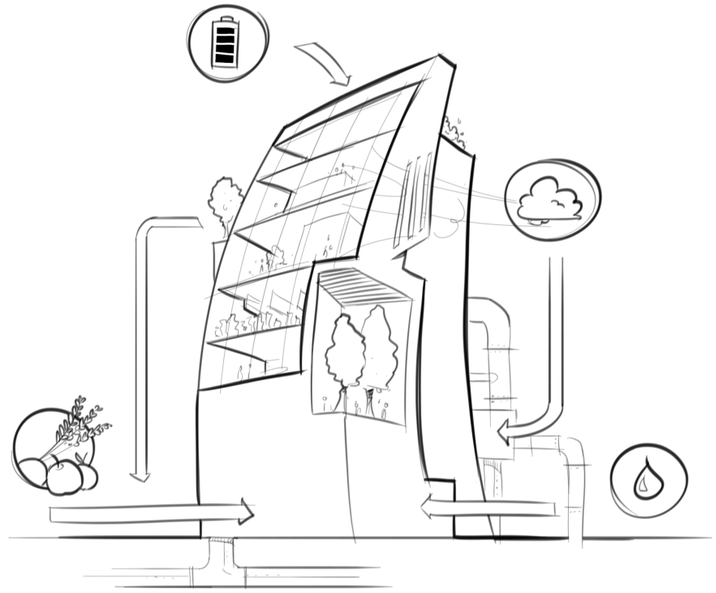
FT19.05. … the way we look at it now with each city having its own public transport corporation for trains, trams, buses, subways. But in a few years all this can be replaced by self-driving cars. There is a new technology coming up, and it is going to change the way of thinking. Suppose we stop this large scale, mass public transport or we limit it to heavy trafficked areas only, and self-driving cars are just open for use by everybody who want to use them. … If we do that, what would be the problem? What is the kind of issue that might be coming up? These questions hook up to the question to what kind of values do we want to design our cities in the future. That is the most relevant question: what values do we have? One of the important values in Europe is inclusiveness. Public transport is now enabling people who do not have a lot of money to take part. It is these values that are important. It is the same for energy: inclusiveness is important to prevent energy poverty. …

FT20.06.One thing that pops into my mind now is also in this inequality is public transport and the affordability of public transport. … Transport needs to be affordable for people, they need to be able to travel easily from A to B. It is already now not affordable anymore, and I cannot see how that can be sustainable for the future. … we have to rethink buses, trams, trains. Make sure people can move around in your city.

FT24.08 The hope is that in future that big cities that really want to improve quality of life that they have the right influence on the operator to ensure that they invest in customer satisfaction, and not only in earning money.

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. ...

Creating the visual of the desired future scenarios

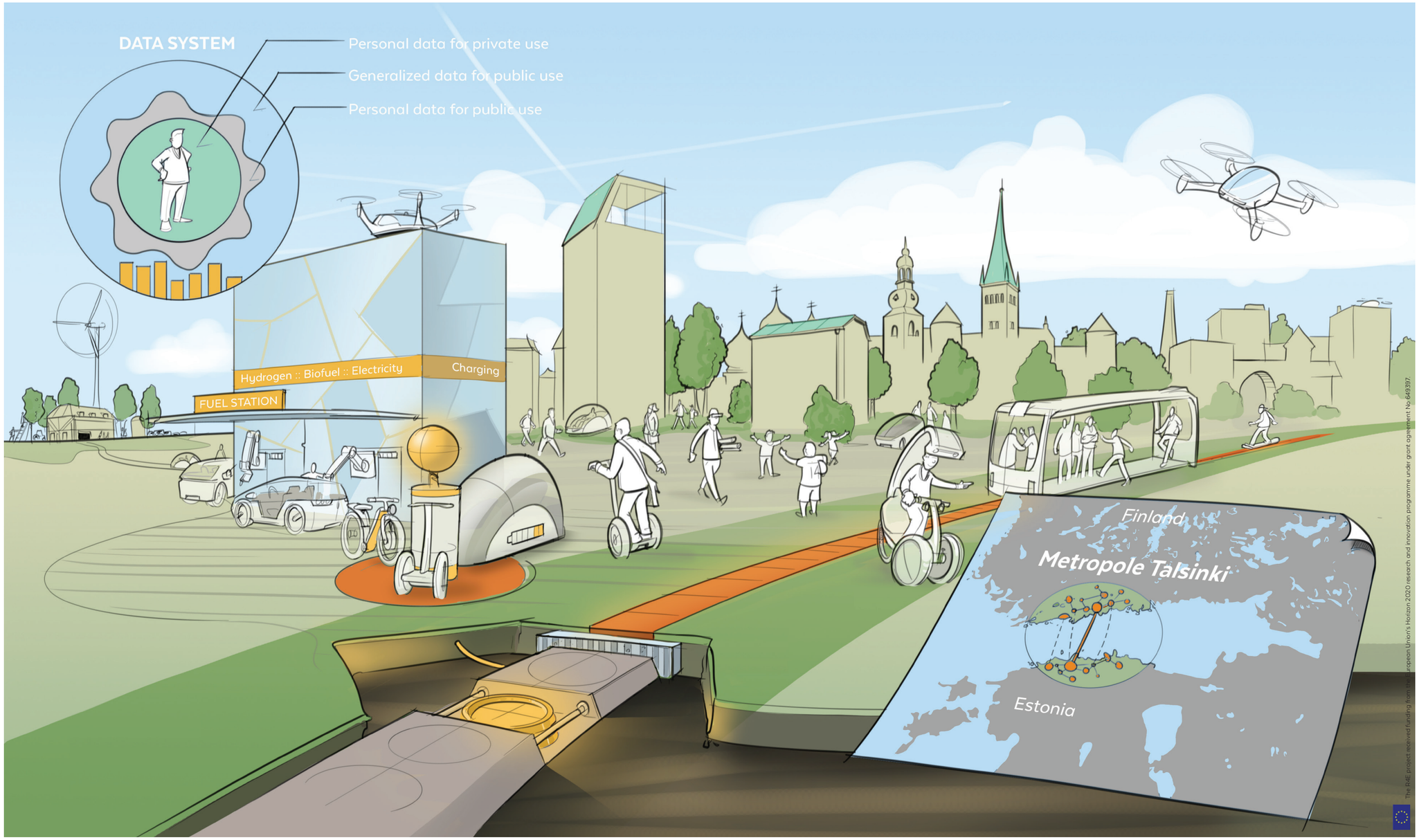
SMART MOBILITY

SMART MOBILITY ENABLES AN ENJOYABLE LIVING ENVIRONMENT IN TALLINN 2050

In 2050, citizens in Tallinn enjoy an attractive, clean and quiet living environment that encourages sustainable behaviour. The cityscape is dense, so all services are within easy reach or are provided in the home. More public space is allocated to living, and less to motorised transport.

Smooth, seamless public transport connects all the city areas. Smart planning is used to respond dynamically to the changing demand for the transport of people and goods. The transport and ticketing systems around the Baltic Sea are integrated in a way that is simple, comfortable, affordable (free), clean and fast.

