Smart transformation of urban areas through integrated actions in energy, mobility and ICTs

9th Annual Symposium on Architectural Research

CARTIF Technology Centre
Miguel Á. GARCÍA-FUENTES
REMOURBAN Project Coordinator

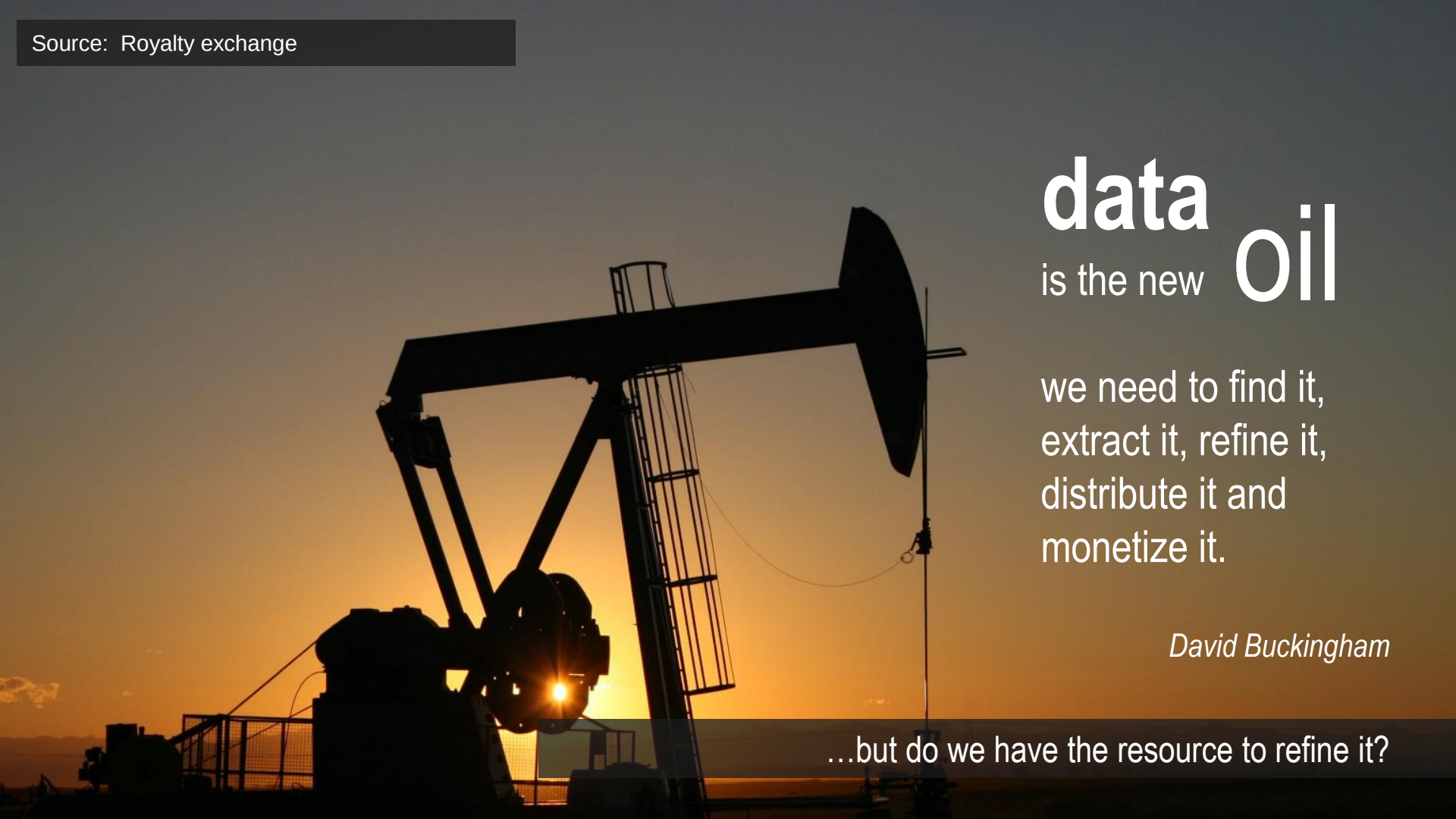
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646511

contact@remourban.eu
www.remourban.eu
@Remourban_EU

Source: Geotagged cities. Wired Magazine January 2012

[…] For me, my city is imposed as an indisputable evidence: the environment of everything or almost everything that happens to me, the greatest place among all I can modify, of all those where I can influence actually, physically, and not only through the fiction of the vote. […]

Pasquall Maragal. Mayor of Barcelona (1982-1997)
Preface to "Cities for a Small Planet" Richard Rogers, 2000

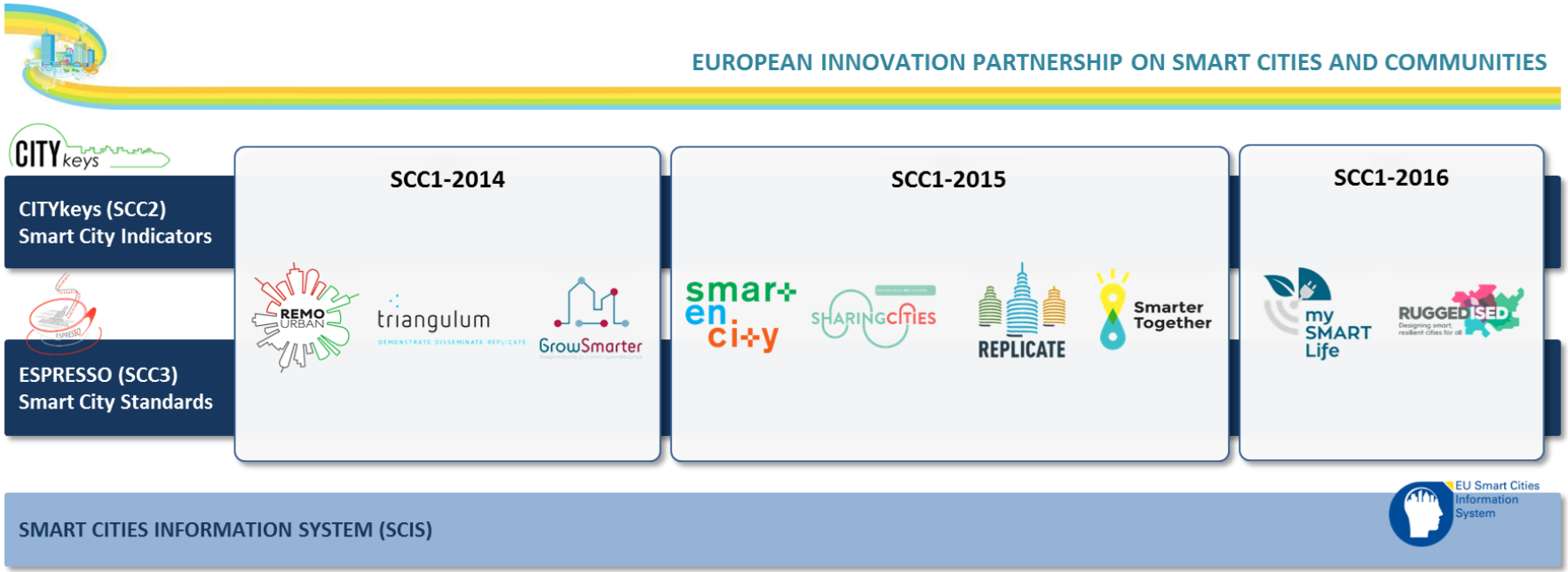

Source: Royalty exchange
data
is the new oil
we need to find it,
extract it, refine it,
distribute it and
monetize it.
David Buckingham
…but do we have the resource to refine it?


