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AMBITION, VISION & ROADMAP

SMART MOBILITY PALERMO

D6.4 Final city report

12 September 2017

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R4E

ROADMAPS
FOR
ENERGY®



AMBITION, VISION & ROADMAP SMART MOBILITY PALERMO

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 Palermo.



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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.

Versions of this report:

| | |
|-------------------|---|
| 18 August 2017 | Concept for internal check by R4E partners (limited distribution) |
| 12 September 2017 | Final version for public distribution |

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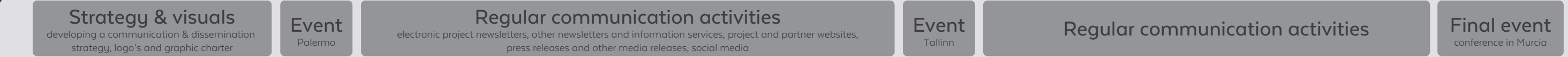
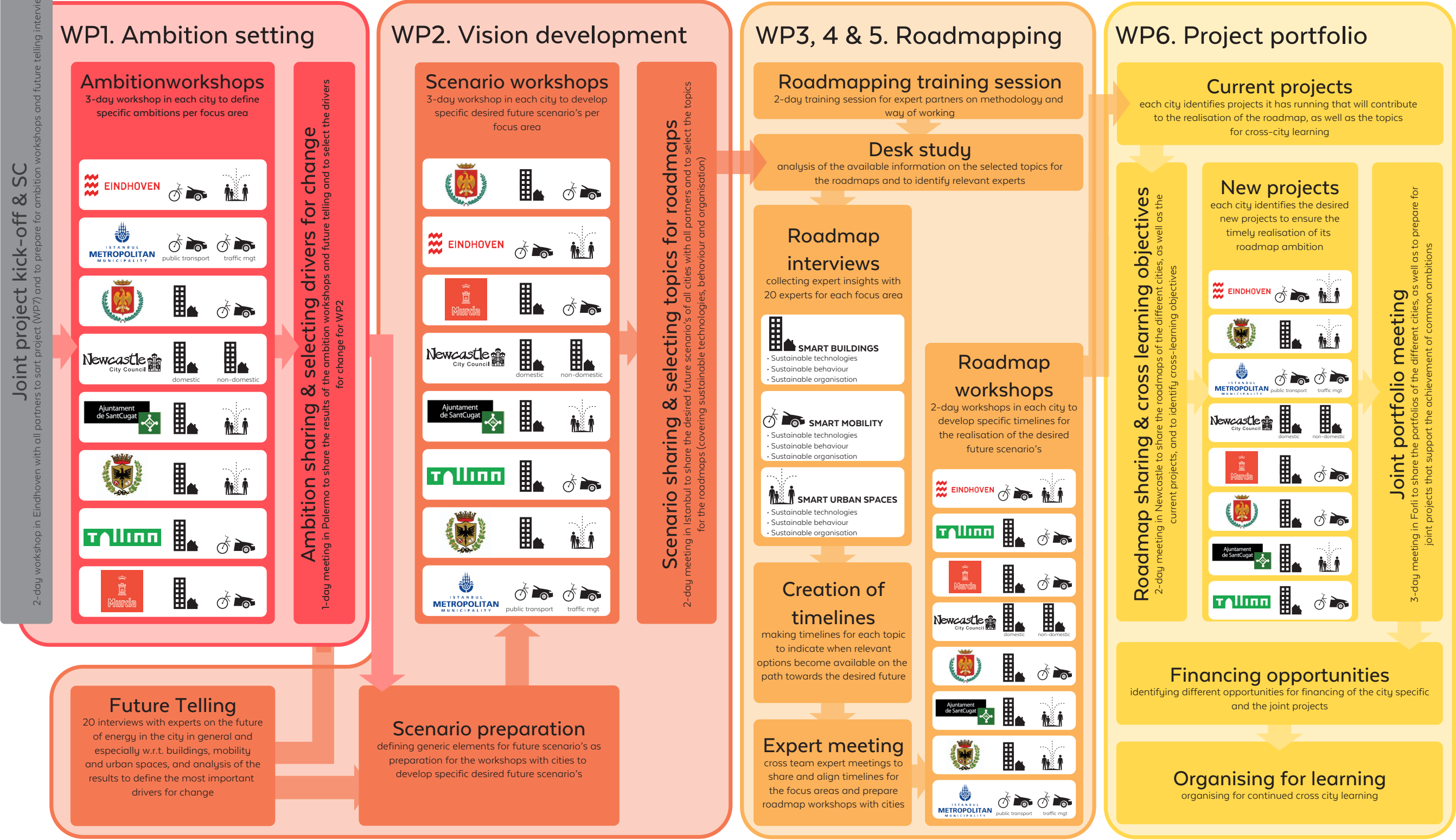
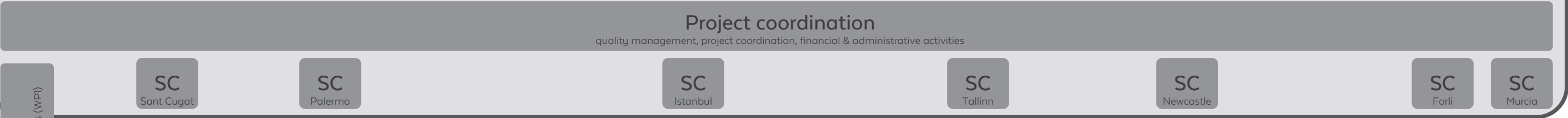
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WP7. Project management



WP8. Communication & dissemination

R4E - ROADMAPS FOR ENERGY

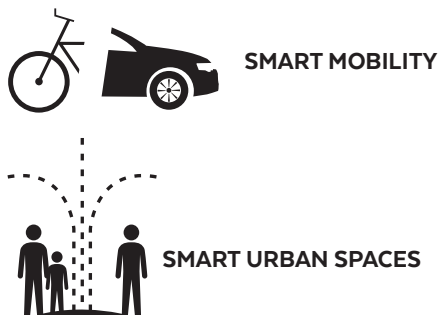


Introduction

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:



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 Kesklinnaamet, 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 Palermo

Introduction to the city

Palermo is a city of the Insular Italy, the capital of both the autonomous region of Sicily and the Province of Palermo. The city is well-known for its history, culture, architecture and gastronomy, playing an important role throughout much of its existence. It was founded as a port town by the Phoenicians around 734 BC

Palermo is located in the north-west of the island of Sicily, right by the Gulf of Palermo in the Tyrrhenian Sea. Palermo is the fifth-largest Italian city by population after Rome, Milan, Naples and Turin.

Many monuments, churches and palaces in Palermo have been recognised for years as national monuments and in 2015 the Arab-Norman buildings were included in the UNESCO’s ‘World Heritage List’.

For cultural, artistic and economic reasons Palermo is the main city of the Euro-Mediterranean region, and today is one of the top tourist destinations in Southern Italy also for Mediterranean cruise ships.

The city is the main centre of the Sicilian Region, it has the oldest parliament in the world, and it is also the home of the University of Palermo and of the regional archdiocese.

It was established as city-port by the Phoenicians around 734 BC. It has always been a trading and cultural cooperation centre between West and East. It has been conquered by several populations at different times. Its a long history has given rise to a remarkable and unique artistic and architectural heritage.



Selection of focus areas

The analyses performed on the greenhouse gases emissions of the city of Palermo show that the sectoral distribution of consumptions is characterized by a clear predominance of the building sector (both housing and service industries) and transport one.

The main objectives of the ‘Sustainable Energy Action Plan (SEAP) are, therefore, the reduction of CO2 emissions in these sectors, by reducing the energy consumption of buildings and improving the efficiency of public and private transport.

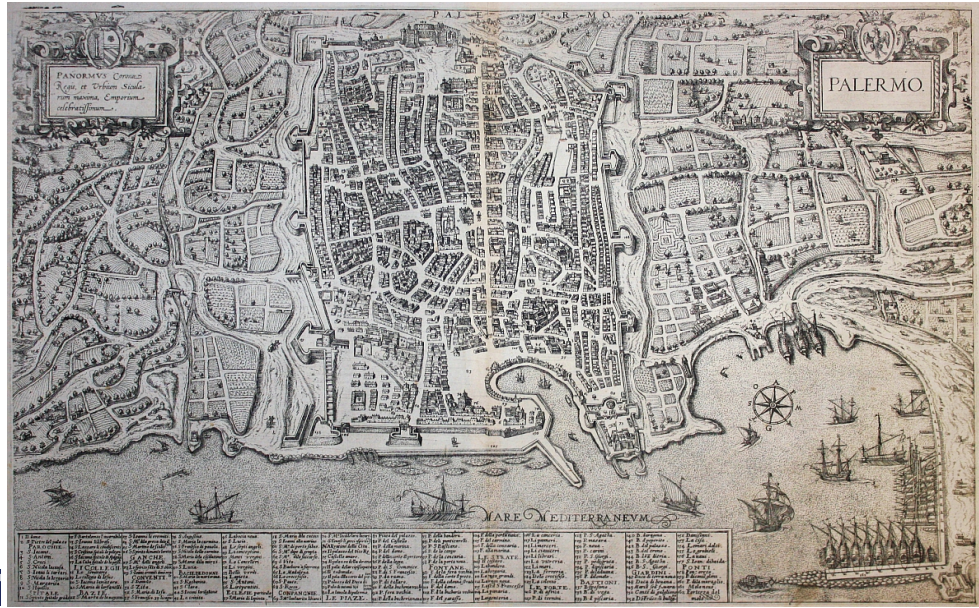
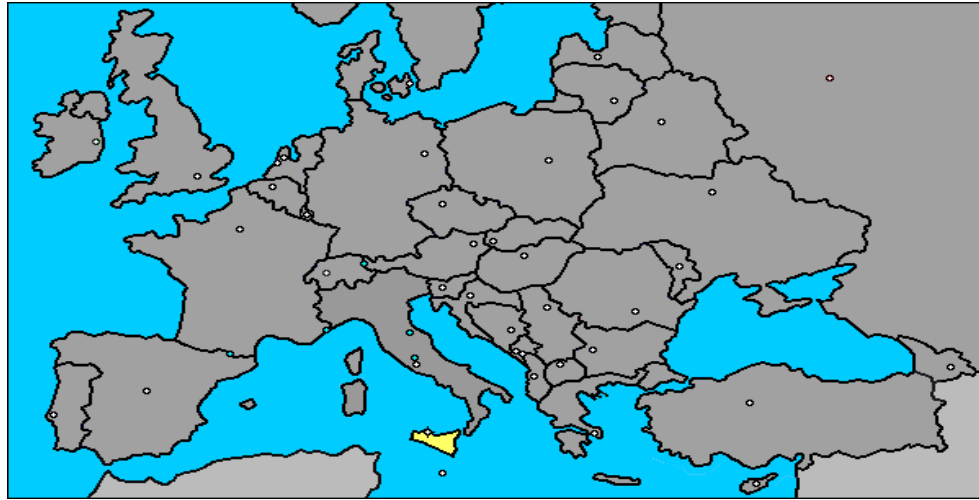
Palermo has therefore selected two focus areas for the R4E project:

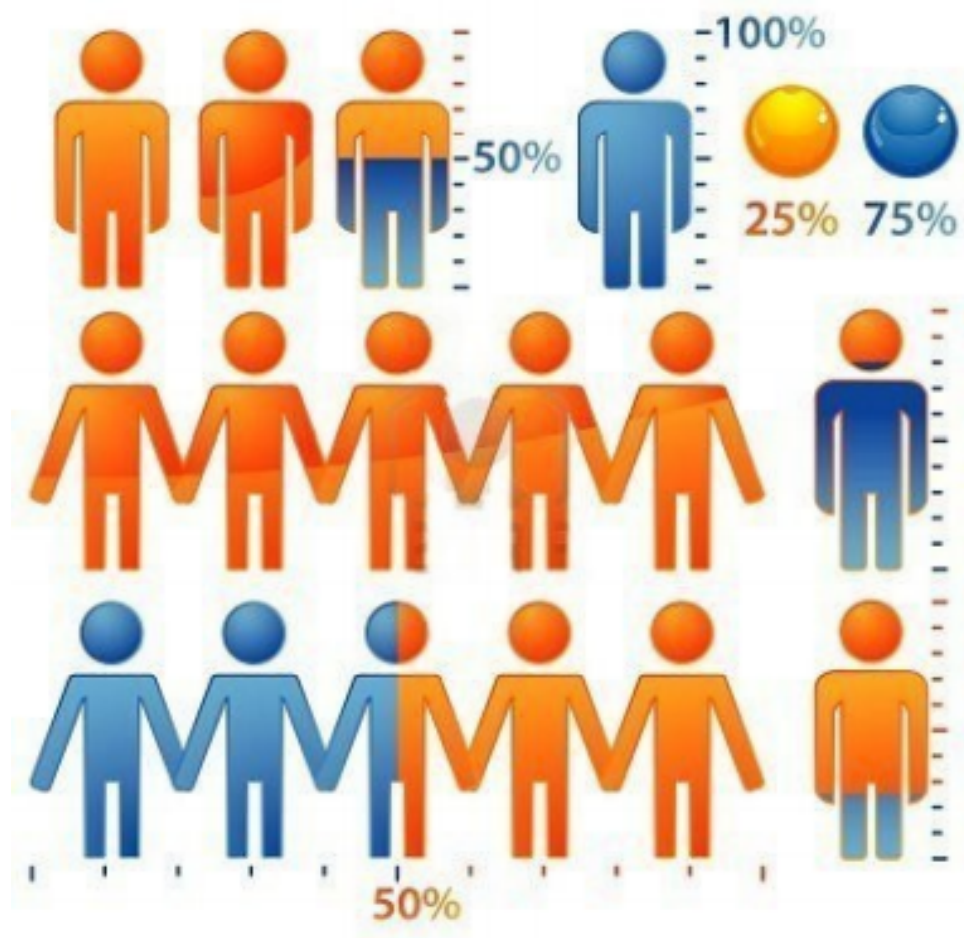


SMART BUILDINGS



SMART MOBILITY





Demographical aspects

Size in km² : 158,88 km²

Number of inhabitants: 678.492 ab

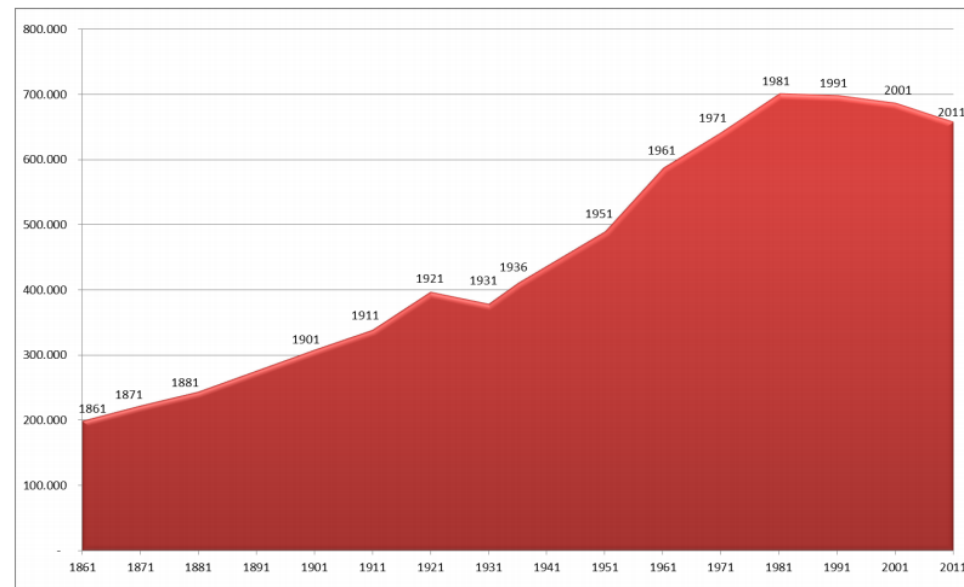
Population trends

Palermo, like many cities of southern Italy, is characterized by a significant activity rate (active population to resident one ratio) of 37.6%, is far below national average, which is 42.2%.

