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AMBITION, VISION & ROADMAP

SMART MOBILITY MURCIA

D6.4 Final city report

18 August 2017

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R4E

ROADMAPS
FOR
ENERGY®

AMBITION, VISION & ROADMAP SMART MOBILITY MURCIA

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 Murcia.



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

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CONTENTS



CONTENTS 3

R4E - ROADMAPS FOR ENERGY.....5

AMBITION SETTING.....7

 Introduction to Murcia8

 Today’s reality: Smart mobility.....14

 Ambition: Safe, clean and affordable mobility in Murcia 2050.....15

VISION DEVELOPMENT17

 Future Telling & selection drivers for change.....19

 Desired future scenario Smart Mobility.....25

ROADMAPPING..... 27

 Relevant topics for Smart Mobility29

 Smart Mobility general roadmap.....30

 Roadmap Smart Mobility Murcia42

PROJECT PORTFOLIO45

 Running Projects Smart Mobility Murcia.....46

 New Project Ambitions Smart Mobility Murcia46

CONTRIBUTIONS.....49

quality management, project coordination, financial & administrative activities

Sant Cugat

Palermo

Istanbul

Tallinn

Newcastle

Forli

Murcia

Joint project kick-off & SC

Organising for learning

Final event

conference in Murcia

R4E - ROADMAPS FOR ENERGY



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, Forlì, 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



Gemeente Eindhoven, the Netherlands

- Population: 220,000
- Area: 90 km²



Comune di Forlì, Italy

- Population: 120,000
- Area: 228 km²



Istanbul Metropolitan Municipality, Turkey

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



Ayuntamiento de Murcia, Spain

- Population: 440,000
- Area: 885 km²



The eight partner cities of R4E



Newcastle City Council, United Kingdom

- Population: 282,000
- Area: 114 km²



Comune di Palermo, Italy

- Population: 885,000
- Area: 160 km²



Ajuntament de Sant Cugat del Vallès, Spain

- Population: 86,000
- Area: 50 km²



Tallinna Keskkonnaamet, Estonia

- Population: 430,000
- Area: 160 km²





Ambition Setting



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 <ul style="list-style-type: none">Each city presents their ambition for the focus areas |
| | Learning from each other’s ambitions <ul style="list-style-type: none">In-depth discussion on common and specific ambitions |
| Afternoon Preparing for Step 2 | Presentation of the Drivers for Change <ul style="list-style-type: none">Sharing of results of Future Telling research |
| | Understanding the Drivers for Change <ul style="list-style-type: none">Exploring the relevance for the focus area and selection of drivers for scenario workshops |

Programme of the Joint Ambition Workshop



Introduction to Murcia

Introduction to the city

Murcia is the major city in south-eastern Spain, and the capital and most populous city of the autonomous community of the region (with the same name, Murcia). It is Spain’s seventh-largest city, with a population of 439,712 inhabitants (about one-third of the total population of the region). Murcia has a mild climate with hot summers, mild winters and relatively low rainfall. In global terms, the region’s climate can be described as ‘an eternal spring’.

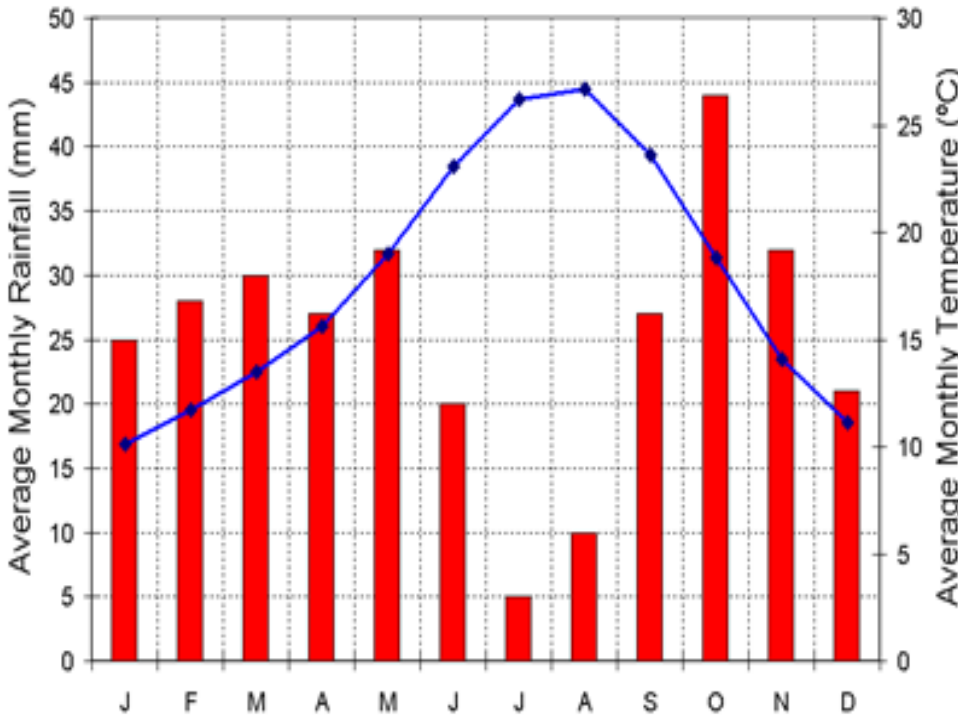
Murcia is a municipality of 890 km², at 43 metres above sea level, covering the city and 52 parishes in the surrounding 40 km. The region has 2,800 hours of sunshine each year, and the average rainfall in the Segura basin is one of the lowest in Spain (only 301 l/m²).

The average temperature is 17.8 °C. Yearly average relative humidity is 59% Irrigation uses the 85% of the 240 Hm3 consumed in the basin, whilst domestic, industrial and other uses represent only the 15% of the water consumption, 50% of it will soon be supplied with desalinated water.

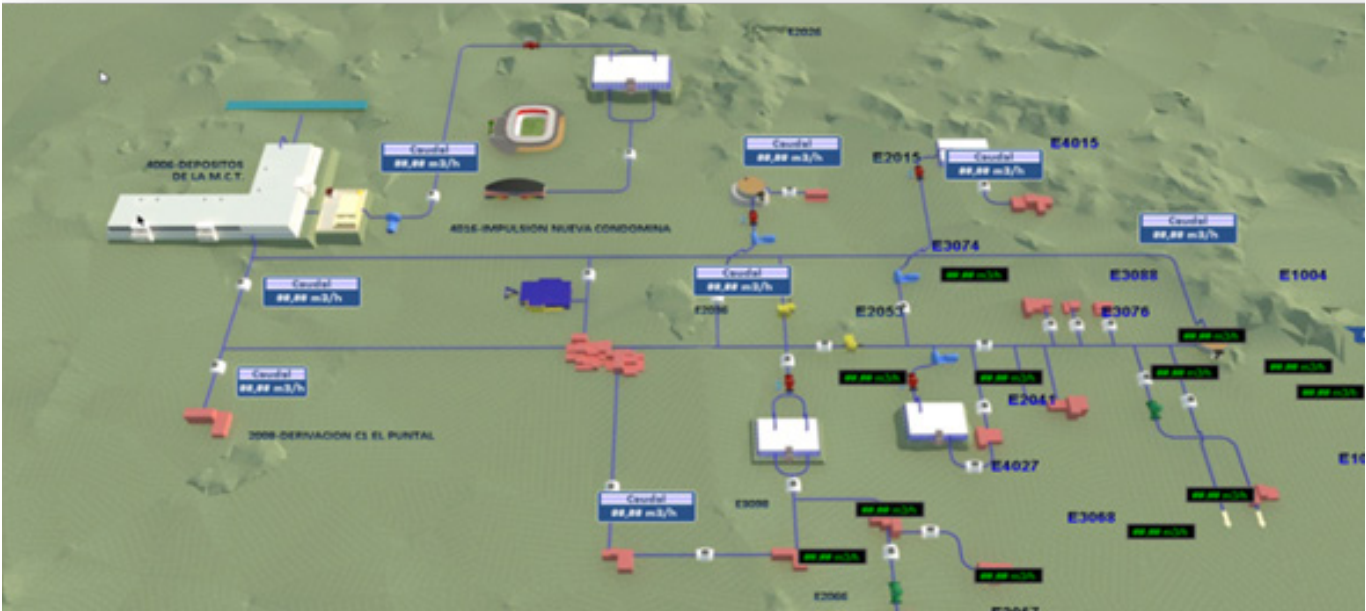


Due to its location, Murcia has high levels of solar radiation during the whole year. Specifically, it has a yearly average of 5 kWh/m²/day, one of the highest in Spain. The Municipality of Murcia owns 27 roof-mounted PV installations on a number of buildings to generate electricity, producing 362 KWp. The income from the sale of this energy is used to improve the energy efficiency of the installations in these buildings.

On the other hand there is little rain, which is why Murcia has developed very advanced irrigation system to make efficient use of the available water. Traditionally Murcia has been known for its agriculture, and at present it exports fruits and vegetables to the whole of Europe. The shortage of water and its importance for crops has forced farmers to invest in high-tech systems to get the most out of the available water.

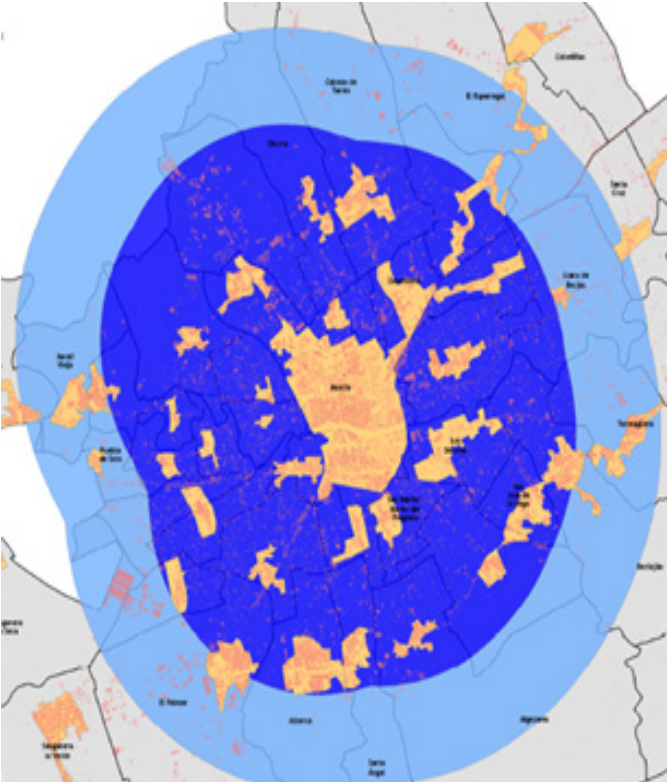


Murcia Drinking Water Network






The Municipality of Murcia has a complex land planning system. 83% of the population live within a 5 km radius, and within a radius of 7 km the figure is 89%. The city centre attracts most commuters each day, and this is also the area with the most severe congestion problems.



Murcia has selected two focus areas for the R4E project:

-  **SMART BUILDINGS**
-  **SMART MOBILITY**

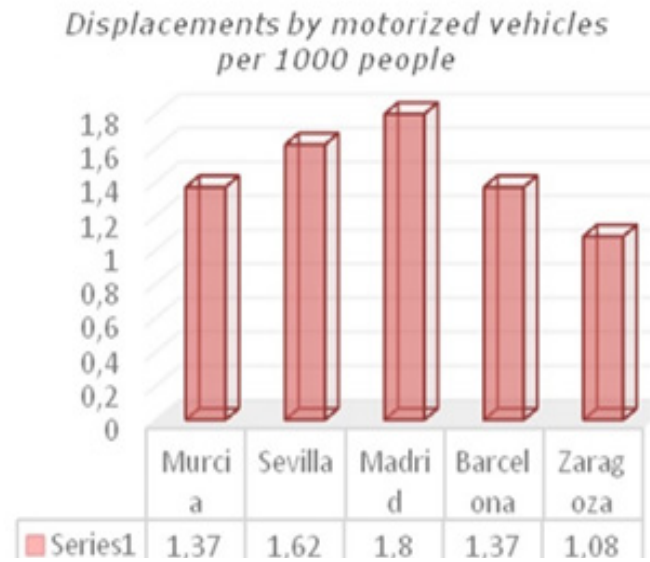


Mobility and transport

| MOBILITY KEY DATA OF MURCIA | | | |
|-----------------------------|---------|---------|------------|
| | TOTAL | % | Per person |
| Total moves | 915.770 | 100,00% | 2,21 |
| Public transport | 94.549 | 10,33% | 0,23 |
| Private trasnport | 463.075 | 50,57% | 1,12 |
| Other | 10.200 | 1,11% | 0,02 |
| By foot | 337.786 | 36,89% | 0,81 |
| Bycicle | 10.115 | 1,10% | 0,02 |

To make a good diagnosis of Urban Mobility in Murcia, it is necessary to analyse the social and demographic situation in detail. Regarding mobility, the chart of “MOBILITY KEY DATA OF MURCIA” shows the essential mobility data of Murcia Municipality, based on our SUMP (Sept. 2009). This shows that the use of public transport remains relatively low compared to other large cities (10.33%).

In terms of comparativeness with the rest of Spain, the following chart shows that Murcia has similar levels to Barcelona regarding motorised travel:



Walking

The City of Murcia has over 252.000m2 of pedestrian zones – just in the city centre and 100.000m2 in the surroundings districts. Murcia City Council has built and marked an urban route, so-called “Walk 10.000steps”, which covers a distance of 10.000 steps and connects 8 urban districts within the centre of Murcia. (See pedestrian areas in orange colour).

Our Council continues to highlight streets and pathways to further expand the pedestrian zones and enlarge the traffic-restricted areas in order to encourage people to walk on daily basis. So far, we do have in Murcia over 338,000 daily trips made by foot. This accounts for 37% of total daily trips, being equivalent to 0.87 trips per person per day.