Planning and decision-making processes are based on open collaboration that includes different views and knowledge sources. Tallinn is recognised as a front-runner in openness. Citizens are aware of their roles, and 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. 649397.

Elements of the desired future scenario are:

Human scale squares

The city's streets and squares are designed around people. The urban environment is safe, attractive and suitable for a wide range of social interactions. The design of the spaces, with an extensive network of cycle tracks and pedestrian-only areas, gives clear priority to walking, cycling and new modes of personal mobility like self-driving bikes and wheelchairs. This ensures easy accessibility for all citizens.

Vehicles on renewable energy

All vehicles, bikes and cars are shared, self-driving and adaptive to the available infrastructure. A shared electrical vehicle system provides the city with renewable energy storage by allowing access to the vehicle batteries. The smart infrastructure collects information from the vehicles for the central system, through which users receive relevant information such as traffic signs, traffic information and navigation suggestions.

Innovative public transport

Different energy-efficient mobility modes include more flexible infrastructure, like trams with magnetic tracks for midrange distances between the neighbourhoods. The non-disruptive infrastructure allows shared use by all vehicles. For longer distances, an integrated public transport system covers Estonia, Scandinavia and the Baltic States, based on superfast and energy-efficient solutions.

Metropole Talsinki

Tallinn and Helsinki together form one big metropolis, with the advantages of economy of scale. This also provides advantages for direct goods logistics connections to Helsinki and beyond. Tallinn is a key hub between mainland Europe and Helsinki. The airport in Tallinn and a high speed transportation system provide fast, comfortable and reliable links for people and goods, and have a positive impact on the labour market and economics.

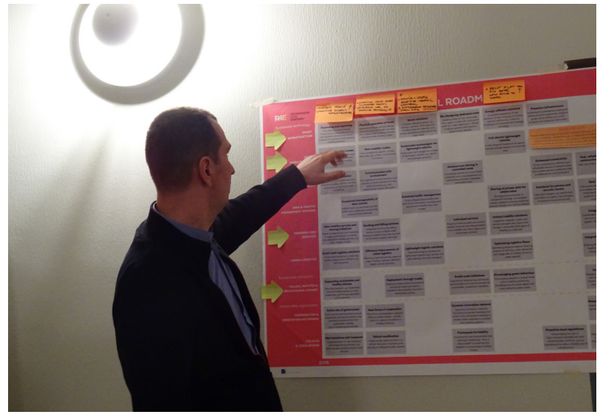
Data system

The 'Smart Department' of Tallinn collects and analyses real-time information for use in smart algorithms that optimise the system based on people's needs. The system is used for decision-making and planning purposes, such as parking & charging of e-vehicles and use of public transport lines. All kinds of applications use the resulting information to provide users with valuable services.

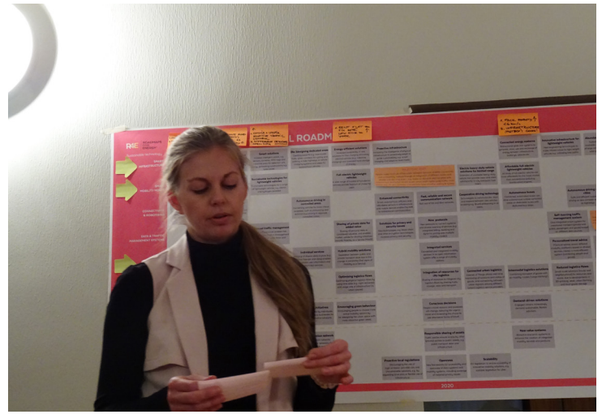
Version 15 June 2016

R4E ROADMAPS FOR ENERGY



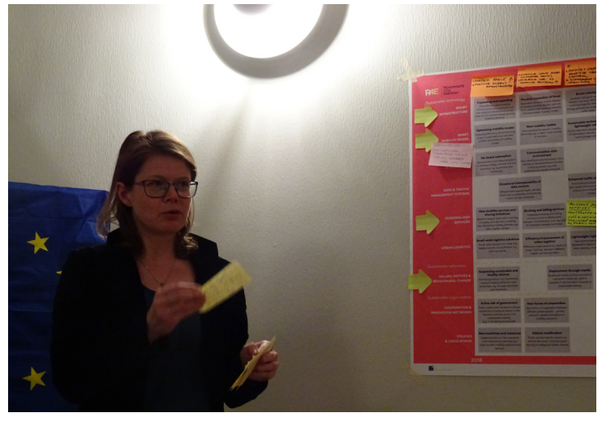












ROADMAPPING

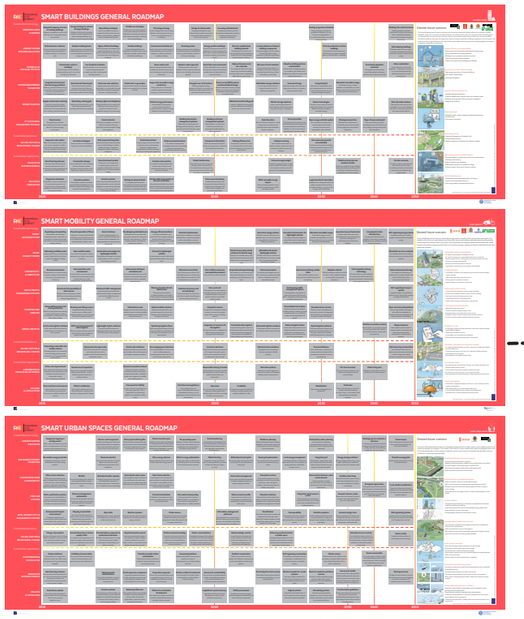
SMART MOBILITY

Roadmapping

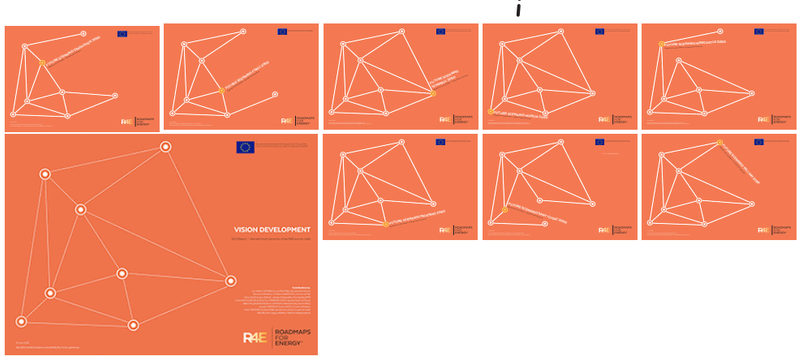
The aim of Step 3 is to develop specific roadmaps for the cities in the selected focus areas. A roadmap shows all existing and future technologies and other relevant developments that enable the achievement of the desired future scenarios by 2050. Two main activities take place in this step. Firstly, 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