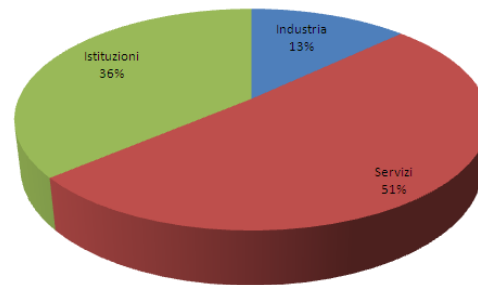
2.2% of the employed people are distributed in agriculture, fishing and breeding sectors, 20.8% are in the industrial sector while the remaining 77.0% are in services, where an important role is played by tourism services.

This distribution is very different from the national average, which is characterized by a lesser incidence in the service sector (55.7%) and, on the contrary, by a much larger one in the first two sectors (agriculture and fishing: 7.6%; industry: 35.6%).

As for education, 33.3% of the population has a good level of education (university degree and diploma), 53.9% have a middle school or elementary certificate, while 12.8% have no qualification, however, only 2.1% are illiterate.



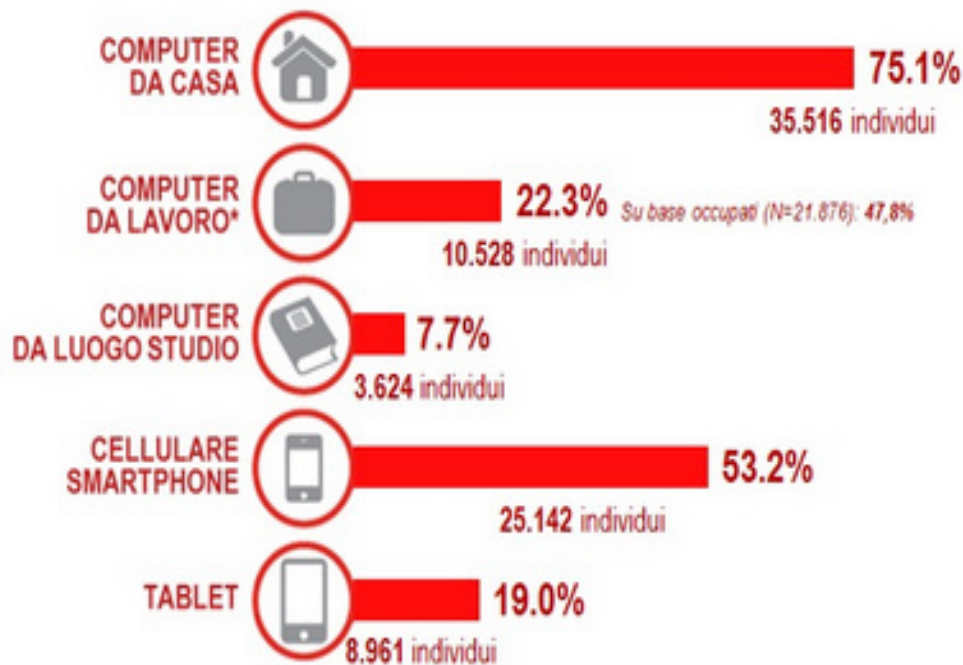
Resident population in Palermo 1861 – 2011



Number of employees for the productive sector

Gli italiani e l'accesso a internet

Base: totale individui 11-74 anni – Valori % e Stime in '000



Audiweb Trends - Giugno 2014

In Italy, 39.7 million of citizens, aged 11 and 74, can access the Internet from fixed locations (home, office, or a place of study) or from the mobile, 83, 9% of the population in the age group concerned. Studies show that:

35.5 million of individuals, aged 11 and 74 years, accounting for 75.1% of cases, access the Internet from home via computer;

25 million people say they access the Internet from a mobile phone / smart-phone (53.2% of the Italians concerned), an increase of 13.7% in the last half of 2014;

9 million people say they access the Internet from the tablet, with an annual growth of 88% (June 2014 VS June 2013).

The internet access has similar values in all segments of the Italian population, confirming the high spreading rate of online in Italy. Some segments of the population, also have concentration ratios almost equal to 100%:

over 96% of young people aged between 11 and 34 years.– 98.5% of graduates,

95.8% of high school graduates,

93.8% of workers and, more specifically, 99.6% of managers, executives and academics, 98.2% of entrepreneurs and self-employed and employees, and 98.4% of teachers.

There are very high rates among students: 100% of university students and 97.8% of middle and high schools students.



The latest report of the European Commission, “Quality of life in European cities - Italy” of 2014, contains the results of the survey on the perception of quality of life in 79 European cities. This report reveals a general dissatisfaction expressed by the citizens of the cities of southern Italy in relation to the chances of finding employment, to public transport services and garbage collection, as well as the wish that the local administration will improve all the services for the use of urban areas, sports facilities and, in general, services to citizens. However, according to the people living in Palermo who were interviewed, there are some positive exceptions, which would consist in the possibility of finding a cheap accommodation and in the rate of integration of foreigners in the city. These aspects place Palermo in the top half of the rankings on European cities.

Economical aspects

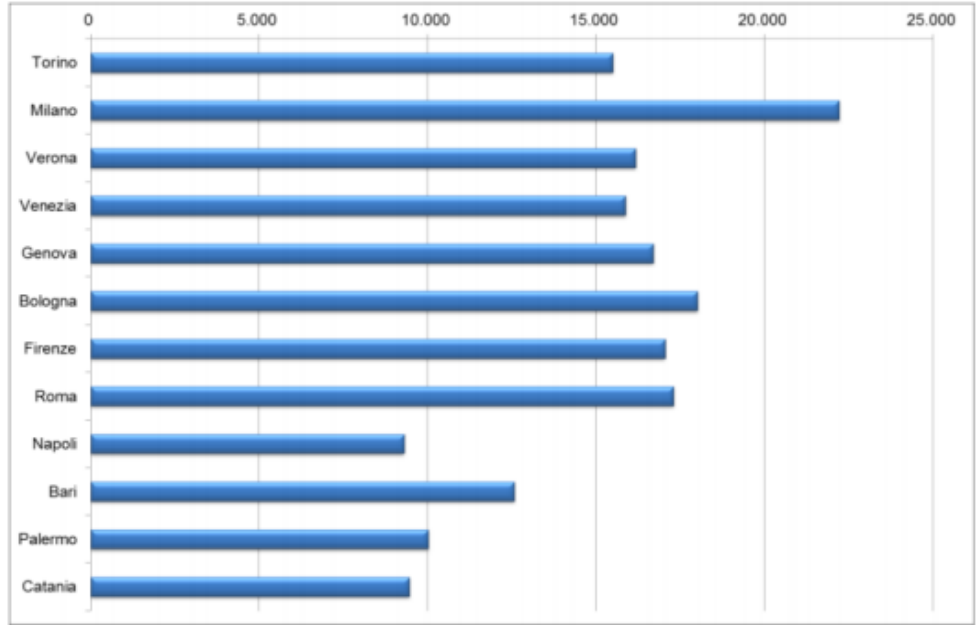
The per capita income of the Sicilians is about 10,000 euro per inhabitant, but if we consider only the number of people who register their income to the State, the per capita income amounts to about EUR 25,600.00 per registrant.

The data on per capita income of the inhabitants of the city of Palermo, capital of Sicily Region, are in line with national ones, but higher for about 20% if compared to the regional average.

The actions proposed in the PUT (Urban Traffic Plan), in general, are linked to improving pedestrian mobility, the establishment of Limited Traffic Zones (ZTL), the introduction of measures to improve the mobility of collective public transport, the reorganization of the movement and parking of private motor vehicles, the improvement of road safety, the introduction of measures to reduce traffic, the use of ITS technologies, strengthening services of urban supervision and the activities of Urban Mobility Management.

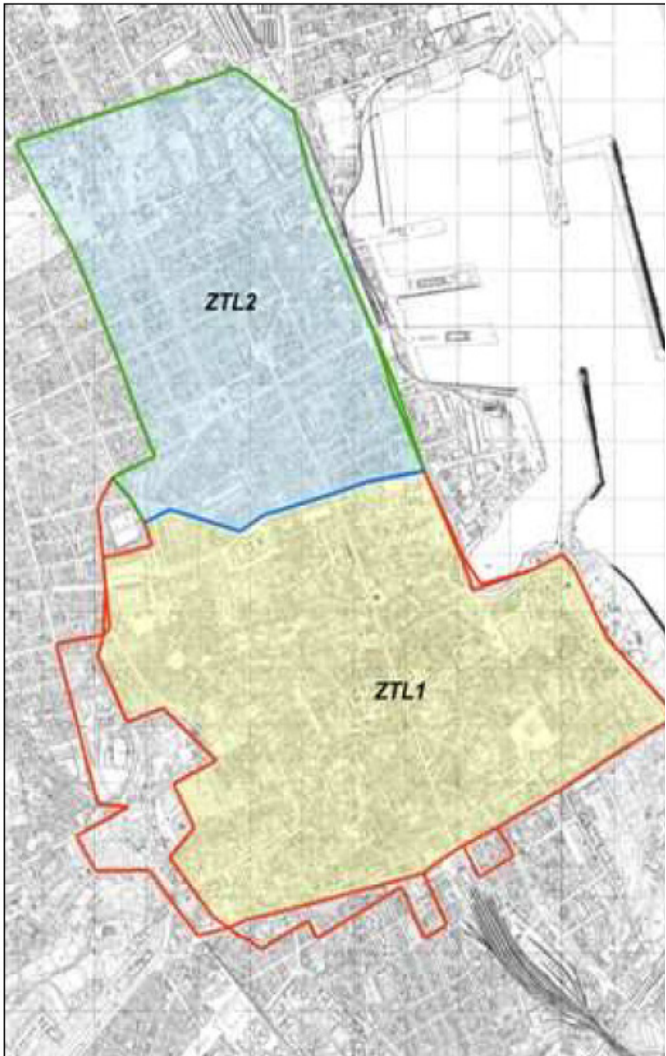
In particular, the Plan of Palermo involves some important measures:

- The creation of a network of the streets and pedestrian areas, especially in the Old Town, which is the most important urban area from the historical, urban, and monumental point of view. The extension of the pedestrian area will increase from 41 hectares to more than 83 hectares; if we add to these ones the areas affected by the presence of historical markets, the surface of the pedestrian areas of the Old Town will reach about 120 hectares.
- The establishment of Limited Traffic Zone, where only public transport and private transport to zero or low emissions will be allowed to pass;



Per capita income in Italy

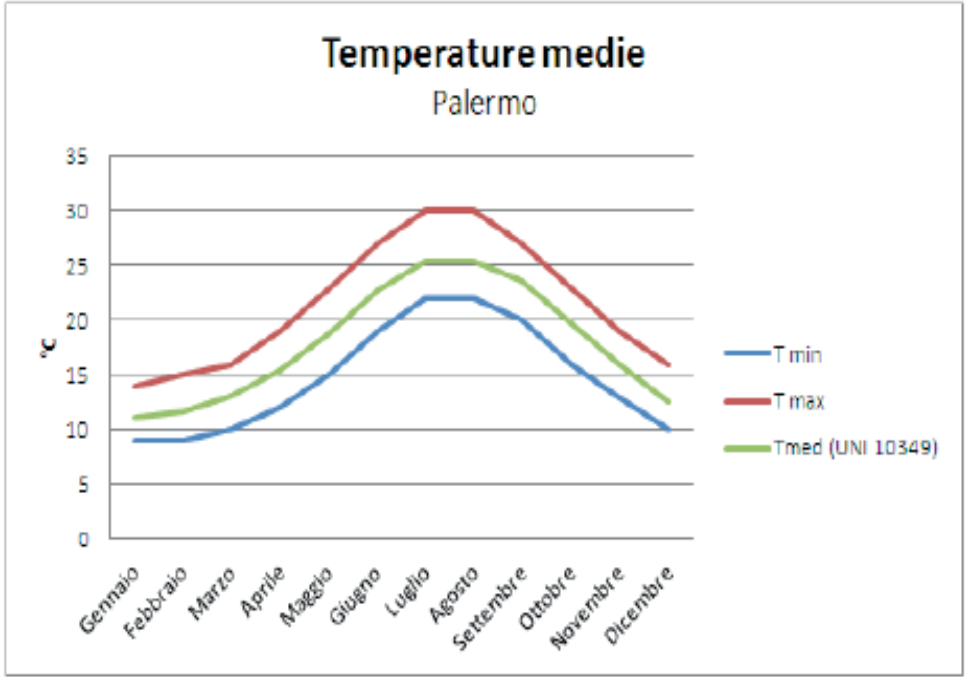
- Improving public transport through the establishment of tram networks, metro networks, cycle paths, the doubling of the railway line linking Palermo to the villages nearby;
- The replacement of old buses with low-emission vehicles (natural gas and diesel € 6, hybrids);
- Strengthening the car sharing service and promoting carpooling and shared taxis.



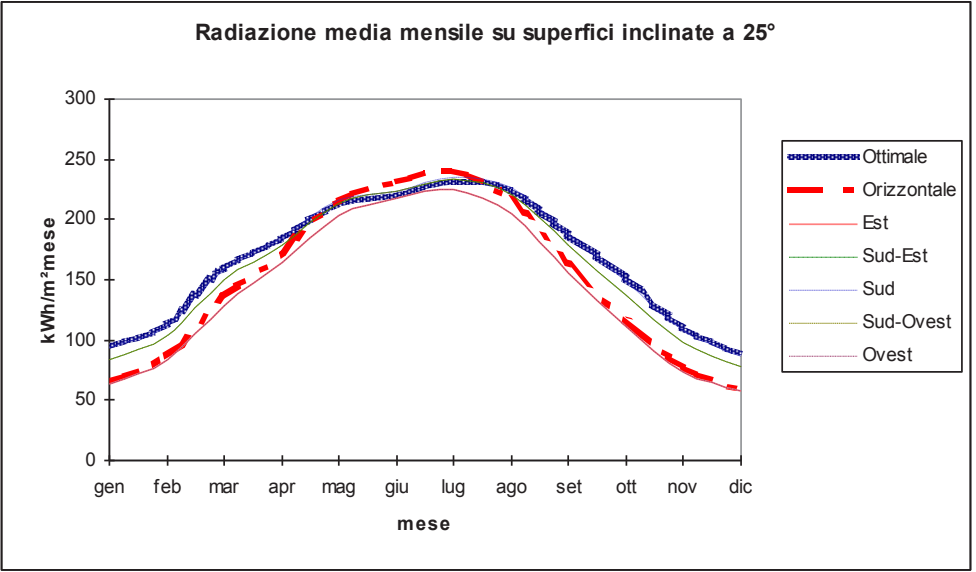
Traffic in the city centre

Environmental aspects

The city of Palermo is characterized by a Mediterranean climate, with low temperatures slightly below 10 ° C and maximum temperatures that can exceed 30 ° C (in August 1999 it was recorded a maximum temperature of 45.2 ° C). Average annual rainfall amounted to 855 mm, an average spread of 81 days of rain, with minimum in summer, peaking in the winter and secondary maximum in the fall for accumulations. The annual average of relative humidity recorded the value of 62.3% with a minimum of 57% in July and maximum of 67% in December and January; on average, there are zero days of fog a year.