The following graph shows the distribution of journeys by foot in Murcia:



Bicycle

The bicycle in Murcia is under a high process of transformation. The City has over 162 km of cycle paths, bike friendly routes and streets with limited speed. The City has 10,100 daily trips by bicycle, which represented 1.1% of total daily trips, (Sept, 2009), nevertheless we are updating the statistics, that are rather closed to 3% nowadays). Of all these trips, 66% may be considered “needed” trips due to different causes. In addition, 60% of bicycle users take the bike daily from Monday to Friday in their displacements.

Public transport

The use of Public transport represents the 10% of all journeys in Murcia, meaning the 17% of all motorised journeys. Regarding the City Bus System, the City has a good set of accessibility to travellers and several bus stops. It offers a good system of bus information and an adequate cover: 300 meters within the Murcia City Centre. The tram has very positively benefited public transport in Murcia. Over the last two years has improved the rate of use of public transport. Murcia’s tram has served in those 2 years to 7,047,475 passengers.

Electric mobility

Murcia City has a considerable fleet of electric vehicles. Nevertheless, our public electric network of chargers must be expanded. This would Foster the demand of electric vehicles and would gradually grow the number of registered electric vehicles. Great efforts are being made by our Municipality in order to spread out the needs of changing mobility habits. We do incorporate electric vehicles to our usual means of transport, always in detriment of fossil fuels. Murcia City Council is currently looking for strong financing schemes in order to support the development of a proper e-mobility infrastructure, to better facilitate the introduction of electric mobility in Murcia.

Traffic and circulation

Traffic in Murcia indicates that there is a high use of private vehicles for commuting, which accounts for 51% of all trips and 81 % of all motorised trips, (Sept, 2009). Roundabouts are our main Traffic hotspots in the City, where there is the higher volume of traffic. In addition, also make it a place where unfortunately there is the higher level of conflicts, casuistic and accidents. The average speed is quite high in Murcia (22km/h) and there are no significant variations between peak and valley period. Furthermore we cannot address significant traffic congestion in Murcia, though it is a big city. From further analysis, it has been concluded that the global system used for traffic management in Murcia should give more priority to public transport rather than private one. Nevertheless, Murcia offers a massive use of private vehicles, which mainly causes heavy traffic in the roundabouts of the City (here below Murcia road’s distribution).

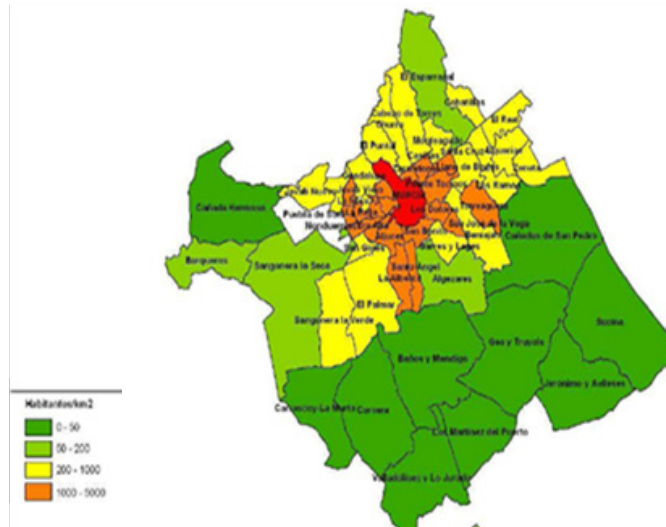
Existing studies and surveys show a great interest by citizens to change their usual means of transport, as for a more efficient one. Citizens in Murcia give great importance – as mainly everywhere else – to saving opportunities, towards mobility alternatives.



Demographical aspects

Number of inhabitants in 2014: 439.712

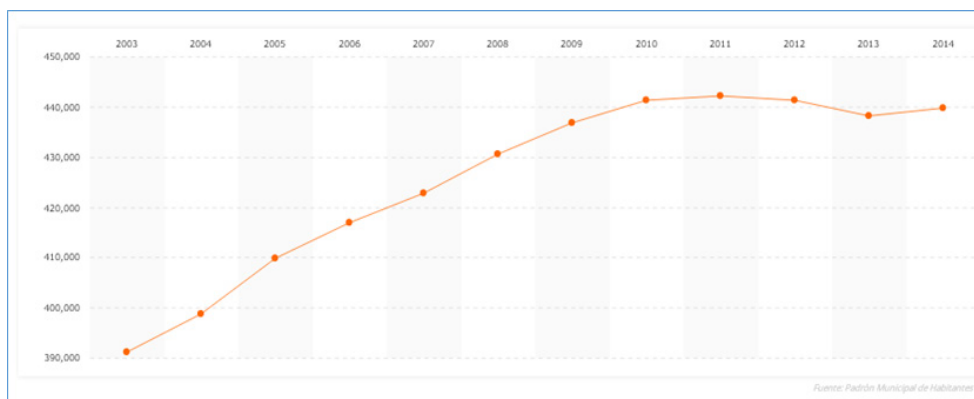
Population density 497 inhab./km². Due to the extension of Murcia Municipality, percentage of people living outside the city is bigger (61,33%) than percentage living in the urban centre (38,67%). The highest density of population (in red) occurs in the urban centre.



In Murcia the population increased to 50.000 people from 2003 to 2011. A soft decrease of population has been registered in the last years.



Evolution of the population in Murcia 2003-2014:



Social aspects

Percentage and evolution of people from foreign origin:

| Inhabitants (2014) | percentage |
|--------------------|----------------|
| Spanish origin | 388.510 88,36% |
| African origin | 18.121 4,12% |
| American origin | 17.420 3,96% |
| European origin | 13.387 3,04% |
| Asian origin | 2.258 0,51% |
| others | 16 0,00% |

Economical aspects

Income per head in comparison to the national average income in 2014: Murcia €18.529, Spain €22.780.

Due to financial and economic global crisis which extremely affected Spain and its regions, the number of unemployed in Murcia increased in 32.600 people since 2007 to 2013. In 2014 a downward evolution can be seen, and number of unemployed was reduced in 2600 people.

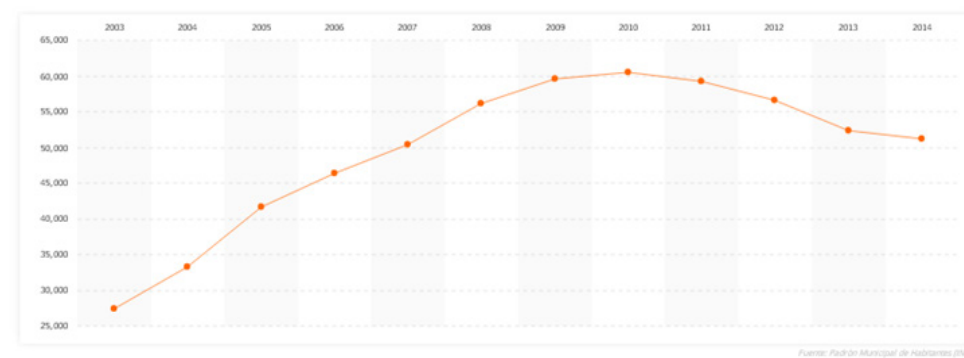
According to sector, unemployment in Murcia (2014) mainly affects Services.



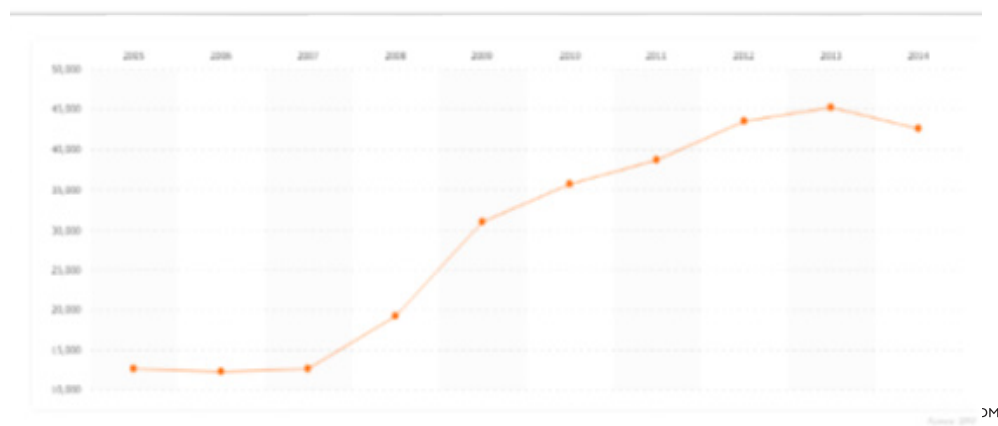
| | | | |
|--------------|-------|----------|------------------------|
| Agricultural | 1,117 | Industry | 4,286 |
| Construction | 5,694 | Services | 28,555 |
| No activity | 3,031 | | Numbers in percentages |

<http://www.murciaencifras.com/datos-basicos>

Murcia foreign population 2003-2014:



Registered unemployment. Murcia. 2005-2014:





Environmental aspects

In 2008 Murcia was the first Spanish city to joint the Covenant of Mayors initiative, in order to take action to reduce 20% of CO2 emissions in 2020. Within this context, Murcia also launched in 2008 the ‘Local Climate Change Strategy.’ recently, in 2015, Murcia joined the European initiative to fight the climate change, Mayors Adapt.

The total area of the city is 890km2. The extension of with green space making up 67.72km, or 55%.

Total surface of public parks and gardens in the municipality: 4,2 km2

Water consumption per head 143 lit/day. Cost of water in Murcia is the higher in Spain 2,5 €/m3

SMART Real Time Water Management Center – smart meter infrastructure

Drinking Water Network is 2,187 km long. 164 km are main pipes of up to 1,000 mm diameter.

Biogas production in the Waste Water Treatment Processes (WWTP), which ensures a large part of its energy consumption of the by this renewable energy source.

Climate conditions: average temperature 18,4 °C, rain→fall 215 mm in 2013 .

Evolution of air quality (in number of days):

| | 2010 | 2011 | 2012 | 2013 | 2014 |
|-----------|------|------|------|------|------|
| Good | 172 | 123 | 84 | 111 | 92 |
| Admisible | 186 | 229 | 280 | 246 | 273 |
| Bad | 4 | 13 | 1 | 6 | 3 |
| Very bad | 3 | 1 | 0 | 0 | 0 |

Recent projects

1. MOBISEC – Mobility Initiatives for Sustainable European Communities

Grant DG MOVE (Transport and mobility) of the EU.

Current

Coordinator of the project.

Main topics: Promotion of the use of the bicycle as usual transport; Guarantee the safety of users of public roads and especially cyclists and pedestrians; strategies to promote the intermodality of bicycle with other transport and Citizen participation

2. MUTRANS (Murcia-Transport).

Grant DG MOVE (Transport and mobility) of the EU.

Current

Coordinator of the project.

Mutrans is the integrated urban mobility platform of the City of Murcia. The web and App include all the information needed to move around Murcia tram, bus and bicycle, and can set routes combined. Also available in English to encourage a sustainable tourism

3. R4E: Roadmaps for Energy

H2020-EE-2014-3-MarketUptake

Current

Topics:Enhancing the capacity of public authorities to plan and implement sustainable energy policies and measures

4. SMARTSPACES – Saving Energy in Europe’s Public Buildings Using ICT

CIP ICT Policy Support Programme.

Current

The project started on 1 January 2012 and will last for three years. It will set up 11 pilot sites in 11 cities in 8 countries and be operated by 26 partners with an overall budget of almost 7 million Euros.

5. SMARTPA – Smarter Public Administrations in the EU

Life Long Learning Programme

Current

This project aims to improve the use of ICT, particularly cloud computing and required competences, in European public administrations

6. SURE. Sustainable Urban Energy in the ENPI Region.

Program CIUDAD of the EuropeAid Office of the European Commission.

The aim of the project is exchanging experiences in energy planing, promotion of the Covenant of Mayors and technical advice for achieving the targets of the Covenant (20-20-20), meaning: decrease of CO2 emissions 20%, increase of energy efficiency 20% and renewable share 20% for the year 2020.

7. « ENPCOM project- European network for the promotion of the Covenant of Mayors »

“Europe for Citizens”. DG Culture

ENPCOM is a network of local governments, citizens, industry organizations and associations aimed at strengthening the involvement of European citizens in the fight against climate.

8.Creation of Local Energy Agencies in Bordeaux, Latina, Murcia, Riga and Porto

Intelligent Energy for Europe Programme

9. Partnership Energy Planning as a tool for realising European Sustainable Energy Communities (PEPESEC)

Intelligent Energy for Europe Programme

PEPESEC supports the development of sustainable energy communities by increasing the role of local community planning in developing a more efficient supply, distribution and use of renewal energy sources (RES) and conventional energy, demand-side management and associated mobility.

10. ProSto project

Intelligent Energy for Europe Programme

The overall objective of ProSTO is to support European local authorities in planning, developing, introducing and managing efficient solar thermal ordinances (STOs).

11. Pro-EE: improve energy efficiency through sustainable public procurement.

Intelligent Energy for Europe Programme

Pro-EE brought together producers and consumers, implemented energy-efficient green public procurement (GPP) procedures in local administrations, and organised training sessions for municipalities’ procurement staff. At the same time, five pilot cities set up integrated energy efficiency action plans, which included the involvement of stakeholders and awareness-raising campaigns for citizens.

12. NICE Project (Networking Intelligent Cities for Energy Efficency)

FP7 funded project

The NiCE project aimed to support the fulfilment of the Green Digital Charter commitments.