Source: Jason Hawkes. Valladolid: Cúpula del Milenio
the goal is providing a model to make cities
smarter
and more
sustainable


Source: naturetime.wordpress.com
[…] displaying or flashing a very bright light for the guidance of ships in avoiding dangerous areas, in following certain routes, etc.

[…] displaying or flashing a very bright light for the ***guidance*** *of ships in avoiding dangerous areas,* ***in following certain routes****, etc.*

EU roadmap of SCC Projects and Initiatives

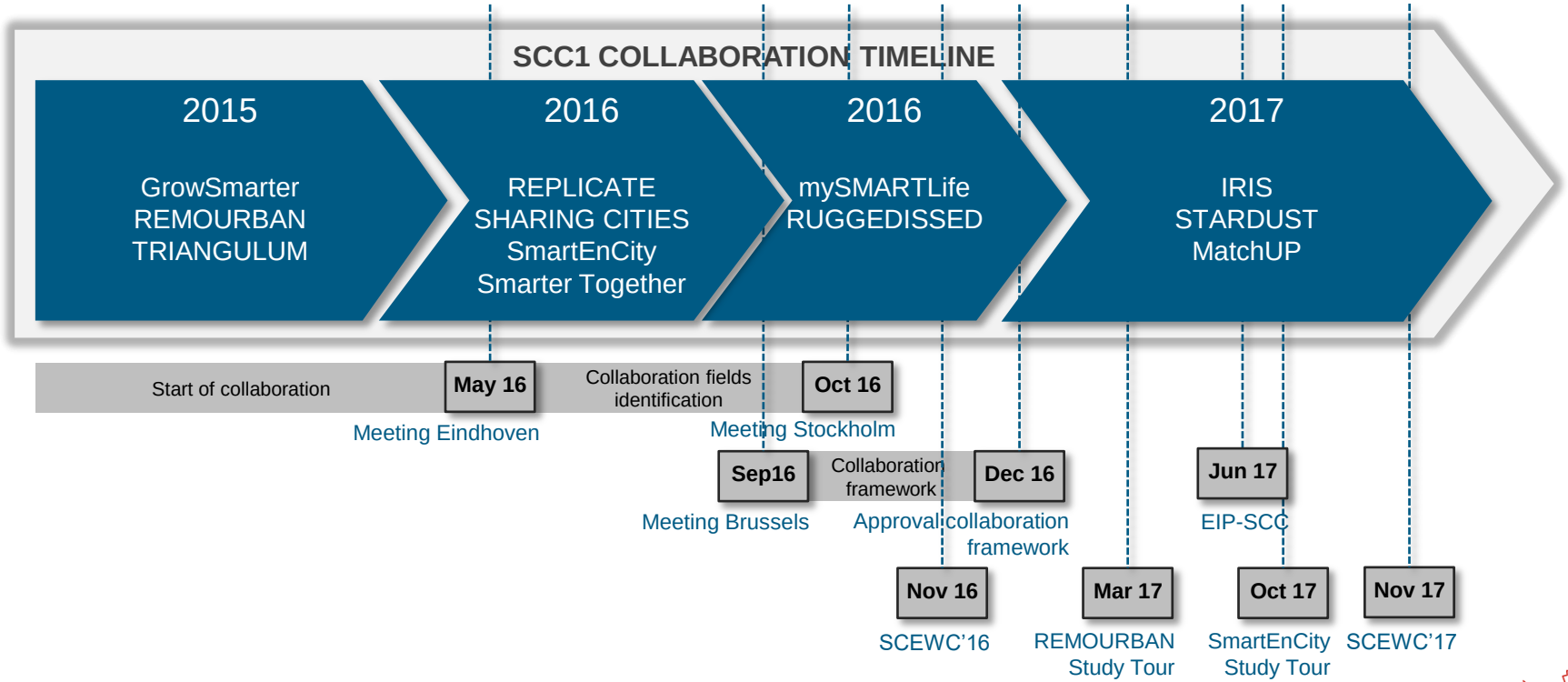


Lighthouse projects cooperation

57 cities paving the way towards a Smarter and more Sustainable Europa

The Smart Cities and Communities lighthouse projects are funded by the European Commission Research and Innovation Framework Horizon 2020 and managed by the Innovation and Networks Executive Agency INEA.

SCC1 lighthouse projects' cluster



SCC1 lighthouse projects' cluster

Lighthouse Projects Cooperation Manifesto

- Approved by all SCC1 coordinators and EC
- Signed by all SCC1 coordinators in Nottingham

  (March, 23 2017)
- Establishes the basis for the cooperation

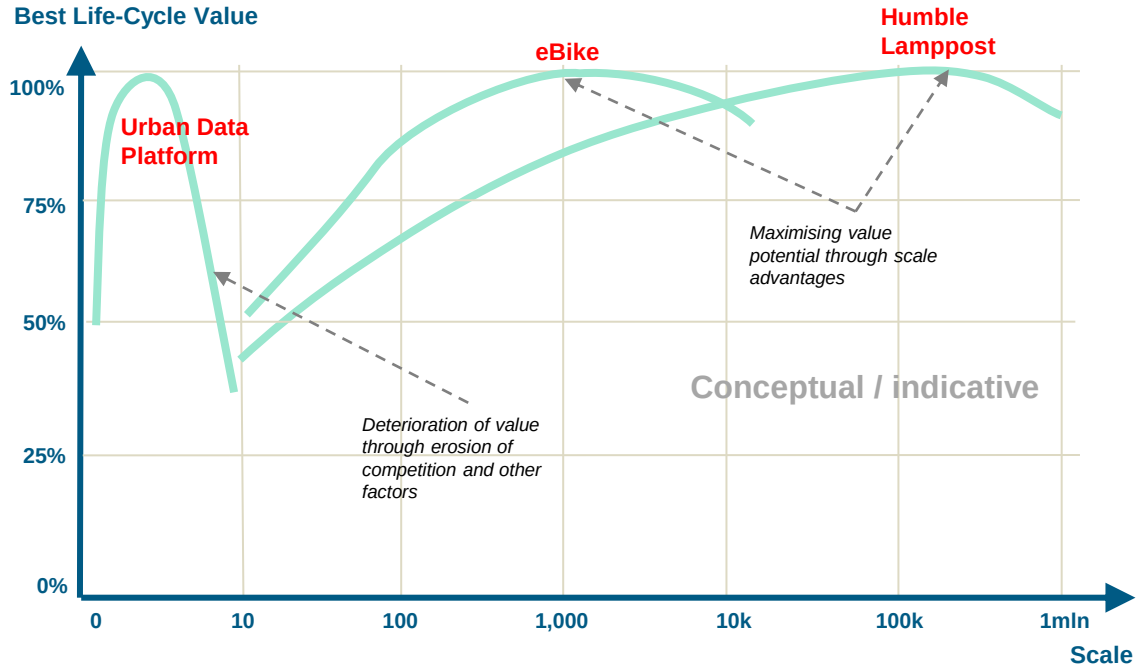
SCC1 lighthouse projects' cluster

SCC1 lighthouse projects' cluster

Expected outcomes (the 5 collaboration pillars)