Monthly average temperature in Palermo



Monthly average solar radiation on inclined surfaces in Palermo



| Horizontal | Optimal | Eastward oriented | South - eastward oriented | Southward oriented | South-westward oriented | Westward oriented | 25° east incl. | 25° south-east incl. | 25° south incl. | 25° south-west incl. | 25° west incl. |
|-------------|-------------|-------------------|---------------------------|--------------------|-------------------------|-------------------|----------------|----------------------|-----------------|----------------------|----------------|
| kWh/m² year | kWh/m² year | kWh/m² year | kWh/m² year | kWh/m² year | kWh/m² year | kWh/m² year | kWh/m² year | kWh/m² year | kWh/m² year | kWh/m² year | kWh/m² year |
| 1784 | 1985 | 975 | 1191 | 1230 | 1191 | 975 | 1689 | 1898 | 1980 | 1898 | 1689 |

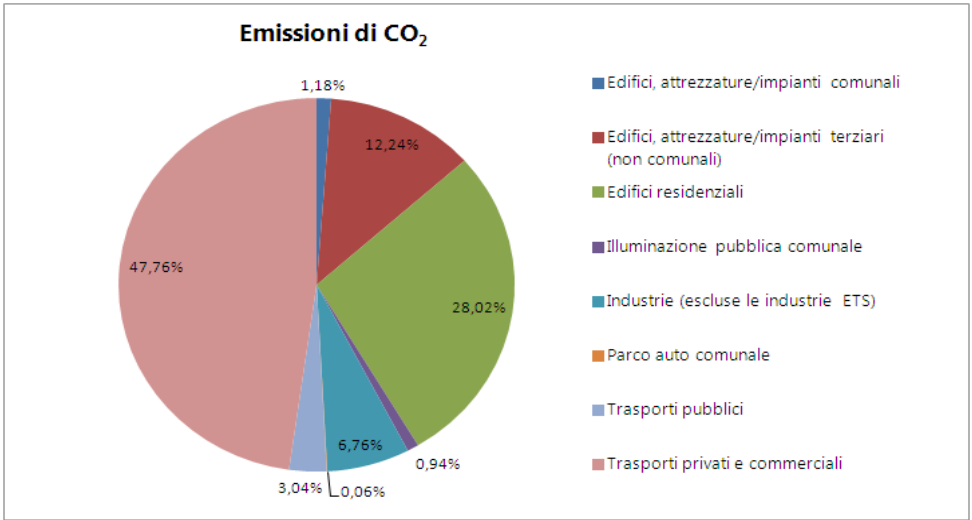
The city of Palermo is located in a region with very favourable sunlight conditions throughout the year and, consequently, with a high potential for the exploitation of solar energy for the production of thermal and electric energy.

The following table shows the mean values of solar radiation for different exposed and oriented surfaces; values greater than 1900 kWh / M2 year can be reached.

The city of Palermo approved the Sustainable Energy Action Plan in 2015, calculating CO 2 emissions [1] in the city, for the reference year 1990 (IBE year), equal to 1,864,142 tons (2.7 tons CO 2 per capita).

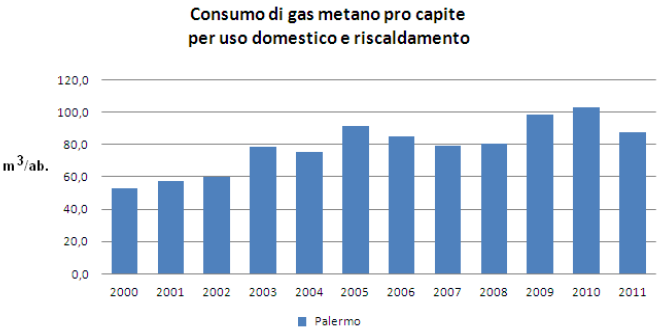
In order to meet the target for 2020 (20% less emissions than in 1990), the Administration has committed to reducing the emissions by an amount 400,000 tons of CO2/ year, ie by 21.5% compared to the year 1990.

The data provided by the SEAP on final energy consumption show that the sectors having the greatest impact are transport (60% for Palermo and about 45% for Sicily), followed by the civil sector (34,9,2% for Palermo 23.8% for Sicily), while agriculture and fishing account for only 0.4% of Palermo consumptions and 3.9% of the region ones. It should be noticed, even today, a predominant consumption of petroleum products and energy, although in the last years the share of natural gas consumptions has increased substantially, together with the production of electricity from renewable sources (photovoltaic and wind systems).



Percentage breakdown of CO2 emissions between different sectors, except industry

As for the residential sector, there is a large gap between the southern cities of Italy, which are located in coast areas with a mild climate, such as Palermo, and the centre-northern cities. By way of example, it should be noticed how the average per capita consumption of natural gas for domestic use and for heating concerning Palermo is about 15% (90 ÷ 100 m3 / inh) of that one of Turin (700 m3 / ab approximately). As for the consumption of electricity, however, there are no substantial differences among per capita consumption of Italian cities, which are about 1,200 kWh / inhabitant.



The beach of Palermo (Mondello)

MEDCLIMA

GUIDE FOR LOCAL CLIMATE PROTECTION

Easy Steps for Reducing CO₂ Emissions



Historical / cultural aspects

Today Palermo is working for defining its role as a city of art and a place of culture, valuing the past and the historical evidence, on one hand, but also looking to the future, turning to new developments in contemporary art and multimedia research on cultural heritage.

The policies of the Administration aim to define stable structures and organizations for cultural heritage management in the belief that, we can build the future development of the city, including the economic one, over them.

It 'a long path, whose action is expected to continue over time, placing short, medium and long range goals. A path that is identified with the activities of museums, libraries, archives, foundations that have increasingly taken a leading role in the cultural, social and economic life of the city.



Way of working

The organizational structure of the Administration of Palermo is divided into several macro-structural levels defined Areas, Sectors, Autonomous Offices, Services, Project Unit, Staff Unit. In order to ensure more streamlined and efficient administration, within the Services and Autonomous Offices, there are micro structures defined as organizational units of different levels.

At the end of 2014, the employees of the sector amounted to 9,838 units, n. 75 of which were executives; n. 6940 of the employees had Local Authorities sector contracts (of which n. 666 had temporary contracts); n. 916 had Construction Companies contracts, n. 1907 belonged to “precariat”. Over 51% of all employees in the sector are men.

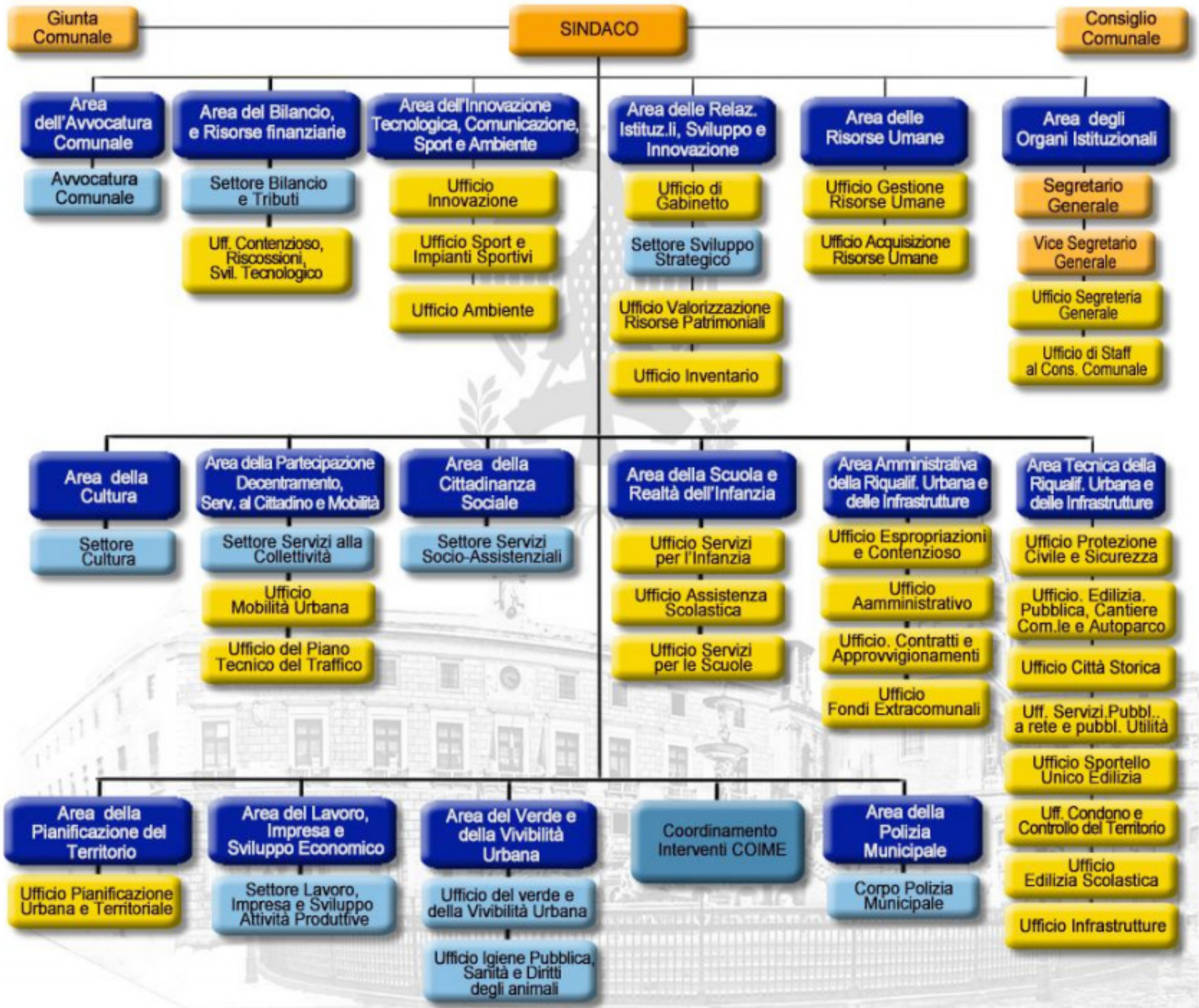
In order to manage the necessary resources to provide services to the community of citizens, like all organizations, the Municipality has its own budget. This one has a part including any business and revenue, and a part concerning the liabilities and expenses. To give an idea of the importance of the municipal budget of the city of Palermo, just think that the total amount of funds for the year 2013 amounted to over one billion and one hundred million Euros. The Municipality of Palermo, moreover, reached the budgetary objectives with particular attention to the respect of the “Stability Pact”.

The Municipality manages public services through some subsidiaries such as:

- AMAP S.p.A. manages the integrated water service in the city of Palermo. It is responsible for the infrastructures for the supply, delivery and conversion of seawater into drinkable water, which provide, mainly, Palermo and the various coast municipalities of all the Province;
- AMAT Palermo S.p.A. is responsible for the organization and management of public transport systems, including the management of fleets (car-sharing, car pooling, shared taxis, global service of vehicles made by any means), for the installation and maintenance of road signs, for the management of public car parks and tarified parking areas; it also controls the parking along the urban road network, the removal of illegally parked vehicles and of those ones for reasons of public order and safety;

- RAP S.p.A. is responsible for the waste management service, the environmental hygiene service and the road maintenance;
- AMG S.p.A. is in charge of the practice and management of the activities in the fields of research, production, supply, transportation, processing, distribution, sale, use and recovery of energy in any form, promoting rational use and enhancing renewable energy sources;
- SISPI S.p.A. is responsible for the management of all systems and IT services of the Municipal Administration.

Since 2002, the Administration has enabled participatory processes with stakeholders through the Agenda 21 and the Sustainable Energy Action Plan, in order to develop environmental sustainability policies.





Actions to improve energy efficiency in public lighting systems

In the Municipality of Palermo there are 47,022 light centres for public lighting (updated to the 31st of December 2012). The street lighting system consists of 25,388 light points powered in series (medium and low voltage) and 21,634 light points powered in shunt. The light centres are powered by an electrical network that extends for about 1,200 kilometres, with an electric rated output installed of 9.0 MW. The Municipal Administration has approved a program of replacement of old plants, which were built between “the 1960s and the 1970s”, with others, characterized by cutting-edge technology, which will produce a higher quality light, granting a saving of energy consumption and a reduction of polluting CO2 emission of about 60% compared to the original values. The project will cost 26,525,000.00.

P.O. N. METROPOLITAN CITIES 2014/2020

National Operational Programme Metropolitan Cities 2014/2020: Palermo is expected to receive from 80 million to 100 million euro to be used for the redevelopment of the Southern Coast, actions to improve sustainable mobility, the reduction of energy consumption and pollutant emissions, for the social inclusion of the most fragile segments of the population and for disadvantaged areas and neighbourhoods.

Promotion of car sharing and bike sharing

The Municipal Administration, through its public transport company, and also through private operators, will start policies to increase sustainable transfers of citizens and tourists, enhancing the existing car sharing service and activating a new bike sharing service. As regards the car-sharing, the action will involve the increase of the parking lots from 45 to more than 80, of methane cars from 36 to 92 and the introduction of over 20 new electric vehicles. At the beginning, the car sharing service will be integrated with the bike sharing, that will be composed of more than 23 cycle-parking places, some of which are equipped with photovoltaic shelters, and more than 400 bicycles, both traditional and with pedal assistance.

Construction of the underground rail circuit

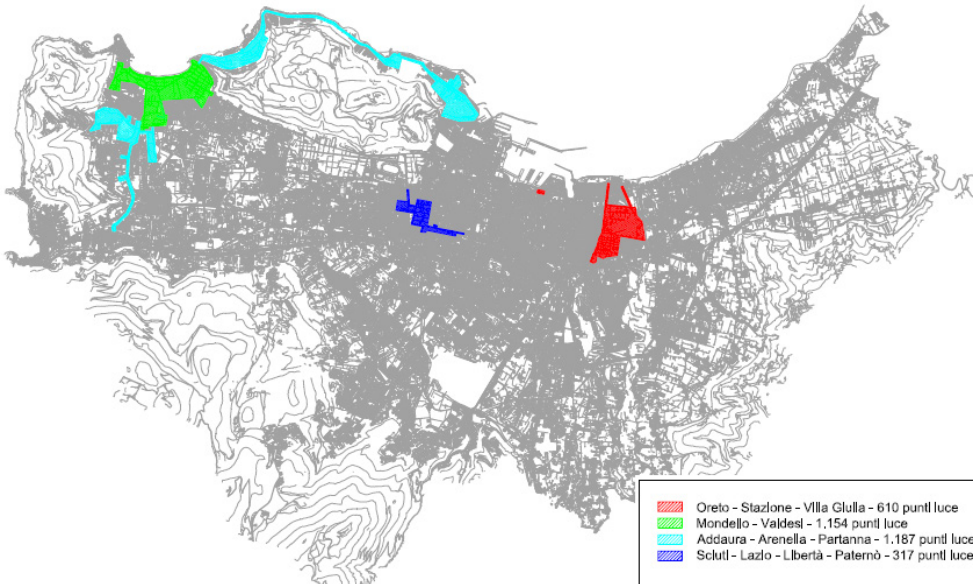
It’s already under completion the construction of the circular route, about 6.5 km long, almost entirely in the underground, which will encompass the main urban attraction poles, networked by a system of “metro-railway”. The plan provides, in two distinct phases, the “closing” of the circuit with the realization of the missing section (about 3 km: 1.7 km with the first section from Giachery to Politeama; 1.3 km with the second functional part from Politeama to Notarbartolo) and the creation of four new stops.