13. Networks:

- Signature in 2008 of the Covenant of Mayors
- Member of Mayors Adapt, launched in the context of the EU Adaptation Strategy and is implemented within the Covenant of Mayors
- Vice president of the CIVITAS network in Spain and Portugal
- Member of Eurocities.
- Member of Eneragen, Spanish network of Energy Agencies
- Signature in 2009 of the Green Digital Charter. European Innovation Partnership on Smart Cities and Communities (EIP-SCC)
- Members of EnerAgen, the Spanish Association of Energy Agencies
- Members of RECI, the Spanish network of Smart cities
- Vice-Chair of the Technical Committee of Standardization AENOR CTN 178 on Energy in

Smart Cities

- Presidents of the Spanish Network of Cities for the Bicycle (RCxB)
- Municipal Observatory of bicycle. It is a consultative body of the City of Murcia composed of representatives of all political groups of the municipal corporation, municipal technicians, representatives of associations of bicycle users, citizens' associations in defence of sustainable mobility and companies that regularly work with the City Council in advocacy and promotion of cycling.



15 December 2015

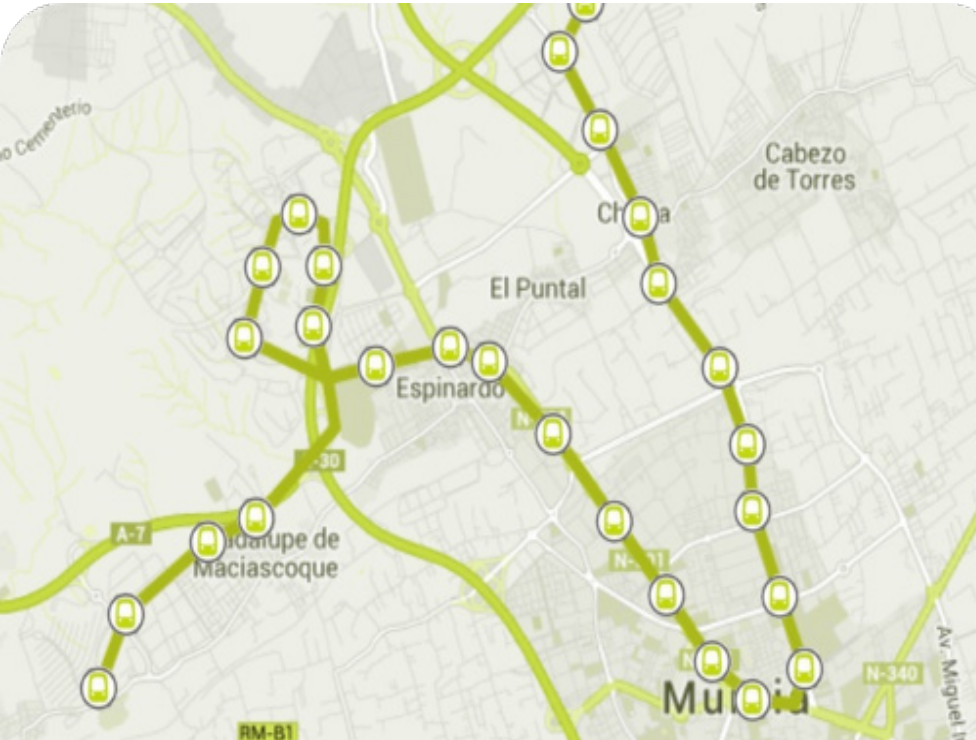
Jaime RUIZ HUESCAR & María Cruz FERREIRA COSTA, Ayuntamiento de Murcia



Today’s reality: Smart mobility

Murcia has taken important steps towards becoming a reference in Smart Mobility in the past decade.

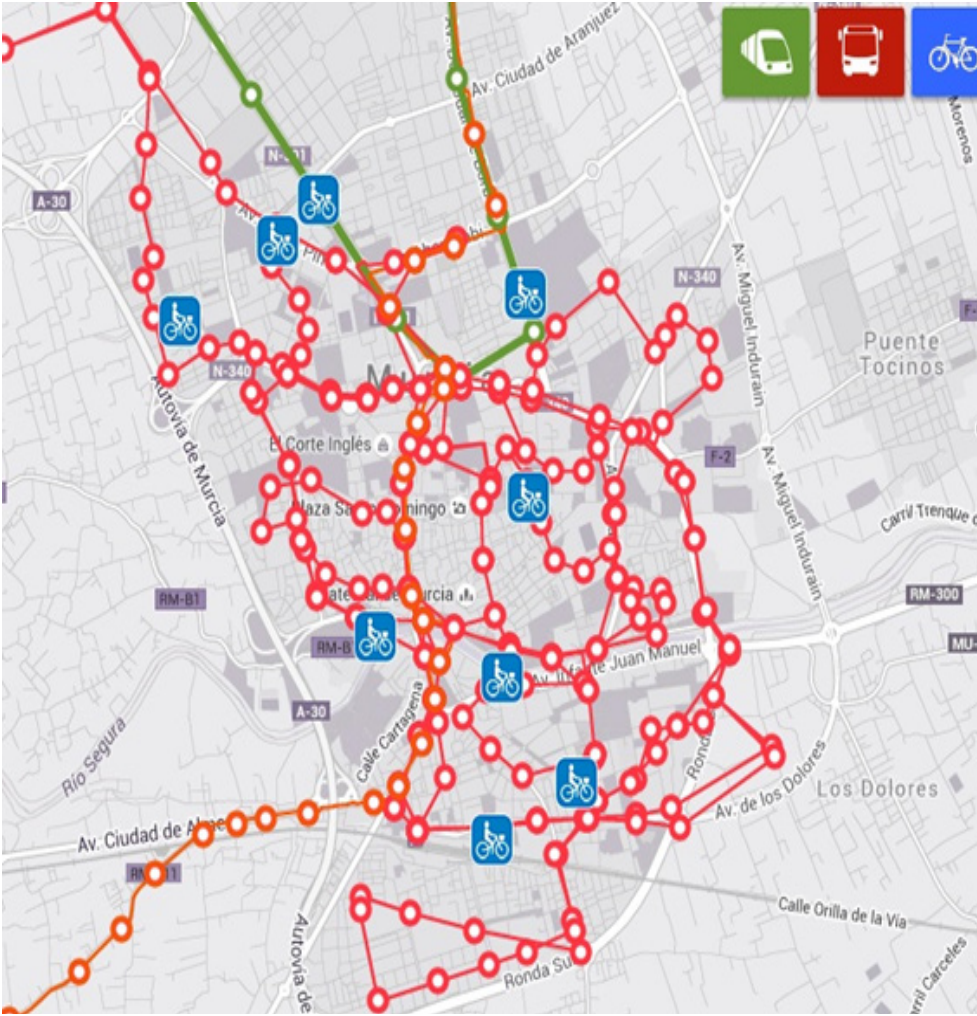
One of the major projects has been the construction on line 1 of the Murcia’s Tram, which has very positively benefited public transport in Murcia. Over the last two years this service has increased the use of public transport. Murcia’s tram has served 7,047,475 passengers in those 2 years.



MUyBICI is another recent and successful project that has been working since March 2015. MUyBICI is a public bicycle-sharing system that aims to increase the use of bicycles in Murcia. The system has 60 sharing stations and 600 bicycles, and it has a Smartphone App that informs users in real time about the availability of bicycles at each station. MUyBICI has been devised to provide a smart service for citizens and support them in their daily journeys.



MUTRANS is an online platform created to help citizens to plan their journeys using public transport in Murcia. Through MUTRANS, users can set their starting points and destinations, then they can see the most efficient route using public transport. The system combines the tram, the public buses and bicycles to make optimised route suggestions for the user. The platform also offers real-time video of 13 different points in the city, chosen to show the traffic in the main streets of Murcia. The MUTRANS project is complemented by a Smartphone App to facilitate access to information regardless of location. The goal is to facilitate intermodal transport use for Murcia citizens. Supporting this concept, an integrated transport card has been created to give access to the tram and both the urban and interurban bus services.





Ambition: Safe, clean and affordable mobility in Murcia 2050

1

Smart, integrated platform for mobility of people and goods

In 2050, people in Murcia value a smart, integrated mobility platform that gives them 'one-click', low-cost movement around the whole city and its surroundings. The system provides optimal transport of both people and goods.

Strategic ambitions

- In 2050 the transport system of vehicles and goods will be optimised through smart and integrated platforms.
- In 2050 I will be able to leave home and move around the city with non-polluting public transport, with 'one click' and at low cost.

2

Clean public transport and vehicle sharing systems

In 2050, people in Murcia enjoy a clean and effective public transport system throughout the city. Vehicles can be shared, and are safe thanks to smart traffic management. Transport modalities incorporate incentives to reduce the user of private cars.

Strategic ambitions

- In 2050 vehicles will use clean energies. We will be able to share them and we will be safer thanks to smart management of traffic and mobility and we will be preferably use public transport.
- In 2050 Murcia will use a collective transport system, moved by clean energies. The use of private cars will be restricted and subject to a car sharing system.