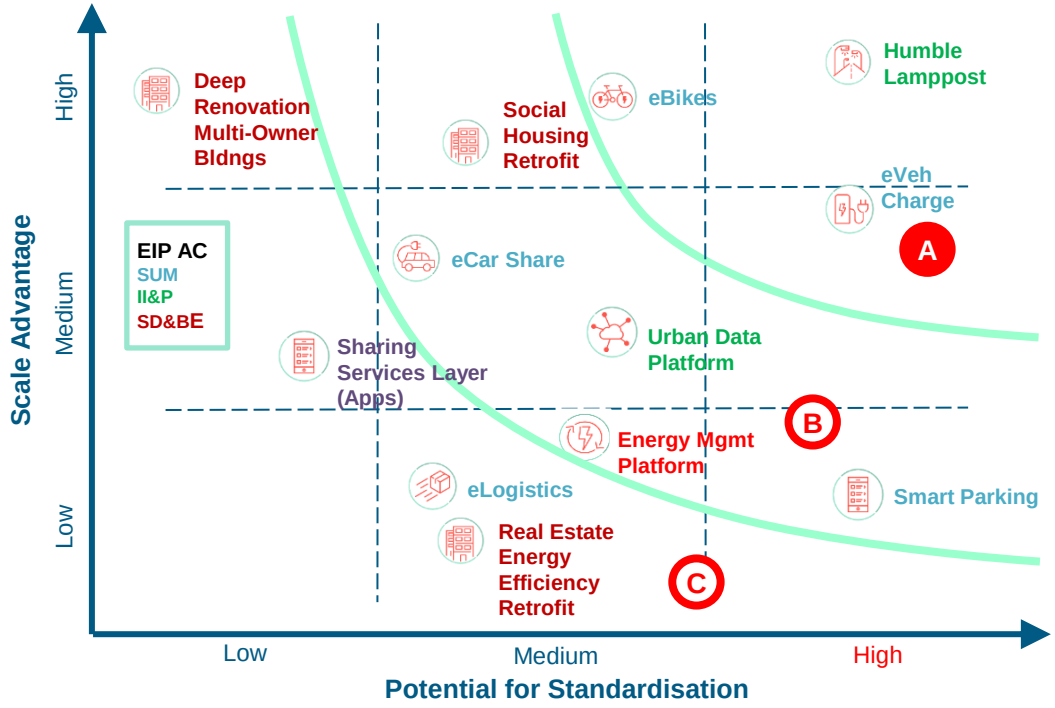
- Mapping of **smart technologies**
- **Shared knowledge** and capacity building
- **Foster scale of economy** (demand aggregation, replicability strategies, market creation)
- Create higher **Value for Money** through:
  - Greater internal efficiency of the projects
  - Demonstrate that the solutions implemented can create market
- **Identification of policies** to support the regulatory change needed to unlock the full potential of Smart Cities

Economies of scale for different solutions



Source: Sharing Cities

Potential for replication and scaling



Source: Sharing Cities

Mapping of actions

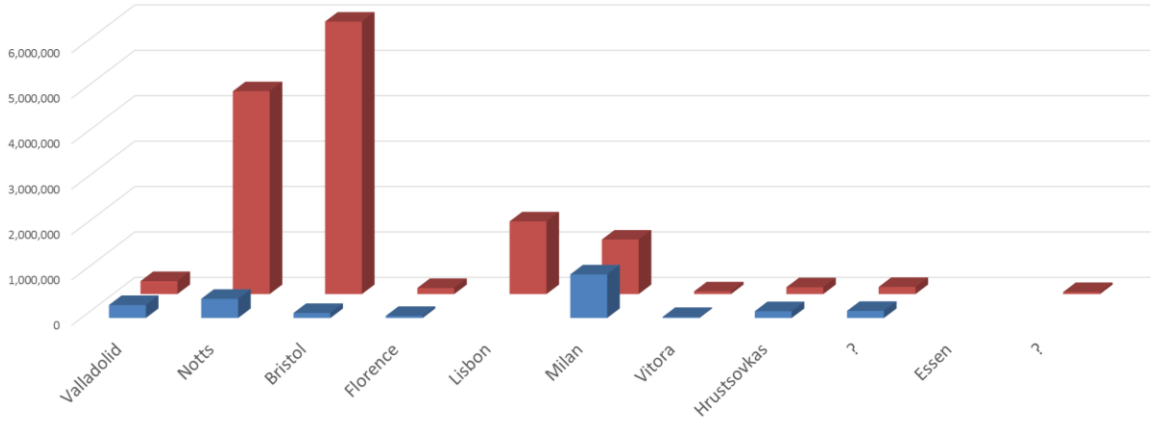
eV and Charging points coarse analysis

Using EC funds to stimulate scale

€ 2.1 m EU funds – ‘stimulus’

€ 14 m Total Direct – city-specific additional investment

€ 40 m identified trigger funds



Source: Sharing Cities

SCC1 lighthouse projects' impacts

Energy actions

Buildings			
EU funding (€)	42 M€	Energy savings (MWh/year)	316,967
Total direct investment (€)	308 M€	CO2 emissions reduction (tCO2/year)	122,279
Leverage factor (before replication)	**7.17**	Total number of citizens impacted	1.15 M
Total direct investment after replication in the city (€)	2,582 M€		
Leverage factor (after replication)	**60.11**		

Source: INEA

SCC1 lighthouse projects' impacts

Total impacts

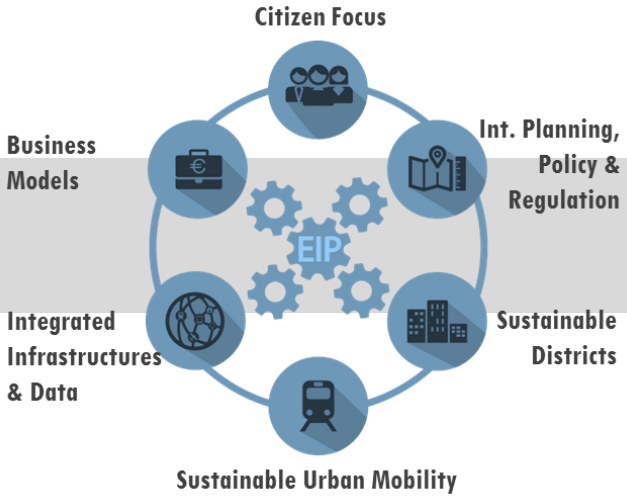
Total expected impacts			
EU funding (€)	109.76 M€	Total direct investment after replication in the cities	3,756.08 M€
Total direct investment (€)	1,201.21 M€	**Leverage factor after replication**	**34.22**
Leverage factor (before replication)	**10.94**	Energy savings (MWh/year)	593,369
Invested €/MWh/year saved	2,024 €	CO2 emissions reduction (tCO2/year)	230,445
EU funding/citizen	22.52	Total number of citizens impacted	4.87 M
Global emission factor (tCO2/MWh)	0.39		