Realization of the tram system

The new tram system in the city of Palermo is under construction. The tramlines are double track to connect some peripheral areas of the city with the central ones. The tramway will be reserved along all paths, except the intersections that will be managed by traffic lights with the traffic light subservience to the tram. The stops, in total about 40, will be 35 m long in order to allow the insertion of a complete vehicle to its maximum intended composition. The service will be provided by 17 bidirectional convoys, with an availability of 250 places, including 62 seats. The total route of the tram system will extend for about 15.2 Km.

The doubling of the railway bypass Palermo-Punta Raisi

The doubling of the railway bypass Palermo-Punta Raisi is already under construction. It realizes a high-capacity connection between the airport of Punta Raisi, Palermo Central Station and the Brancaccio area, along a highly urbanized corridor, about 26 Km long. Through 18 stops, the suburbs are welded together, extending the city to the whole urban area. The construction of new stops, the burial of other ones, the elimination of level crossings through the burying of the future double-track line, will allow to create a metropolitan area without interference with the surrounding roads and urban traffic.



Today’s reality: Smart mobility

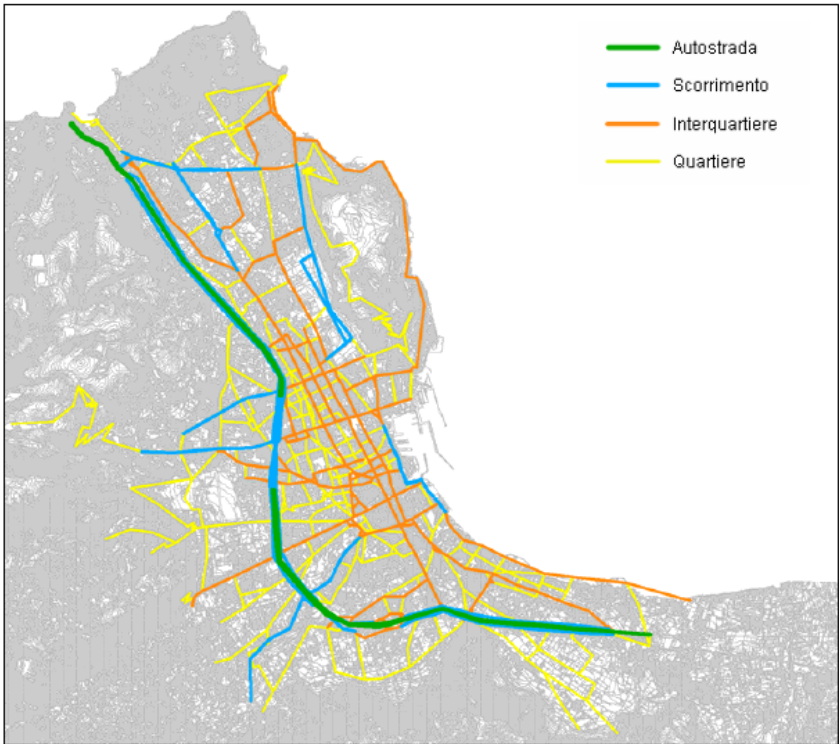
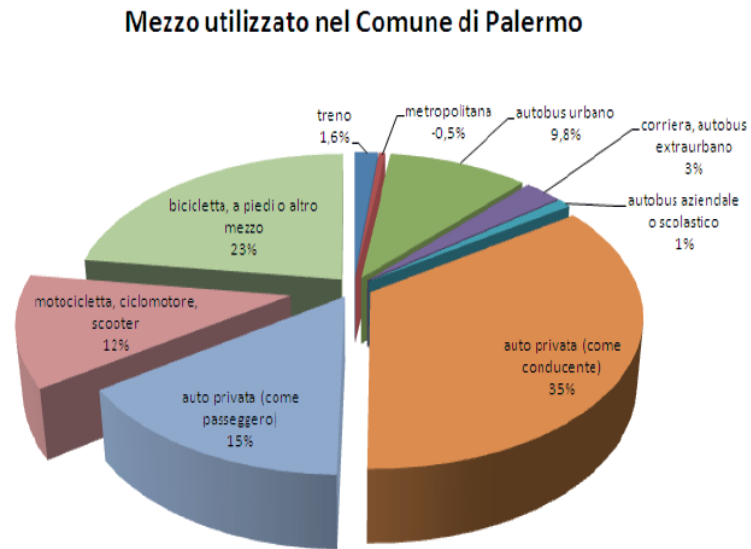
In 2007 the Municipality of Palermo drew up the Strategic Plan for Sustainable Mobility (PSMS) followed in 2010 by the Urban Traffic Plan (PUT). The overall aims were to improve traffic conditions and road safety, reduce air and noise pollution and achieve savings in energy consumption and a reduction of CO₂ emissions by the transport sector.

Analysing transfers data for both the Municipality of Palermo and the entire urban area, it is clear that the most commonly used means of transport is the private car, which is used for about 35% of journeys. A significant percentage of travellers are (regular) passengers in private cars (15% of the total). As a result, almost half of the cars travel with 1 or 2 persons on board. The percentage of the use of public transport is low (it does not exceed 15%), but it can positively be observed that travel by bike and on foot represent almost a quarter of the overall commuter mobility.

Reasons for travelling are divided more or less equally between study and work.

Peak time is between 7.15 and 8.15.

The time spent travelling, in nearly half of cases, does not exceed 15 minutes.



-70%
PER GLI STUDENTI UNIVERSITARI




Guarda le offerte

| CATEGORIA | FRUITORI | Sconto abbonamento | |
|-----------|--|--------------------|--|
| Annuale | Studenti (tessera nominale non cedibile) | - 70% | |

| CATEGORIA | MODELLO | 399 e 200 Km inclusi | costo km oltre 200 Km |
|------------|------------------------|----------------------|-----------------------|
| CITY | Up!, Panda | € 94,00 | 0,35 |
| UTILITARIE | Polo | € 104,00 | 0,35 |
| MEDIE | 500L, Golf, Golf Plus, | € 120,00 | 0,35 |
| MONOVOLUME | Touran, Zafira | € 135,00 | 0,35 |

Ambition: ‘Sweet & green’ mobility in Palermo 2050



1

‘Sweet mobility’

In 2050, people in Palermo value ‘sweet mobility’: cycling, walking and sharing mobility services are obvious choices. These enable people to enjoy the city’s green spaces to the full. All areas of the city are easily accessible by all.

Strategic ambitions

- In 2050 Palermo provides safe mobility for all people: families, children, elderly, disabled, pedestrians and cyclists.
- In 2050 sweet mobility is an obvious choice: such as bike- and car sharing and walking.
- In 2050 the people of Palermo will use biking, because the foundation and infrastructure is available and accessible.
- In 2050 Palermo provides green areas and restricted areas for mobility to stimulate walking.
- In 2050 the coast and nature are preserved and more green areas in the city are realised.
- In 2050 the citizens of Palermo value walking and cycling as obvious part of life and mobility.

2

Safe, reliable public transport systems

In 2050, people in Palermo value safe, reliable public transport options. They enjoy a finely meshed transport network in the city and surrounding areas, all of which are easily accessible.

Strategic ambitions

- In 2050 Palermo provides reliable public transport options for the people through a large network of railways that connect all parts of the town and a subway to connect the city centre.
- In 2050 energy consumption will be reduced for mobility, buildings and public lighting.
- In 2050 a profound public transport system is realised (rail & subway).

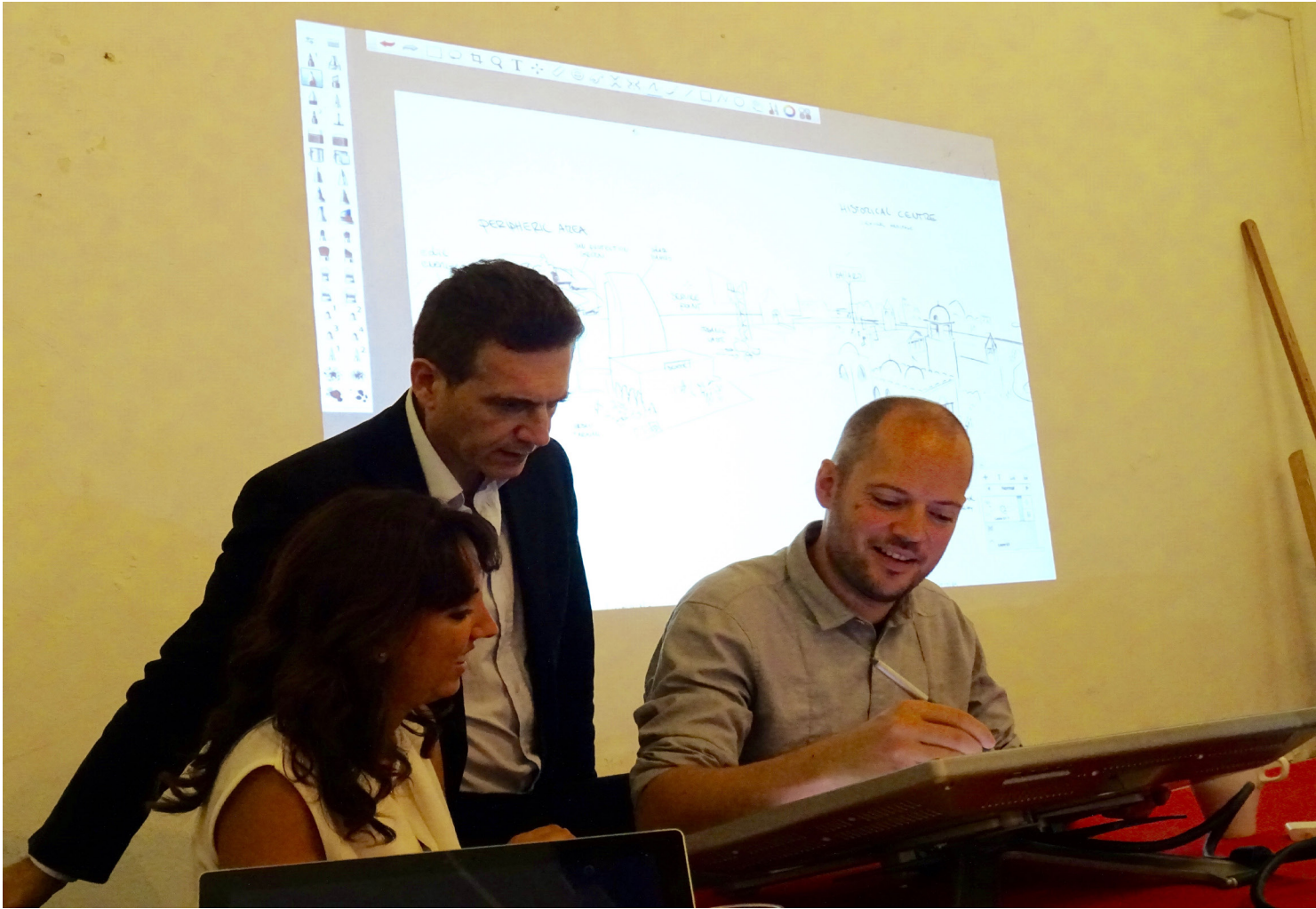
3

A valued cultural heritage

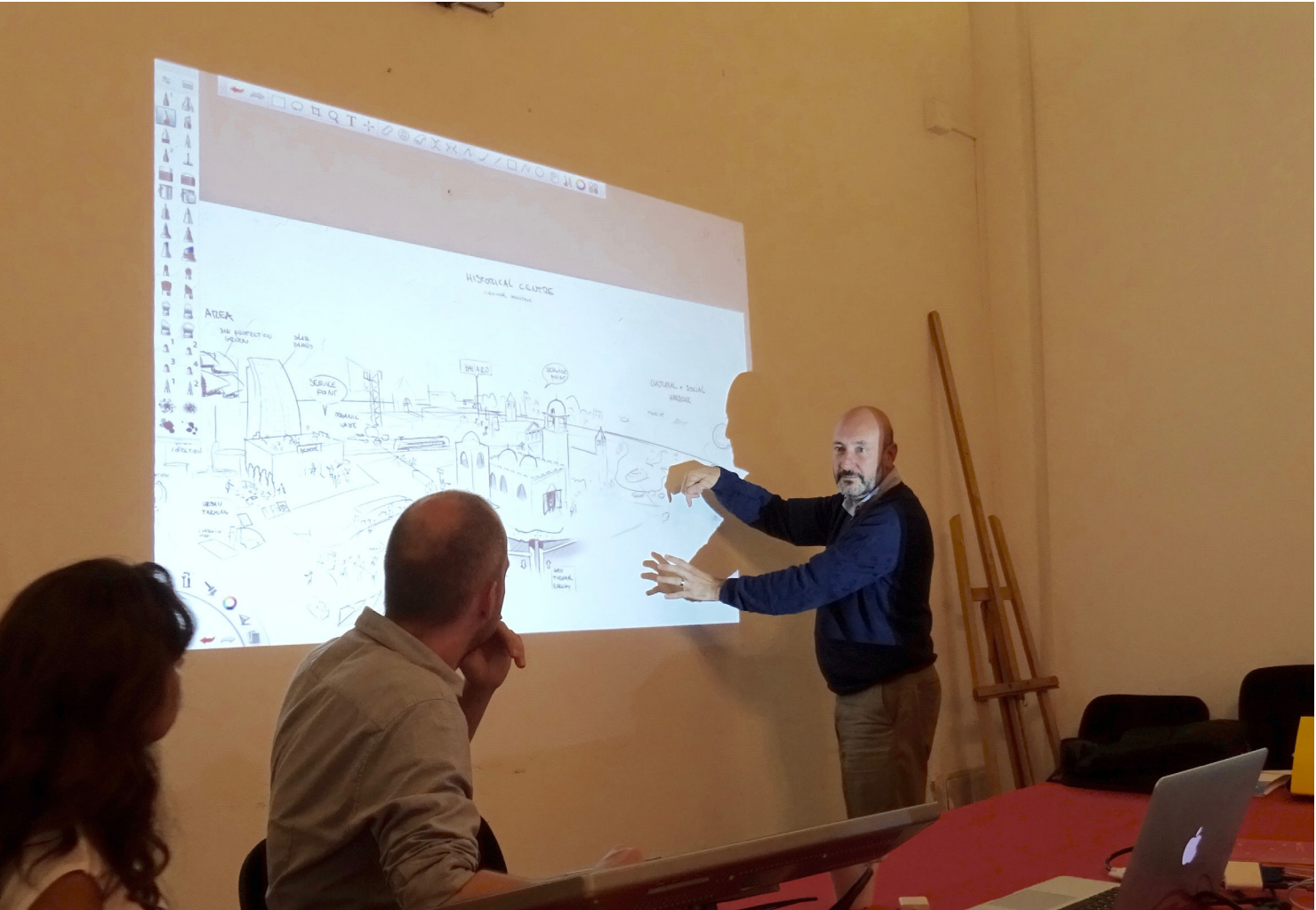
In 2050, people in Palermo value their cultural heritage. They enjoy a good education that gives them ecological awareness. Good citizenship and sustainable behaviour come naturally to everyone.