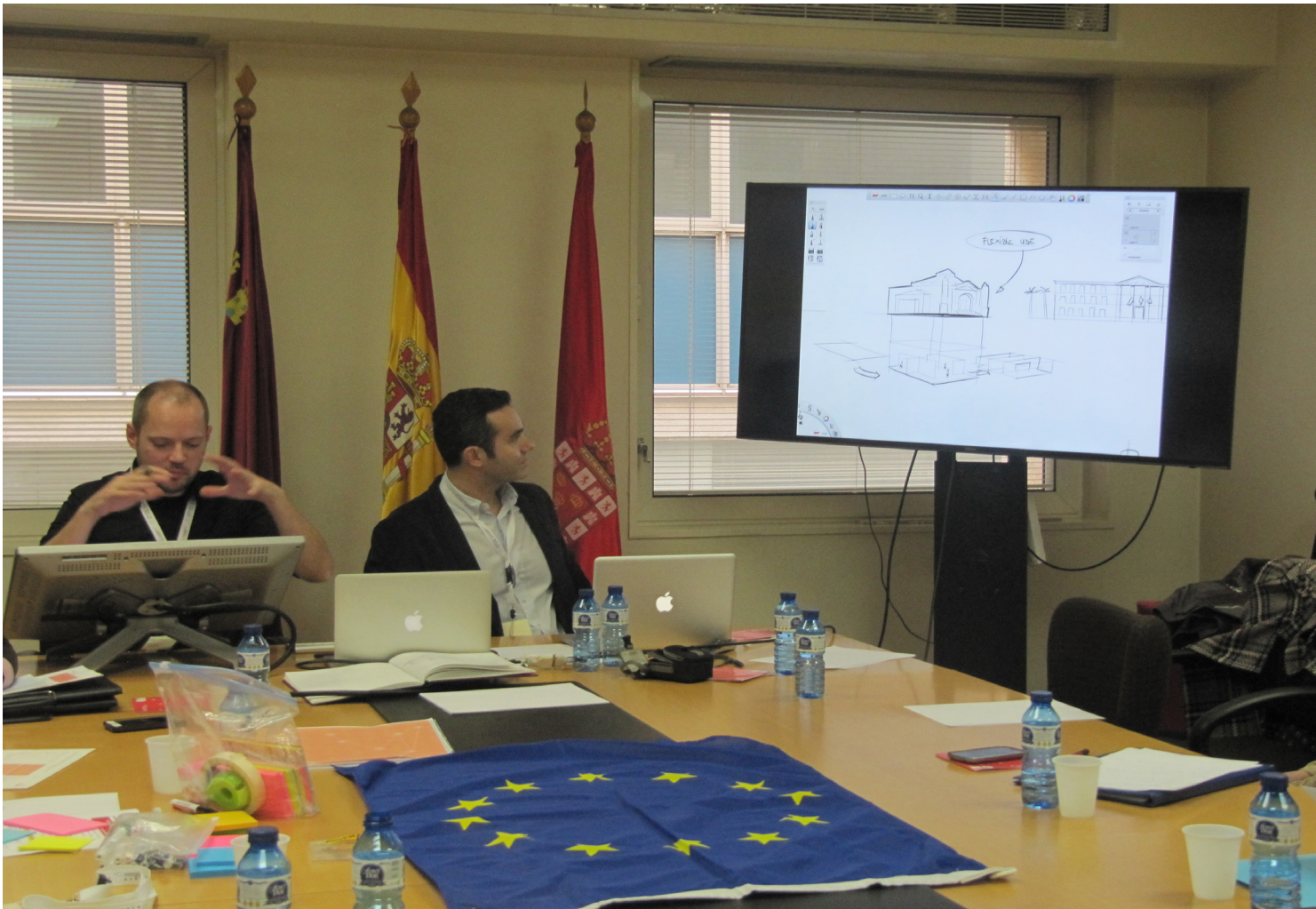
3

A safe, clean city for pedestrians in harmony with clean mobility

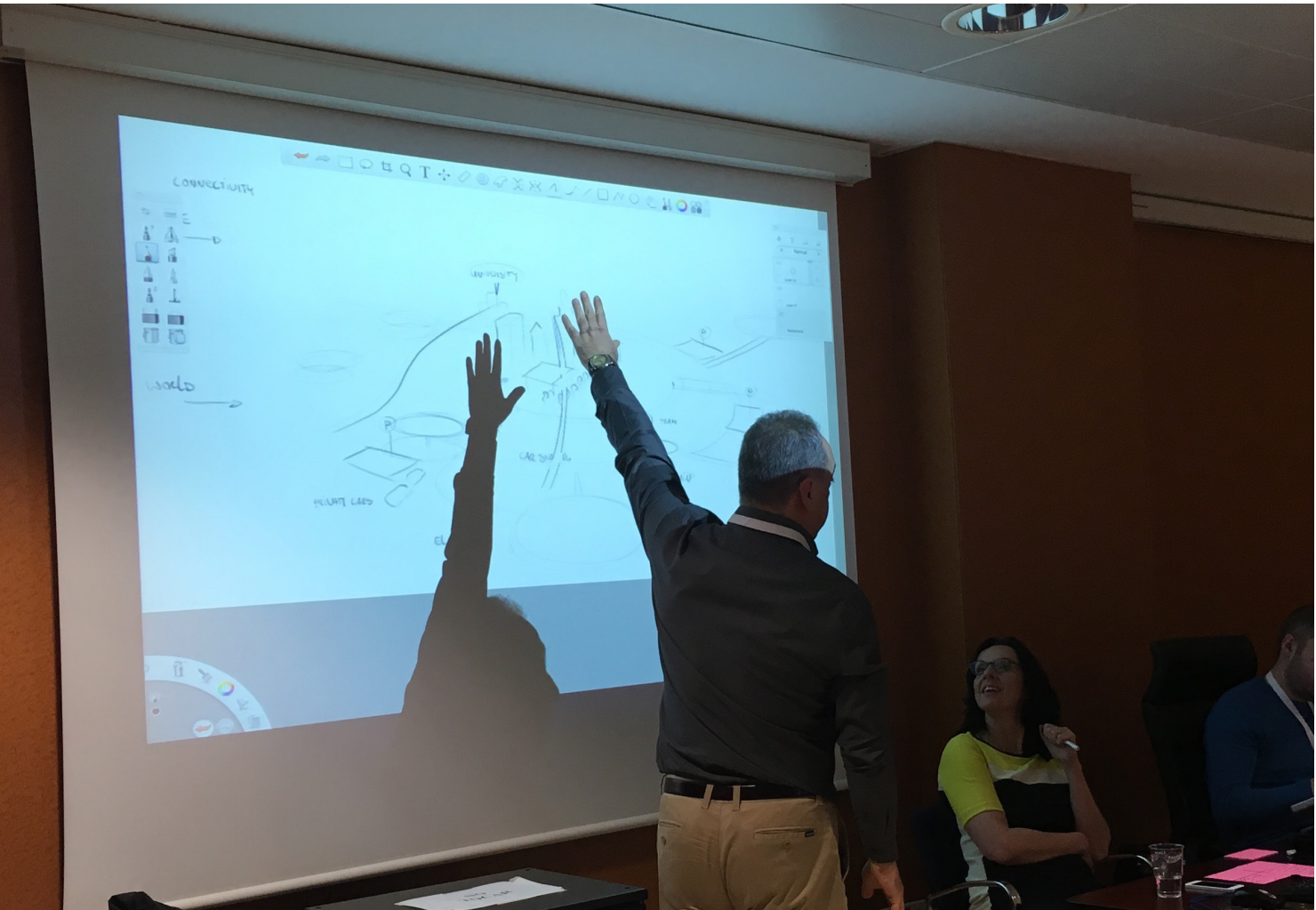
In 2050, Murcia is a city that allows pedestrians to enjoy large, pollution and noise-free areas. These are shared in perfect harmony with cyclists and other safe, clean forms of mobility.

Strategic ambitions

- In 2050 Murcia will be a town for and in favour of pedestrians. It has large areas free of pollution and noise and in perfect harmony with bicycles and other transport means.
- In 2050 extensive pedestrian areas will predominate in Murcia, and in these pedestrians and other safe and clean mobility means will live in harmony.



Creating the visual of the desired future scenarios



VISION DEVELOPMENT

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.

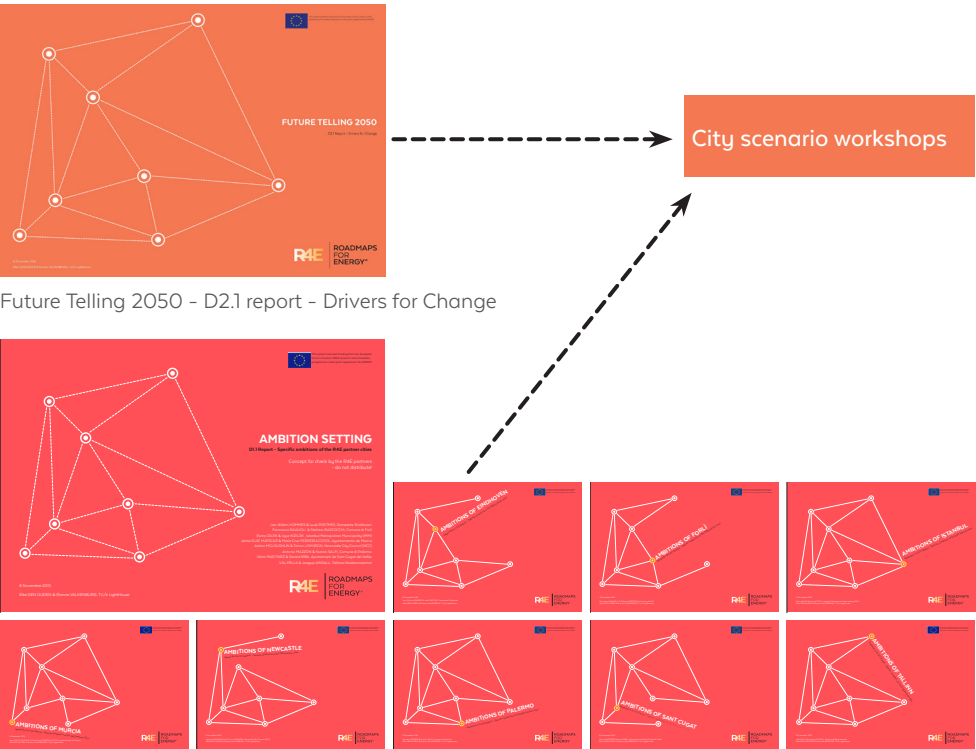
Joint Vision Workshop

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.



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

| Day 1 - Focus area 1 | Day 2 - Focus area 2 | Day 3 - Reporting |
|--|---|---|
| Outlining the vision <ul style="list-style-type: none"> • Exploring the drivers for change in relation to the future of the city • Selecting the main elements of the vision | Outlining the vision <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Exploring the future the city and the main elements of the vision • Enriching the vision with specific additions | Enriching the desired future scenario <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • The cities share their desired future scenarios for the focus areas |
| Day 2 Preparing for Step 3 | Learning from each other's visions <ul style="list-style-type: none"> • In-depth discussion on common and specific needs described in the visions |
| | Presentation of the Roadmapping process <ul style="list-style-type: none"> • Sharing of interim results of the roadmapping desk study |
| | Identifying topics and experts for the roadmap interviews <ul style="list-style-type: none"> • 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



Future Telling & selection drivers for change

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.)

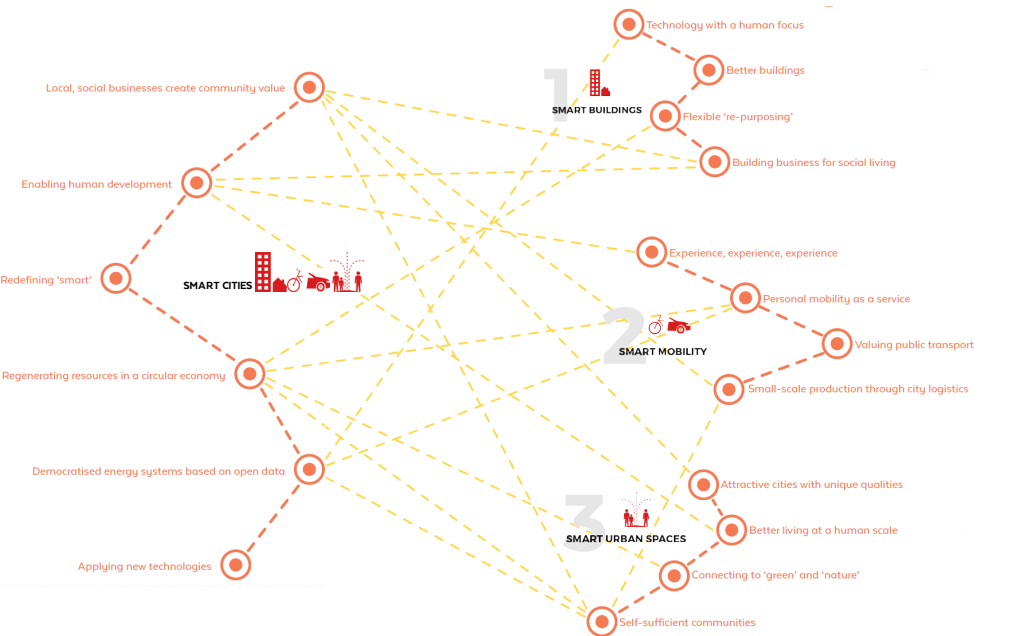
3. Tell stories about how you imagine these 10 trends will develop and what the future in cities will look like.

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 thought 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

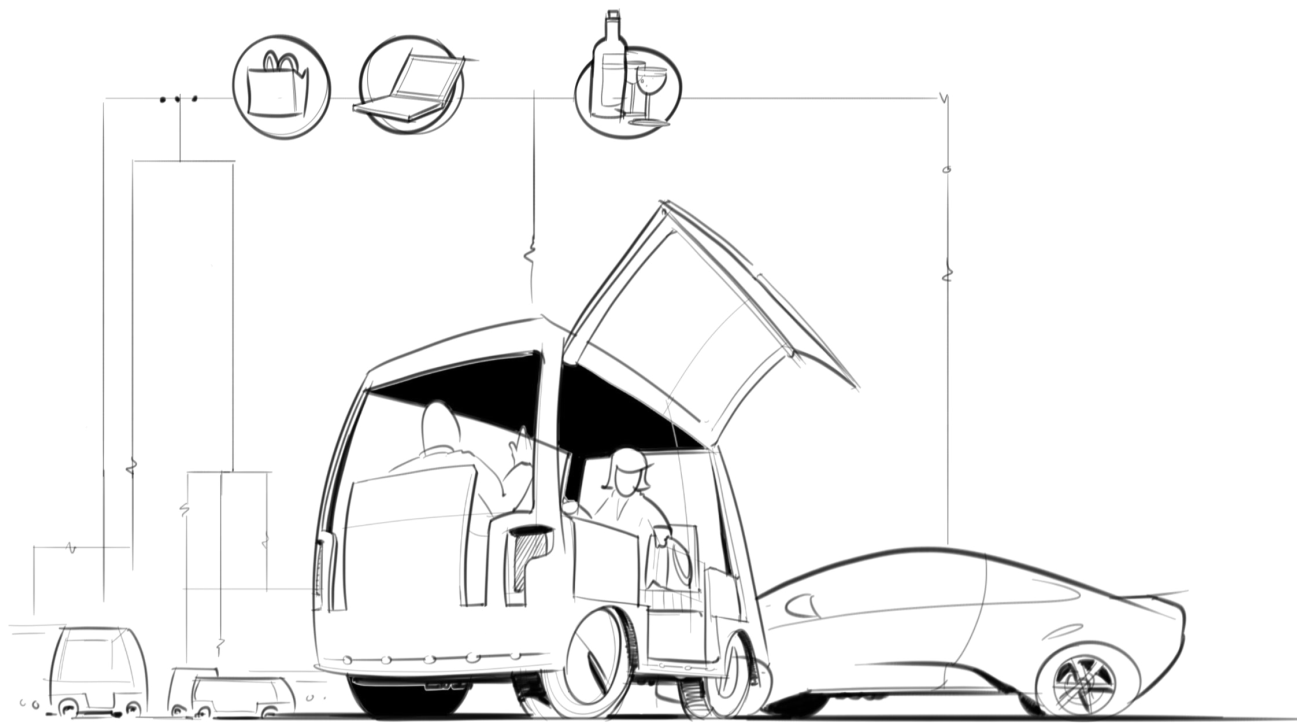
For the focus area Smart Mobility, the city of Murcia selected four Drivers for Change:

- Personal mobility as a service
- Valuing public transport
- Better living at a human scale
- Democratised energy systems based on open data

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.

Personal mobility as a service

In 2050, technology enables autonomous vehicles. These take affordable personal mobility to a whole new level. Technology makes sharing easy, so everyone has access to a vehicle whenever they need it. It also facilitates the transition to a circular economy, gradually replacing legacy systems with cleaner, safer options. Stakeholder resistance is overcome by the availability of complete, resilient system that meet the needs of city dwellers in full.



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

- a. Mobility as a service
- b. Sharing vehicles
- c. Autonomous driving, flying etc...

FT7.10. The sharing of resources and products, like Uber and Airbnb show that systems work. Such systems become more relevant and make society more socio-democratic and sharing. This is an important trend for cities. Somehow it will also impact sharing of energy. It will not be so conscious as with Airbnb, but in energy sharing will also take place. When you install solar cells on your house. You do it because you want to have cheap electricity, or because you want to be disconnected from the grid yourself. But it also because you want to give your surplus energy to your neighbourhood. ...

FT11.05. ... People will want everything as a service, more and more. Not wanting to buy anything. How far will that go? ... In mobility I am pretty sure that is how it is going to be. Why would you want to a vehicle: you only need it like 10% to get you everywhere. The strange thing is that it requires hard thinking to see why we would have public transport as we have it now. Trains maybe, but buses? Why would you have a masses option in automated vehicles?