Source: INEA

Our goal – replication and upscaling

Lighthouse cities

Demonstration of common solutions for shared challenges (technical, social, financial)

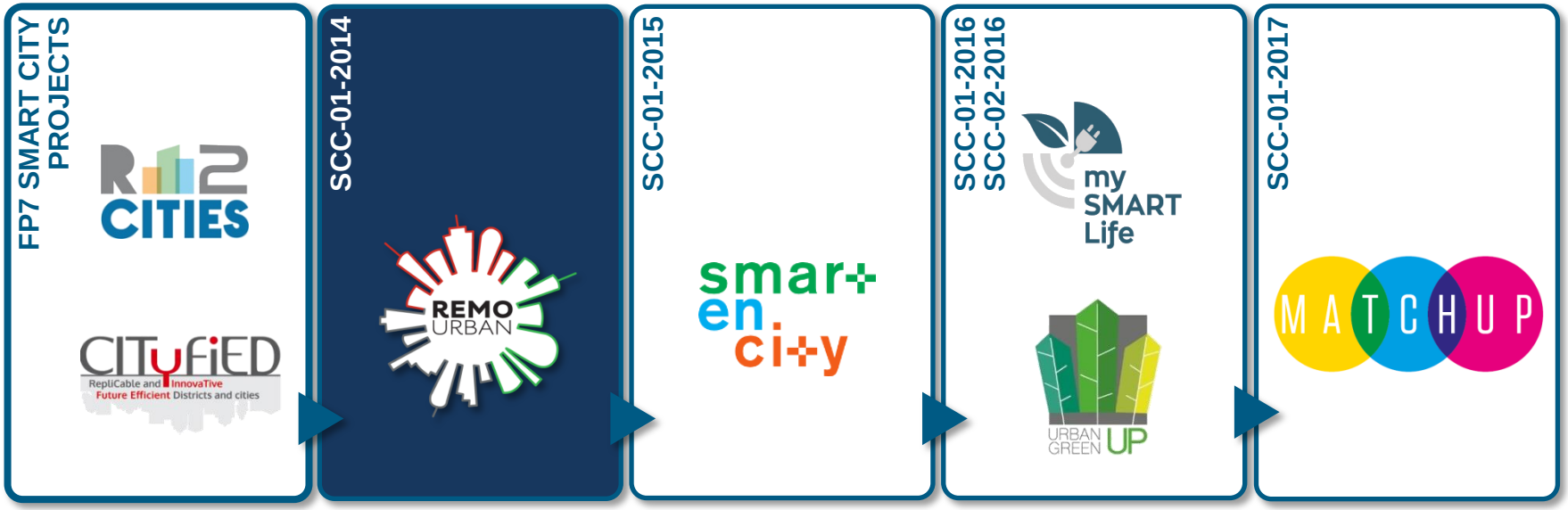


Follower cities

Ground for replication, represent the city needs/demand

REMOURBAN project

Smart City projects in CARTIF



REMOURBAN project

Total REMOURBAN budget: **32.5M€** (21,5M€ EU funded)
Total investment in REMOURBAN actions: **22.9M€** (80% public)
Energy savings: **6,858,735 MWh/yr**
CO_2 emissions avoided: **2,841 TnCO_2/yr**
Citizens directly involved in demos: **19,800**
Direct job creation: **187**
Consortium: **22** partners (5 municipalities, 3 RTD, 5 industries, 9 SMEs)
Nationalities: **7** (Spain, UK, Turkey, Belgium, Hungary, Germany, Italy)

REMOURBAN key objective

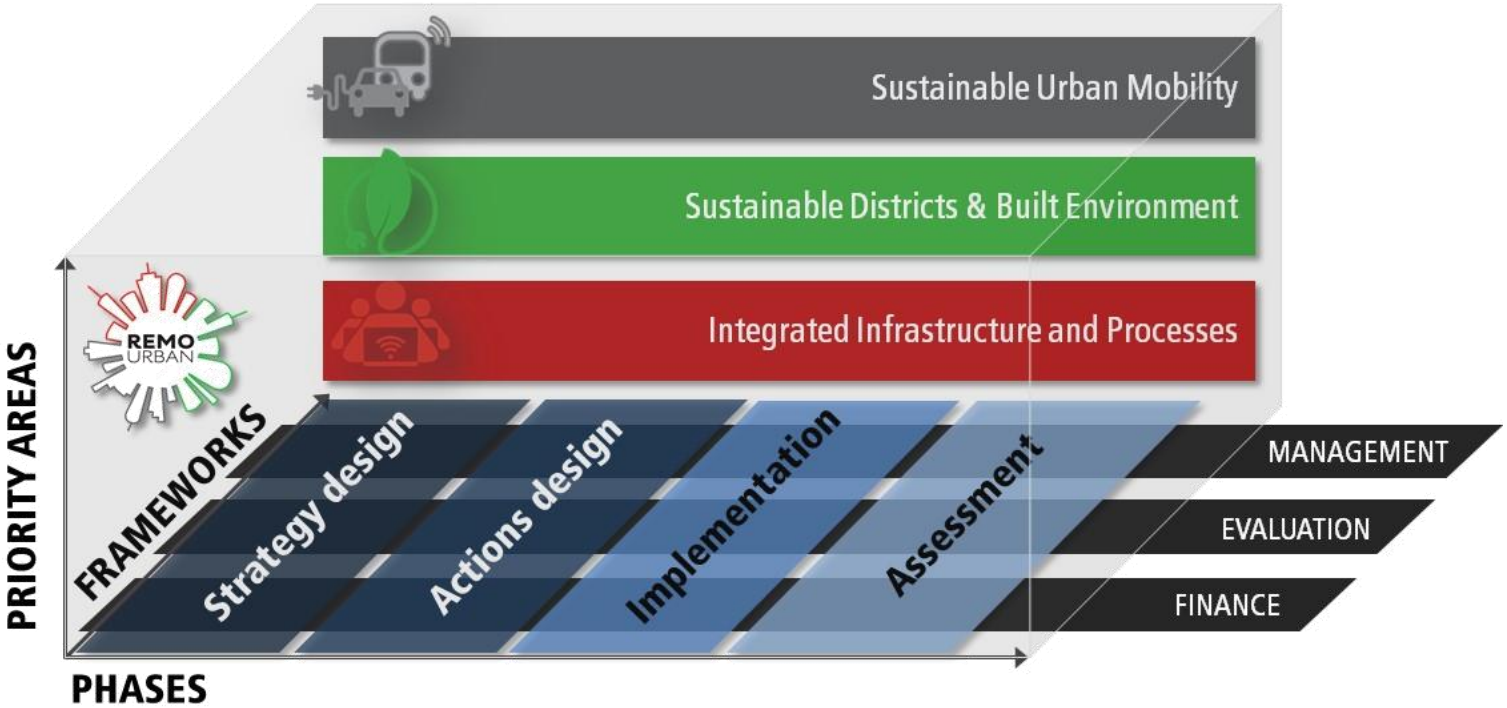
- Develop and validate an **Urban Regeneration Model** – highly replicable and based on the joint transformation of:
  - Buildings/districts towards **Low Energy Districts**
  - City transportation towards a **Sustainable Urban Mobility**
  - Integrate existing city infrastructures through **ICTs**