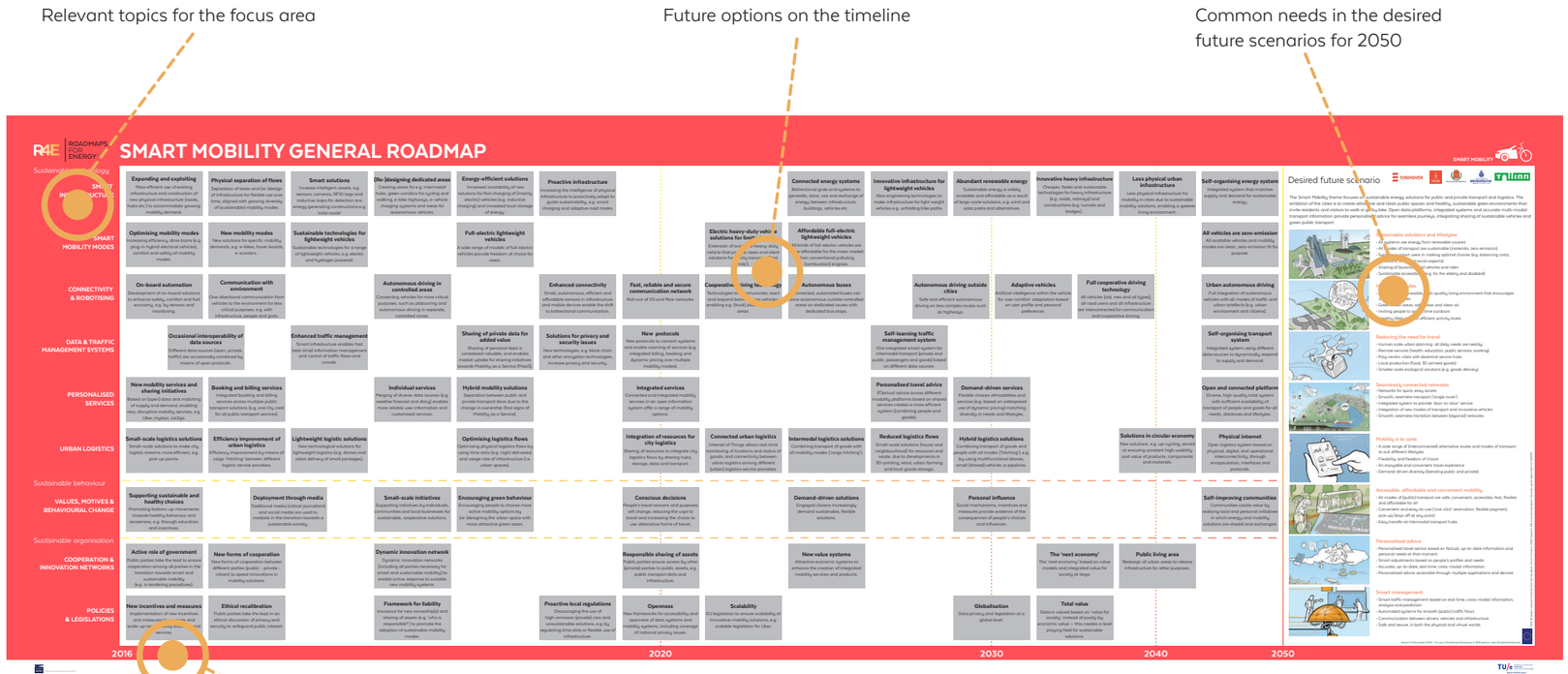
How to read the general roadmap

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 Mobility General Roadmap

Relevant topics for Smart Mobility

In the general roadmap, timelines are created for the topics that require developments to achieve the desired future scenarios in 2050. The topics selected for the Roadmap Smart Mobility 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 Mobility includes the following technology developments:

SMART INFRASTRUCTURE

Smart Infrastructure is about the physical infrastructure and energy systems relating to mobility. Specifically, this topic includes the engineering, (re-)design, maintenance and role of the physical infrastructure in terms of roads, city squares, urban areas, bridges and tunnels. The topic also applies to energy systems in terms of charging infrastructure and (connected) energy systems. It therefore has close links to Smart Buildings and Smart Urban Spaces.

SMART MOBILITY MODES

Smart Mobility Modes is about the different types of (sustainable) mobility, including the development of the required technologies. More specifically, this topic applies to the development, implementation and use of sustainable and smart mobility modes such as cars, trucks, bikes and drones.

CONNECTIVITY & ROBOTISING

Connectivity & Robotising describes developments in ICT infrastructure, communication technologies and autonomous driving. Connectivity & Robotising applies to all forms of intelligent in-vehicle solutions that allow vehicle-to-vehicle, vehicle-to-infrastructure, vehicle-to-person and vehicle-to-grid communication. The topic also includes (semi-)autonomous vehicles and ICT-related developments such as 5G, since these contribute to a connected and automated mobility system.

DATA & TRAFFIC MANAGEMENT SYSTEMS

Data and Traffic Management Systems includes developments relating to transport systems and the increasing use of different types of data, including those relating to the shift towards Mobility as a Service. Data can and will be generated and communicated by the digital infrastructure and communication technologies as described by the Connectivity and Robotising topic. This data topic also applies to the management of transport systems, the developments relating to data interoperability between service providers, data protocols, and personal data and privacy issues.

PERSONALISED SERVICES

Personalised Services include the availability of mobility services, developments in public transport and those relating to applications allowing for mobility à la carte and Mobility as a Service. The Personalised Services topic is also about the development of specific (personalised) services. These are based on different types of data such as open, personal and real-time traffic data, and are aimed at matching supply and demand. As such, this topic also includes the blend of public and private mobility services and personalised travel advice.

URBAN LOGISTICS

In general, Urban Logistics is about logistics solutions and developments that affect the logistics flows in cities. More specifically, it include aspects relating to the (integrated) transport of goods across the whole urban logistics system, integrating multiple urban logistics flows, and the development of new solutions for urban logistics.

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 requires awareness. In many cases, the available technologies are not sufficiently attractive to gain acceptance in mass markets. The Roadmap Smart Mobility includes the following behavioural developments:

VALUES, MOTIVES & BEHAVIOURAL CHANGE

Values, Motives and Behavioural Change includes the way citizens can play an active role in behavioural change, driven by different values and reasoning over time. Small-scale initiatives, the role of the media and healthy behaviour are some of the aspects covered.

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 Mobility includes the following organisational developments:

COOPERATION & INNOVATION NETWORKS

Cooperation and Innovation Networks describes how forms of cooperation between different types of organisations (public and private) will evolve over time to speed innovation and new mobility solutions. Among the aspects covered are active roles of multiple stakeholders, and sharing of assets.

POLICIES & LEGISLATION

Legislative changes and the right policies are important factors in the developments relating to Smart Mobility. This topic includes the developments in this field. More specifically, it applies to developments relating to legislative aspects, and frameworks and measures to enable the creation of Smart Mobility systems.

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 MOBILITY GENERAL ROADMAP

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.

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.

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.