Strategic ambitions

- In 2050 Palermo will use education as a foundation for good citizenship and sustainable behaviour.
- In 2050 cultural and historical tourism will be a showcase for other cities.



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.

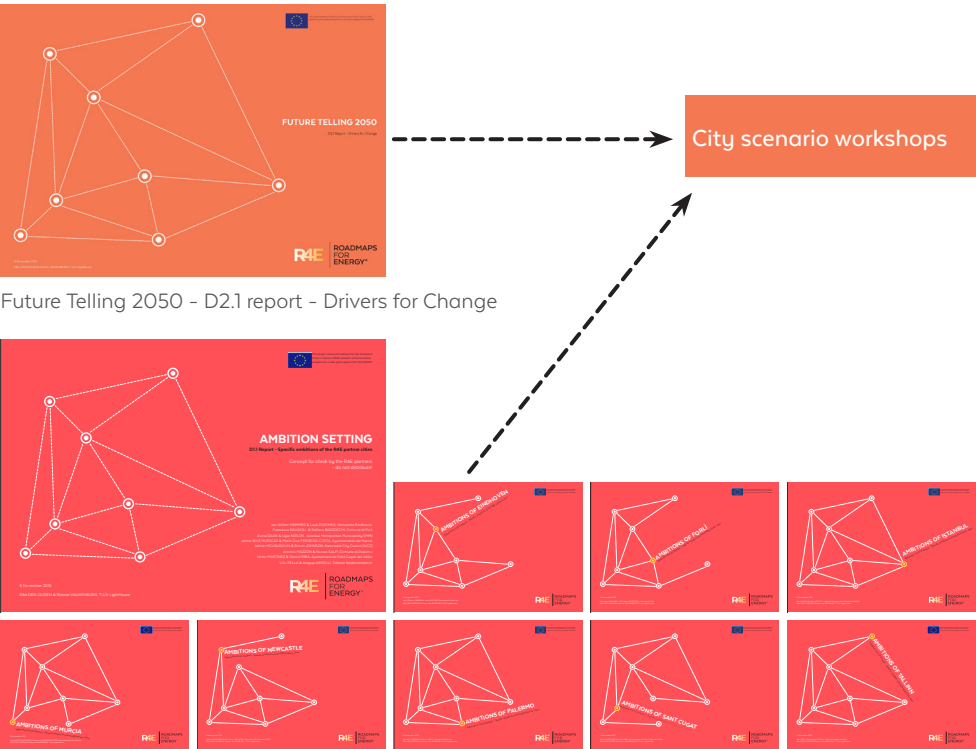
Joint Vision Workshop

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:

- 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

- 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.)

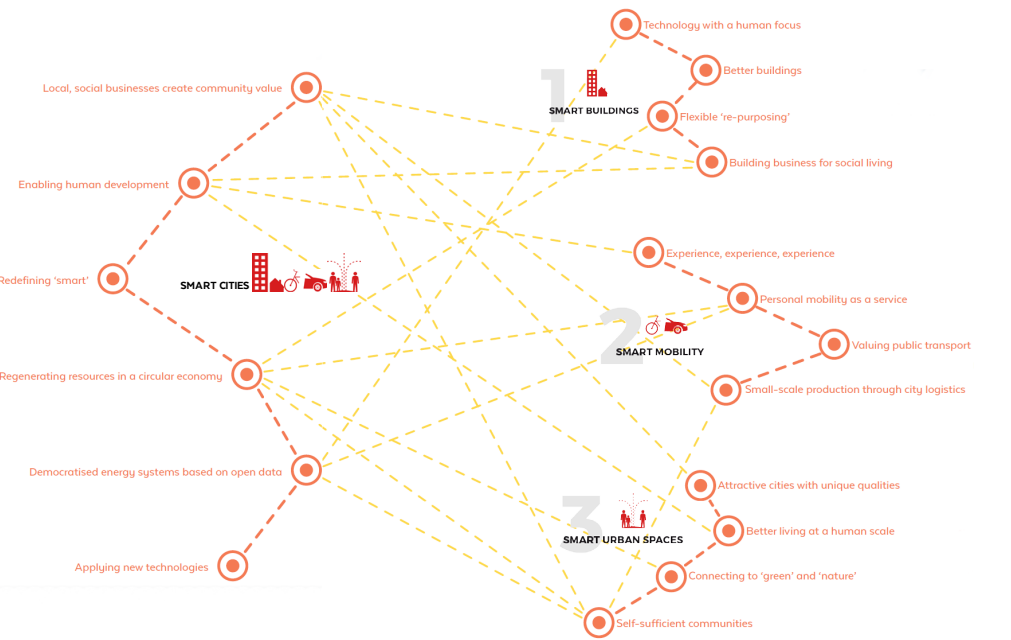
- Tell stories about how you imagine these 10 trends will develop and what the future in cities will look like.

Drivers for Change

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

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

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



18 Drivers for Change resulted from the Future Telling research

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

Selection of Drivers for Change

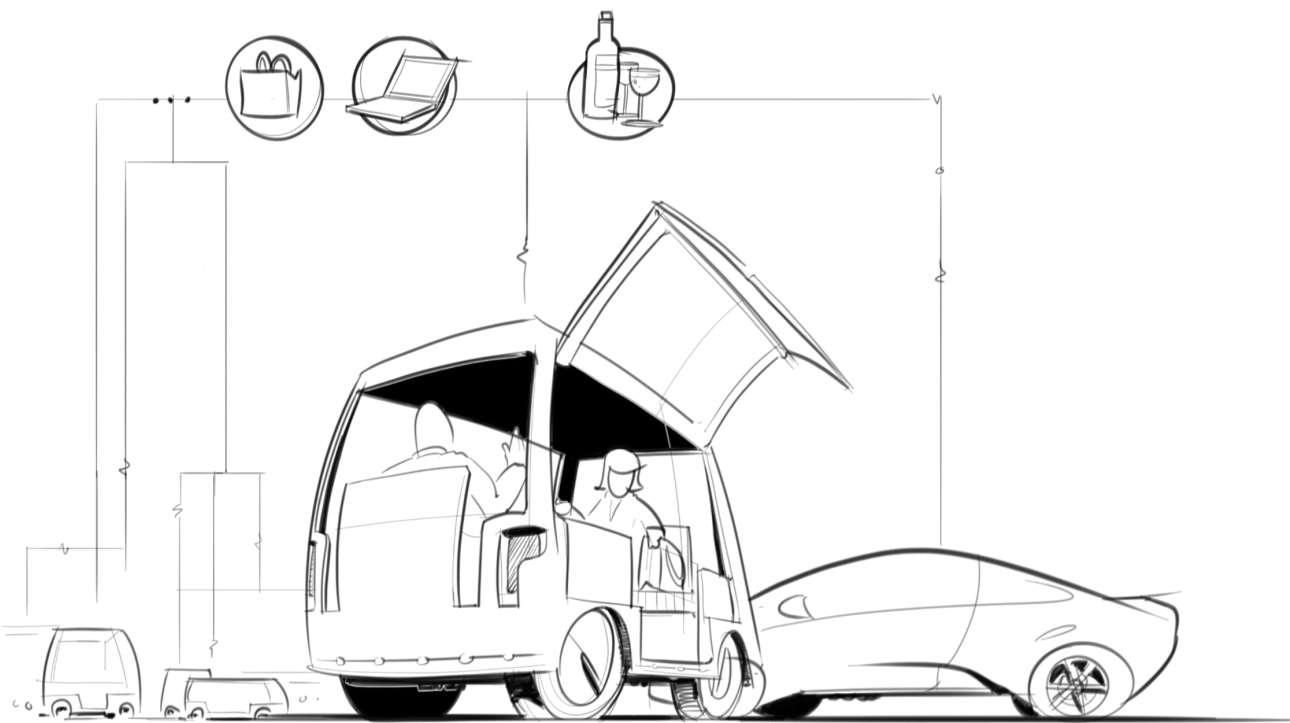
For the focus area Smart Mobility, the city of Palermo selected four Drivers for Change:

- Personal mobility as a service
- Valuing public transport
- Attractive cities with unique qualities
- Regenerating resources in a circular economy

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

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?

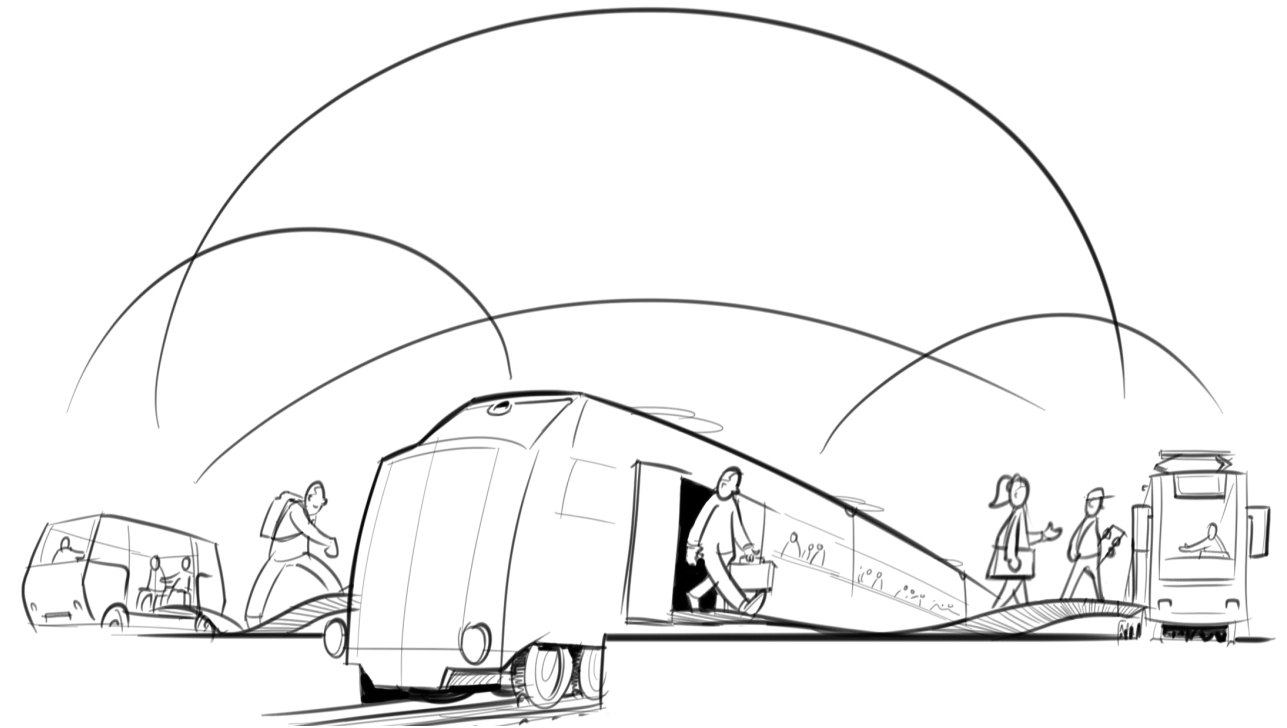
FT3.04. In mobility there is already a demand to take us seamlessly from A to B, that is not new. But the technology will be increasingly there to provide it. Your behaviour will also be changing, because you are just ad hoc or just in time you will change e.g. the reservation of a meeting room when 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. ...

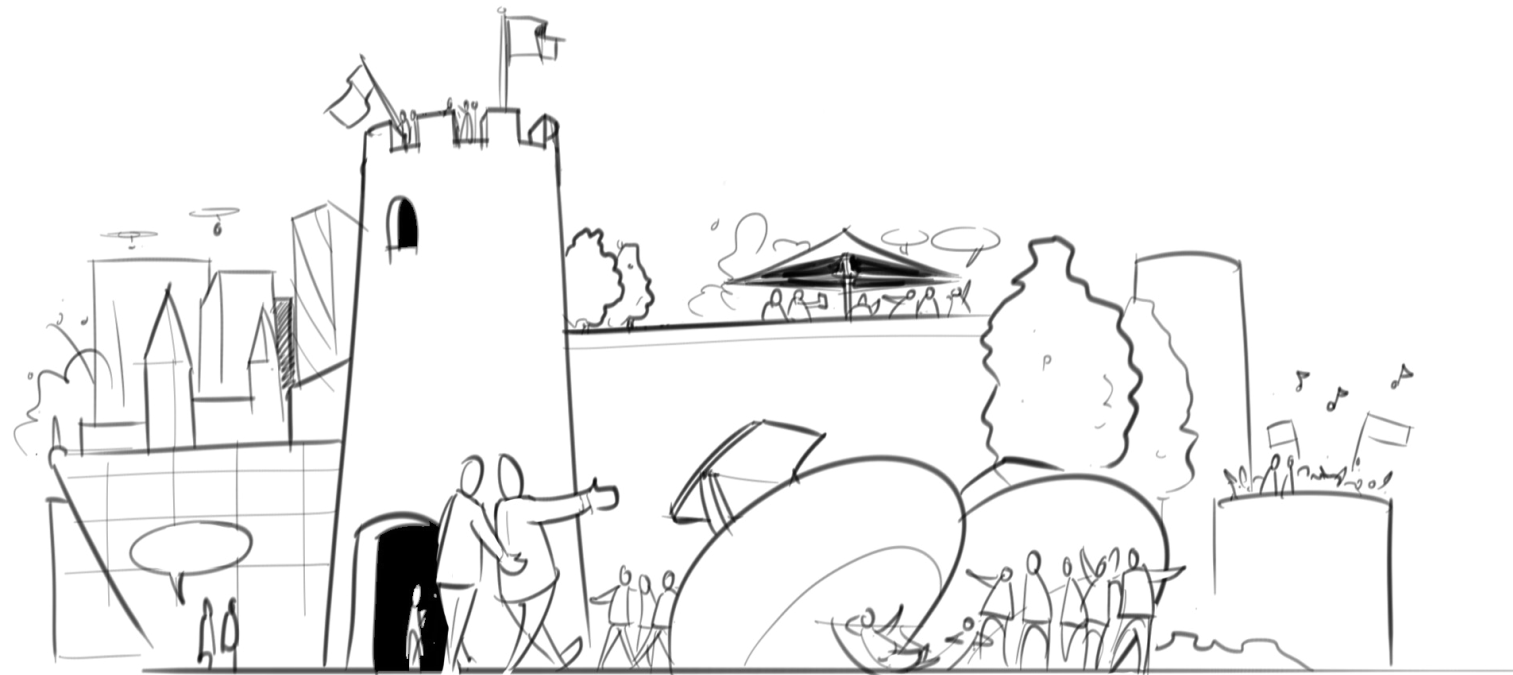
FT20.06. One thing that pops into my mind now is also in this inequality is public transport and the affordability of public transport. ... Transport needs to be affordable for people, they need to be able to travel easily from A to B. It is already now not affordable anymore, and I cannot see how that 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.



Attractive cities with unique qualities

In 2050, cities have unique qualities that embody their own history and culture as an integral part of their DNA. The differences between them make the cities distinctive and attractive places for business and visitors. And people of different backgrounds find them good places to work and live. The cities offer a good balance in the quality of neighbourhoods and infrastructure, with affordable services for all income levels. Social needs drive city design, which is constantly and organically reshaped to meet people’s changing needs. The use of spaces and buildings is always under review to deliver maximum value for users.