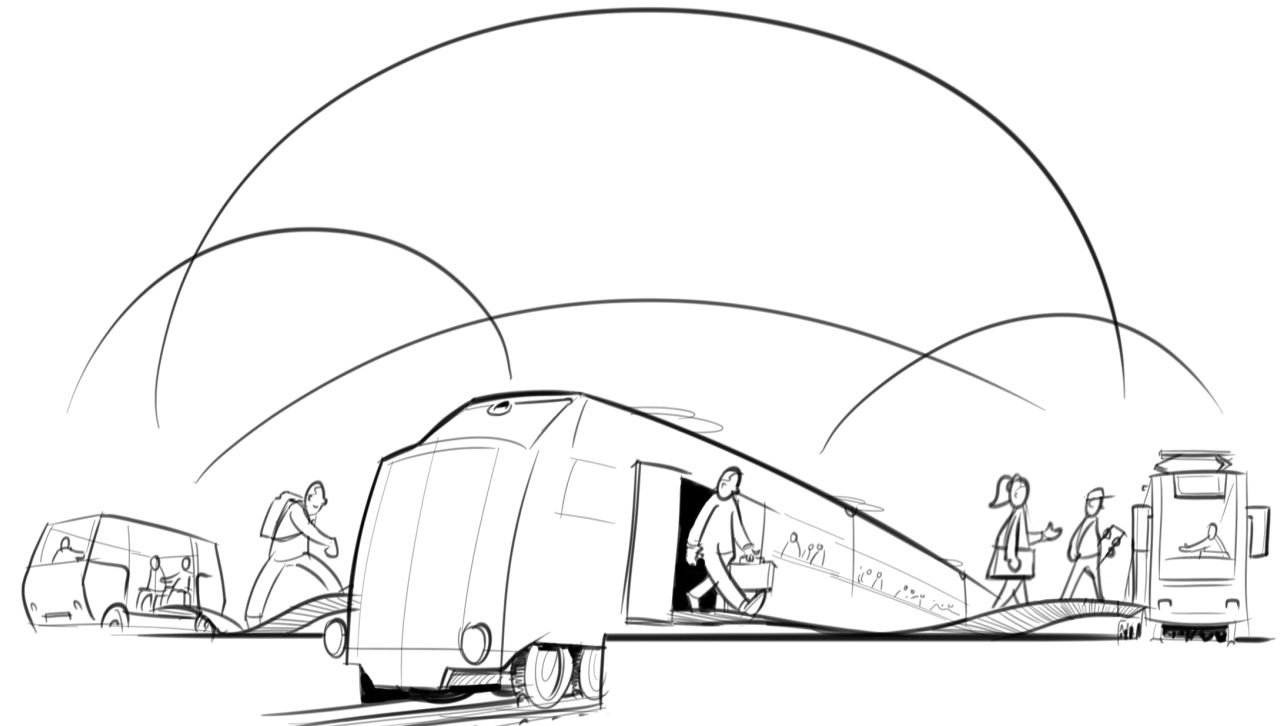
FT3.04. In mobility there is already a demand to take us seamlessly from A to B, that is not new. But the technology will be increasingly there to provide it. Your behaviour will also be changing, because you are just ad hoc or just in time you will change e.g. the reservation of a meeting room when the time schedule is changing. The system is already there to make all these transactions and negotiations possible. It is possible in a very complex system to manage your own agenda, but also to make sure that agendas are aligned and more effectively combined. Even optimising for personal travel time or optimising the average optimum travel time for all the people who want to be transported at the same

time. Those kind of management techniques will be there, and make things more efficient. The technology will give us what we want best, not to plan too much, but still allow us to be spontaneous. It is about “I want it know, I want to be with whom I want to be” and the system will make it possible.

FT3.05. In essence we don’t want to be thinking too much about the whole system, but want our individual needs satisfied. We hope for the system to arrange it. It will probably become so complex that you need to rely on the system. If want to deviate it interferes with everything else, even your own agenda, and all the other things you are planning. So the relation between the individual needs and the global transportation needs will be in the system. Because the individuals will be less and less capable to adjust themselves, as they cannot oversee the total system. Now the system has still some predictability, with the traffic information that is available you can plan it a little bit with your car navigation. It is not too complex to understand. But when it combines more and more, e.g. your agenda, different transport means, etc, it will be less and less transparent how the whole system is behaving, so you will rely more on the system. Your own cock-pit will deal with your own preferences and can also suggest better planning advice, and persuade you to change your behaviour a bit. You will be able to discuss with it.

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.

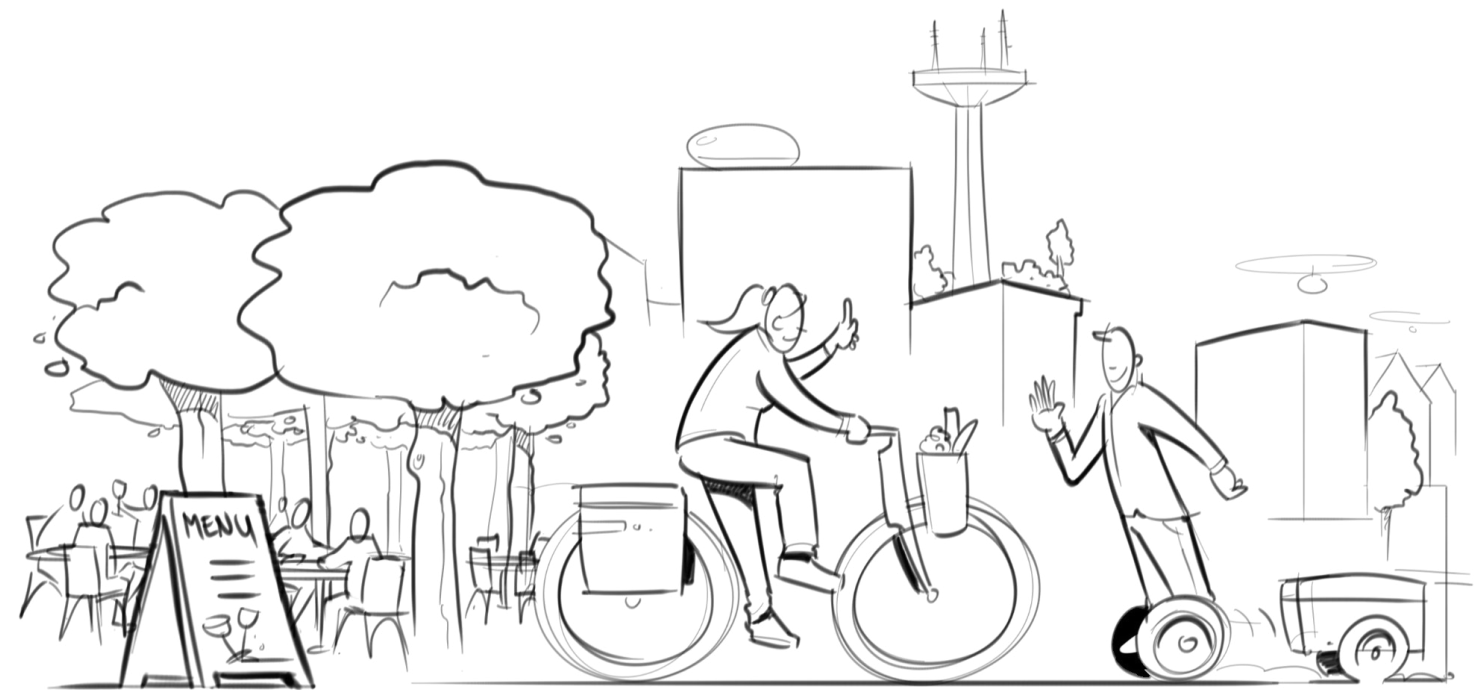
FT19.05. ... the way we look at it now with each city having its own public transport corporation for trains, trams, buses, subways. But in a few years all this can be replaced by self-driving cars. There is a new technology coming up, and it is going to change the way of thinking. Suppose we stop this 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.

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 public 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.

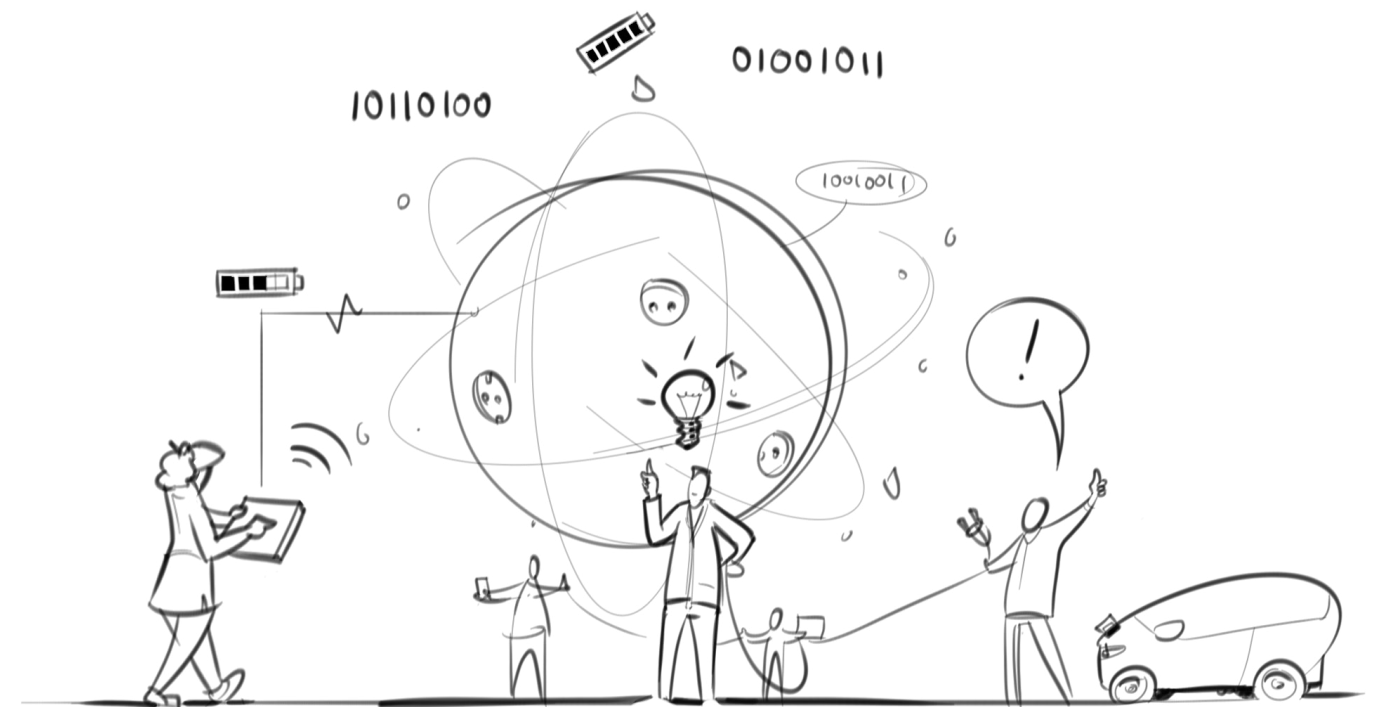
FT4.02. ... The relaxed quality of life that lots of foreign people see in the Netherlands has a lot to do with the special quality of the place, which is that it is much more urbanised landscape, fusing all kinds of qualities, not replacing one for another. In its aggregation of functions, in its aggregation 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 than 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 ...

Democratised energy systems based on open data

In 2050, energy systems are open, bidirectional, multi-purpose platforms on which (renewable) energy and energy management services are open to all. Entrepreneurs have developed business models that provide value for them, for their users and for society at large. Citizens can choose freely from a range of available options. The system ensures privacy and security of users, who are always in control. Ambient energy networks provide connectivity for (wireless) access to data and energy. Increased computing power and artificial intelligence make system resilient: self-organising, self-sustaining and self-learning.



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

- a. Open infrastructures to bring together supply and demand of energy in decentralised systems
- b. Privacy and security in systems and services build on open data
- c. Being in control with or being controlled by intelligent systems
- d. Merging brain power and computer power to make smarter decisions
- e. Integrating (wireless) data and ambient energy networks

FT3.10. There may be a competition of energy networks. Also there will be an integration of data and energy networks. But it could also be a completely new energy internet that is competing with the existing systems.

FT3.09. In cities you will need some sort of layered structure, in which you have a grid that provides stability and interconnectivity, and on top of that you will have more freedom and less restrictions to design your own thing. It will affect the city as it will no longer be needed to have global or national grid that is build by a government. But there will be local grids that provide enough stability by sharing resources so that you have a guaranteed stable energy production in the way you want it. You need to ensure that everybody can connect to such a grid, but it will be more local grids, that do not necessary need interaction. ...

FT19.04 ... One of the other things in district heating now is that the one who owns the network is also the one who provides the service. It is like a monopoly. You cannot choose. We need a new type of district heating - open. Not only to increase the investment capacity, but also for everybody to be able to put heat on the network. So that you have a distinction between the network infrastructure and the heat generation capacity. Because in the city there are a lot of heat sources, e.g. industries, data centres. They produce a lot of heat and this can be used to heat buildings. So you need this openness, like for electricity.

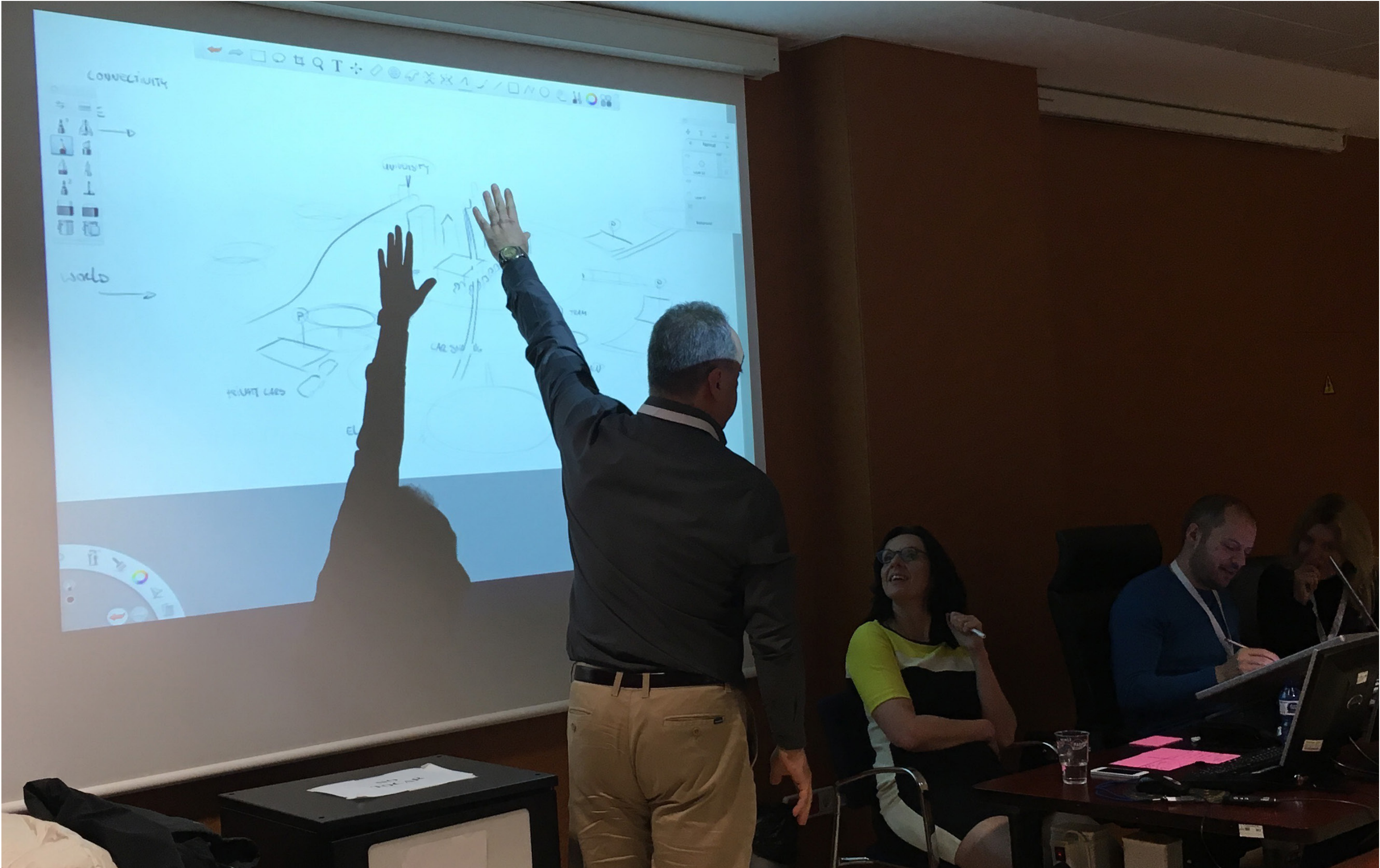
FT19.06. The other important value is openness. The way I described it, the way we organise it has to be open. Technology is available, but what kind of openness do we want? By getting this openness you get a new form democracy. ...