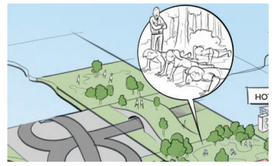
Total value
Data is valued based on 'value for society' instead of purely by economic value — this creates a level playing field for sustainable solutions.

2030 2040 2050

Desired future scenario

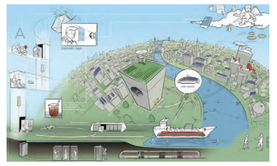
The Smart Mobility theme focuses on sustainable energy solutions for public and private transport and logistics. The ambition of the cities is to create attractive and clean public spaces and healthy, sustainable green environments that invite residents and visitors to walk or go by bike. Open data platforms, integrated systems and accurate multi-modal transport information provide personalised advice for seamless journeys, integrating sharing of sustainable vehicles and green public transport.

Sustainable solutions and lifestyles
- All systems use energy from renewable sources
- All modes of transport are sustainable (materials, zero-emission)
- Systems support users in making optimal choices (e.g. balancing costs, emissions, time and social aspects)
- Sharing of (autonomous) vehicles and rides
- Sustainable accessibility (e.g. for the elderly and disabled)



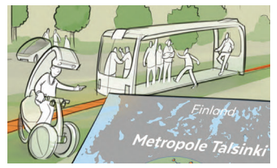
Healthy lifestyles
- Comfortable, accessible, high-quality living environment that encourages outdoor activities
- Green urban areas, safe areas and clean air
- Inviting people to spend time outdoors
- Healthy lifestyles with efficient activity levels

Reducing the need for travel
- Human scale urban planning: all daily needs are nearby
- Remote services (health, education, public services, working)
- Poly-centric cities with decentral service hubs
- Local production (food, 3D-printed goods)
- Smaller-scale ecological solutions (e.g. goods delivery)

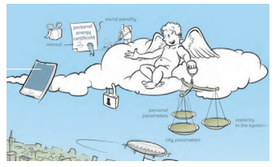


Seamlessly connected networks
- Networks for quick, easy access
- Smooth, seamless transport ('single route')
- Integrated system to provide 'door-to-door' service
- Integration of new modes of transport and innovative vehicles
- Smooth, seamless transition between (regional) networks

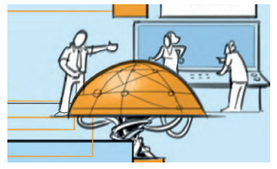
Mobility à la carte
- A wide range of (interconnected) alternative routes and modes of transport to suit different lifestyles
- Flexibility and freedom of choice
- An enjoyable and convenient travel experience
- Demand-driven diversity (blending public and private)



Accessible, affordable and convenient mobility
- All modes of (public) transport are safe, convenient, accessible, fast, flexible and affordable for all
- Convenient and easy-to-use ('one-click' reservation, flexible payment, pick-up/drop-off at any point)
- Easy transfer at intermodal transport hubs



Personalised advice
- Personalised travel advice based on factual, up-to-date information and personal needs at that moment
- Smart adjustments based on people's profiles and needs
- Accurate, up-to-date, real-time, cross-modal information
- Personalised advice accessible through multiple applications and devices



Smart management
- Smart traffic management based on real-time, cross-modal information, analysis and prediction
- Automated systems for smooth (public) traffic flows
- Communication between drivers, vehicles and infrastructure
- Safe and secure, in both the physical and virtual worlds

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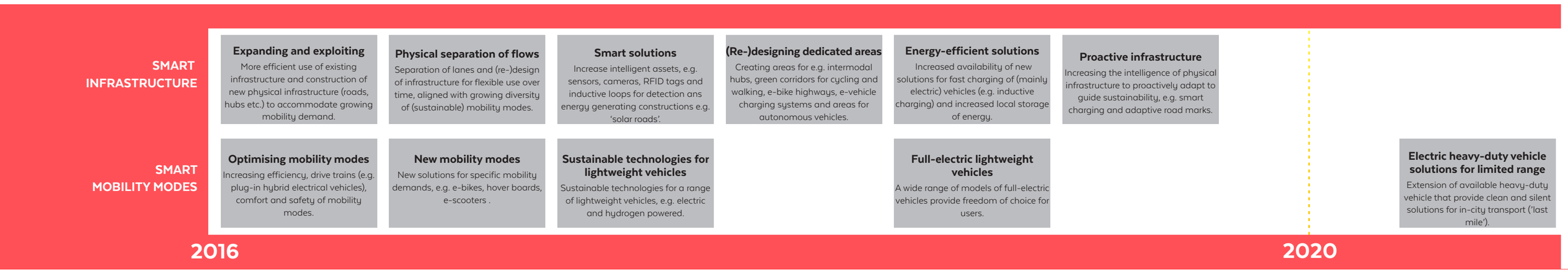


Smart Infrastructure

Short-term developments

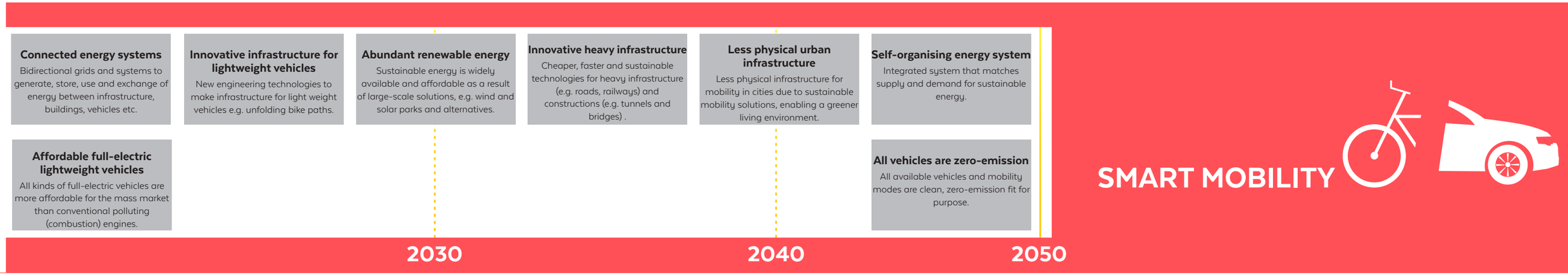
- In the short term, new infrastructure continues to be constructed (mainly outside the city centres), and current infrastructure is used more efficiently to accommodate the growing demand for mobility.
- Separation of lanes and (re-)design of infrastructure allows flexible use of infrastructure over time, aligned with growing diversity of mobility modes. In addition, the creation of new areas or the re-creation of existing areas allows for dedicated areas such as green corridors, e-bike highways and e-vehicle charging systems.
- More (fast) charging solutions and solutions for local energy storage are in place.
- The increase in intelligent assets allows for a more intelligent (proactive) infrastructure. Intelligent infrastructure could, for example, proactively drive sustainability in cities by guiding users of electric vehicles to charging stations or by automatically banning vehicles with high emission levels from city centres.