Source: PETER PARKS/AFP/Getty Images

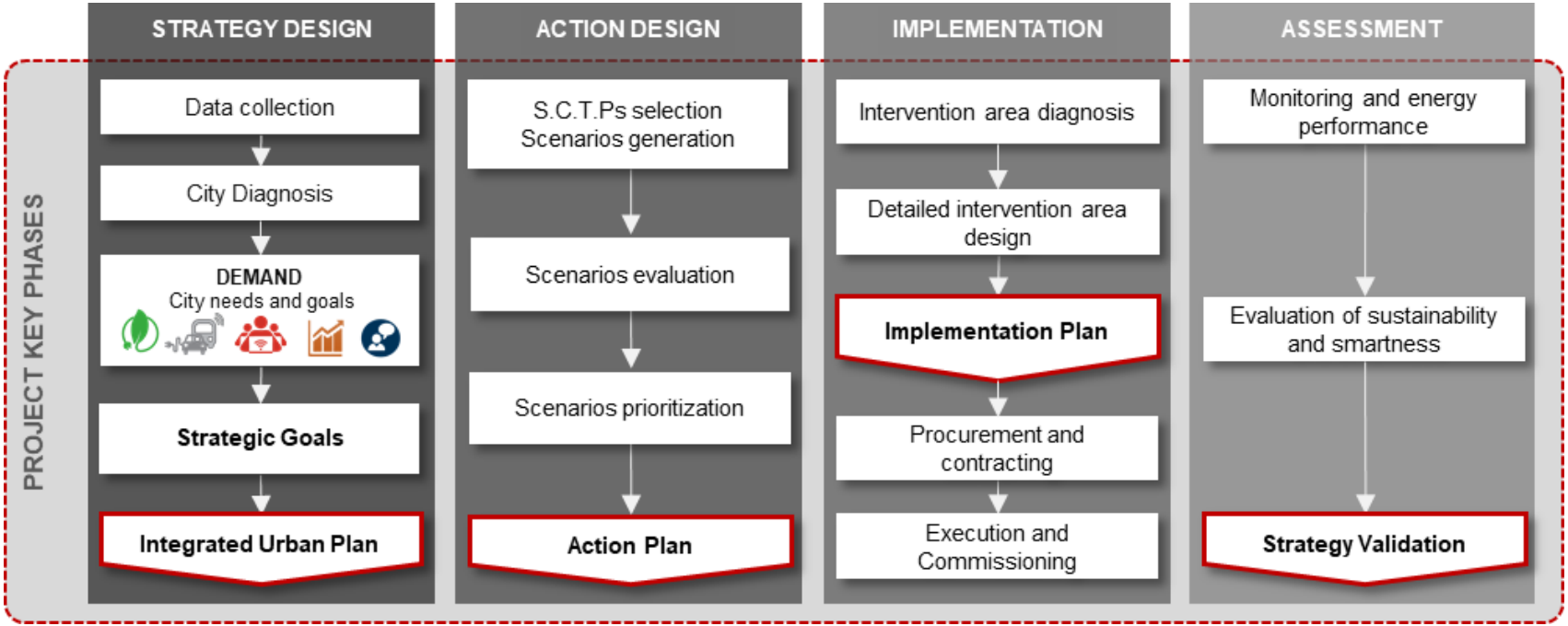

Source: theskyisbig.blogspot.com


Source: Stephen Thomas-Patel

Urban Regeneration Model

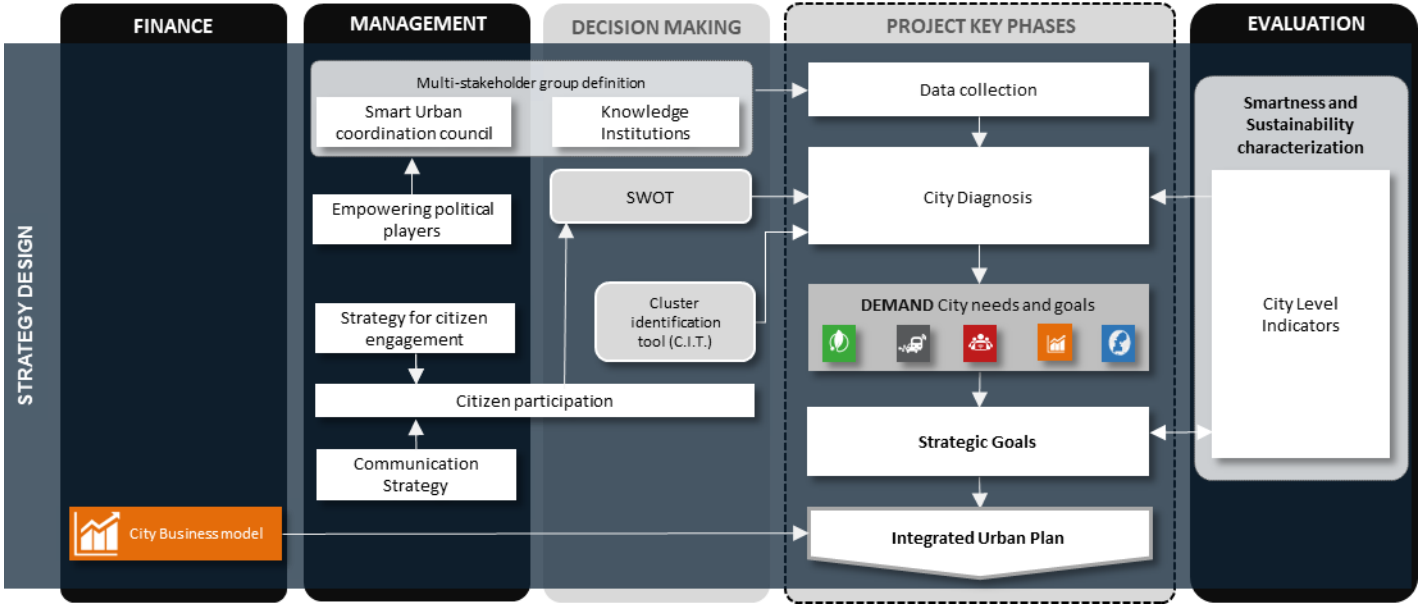


Urban Regeneration Model



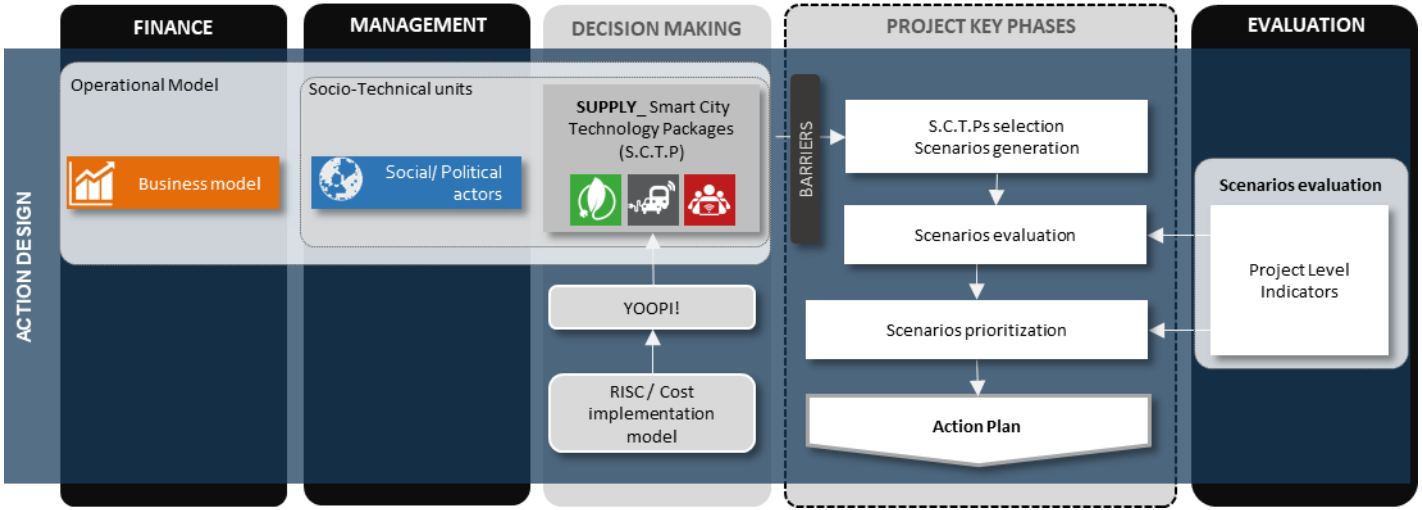
Urban Regeneration Model

- Step 1: strategy design



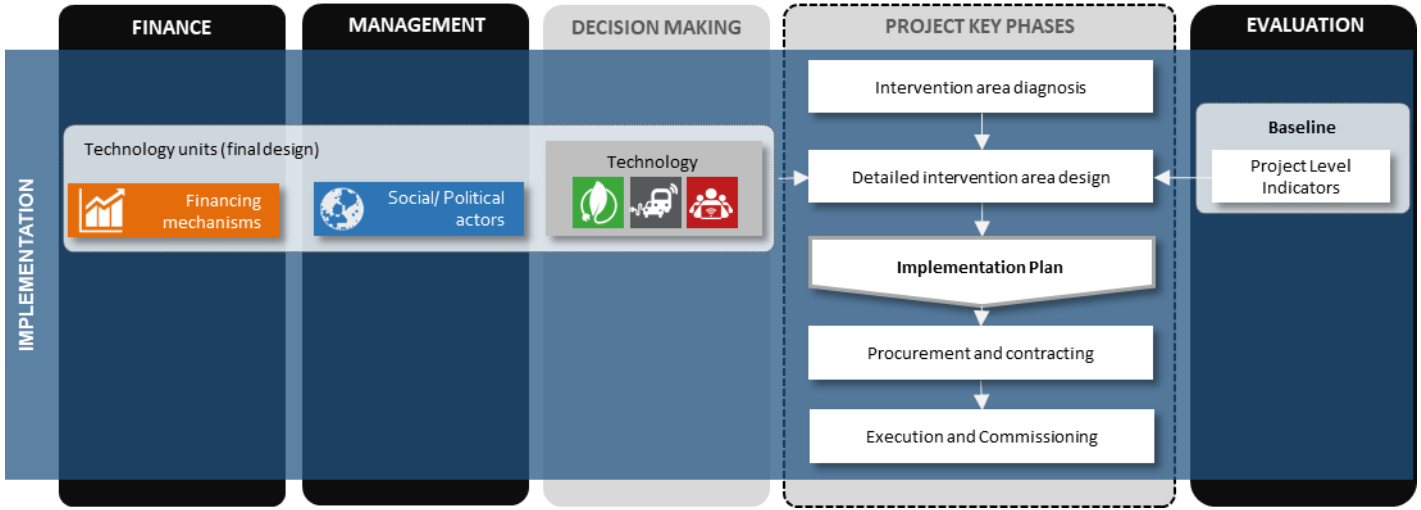