FT13.35. Data is the fuel of the 21st century. ...

FT16.03. ... the fact that people do not need energy, but they need to wash, to cook, to be warm. The fact that they will be able to produce energy directly, or coming from their neighbour. And the fact that digital technology will allow to combine this supply and demand, I will guarantee that all activity will move from energy producer and energy distributor towards energy manager. ...

FT1.06. Analysing and monitoring our human systems on the social level, in public spaces or in social contexts, we will have a lot of new conditions which we do not know up till now. Next to an impact on humanity, it means that we have to redefine what is life and what is public and what are our civil rights. ...

FT10.14. ... I think in 35 years, when we really get this wisdom of the crowd, and let the crowd of humans, robots or together decide. You cannot really draw a line between humans and robots and you can't actually soon draw a line between a human and computer. ...

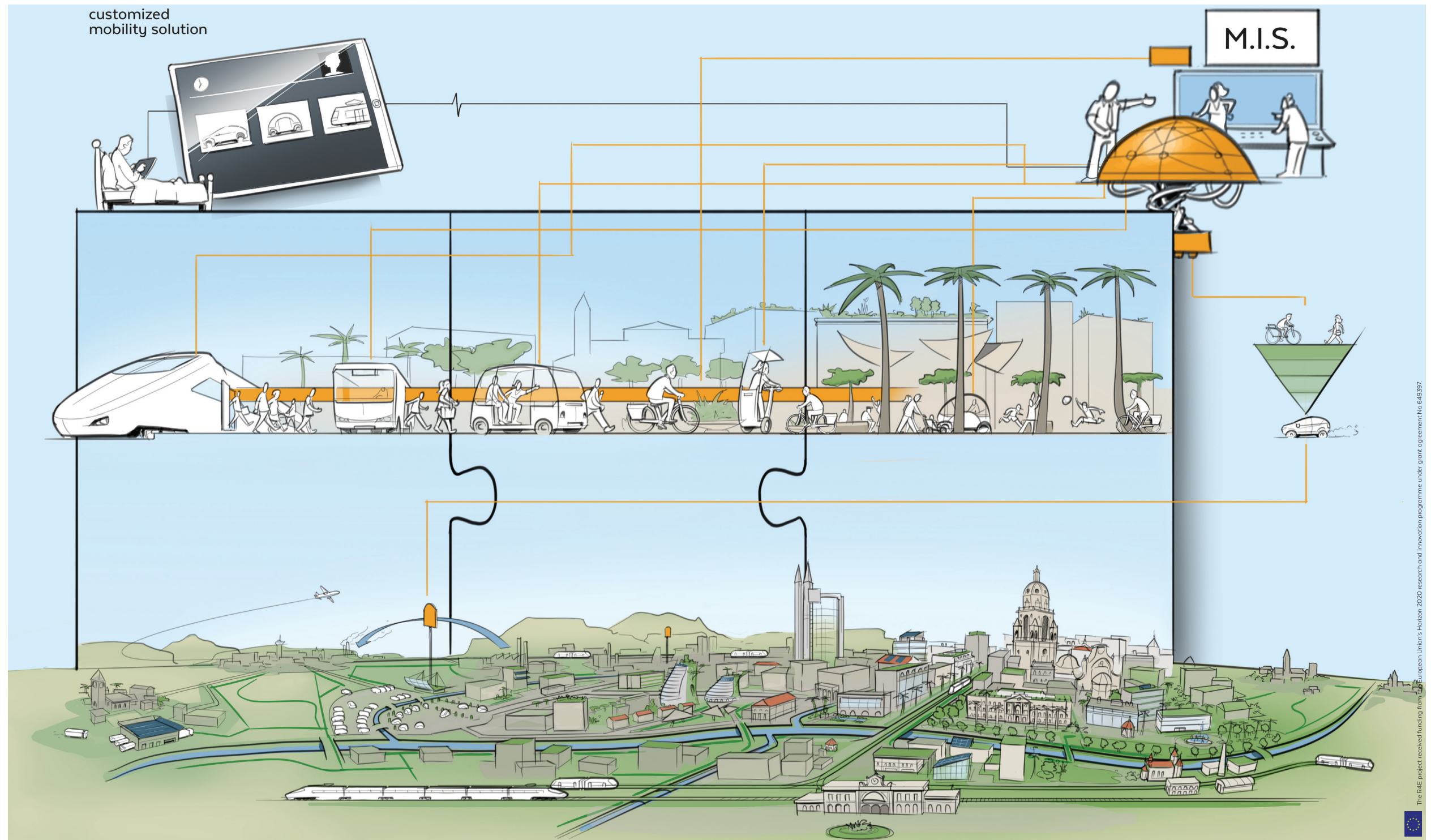


SAFE, CLEAN AND AFFORDABLE MOBILITY IN MURCIA 2050

In 2050, people in the Murcia region enjoy a safe and clean city, with green and healthy areas and safe and clean mobility solutions. Personal mobility needs are met and healthy mobility, such as walking and cycling, co-exists in harmony with other safe, clean forms of (shared) mobility. The public transport system is clean and effective throughout the city region, with 'one-click' accessibility enabled by a master intelligent system.

The design of public space and services and the availability of a wide range of mobility options 'nudges' people towards more sustainable and healthy lifestyles. The flexibility of personal choices is met by a system of different, interconnecting mobility modes, reflecting the differences in needs and possible solutions throughout the city and region.

Urban spaces are designed with a focus on people. Those from the outlying areas and visitors are provided with clean, fast accessibility to the city centre. It is easy for people to move around near the centre with services to meet their daily needs. The down-town area is a safe and pleasant place for pedestrians.



Elements of the desired future scenario are:

All people's avenue

The down-town area is a safe and pleasant place for pedestrians. Public spaces are designed for them and traffic is restricted to emergencies, residents and public services. Urban spaces such as an 'all people's avenue' are pleasant, comfortable, quiet, green, shady and accessible for all. These spaces are shared with bikes and one-person e-cars.

Urban liveability

The 'urban zone' is a place where people can easily move around, with good access to the city as well as the outlying areas. Industrial estates and warehouses are moved from the urban areas to the outskirts, freeing space for sustainable transport, such as trams, electric buses, clean private cars and a public car-sharing system. De-centralised services are provided to meet daily needs, and there are green lanes for long-distance walking and cycling.

Connecting people

The 'pedanías' zone provides accessibility for people from the outlying areas and visitors. (Mass) public transport is provided by train, tram and bus, and is clean, fast and accessible. Free parking for private (unsustainable) cars is available at inter-modal transport hubs. These make it easy for people and goods to switch between different mobility means, encouraging sustainable choices. Easy access to the countryside revalues country lifestyle and products.

Smart citizens

Citizens naturally choose sustainable and healthy solutions. Mentality and behaviour embrace healthy living. People value a clean and safe city, and are willing to contribute to achieving this. Education from an early age and co-creative workshops with citizens and companies, increase awareness and involvement, and challenge people to participate actively in new 'mobility plans'.

Master Intelligent System

An intelligent global system integrates mobility modes and allows users to enjoy 'mobility à la carte'. A 'one-click' system pro-actively adjusts to people's profiles and needs, based on up-to-date information and forecasts. The system is easily accessible with one profile for reservations, payments and information. Controlling incentives avoid misuse and keep the system free of undesired side-effects.





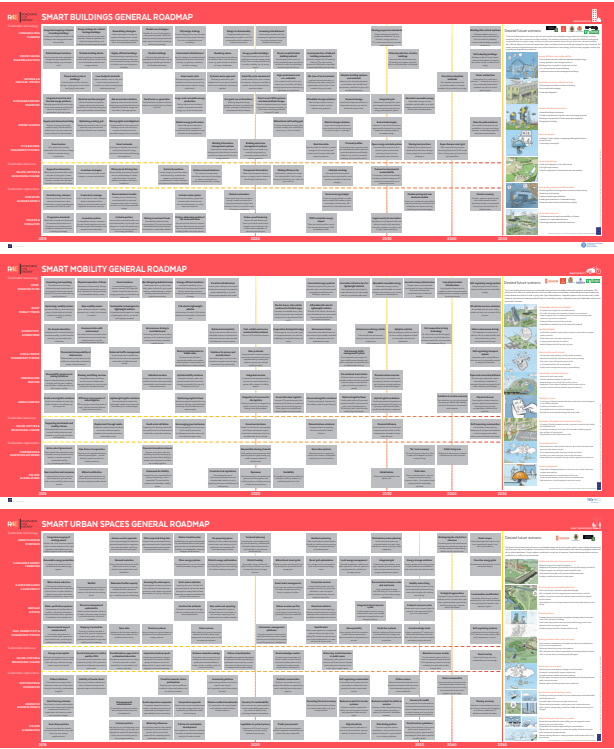
ROADMAPPING

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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> Selecting common ambitions Formulating cross-city learning objectives as input for the Project Portfolio step |

Programme of the Joint Roadmap Workshop



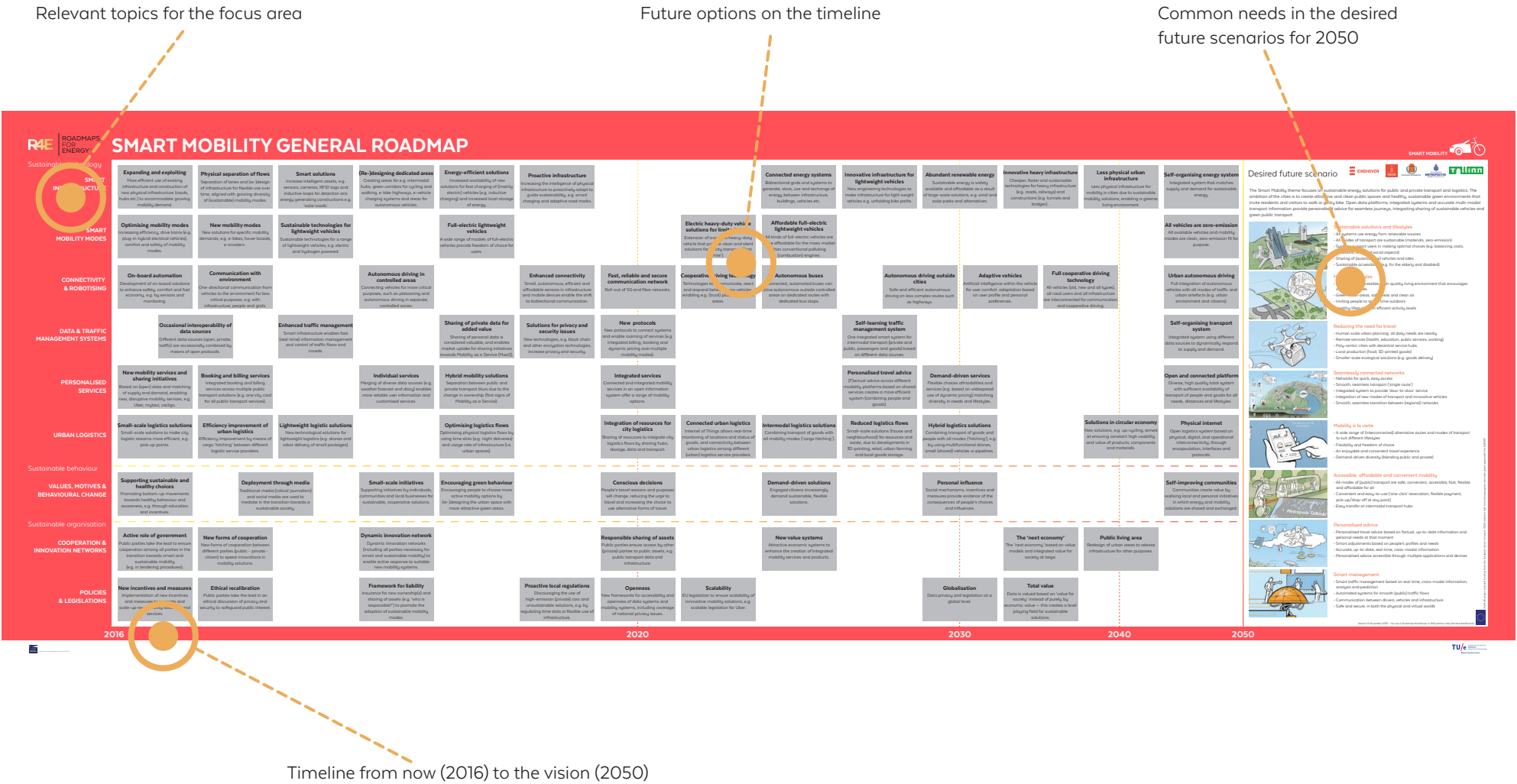
How to read the general roadmap

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.