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

- a. Distinctive and lively
- b. Accessible for a diverse population
- c. Social driven city planning
- d. Re-valuing heritage & culture

FT15.12. ... in the UK you have a secondary comprehensive school, they are now aligned, so this school teaches you everything you need to know, but this one is aligned with art. This one with engineering, that one with sports. So maybe we will have a scenario where the urban developers of tomorrow do the same. So London is about financial services. There is of course a lot more there, but it is recognised for that. Maybe in another place people are into technology development, and they will need another urban environment. So maybe in this scenario and people will go where they feel they belong best.

FT4.06. ... We are aware that cultural values in food, in space, in clothing, in language, in all, that culture matters. Economy is a thing, social networking is a basic thing, because without strong social sense there is no economy, but culture is something extra: having the luxury of time and effort to think about it.

FT3.22. ... Social needs will dictate the design of the city in the future, rather than the technological or industrial needs of the city.

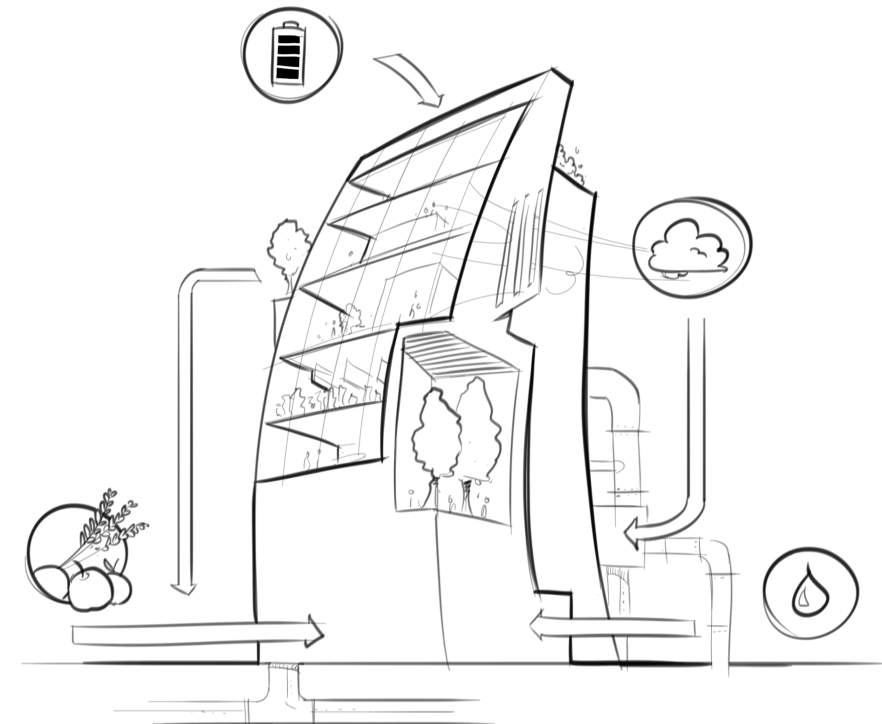
FT20.02. First of all this inequality creates more equality within the city, because there will be more rich and developed people in the city that creates a more homogeneous society. Less interesting probably, and then it becomes less sustainable in a weird sense. ... And I think, and that is the story in this inequality, that cities can steer this and can strike a balance between attracting enough people to bring in money but also enabling people to stay there and keep it fun and interesting diverse.

FT4.01. I think the sustainable city is increasingly seen from a humanistic point of view: an issue of the redevelopment and the continuous development in a more or less evolutionary and organic way of the existing city and not anymore about extensions and tabaleraza. ...

FT11.01. ... I just saw a study how such a [car sharing] system would look like in a city of roughly about a million people – is that there is no more parking space, that provides possibilities for a lot more dense structures. But there are lots of other ways of using the spaces that will be freed up.

Regenerating resources in a circular economy

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



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

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

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

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

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

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

FT21.14. My vision for a city, for the 'ecopolis', or the regenerative city, is a city that basically has all mechanisms to regenerate the resources that are absorbed by the people who live in the city. Be it the materials, the food, be it the energy, the air that they breathe. And if this principle of regeneration becomes the guiding principle for designing cities, then we will come to this ecopolis. Where you have lots of green spaces to regenerate the air. Maybe some

kind of urban farming places. Maybe we see skyscrapers that are not just for offices that remain empty, but that have some kind of food production, that host people, and that are some kind of a sustainable system in themselves, generating the energy. It is actually a very liveable place.

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

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

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

CULTURAL AND SOCIAL HARBOUR PALERMO 2050

In 2050, the city of Palermo values smart, ecological buildings, spaces and mobility.

Palermo values being a social harbour, open and friendly to all, as well as a cultural harbour, enriching people's lives and helping to make good citizenship and sustainable behaviour second nature for everyone.

Innovation and new technologies are embraced to become energy-neutral. Circular systems are implemented to enable sustainable behaviour and businesses. There is an integrated, connected, wireless data and energy network and a green mobility network connects the city and its various centres.

The core of city life is the people of Palermo, with their social interactions and their enjoyment of the city's buildings, spaces and cultural features. Technological solutions are demand-driven and can be personally adjusted. Cultural exchanges enrich people's lives in the city.

Elements of the desired future scenario are:

A social harbour

Palermo is an open and friendly city, welcoming to all, while retaining its unique characters. A city for the people, that is lighter, in the sense of fewer cars, less pollution and lower noise. With buildings and spaces that are comfortable for people and that exploit Palermo's beauty, with its attractive views and sound scape.

A cultural harbour

Palermo cherishes its historical city centre and cultural heritage. These are enriched by new technologies and innovation to create comfortable, energy-efficient housing and neighbourhoods. Innovative solutions are used to maintain historical buildings and to make them energy efficient. (Re-)location of public service buildings and re-purposing of old buildings supports sustainable living.

Circularity

Palermo greatly values new technologies as a means to become an energy-efficient and circular city. Especially in the outlying areas, new technologies are used for energy generation, storage and charging of 'sweet mobility' solutions. Circular systems are used, for example for food: from urban farming, markets, joint cooking and enjoying local food, as well as organic waste recycling. Or for the business of natural materials: from green roofs, natural materials for isolation, local entrepreneurship in printing isolation materials from waste of local food production. School buildings serve as demonstrators of new solutions and behavioural change.

An integrated, connected, wireless data and energy network

The city of Palermo is connected and accessible through a network of infrastructure for energy systems and open data. An energy network connecting the whole city based on renewable energy sources ensures energy-neutrality at city level. Energy production (PV, buildings), storage (cars and batteries) and usage (where needed) are balanced through the network.

Open data is the norm, and enables new entrepreneurship based on services for people. The connected data is valued by citizens because of the improved affordable and reliable information on mobility and public transport. Citizens support this principle of data sharing by providing access to their own data. The connected data is valued by information management experts for the interconnection of mobility modes and the integration with other functionalities, such as measuring air quality, pollution or congestion.

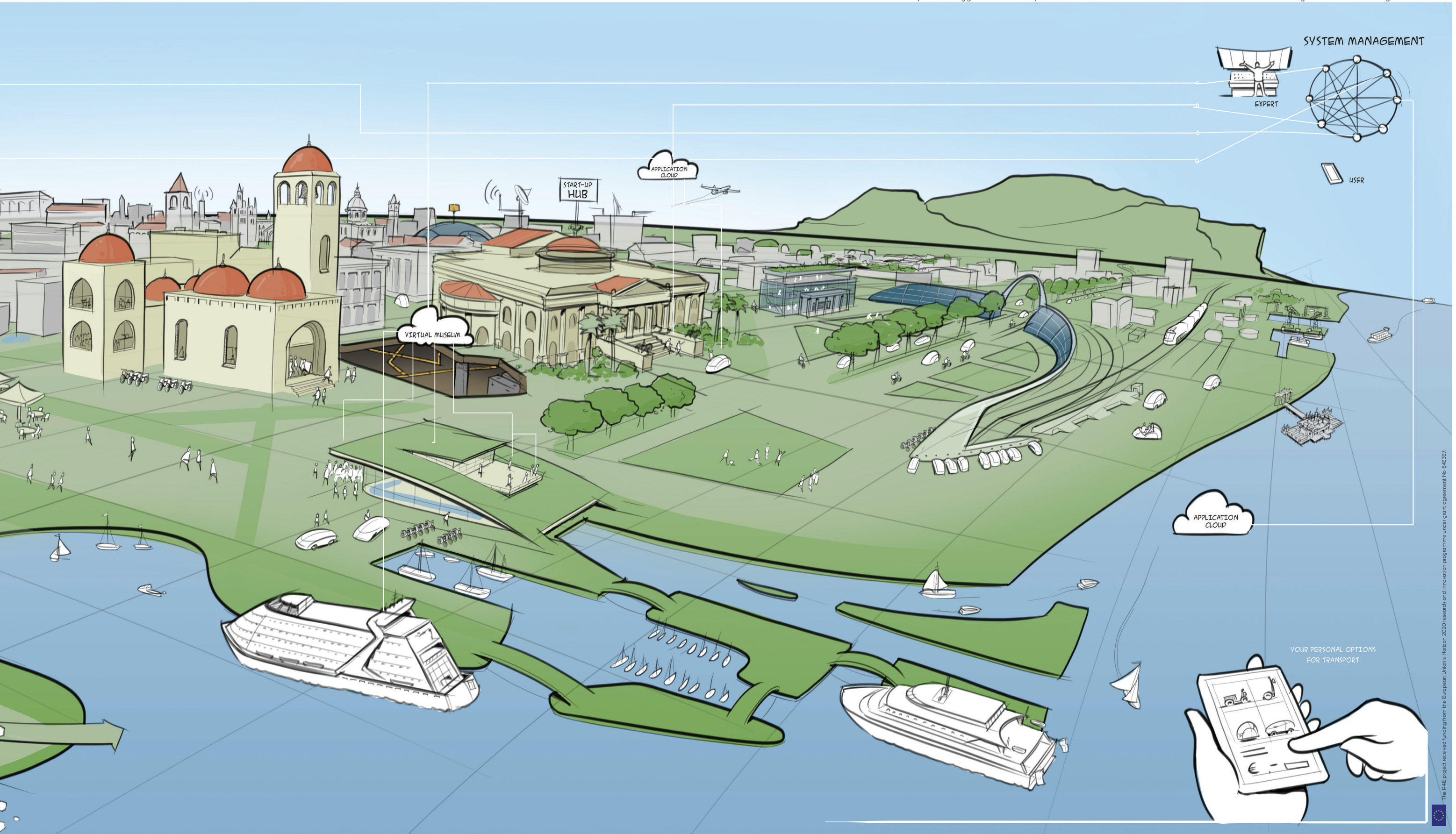


City for the people of Palermo

The heart of the city of Palermo are its people, enjoying social interactions and the city's buildings and spaces. These spaces have been given back to the people, so they can enjoy them in comfort and safety. Children can play outdoors, and can walk to school. The urban space is used by citizens, developing cultural activities and by local entrepreneurs to create awareness and change. Tourists also value the city's cultural history, which they can experience both physically and virtually.

A green mobility network

The city of Palermo has been (re-)designed with a green mobility network, connecting the city and its various centres, adding value to the poly-centric city and integrating the qualities of the different areas into a harmonious whole. The Golden Valley 2.0 connects green roofs and walking areas to make walking and biking into obvious choices for people. All areas are easily accessible and safe, with a closely-knit transport network throughout the city.



'Sweet and green' mobility

A range of mobility solutions provide a dense network of mobility modes. This demand-driven diversity includes walking, bike, scooter, and car sharing, as well as tram and metro connections to the outlying areas. Individual solutions are accessible and affordable for all, supported by local entrepreneurs, new business models and both public and private investments.

Sea motorway and central distribution centre

Palermo is a capital city and an important sea port which serves as a logistics and transport hub, connecting the hinterland with other Italian cities. The sea will be further exploited as a mobility option to reduce traffic volumes on the roads, with a logistics platform based on new technologies. Good transport management also allows smaller-scale ecological solutions, such as smart individual delivery of (personal) goods in the city.

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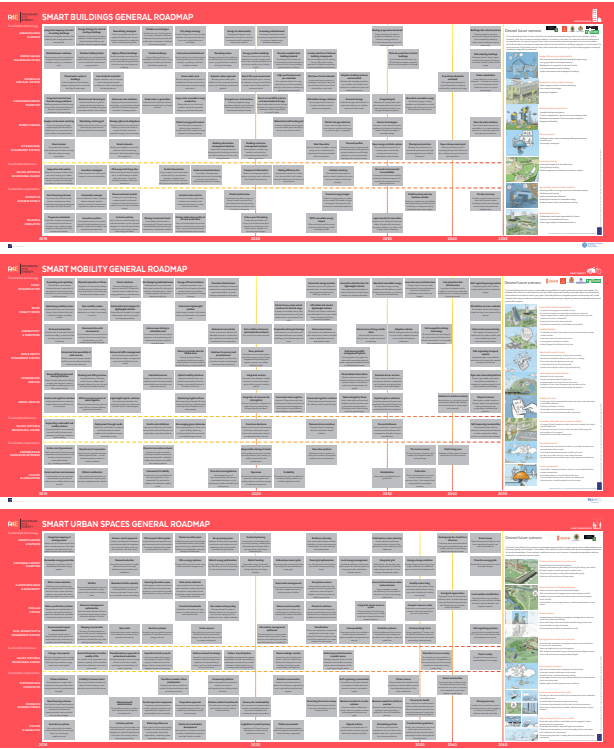
ROADMAPPING