Urban Regeneration Model

- Step 2: action design



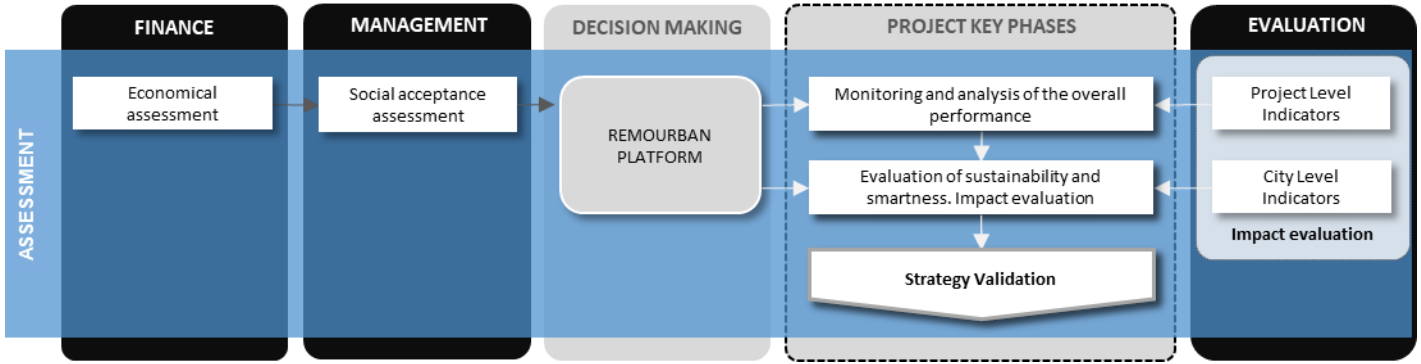
Urban Regeneration Model

- Step 3: implementation



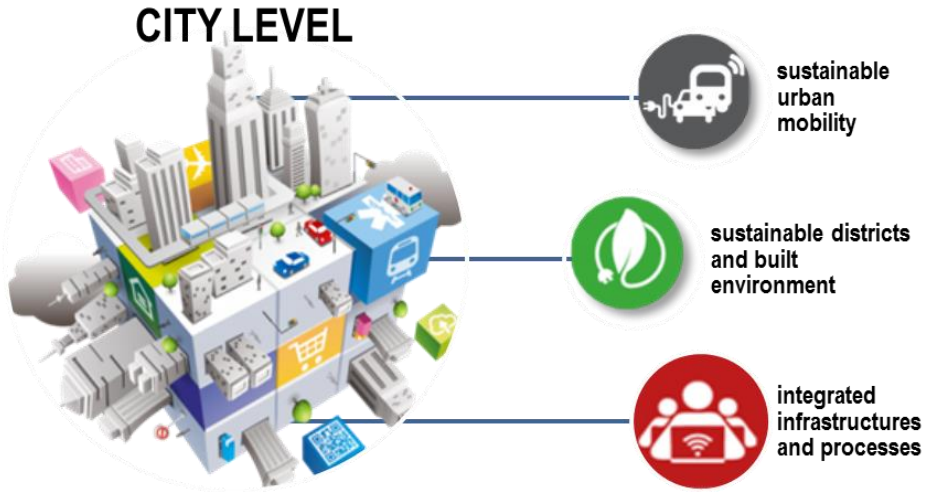
Urban Regeneration Model

- Step 4: assessment



Urban Regeneration Model

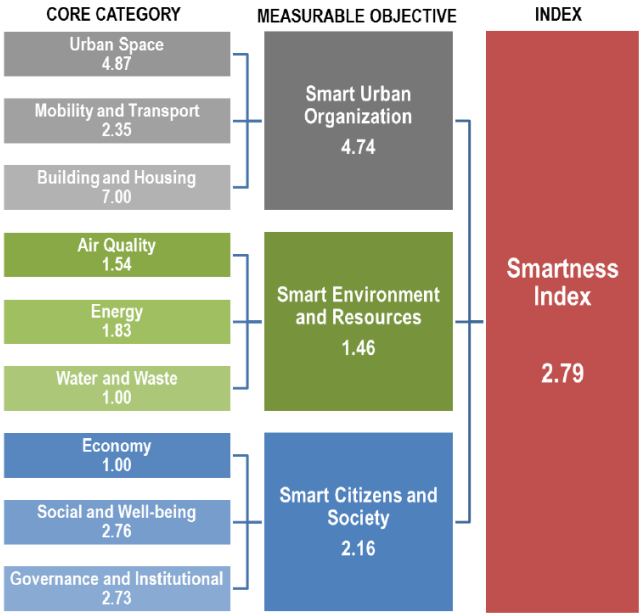
- Evaluation of the transformation process