Mid-term developments

- Connected energy systems allow for the generation, storage, use and exchange of energy between infrastructure, buildings and other assets.
- New engineering technologies are in place to make lightweight infrastructure (e.g. unfoldable bike paths and footpaths).
- Sustainable energy is largely available in the medium term as a result of large-scale solutions such as wind and solar parks. The resulting abundant sustainable energy is affordable for all.

Long-term developments

- In the long term, new engineering technologies are in place to build heavy infrastructure. This results in cheaper, faster and more sustainable ways to build and maintain heavy infrastructure such as roads, railways and constructions such as tunnels and bridges.
- Finally, a wide range of sustainable mobility solutions, less physical infrastructure and an integrated energy system enable a greener living environment in which sustainable energy supply and demand can be organised efficiently.



Smart Mobility Modes

Short-term developments

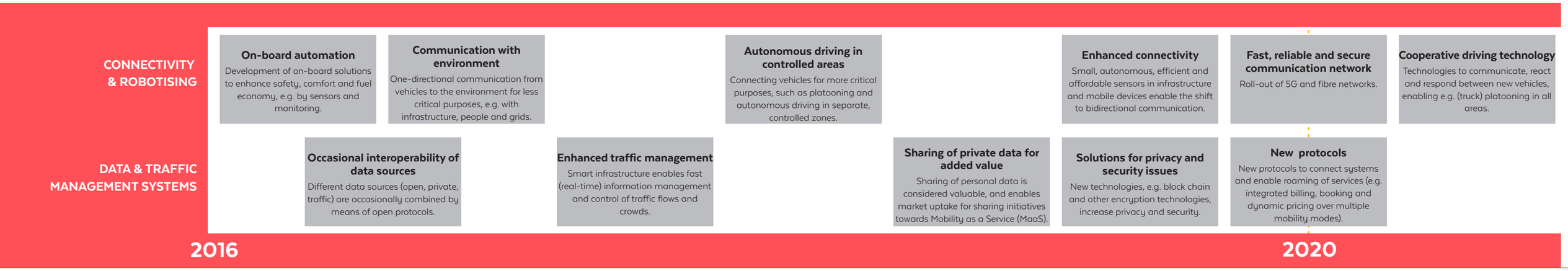
- In the short term there are incremental improvements in vehicle drivetrains, comfort and safety. As well as optimising current mobility modes, new mobility modes are also emerging as solutions for specific mobility demands, such as e-bikes, hoverboards and e scooters.
- Over time, but still in the short term, sustainable technologies enable a wide range of lightweight (electric or hydrogen-powered) vehicles. The range of lightweight vehicles is accompanied by increasing availability of full-electric vehicles, giving users freedom of choice.

Mid-term developments

- In the mid-term, a limited range of heavy-duty vehicles is available. More specifically, the available range of heavy-duty vehicles increases, providing clean and silent solutions for in-city transport.
- In addition to the developments in heavy-duty vehicles, all kinds of sustainable (mainly electric) vehicles are more affordable for the mass market than conventional, polluting vehicles. From this point on, the numbers of sustainable vehicles grow faster than the traditional, polluting vehicles.

Long-term developments

- In the long term, all available vehicles and mobility modes are clean, zero-emission and fit for their intended purposes. But it will still take a very long time before all vehicles on the road are clean and non-polluting.



Connectivity & Robotising

Short-term developments

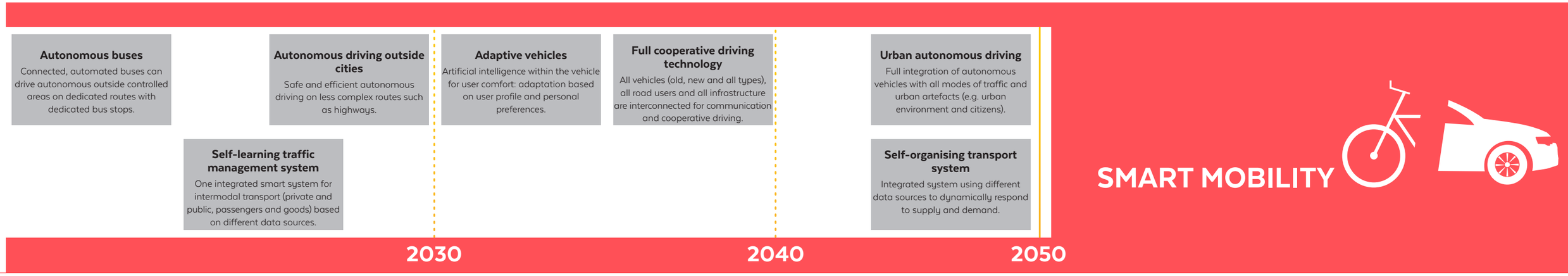
- Short-term developments in connectivity and robotising can first of all be relate mainly to in-vehicle automation and autonomous driving in controlled areas. This means that the development of in-vehicle solutions enhances safety, comfort and fuel economy, e.g. by means of sensors and monitoring. In addition, autonomous driving is possible in separate controlled zones.
- Secondly, short-term developments in connectivity and robotising are related to one-directional communication. Later in this period, enhanced connectivity enables a shift to bidirectional communication. More specifically, one-directional communication between vehicles and their environment shifts over time towards bidirectional communication. This will be enabled by efficient, affordable sensors in infrastructure and mobile devices.

Mid-term developments

- In the mid-term, the experts predict developments relating to the creation of a fast, reliable and secure communication network, enabled by the roll-out of high-speed 5G and fibre networks. In addition, cooperative driving technologies to communicate, react and respond between new vehicles enable forms of ‘platooning’ of vehicles in almost all areas. Autonomous buses and autonomous driving outside cities are expected to be possible (on a larger scale) by the end of the mid-term period.

Long-term developments

- Long-term developments in connectivity and robotising relate mainly to adaptive vehicles, full cooperative driving technology and finally autonomous urban driving. Artificial intelligence, fully interconnected and communicating vehicles (both old and new) and full integration of autonomous vehicles with other modes of traffic and urban infrastructure are some of the core aspects of these long-term developments.