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



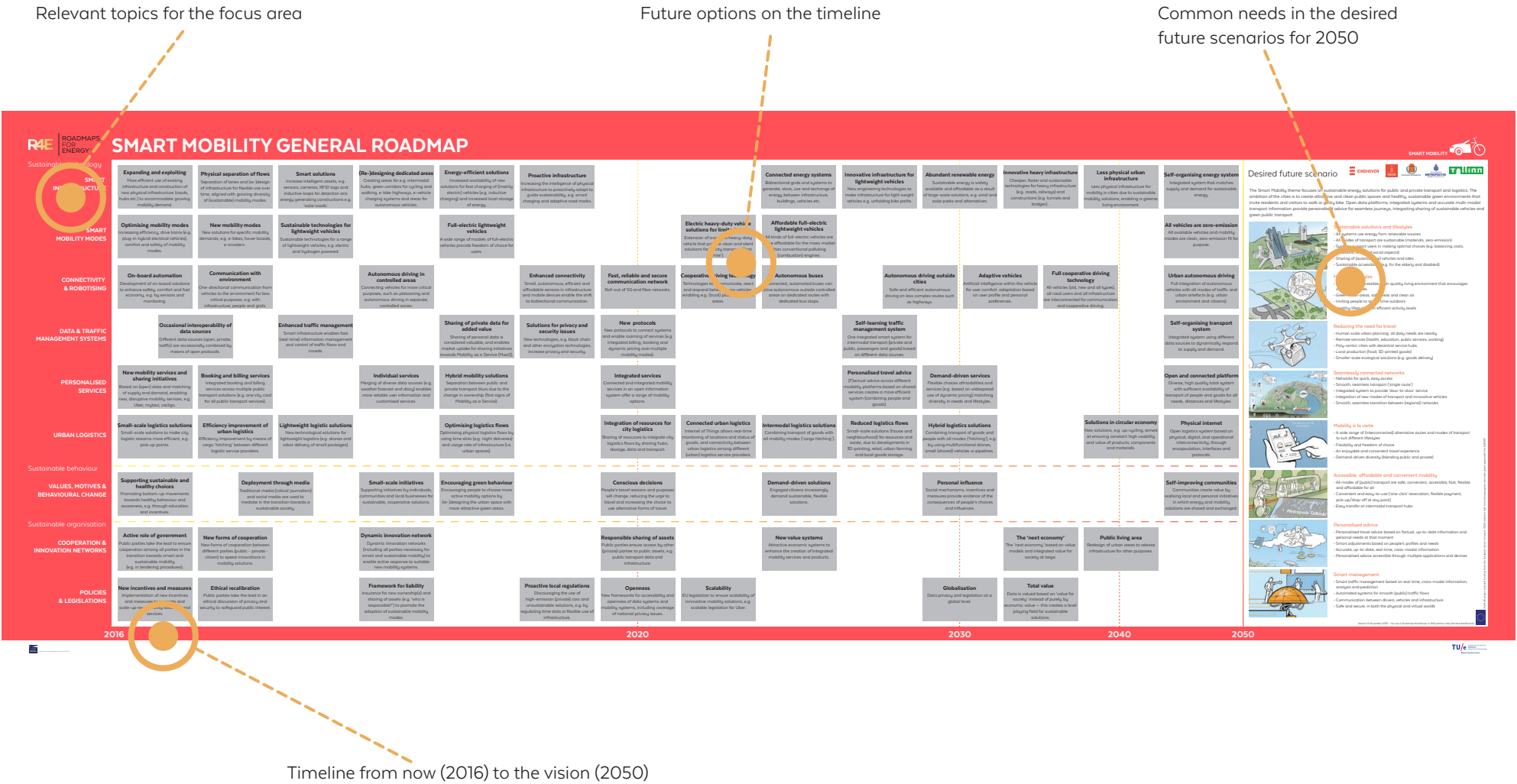
How to read the general roadmap

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

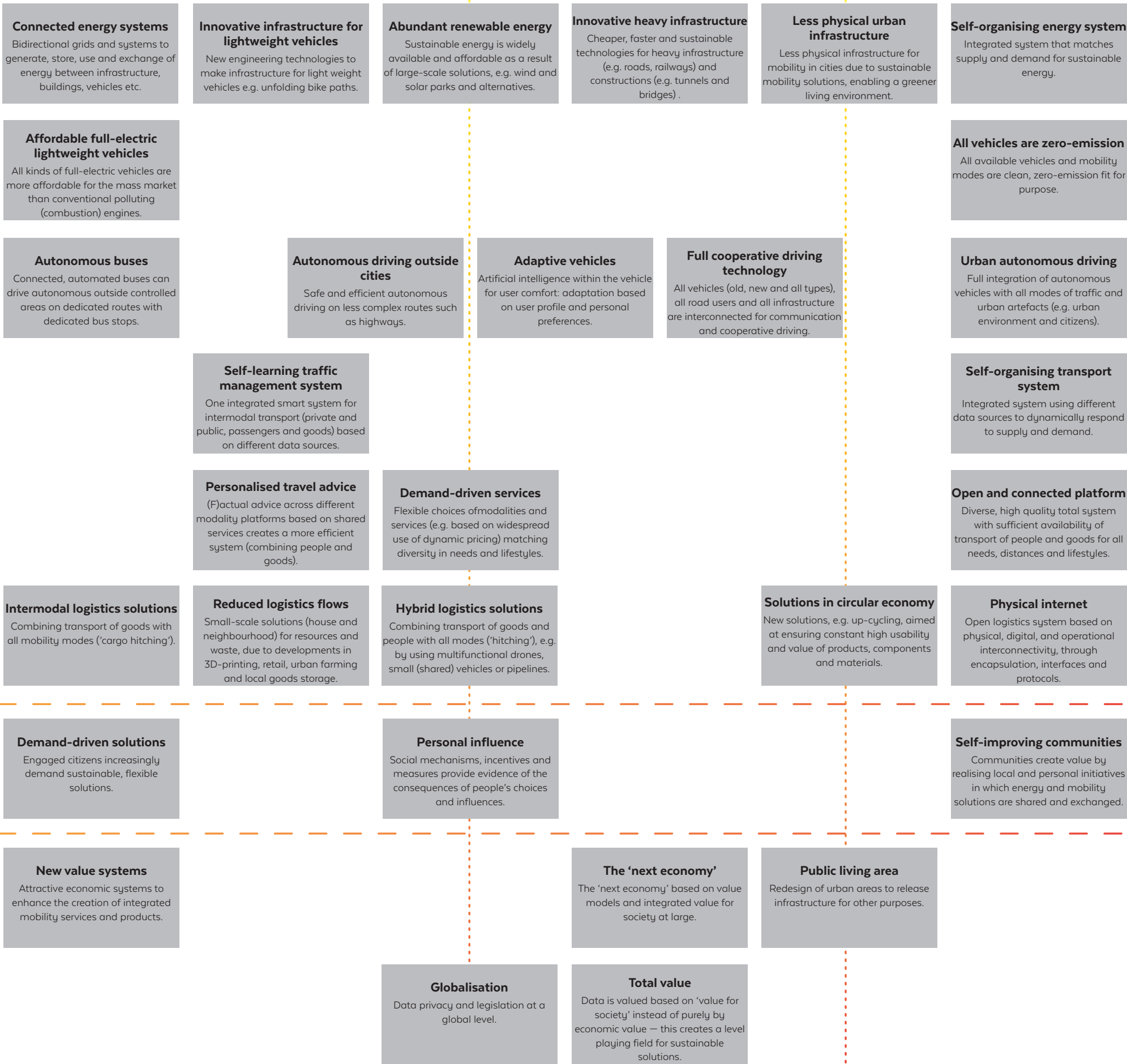
New frameworks for accessibility and openness of data systems and mobility systems, including coverage of national privacy issues.

Scalability

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

2016

2020



2030

2040

2050

Desired future scenario



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



Sustainable solutions and lifestyles

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



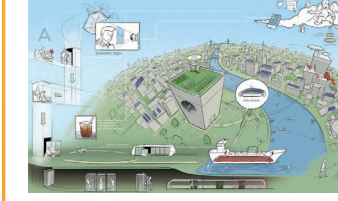
Healthy lifestyles

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



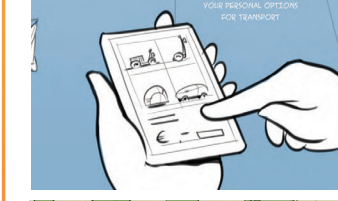
Reducing the need for travel

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



Seamlessly connected networks

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



Mobility à la carte

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



Accessible, affordable and convenient mobility

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



Personalised advice

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

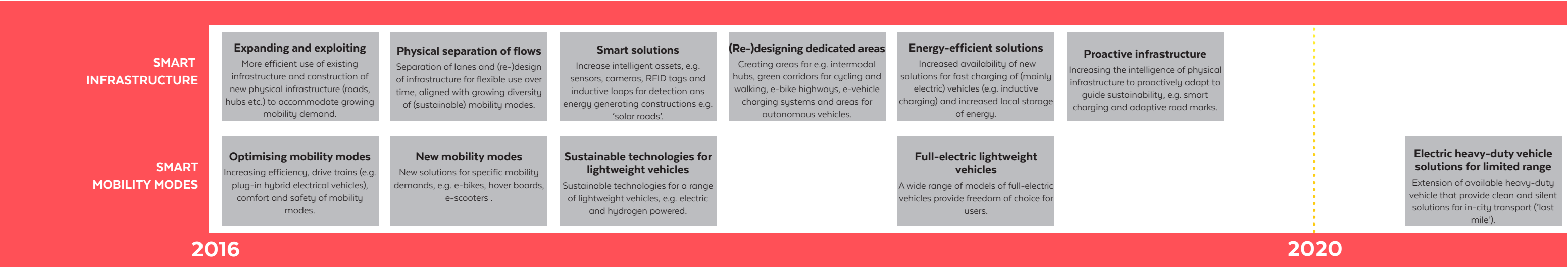


Smart management

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

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Smart Infrastructure

Short-term developments

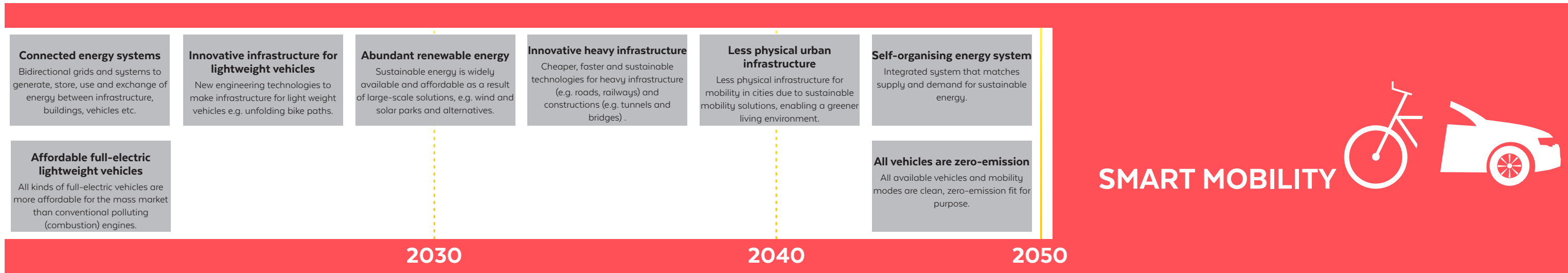
- In the short term, new infrastructure continues to be constructed (mainly outside the city centres), and current infrastructure is used more efficiently to accommodate the growing demand for mobility.
- Separation of lanes and (re-)design of infrastructure allows flexible use of infrastructure over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

Mid-term developments

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

Long-term developments

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



Smart Mobility Modes

Short-term developments

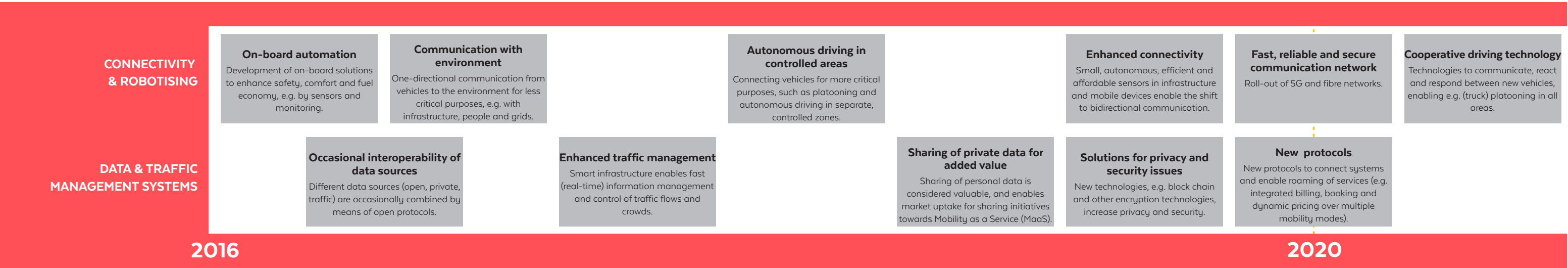
- In the short term there are incremental improvements in vehicle drivetrains, comfort and safety. As well as optimising current mobility modes, new mobility modes are also emerging as solutions for specific mobility demands, such as e-bikes, hoverboards and e scooters.
- Over time, but still in the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

Mid-term developments

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

Long-term developments

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



Connectivity & Robotising

Short-term developments

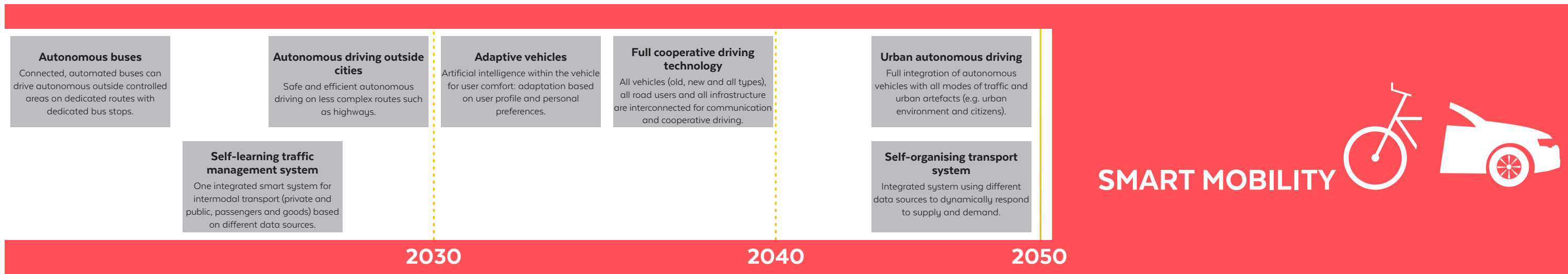
- Short-term developments in connectivity and robotising can first of all be relate mainly to in-vehicle automation and autonomous driving in controlled areas. This means that the development of in-vehicle solutions enhances safety, comfort and fuel economy, e.g. by means of sensors and monitoring. In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

Mid-term developments

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

Long-term developments

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



Data & Traffic Management Systems

Short-term developments

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

Mid-term developments

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

Long-term developments

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



Personalised Services

Short-term developments

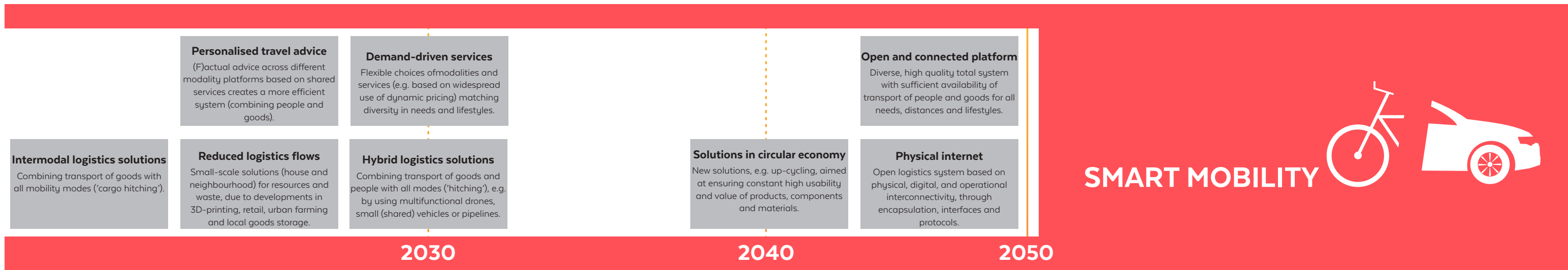
- In the short term, the number of new mobility services and sharing initiatives is likely to increase. This is mainly due to the increase in (open) data and matching of supply and demand, which enables new mobility services that could potentially disrupt the market. Integrated booking and billing services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

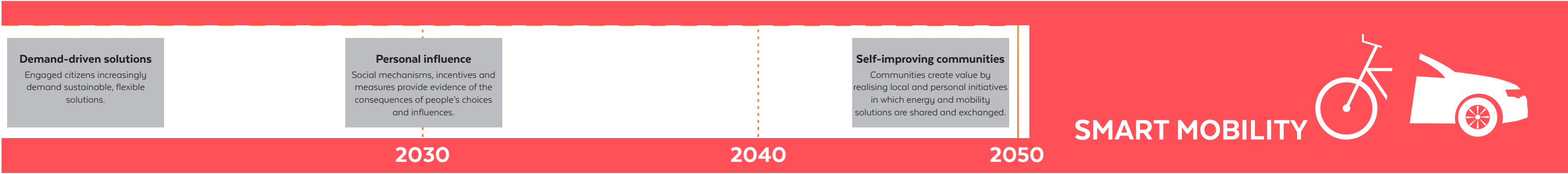
- Values, motives and behavioural change are about the way citizens can play an active role in their own behavioural change, driven by different values and reasoning over time. In the short term, this is made possible by promoting bottom-up movements towards healthy behaviour and awareness, for example 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.