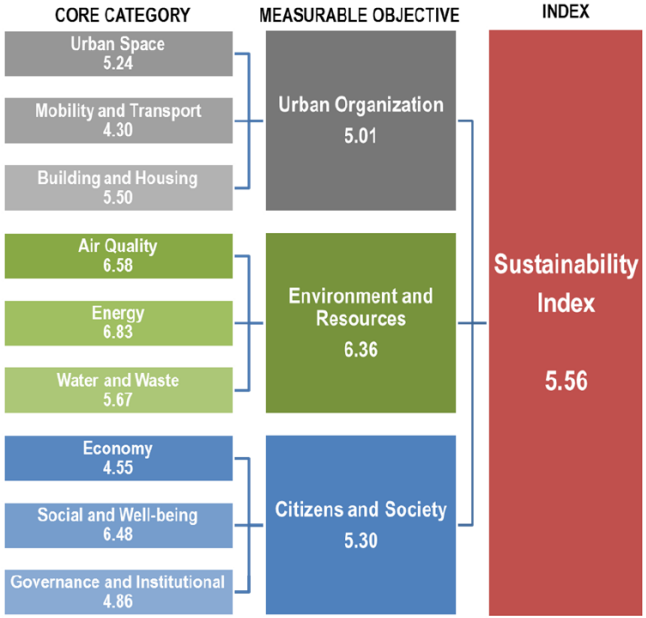


PROJECT LEVEL

Urban Regeneration Model

- Evaluation of the transformation process

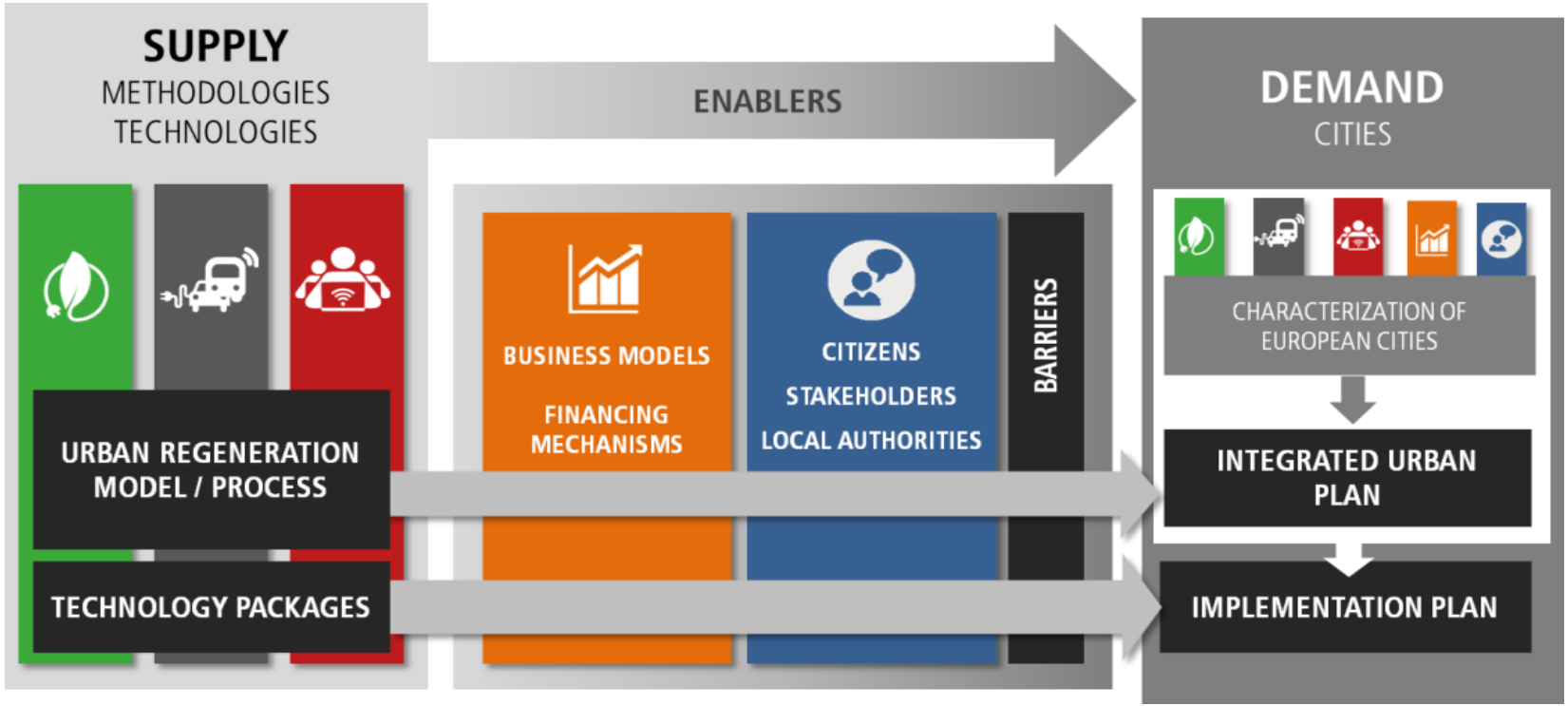




Urban Regeneration Model

- Evaluation of the transformation process

Ensuring the replication of the model



Non-technical barriers

Social and cultural barriers

- Lack of confidence in innovative energy efficient solutions
- Bad opinion of the residents against energy efficiency solutions and lack of understanding of benefits
- Annoyance for residents during the retrofitting works
- Lack of knowledge in financial options to tackle the works to be carried out
- Lack of best practices on energy efficiency and renewable energy technologies
- Lack of easy identification of savings coming from the e-mobility sector

Non-technical barriers

Social and cultural barriers

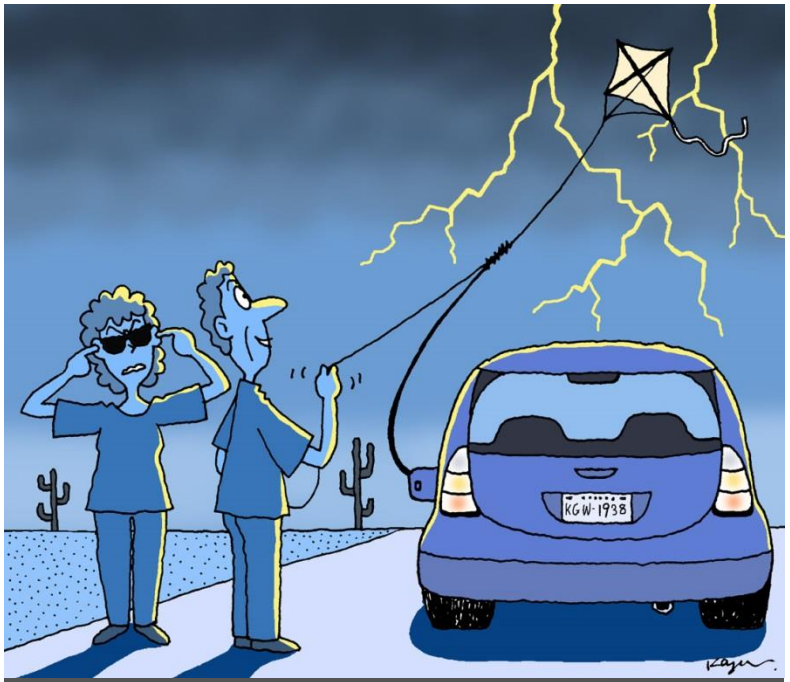
- Little control exists over them – **Communication is key to overcome them**
- Certain actions should be implemented:
  - Place high the communication issues in the Smart City Agenda
  - Devote more resources (human, money, time) to communication
  - Communication needs to be more “local”
  - Key messages should be focused on the benefits of the project

Non-technical barriers

Non-technical barriers

- Some of them are **perceived to be barriers (behavioural) rather than being actual barriers**. An example – range anxiety that prevented people and businesses from using electric vehicles.

- Need to address the perceived barriers and **changes in behaviour of citizens** in order to ensure the successful and sustainable implementation of urban development.



Source: Electric Blue

Non-technical barriers

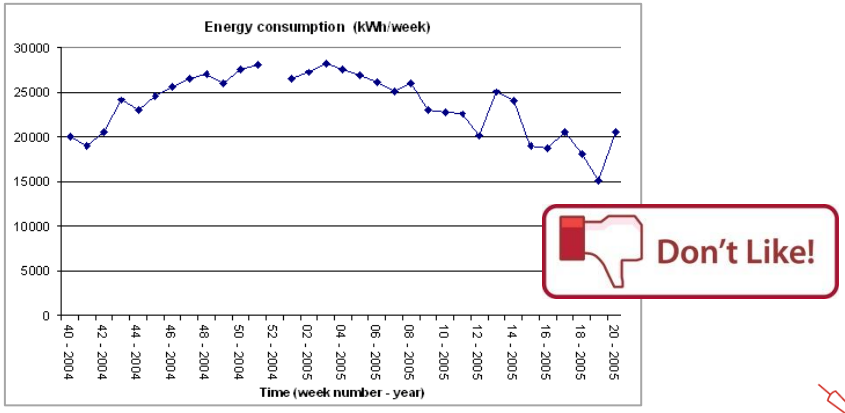
Perceived barriers in public sector

- However, these perceived barriers were just **as likely to be found in public sector organisations**.
- For example the continued use of procurement regulations that blocked innovative approaches, when, in fact, the mechanisms existed to enable the procurement to be undertaken in an open, transparent manner, completely in line with the Official Journal of the European Union processes.