Data & Traffic Management Systems

Short-term developments

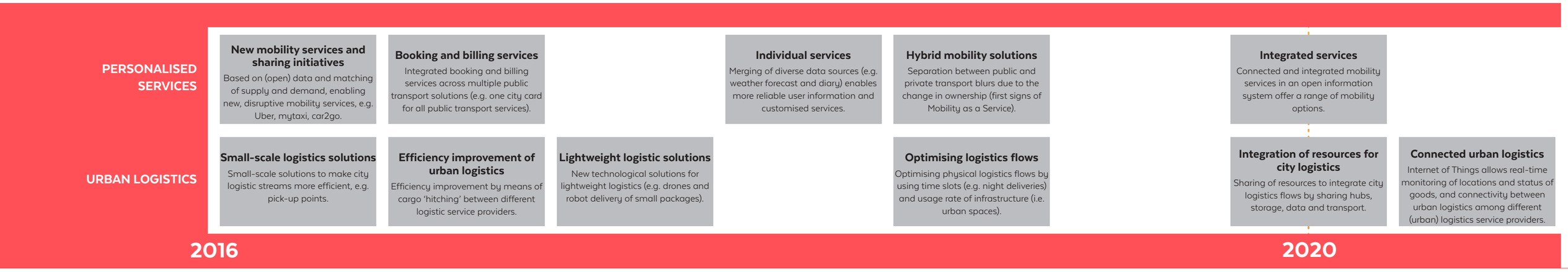
- In the short term, several main developments can be identified. The first developments relate to the interoperability of different data sources. The creation of a fully interoperable platform is perhaps the main challenge in creating complete, sophisticated data & traffic management systems. Currently open protocols allow different data sources to be combined and integrated on an occasional basis. This kind of occasional interoperability of multiple data sources continues to increase over time.
- Recognition of the value of data drives the market uptake of sharing initiatives towards Mobility as a Service. This valuing of data is already visible, but this development is likely to increase over time. In addition, the development of new protocols enables the interconnection of systems and roaming of services across multiple mobility modes. However, this requires new solutions to address privacy and security issues.
- Enhanced traffic management is already happening. The increasing amount of smart infrastructure speeds the potential of enhanced traffic management. Smart infrastructure also enables fast (real-time) information management and control of traffic flows and crowds.

Mid-term developments

- The development of new protocols is likely to increase over time, and this development also continues to intensify in the mid-term period, allowing an increase in the interconnection of systems and roaming of services across multiple mobility modes. Self-learning traffic management systems begin to emerge as a result of the enhanced traffic management system and the increase in connectivity. These integrated smart system allow the management of intermodal transport of passengers and goods, using different (secure) data sources.

Long-term developments

- The creation and use of a self-organising transport system is already possible and applicable within a (secure) small-scale environment. However, an integrated system that uses different data sources to dynamically respond to supply and demand of goods, services and passengers on a large scale is still some years away.



Personalised Services

Short-term developments

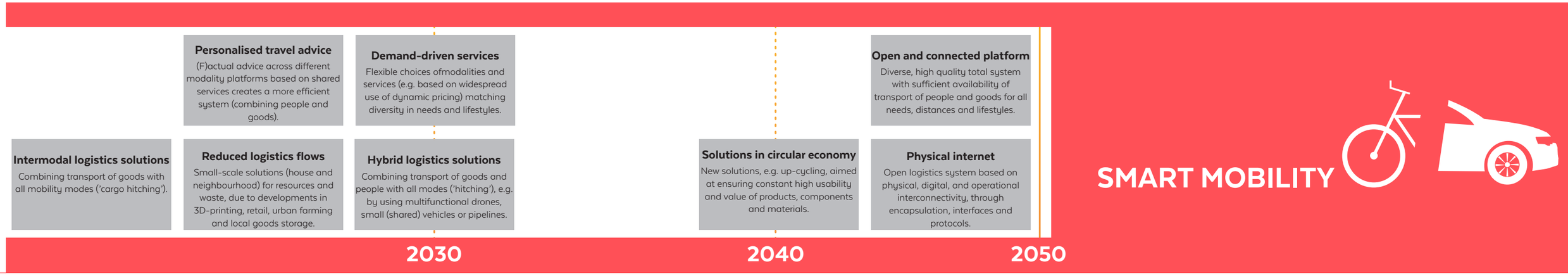
- In the short term, the number of new mobility services and sharing initiatives is likely to increase. This is mainly due to the increase in (open) data and matching of supply and demand, which enables new mobility services that could potentially disrupt the market. Integrated booking and billing services across multiple public transport solutions such as an a single city card for all public transport services, as well as individual, personalised services, enable more reliable and convenient services.
- By the end of the short term, at around the beginning of 2020, there is a shift from hybrid mobility solutions towards more integrated services. The separation of public and private also blurs over time, due to the change in ownership. In addition, connected and integrated mobility services in an open information system will offer a range of mobility options.

Mid-term developments

- New protocols to connect systems and enable roaming services allow better connected and more integrated services. Factual, up to date advice across different modalities and based on shared services creates a more efficient mobility system that combines services and the transport of goods and peoples. In the long term, this development results in demand-driven services.

Long-term developments

- In the long term, demand-drive services allow for flexible choices of modalities and services matching a wide range of needs and lifestyles. These demand-driven services are enabled by a fully open and connected platform. The result is a diverse and high-quality total system that offers sufficient capacity for all transport needs – for people and goods, for all distances and for all lifestyles. However, it will still take a couple of years and some conditions need to be met before all these services are available on a large scale.



Urban Logistics

Short-term developments

- In the short term, small-scale logistics solutions are further developed making city logistics flows more efficient, for example by using pick-up and drop-off points, and these solutions become more widely available. Efficiency improvements by means of cargo 'hitching' between logistics service providers and the development of new technological solutions for lightweight goods logistics are two developments that reach maturity and are ready for market uptake in the short term.
- Optimising physical logistics flows by exploiting time slots, for example night deliveries and higher usage of infrastructure such as urban spaces, have already been implemented on a local scale. By the end of the short term, these developments are widespread.

Mid-term developments

- The integration of resources for city logistics is a development that occurs by the end of the short term and in the beginning of the mid term period. Sharing of resources is more common and allows the integration of city logistics flows. The sharing of hubs, storage facilities, data and transport solutions is seen as a straightforward solution for urban logistics.
- In the mid-term the Internet of Things (IoT) allows extensive real-time monitoring of the locations and status of goods. In addition to real-time monitoring, IoT will allow increased connectivity of urban logistics among different service providers. The connectivity of urban logistics and the market uptake of Mobility as a Service allow intermodal logistics solutions, combining goods transport with all mobility modes (cargo 'hitching').
- Small-scale solutions (home and neighbourhood) for resources and waste resulting from developments in 3D printing, retail, urban farming and local goods storage allow logistics flows in urban areas to be reduced by the end of the mid-term period.

Long-term developments

- Hybrid logistics solutions are widely available, using all mobility modes to transport goods and people. These developments emerge in line with those already referred to in connectivity, personal services and data & traffic systems. Overall, the result is an open logistics system based on physical, digital and operational interconnectivity through embedded interfaces and protocols. These long-term developments are also known as the physical internet.
- Solutions in circular have the potential to disrupt urban logistics flows. New solutions, products, components and materials are designed to constantly maintain the highest value and efficiency.

Values, Motives & Behavioural Change

Short-term developments

- Values, motives and behavioural change are about the way citizens can play an active role in their own behavioural change, driven by different values and reasoning over time. In the short term, this is made possible by promoting bottom-up movements towards healthy behaviour and awareness, for example with education and incentives. The role of the media is crucial for people's values, motives and behavioural change relating to the use of smart, sustainable mobility solutions. Both traditional (critical) journalism and new (social) media are used in the short term to support and facilitate the transition towards a sustainable society.
- Small-scale initiatives for sustainable and cooperative solutions by individuals, communities and local business are more widespread in the short term. This develops in line with the encouragement of green behaviour so people choose more active mobility options (e.g. bikes or walking). For this purpose, the urban space is redesigned with more green, liveable and attractive areas.