Timeline from now (2016) to the vision (2050)

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.

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 and 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

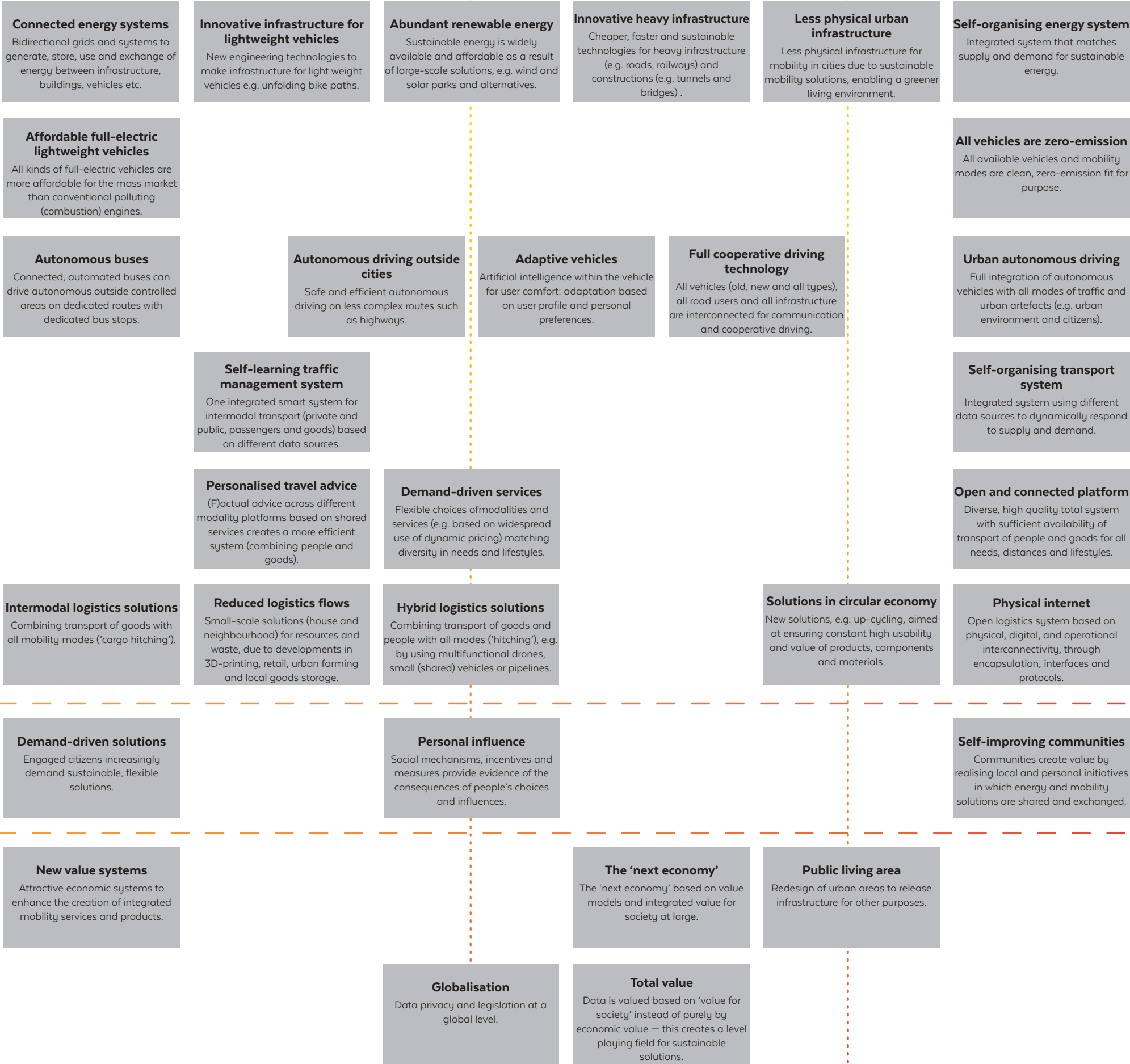
New frameworks for accessibility and openness of data systems and mobility systems, including coverage of national privacy issues.

Scalability

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

2016

2020



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

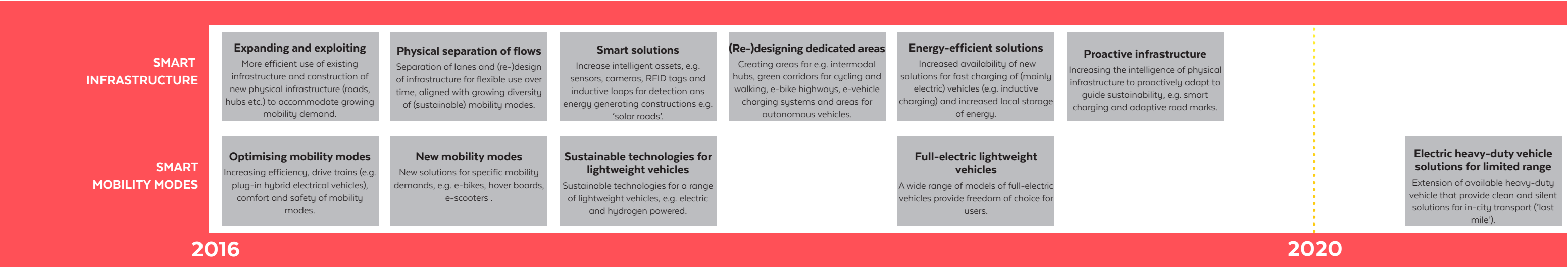
- Smart traffic management based on real-time, cross-modal information, analysis and prediction
- Automated systems for smooth (public) traffic flows
- Communication between drivers, vehicles and infrastructure
- Safe and secure, in both the physical and virtual worlds

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Smart Infrastructure

Short-term developments

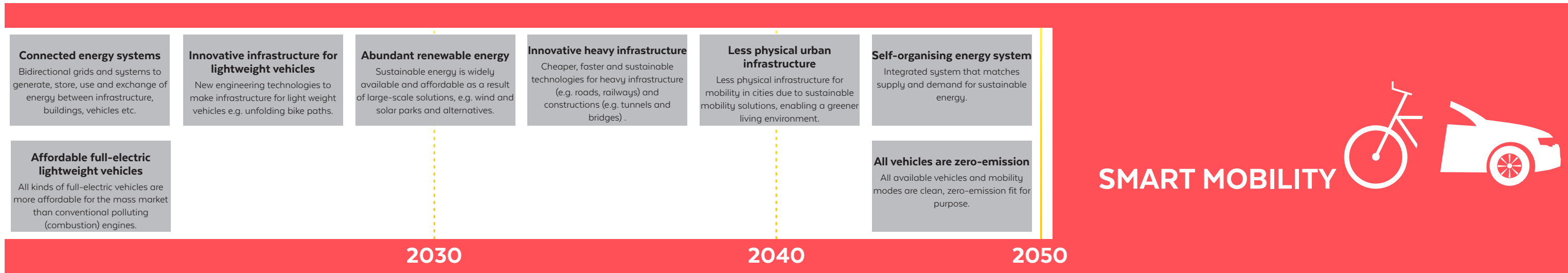
- In the short term, new infrastructure continues to be constructed (mainly outside the city centres), and current infrastructure is used more efficiently to accommodate the growing demand for mobility.
- Separation of lanes and (re-)design of infrastructure allows flexible use of infrastructure over 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

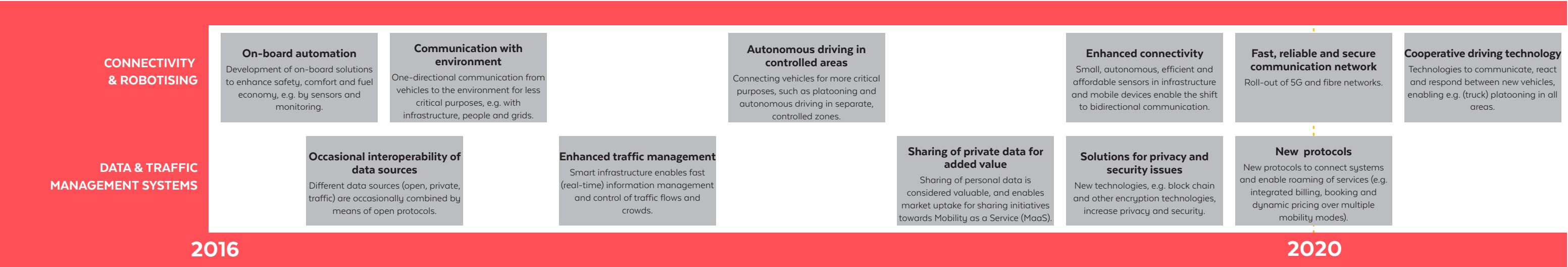
- In the short term there are incremental improvements in vehicle drivetrains, comfort and safety. As well as optimising current mobility modes, new mobility modes are also emerging as solutions for specific mobility demands, such as e-bikes, hoverboards and e scooters.
- Over time, but still in the 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

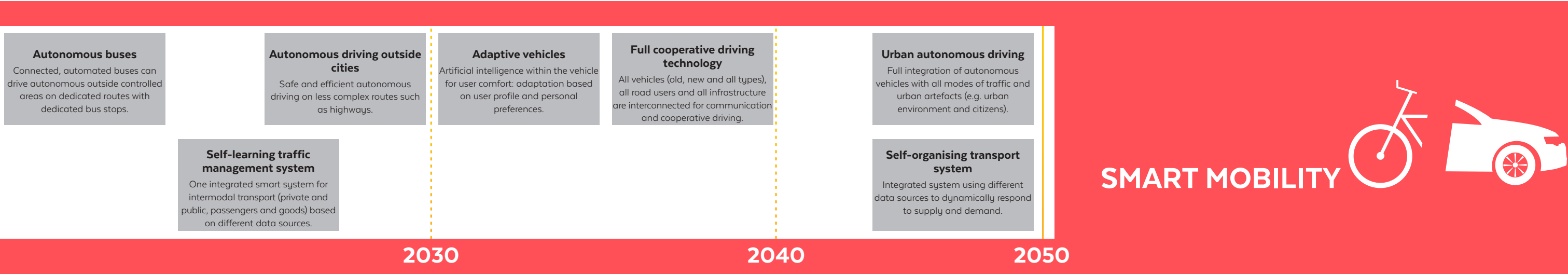
- Short-term developments in connectivity and robotising can first of all be relate mainly to in-vehicle automation and autonomous driving in controlled areas. This means that the development of in-vehicle solutions enhances safety, comfort and fuel economy, e.g. by means of sensors and monitoring. In 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

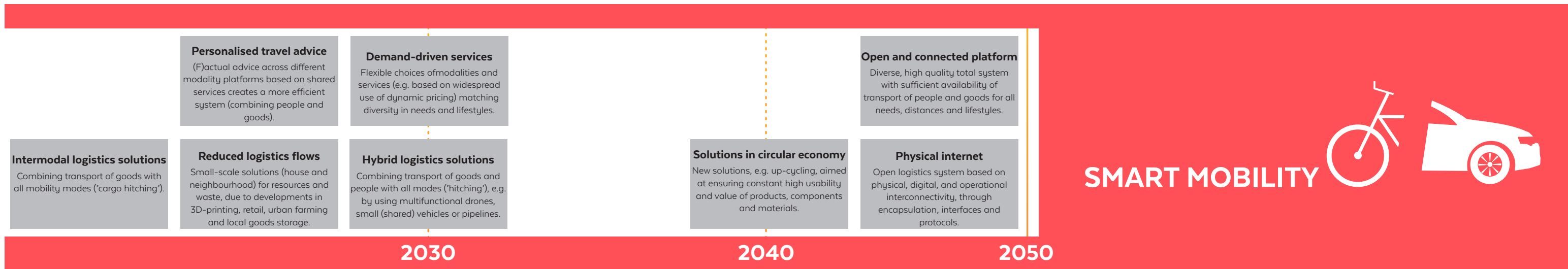
- In the short term, the number of new mobility services and sharing initiatives is likely to increase. This is mainly due to the increase in (open) data and matching of supply and demand, which enables new mobility services that could potentially disrupt the market. Integrated booking and billing services across multiple public transport solutions such as on 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.

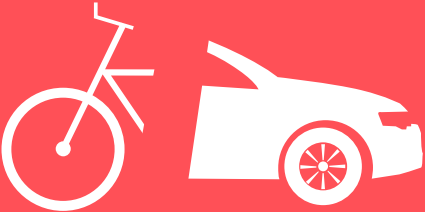
Self-improving communities
Communities create value by realising local and personal initiatives in which energy and mobility solutions are shared and exchanged.