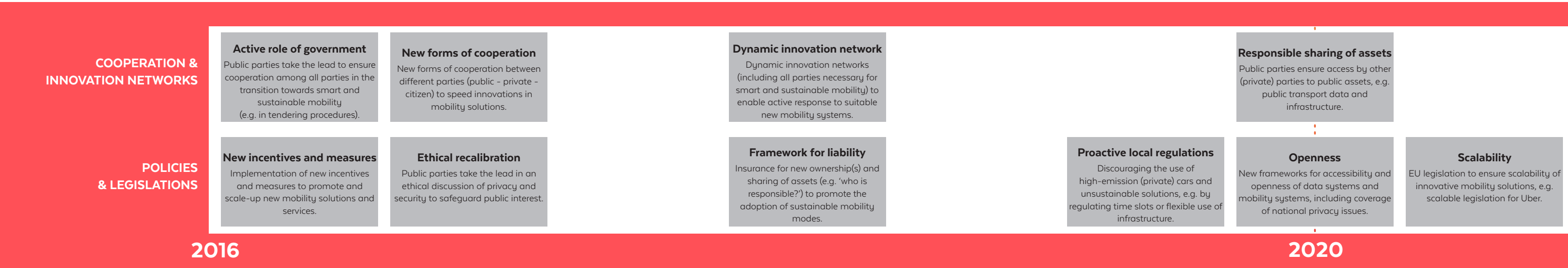
Mid-term developments

- 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.





Cooperation & Innovation Networks

Short-term developments

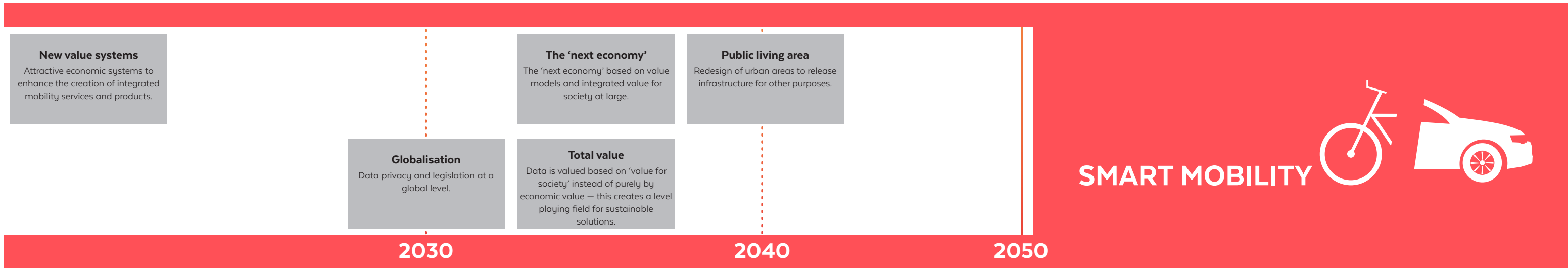
- Cooperation and innovation networks describe how new forms of cooperation between different types of organisations (public–private) evolve over time, speeding innovation and the roll-out of new mobility solutions. In the short term, public parties take active roles in ensuring cooperation between all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

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
The people of Palermo travel around the city on the new subway line and the tram lines that have doubled in number since 2016. The airport and suburbs are well connected to the city centre. Citizens are increasingly aware of sharing options, and the use of sustainable mobility is rising. School and student communities are early adopters, leading the way in showing new behaviour. A new master plan provides an integrated roadmap towards a smart city.

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



CULTURAL AND SOCIAL HARBOUR PALERMO 2050

In 2050, the city of Palermo values smart, ecological buildings, spaces and mobility.

Palermo values being a social harbour, open and friendly to all, as well as a cultural harbour, enriching people's lives and helping to make good citizenship and sustainable behaviour second nature for everyone.

Innovation and new technologies are embraced to become energy-neutral. Circular systems are implemented to enable sustainable behaviour and businesses. There is an integrated, connected, wireless data and energy network and a green mobility network connects the city and its various centres.

The core of city life is the people of Palermo, with their social interactions and their enjoyment of the city's buildings, spaces and cultural features. Technological solutions are demand-driven and can be personally adjusted. Cultural exchanges enrich people's lives in the city.

Elements of the desired future scenario are:

A social harbour

Palermo is an open and friendly city, welcoming to all, while retaining its unique characters. A city for the people, that is lighter, in the sense of fewer cars, less pollution and lower noise. With buildings and spaces that are comfortable for people and that exploit Palermo's beauty, with its attractive views and sound scape.

A cultural harbour

Palermo cherishes its historical city centre and cultural heritage. These are enriched by new technologies and innovation to create comfortable, energy-efficient housing and neighbourhoods. Innovative solutions are used to maintain historical buildings and to make them energy efficient. (Re-)location of public service buildings and re-purposing of old buildings supports sustainable living.

Circularity

Palermo greatly values new technologies as a means to become an energy-efficient and circular city. Especially in the outlying areas, new technologies are used for energy generation, storage and charging of 'sweet mobility' solutions. Circular systems are used, for example for food: from urban farming, markets, joint cooking and enjoying local food, as well as organic waste recycling. Or for the business of natural materials: from green roofs, natural materials for isolation, local entrepreneurship in printing isolation materials from waste of local food production. School buildings serve as demonstrators of new solutions and behavioural change.

An integrated, connected, wireless data and energy network

The city of Palermo is connected and accessible through a network of infrastructure for energy systems and open data. An energy network connecting the whole city based on renewable energy sources ensures energy-neutrality at city level. Energy production (PV, buildings), storage (cars and batteries) and usage (where needed) are balanced through the network.

Open data is the norm, and enables new entrepreneurship based on services for people. The connected data is valued by citizens because of the improved affordable and reliable information on mobility and public transport. Citizens support this principle of data sharing by providing access to their own data. The connected data is valued by information management experts for the interconnection of mobility modes and the integration with other functionalities, such as measuring air quality, pollution or congestion.

City for the people of Palermo

The heart of the city of Palermo are its people, enjoying social interactions and the city's buildings and spaces. These spaces have been given back to the people, so they can enjoy them in comfort and safety. Children can play outdoors, and can walk to school. The urban space is used by citizens, developing cultural activities and by local entrepreneurs to create awareness and change. Tourists also value the city's cultural history, which they can experience both physically and virtually.

A green mobility network

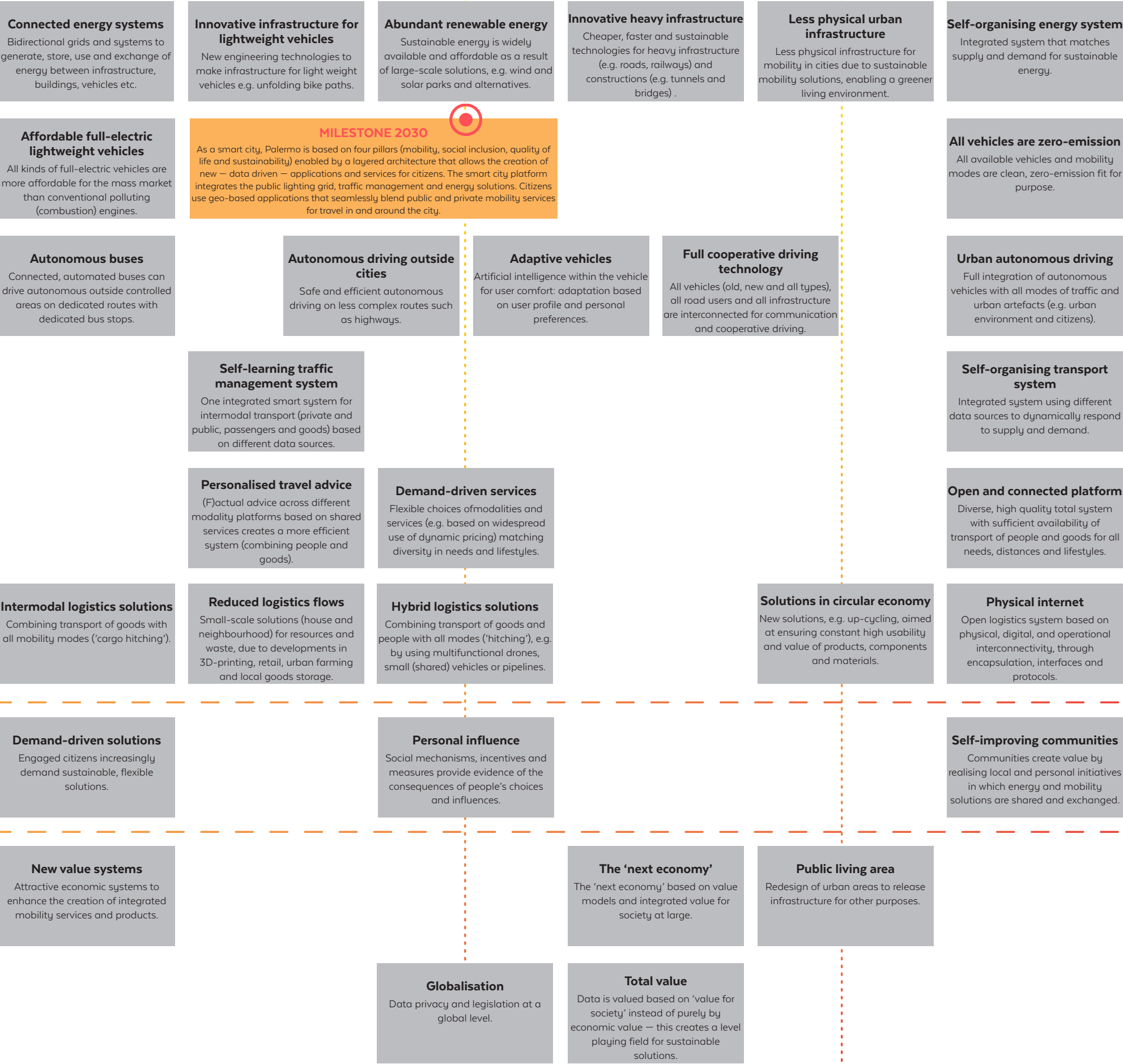
The city of Palermo has been (re-)designed with a green mobility network, connecting the city and its various centres, adding value to the poly-centric city and integrating the qualities of the different areas into a harmonious whole. The Golden Valley 2.0 connects green roofs and walking areas to make walking and biking into obvious choices for people. All areas are easily accessible and safe, with a closely-knit transport network throughout the city.

'Sweet and green' mobility

A range of mobility solutions provide a dense network of mobility modes. This demand-driven diversity includes walking, bike, scooter, and car sharing, as well as tram and metro connections to the outlying areas. Individual solutions are accessible and affordable for all, supported by local entrepreneurs, new business models and both public and private investments.

Sea motorway and central distribution centre

Palermo is a capital city and an important sea port which serves as a logistics and transport hub, connecting the hinterland with other Italian cities. The sea will be further exploited as a mobility option to reduce traffic volumes on the roads, with a logistics platform based on new technologies. Good transport management also allows smaller-scale ecological solutions, such as smart individual delivery of (personal) goods in the city.





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 Palermo



1 D.E.M.E.T.R.A. (Development of Ecology system for MEtro TRAnsport)



Construction of an integrated service of car sharing and bike sharing in the city of Palermo, managed with a single smart card and dedicated app for reservations. The car sharing service is constituted by 116 methane and 24 electrical cars, 360 stalls reserved and more than 4300 subscribers; the bike sharing service is constituted by around 37 racks and 420 bicycles, the subscribers are over 1020.



2 TRAM LINES

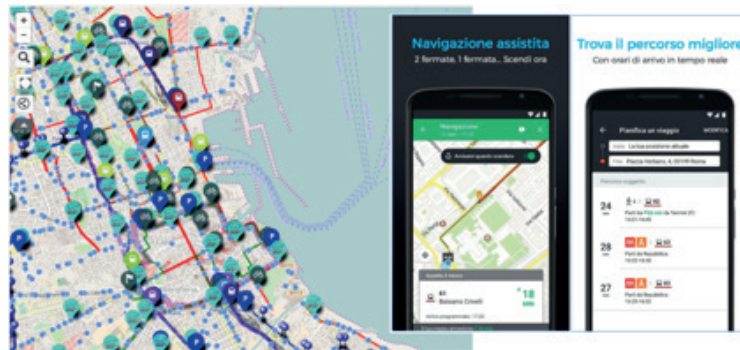


Construction of the new tram system, which allows residents of three areas located at the suburbs of the city (Brancaccio, Borgo Nuovo, CEP) to reach the city center by public transport instead of using private cars. The tram way is exclusively reserved for the passage of the tram, there are 40 stops and the line length is 15.2 km. The stops are associated with the other public transport: bus, car sharing, subway.

New Project Ambitions Smart Mobility Palermo



1 CITY COMPASS



The project is based on an information platform that combines the ICT with urban mobility on the public transport. The basic idea is to create an information system which contains all the information on the departure times and the availability of public transport in the city of Palermo (tram, metro, bus, car sharing, bike sharing, etc.) and to drive citizens to perform movements in a more efficient and sustainable.

3 SOFT MOBILITY



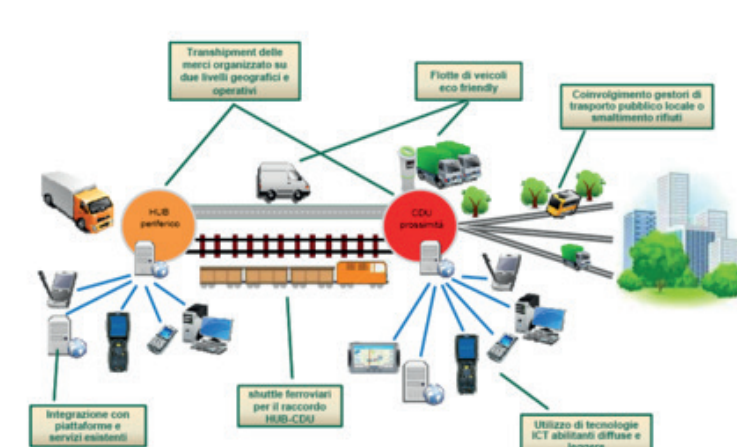
The project envisages the establishment of Restricted Traffic Zones and Pedestrian Areas, in order to encourage walking and cycling trips (soft mobility). It will be strengthened the bike paths and bike sharing network and will be manufactured automated parking spaces for private bicycles at the main poles of attraction. Pedestrian areas will be equipped with video surveillance systems to increase urban security and wifi ones to provide services to citizens.

2 ENERGY-EFFICIENT SOLUTIONS



Enhancement of the charging network for electric vehicles; upgrading of the car / bike sharing network; electric public vehicles and / or with integrated photovoltaic; HUB intermodal metropolitan area equipped with charging stations powered by photovoltaic; garages for electric bus recharged with solar panels.

4 LOGISTICS PLATFORM



Construction of adequate areas served by efficient intermodal structures (highways, railways, port, airport) for Palermo - Port of Termini Imerese, in the context areas of railway stations ; with the aim to induce the interruption of heavy transport on the urban perimeter orienting towards the use of smaller media and towards a greater rationalization of flux, creating a link among the different methods of transportation.



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 PALERMO

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 Palermo. 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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