Mid-term developments

- Mid-term developments show that people's thinking and reasons for travelling will change due to technological developments and MaaS (Mobility as a Service), which reduces the urge to travel and increases the choice of alternative ways of travel. The shift in people's thinking and reasons for travelling enables demand-driven solutions, in which engaged citizens increasingly demand sustainable and flexible solutions.

Long-term developments

- Social mechanisms, incentives and measures provide help to show people the consequences of their choices by the end of the mid-term and the beginning of the long term. By the end of the long-term period self-improving communities emerge. More specifically, in the long term these communities create value through local and personal initiatives to share and exchange energy and mobility solutions.

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.

2030

2040

2050

SMART MOBILITY

Cooperation & Innovation Networks

Short-term developments

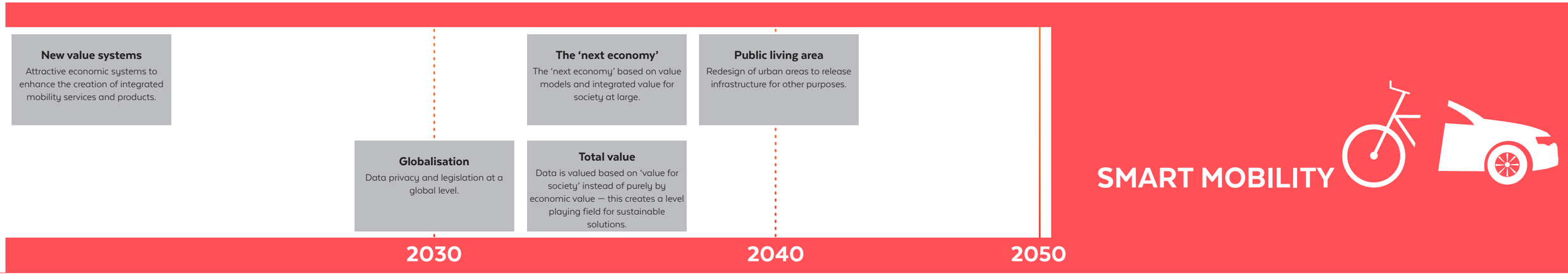
- Cooperation and innovation networks describe how new forms of cooperation between different types of organisations (public–private) evolve over time, speeding innovation and the roll-out of new mobility solutions. In the short term, public parties take active roles in ensuring cooperation between all those involved in the transition towards smart mobility; this is a trend that is already taking place. New forms of cooperation between the different parties – public, private and citizens – are established to speed innovation and the roll-out of new mobility solutions.
- Dynamic innovation networks, including all parties needed for smart mobility solutions, enable an active response to new mobility systems in the short term. Public parties play a leading role in this process by ensuring that other (private) parties have access to public asset such as data, transport data and infrastructure.

Mid-term developments

- As a result of the sharing of assets and other developments, a new value system emerges in the mid term. This is based on attractive economic systems that enhance the creation of integrated mobility services and solutions.

Long-term developments

- In the long term, expected developments relate to the 'next economy', based on value models and overall value for society at large. Finally in the long term, redesigned urban areas release infrastructure for other purposes.



Policies & Legislation

Short-term developments

- Legislative changes and the right polices are important factors in the developments relating to Smart Mobility. In the short term, the implementation of new incentives and measures is stimulated and new mobility solutions and services are scaled-up. In this phase, public parties play an important leadership role in the ethical discussion of privacy and security to safeguard public interest. Technological developments in data security are an important factor in allowing and enabling the discussion of ethical recalibration.
- Frameworks for liability continue to develop in the short term. The availability of insurance for new asset ownerships and sharing models drives the penetration of sustainable mobility modes and the shift towards Mobility as a Service. Proactive local regulation encourages the adoption of smart, sustainable mobility solutions. At the same time it discourages the use of polluting vehicles, for example by regulating time slots or flexible use of infrastructure.

Mid-term developments

- In the mid-term, there is more openness in terms of new frameworks for accessibility of data systems and mobility systems. The openness of these data and mobility systems takes into account national privacy issues. The way national privacy is handled, together with EU legislation, also enables the scaling-up of innovative mobility solutions, for example with scalable legislation for taxi services such as Uber.

Long-term developments

- Frameworks and long-term legislation at both national and EU level ensure global data privacy. In the long term, experts expect to see a total value system in which data is value for its societal benefits instead of purely in terms of economic value. This creates a level playing field for sustainable solutions.

R4E ROADMAPS FOR ENERGY®

SMART MOBILITY ROADMAP TALLINN

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
People make more use of free public transport because it offers better connectivity and accessibility. The system integrates different modes, with reliable, real-time data – e.g. buses on demand and first pilots of autonomously driving, full-electric buses. Smart traffic lights guide traffic, more private cars are zero-emission, and separate lanes give priority to walkers and cyclists.

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
People use more personalised services, e.g. provided by electric and shared vehicles. They have adopted healthier lifestyles using locally produced food. The impact of online shopping and home deliveries is visible in the city through lower urban logistics activity. The city is greener, and has more parks. The connection with Helsinki is improved by a tunnel, and a hyperloop system is under construction.

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.

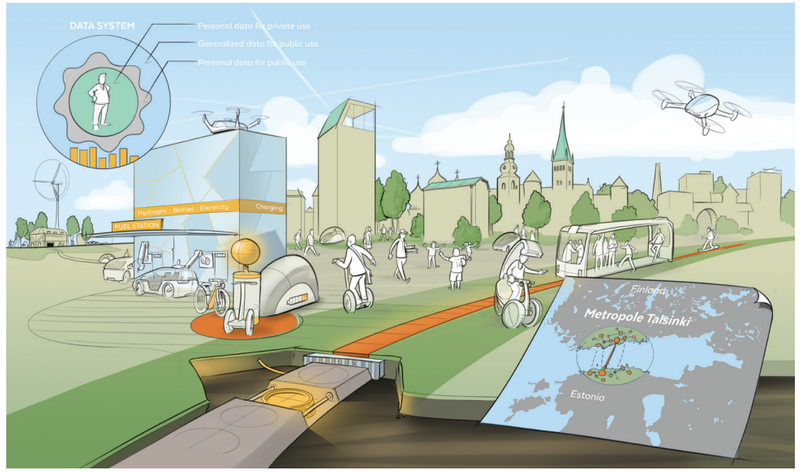
Globalisation
Data privacy and legislation at a global level.

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

Tallinn



SMART MOBILITY ENABLES AN ENJOYABLE LIVING ENVIRONMENT IN TALLINN 2050

In 2050, citizens in Tallinn enjoy an attractive, clean and quiet living environment that encourages sustainable behaviour. The cityscape is dense, so all services are within easy reach or are provided in the home. More public space is allocated to living, and less to motorised transport.