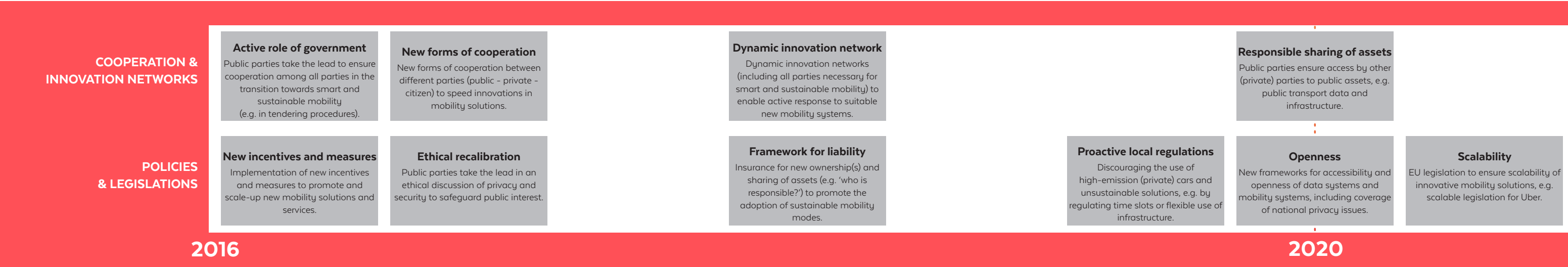
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SMART MOBILITY





Cooperation & Innovation Networks

Short-term developments

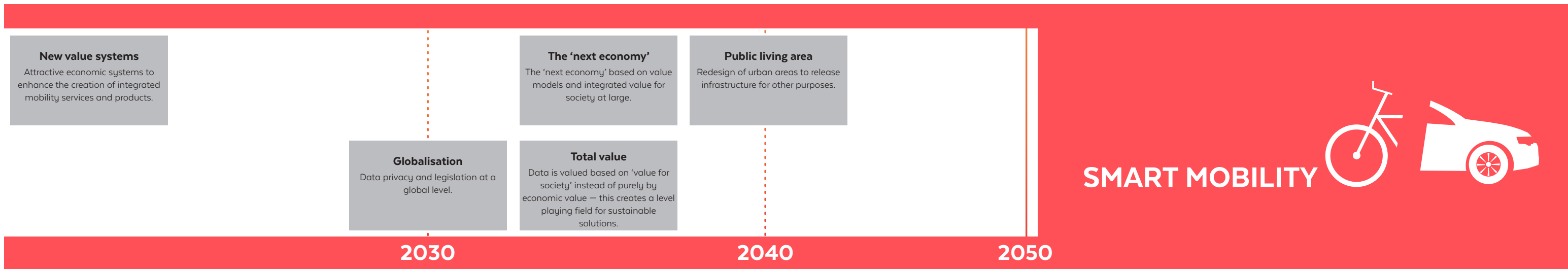
- Cooperation and innovation networks describe how new forms of cooperation between different types of organisations (public-private) evolve over time, speeding innovation and the roll-out of new mobility solutions. In the short term, public parties take active roles in ensuring cooperation between all 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 policies 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.

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 and 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. |
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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 Mobility infrastructure enables cycling, walking and use of electric vehicles as attractive ways to travel around the city. Overall, transport is shifting towards more sustainable solutions. The collection of mobility data has started for the development of personalised services. | 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'). |
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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. |
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DATA & TRAFFIC MANAGEMENT SYSTEMS

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| 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). |
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PERSONALISED SERVICES

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| 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. |
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URBAN LOGISTICS

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| 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. |
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Sustainable behaviour

VALUES, MOTIVES & BEHAVIOURAL CHANGE

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| 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. |
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Sustainable organisation

COOPERATION & INNOVATION NETWORKS

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| 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. |
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POLICIES & LEGISLATIONS

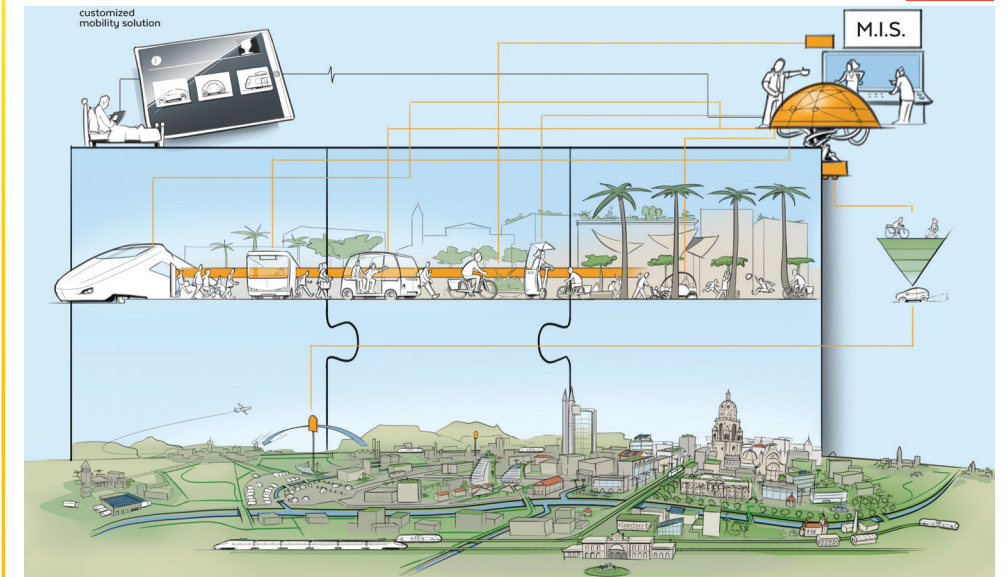
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|--|---|--|--|--|--|---|--|
| New incentives and measures Implementation of new incentives and measures to promote and scale-up new mobility solutions and services. | Ethical recalibration Public parties take the lead in an ethical discussion of privacy 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. |
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2016

2020



Desired future scenario



SAFE, CLEAN AND AFFORDABLE MOBILITY IN MURCIA 2050

In 2050, people in the Murcia region enjoy a safe and clean city, with green and healthy areas and safe and clean mobility solutions.

Personal mobility needs are met and healthy mobility, such as walking and cycling, co-exists in harmony with other safe, clean forms of (shared) mobility.

The public transport system is clean and effective throughout the city region, with 'one-click' accessibility enabled by a master intelligent system.

The design of public space and services and the availability of a wide range of mobility options 'nudges' people towards more sustainable and healthy lifestyles. The flexibility of personal choices is met by a system of different, interconnecting mobility modes, reflecting the differences in needs and possible solutions throughout the city and region.

Urban spaces are designed with a focus on people. Those from the outlying areas and visitors are provided with clean, fast accessibility to the city centre. It is easy for people to move around near the centre with services to meet their daily needs. The down-town area is a safe and pleasant place for pedestrians.

Elements of the desired future scenario are:

All people's avenue

The down-town area is a safe and pleasant place for pedestrians. Public spaces are designed for them and traffic is restricted to emergencies, residents and public services. Urban spaces such as an 'all people's avenue' are pleasant, comfortable, quiet, green, shady and accessible for all. These spaces are shared with bikes and one-person e-cars.

Urban liveability

The 'urban zone' is a place where people can easily move around, with good access to the city as well as the outlying areas. Industrial estates and warehouses are moved from the urban areas to the outskirts, freeing space for sustainable transport, such as trams, electric buses, clean private cars and a public car-sharing system. De-centralised services are provided to meet daily needs, and there are green lanes for long-distance walking and cycling.

Connecting people

The 'pedanías' zone provides accessibility for people from the outlying areas and visitors. (Mass) public transport is provided by train, tram and bus, and is clean, fast and accessible. Free parking for private (unsustainable) cars is available at inter-modal transport hubs. These make it easy for people and goods to switch between different mobility means, encouraging sustainable choices. Easy access to the countryside revalues country lifestyle and products.

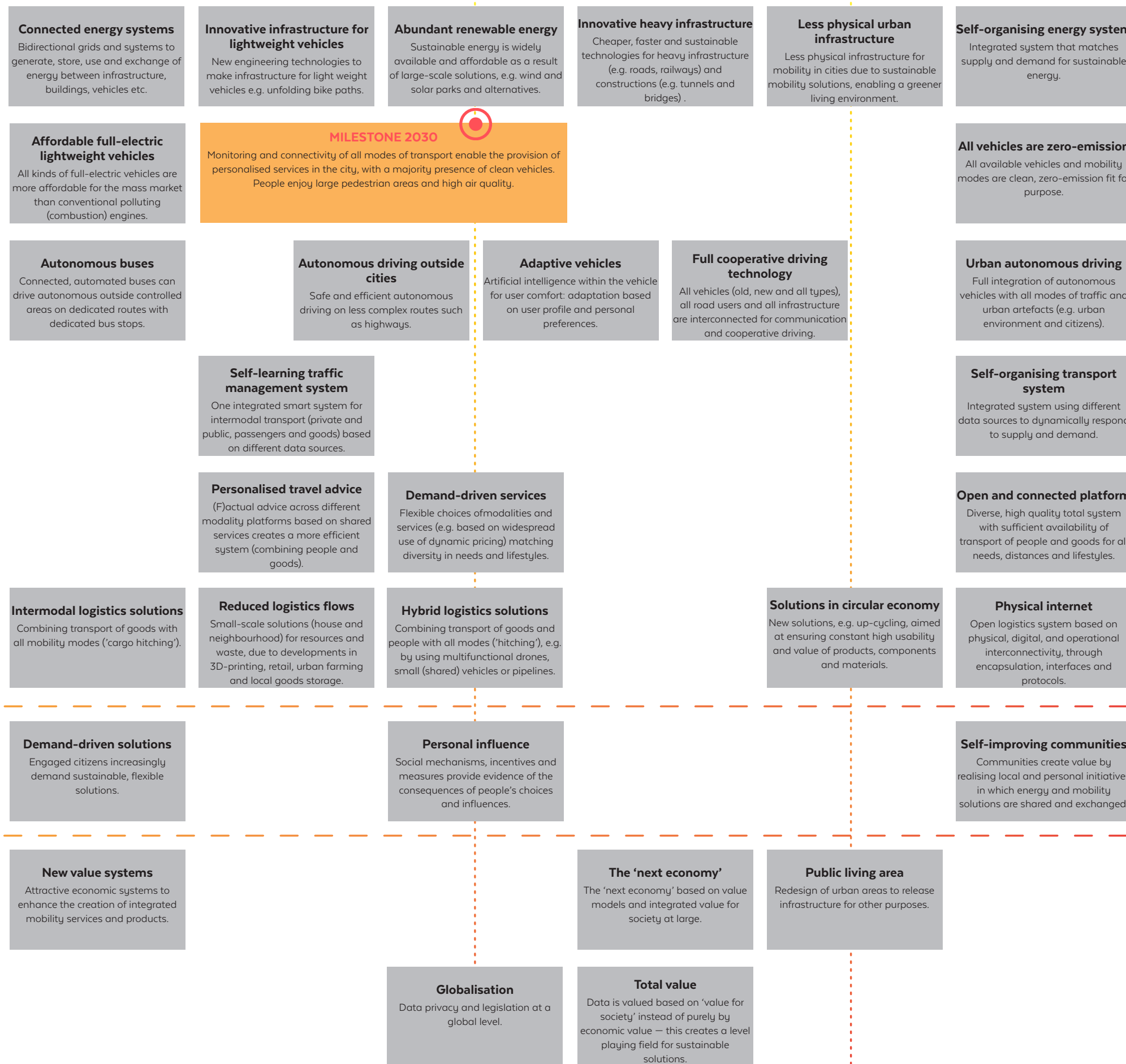
Smart citizens

Citizens naturally choose sustainable and healthy solutions. Mentality and behaviour embrace healthy living. People value a clean and safe city, and are willing to contribute to achieving this.

Education from an early age and co-creative workshops with citizens and companies, increase awareness and involvement, and challenge people to participate actively in new 'mobility plans'.

Master Intelligent System

An intelligent global system integrates mobility modes and allows users to enjoy 'mobility à la carte'. A 'one-click' system pro-actively adjusts to people's profiles and needs, based on up-to-date information and forecasts. The system is easily accessible with one profile for reservations, payments and information. Controlling incentives avoid misuse and keep the system free of undesired side-effects.



2030

2040

2050





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

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 Murcia

1 CYCLE PATHALONG THE RIVER SIDE



This project consists of the construction of a cycle path along the river side of Murcia (Segura River). The budget was 237.00 Euros and it is 2,3km length. This can be considered as a section cycle path that links another two cycle paths that go at ground level in the west and east part of the city. This cycle path has 322 high efficient lighting points in order to make its use safer at night.

New Project Ambitions Smart Mobility Murcia

1 INSTALLATION OF EV-CHARGING STATION NETWORK



We are planning to install a network of high tech 8 EV charging stations to support both the existing EV users and potential EV users when it comes to charge the vehicle in the street in Murcia. At present there is only one charging station and that's not enough. This new network will have 22kw power charging points and will be built, maintained and managed completely by an external company.

2 RESERVED PARKING SPACES FOR EVs



The Municipality will reserve nearly 50 parking spaces for EVs in the most valued streets and spots of Murcia in order to raise interest and awareness on e-vehicles. This is an incentive measure that will be benefit both for existing users of EVs and for potential buyers. These reserved parking spaces will be signaled and highlighted properly in order to catch the attention of drivers and pedestrians.

3 COOPERATION AGREEMENT TO FOSTERING ELECTROMOBILITY



The Murcia city council will sign a cooperation agreement with Renault in order to initiate cross actions to foster and promote electro mobility in the Municipality of Murcia. The first action is going to be the free rental of a Renault ZOE during 1 year for the Mayor. That way , the municipality is going to show his support for the electric vehicles in a clear and solid way. Apart from that initiative, there will be more in the coming months.

5 REAL TIME MONITORING AND INFORMATION ON E-MOBILITY



The Smartcity "MiMURCIA" platform for integrated service management will incorporate and display real-time data on the operation of the future electric vehicle recharging network and will also include all data related to the electro mobility infrastructures and services that the city will progressively have.

4 RAISING AWARENESS CAMPAIGNS ABOUT ELECTROMOBILITY



The Murcia city Council will organise media campaigns to inform about the benefits of e-vehicles and raise citizens' awareness about sustainable mobility. The objective is to carry out information campaigns, awareness and promotion of electric vehicleS in collaboration with the entities involved in e-mobility. These campaigns will be adapted to the different types of electric vehicles and to the needs of all social groups.



CONTRIBUTIONS



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 MURCIA

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 Murcia. 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.



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