Smooth, seamless public transport connects all the city areas. Smart planning is used to respond dynamically to the changing demand for the transport of people and goods. The transport and ticketing systems around the Baltic Sea are integrated in a way that is simple, comfortable, affordable (free), clean and fast.

Planning and decision-making processes are based on open collaboration that includes different views and knowledge sources. Tallinn is recognised as a front-runner in openness. Citizens are aware of their roles, and actively take part in making decisions that influence their living environment.

Elements of the desired future scenario are:

Human scale squares
The city's streets and squares are designed around people. The urban environment is safe, attractive and suitable for a wide range of social interactions. The design of the spaces, with an extensive network of cycle tracks and pedestrian-only areas, gives clear priority to walking, cycling and new modes of personal mobility like self-driving bikes and wheelchairs. This ensures easy accessibility for all citizens.

Vehicles on renewable energy
All vehicles, bikes and cars are shared, self-driving and adaptive to the available infrastructure. A shared electrical vehicle system provides the city with renewable energy storage by allowing access to the vehicle batteries. The smart infrastructure collects information from the vehicles for the central system, through which users receive relevant information such as traffic signs, traffic information and navigation suggestions.

Innovative public transport
Different energy-efficient mobility modes include more flexible infrastructure, like trams with magnetic tracks for midrange distances between the neighbourhoods. The non-disruptive infrastructure allows shared use by all vehicles. For longer distances, an integrated public transport system covers Estonia, Scandinavia and the Baltic States, based on superfast and energy-efficient solutions.

Metropole Talsinki
Tallinn and Helsinki together form one big metropolis, with the advantages of economy of scale. This also provides advantages for direct goods logistics connections to Helsinki and beyond. Tallinn is a key hub between mainland Europe and Helsinki. The airport in Tallinn and a high speed transportation system provide fast, comfortable and reliable links for people and goods, and have a positive impact on the labour market and economics.

Data system
The 'Smart Department' of Tallinn collects and analyses real-time information for use in smart algorithms that optimise the system based on people's needs. The system is used for decision-making and planning purposes, such as parking & charging of e-vehicles and use of public transport lines. All kinds of applications use the resulting information to provide users with valuable services.

The R4E project, received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649357

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

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 MOBILITY

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.

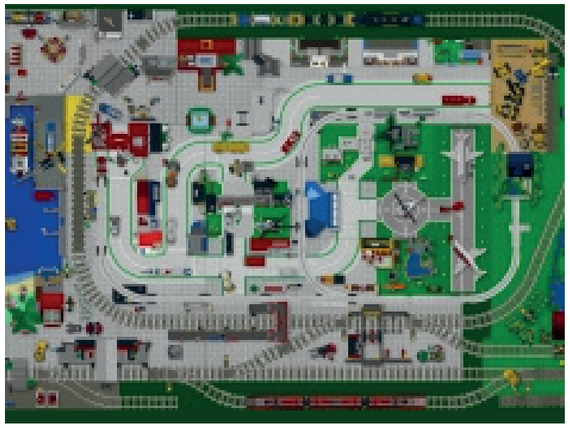
The groups then presented their proposals in a plenary session, after which all the cities described their learning objectives related to the themes.

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 Mobility Tallinn

1 URBACT III Freight TAILS



The Freight TAILS Action Planning Network will address the challenges posed by rapidly increasing freight movements, within the context of all urban logistics. This Freight TAILS project will develop tailored freight management policies using the URBACT Integrated Action Planning methodology to pro-actively support the functioning of different growing cities, whilst reducing the carbon emissions.

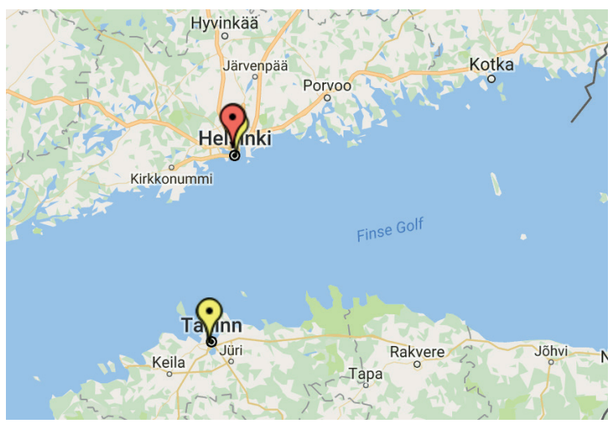
2 NSB CORE
(North Sea Baltic Connector of Regions)

NSB CoRe improves the sustainable accessibility of the Eastern BSR (EBSR) in freight and passenger transport. The project produces a joint transnational vision of regional development with recommendations for policymakers in passenger and freight transport.

3 FinEstSmartMobility
(Improving old city harbour)

FinEst Smart Mobility is a project that seeks to improve transport flows between Tallinn's Old City Harbor and Jatkasaari harbor of Helsinki as well as to improve passengers' customer experience. The project includes various smart mobility experiments such as smart "park and ride" and control of heavy traffic. It is also planned to improve connections from the harbors to the airport in Helsinki and to the ring road in Tallinn.

4 FinEst Link
(Finnish Estonian Transport Link)



The project will create comprehensive assessment of FinEst Transport Link and a plan for the future fixed link (tunnel) between Helsinki and Tallinn. The project focuses in wider Finnish-Estonian perspective, European TEN-T perspective, transport technology development, environmental aspects and in changing socio-economic context of the emerging twin-city region.

New Project Ambitions Smart Mobility Tallinn

SMART MOBILITY

1 ONE TICKETING SYSTEM IN TALLINN AND HELSINKI

Tallinn

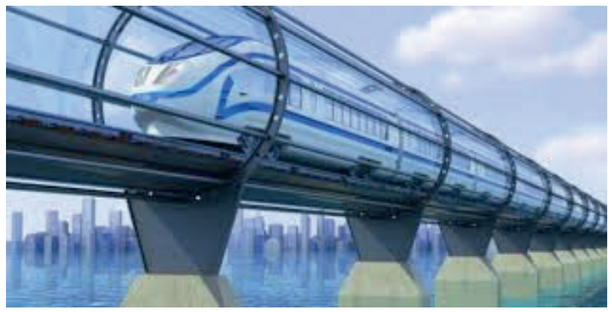
We want to that in two cities has the one ticketing system. So Tallinn and Helsinki citizens can use one ticket in different kind of Cities.

R4E ROADMAPS FOR ENERGY

SMART MOBILITY

2 TALLINN-BERLIN HYPERLOOP

Tallinn



Maybe in the futuure the cargo will sent through hyperloop.

R4E ROADMAPS FOR ENERGY

SMART MOBILITY


R4E ROADMAPS FOR ENERGY
Ambition workshop - Stakeholders - Smart Mobility
Tallinn
2015
2025
2
5
6
8

CONTRIBUTIONS

SMART MOBILITY

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.

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AMBITION, VISION & ROADMAP

SMART MOBILITY TALLINN

D6.4 Final city report

This report contains the results of the ambition setting, vision development and roadmapping activities for smart mobility in the city of Tallinn. 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®