Non-technical barriers

Use of data: finding the balance between privacy and economic development

- Be able to process and aggregate the information before it comes to the public
- Public sector is usually more trustable rather than private companies
- Need to make it clear what data is needed and on what purpose is it collected



Non-technical barriers

Financial barriers

- Financial issues are particularly critical in relation to their ability to act as barriers if not dealt with effectively. For example:
  - High investment and upfront costs
  - Lack of long term guarantee for heat and electricity prices
  - Lack of financial support to finance early stages
  - Long payback periods
  - Fluctuations and sometimes cheaper fossil energy prices
  - Short depreciation period for some technologies
- Overreliance on EU funding: lack of workable local business models that are successful and scalable

Non-technical barriers

Some proposed solutions

- **Training** programmes for an ideal local skill development
- Assitance to **promotion initiatives** of crowd-sourcing, microfinance and community projects
- Establishment of entities that **share risk and costs**
- **Externalisation** of investment costs and risks through innovative contracting
- **Incentives** to citizens and local governments willing to exploit potentials for smart solutions

Procuring low energy districts

Barriers:

- Continuing with existing procurement practices tends to reinforce the established standards
- Municipalities tender with very detailed specifications that do not test the market

Solutions:

- Tendering for bids that deliver solutions to urban challenges (rather than specific items)
- Change to the evaluation of scoring (performance is valued)
- Municipality needs to take the role of the “intelligent customer” and work with the construction sector in a collaborative manner

Procuring low energy districts

Incentives for eMobility

- Sufficient charging infrastructure to ensure that users are more likely to use electric vehicles
- Establishment of ultra-low emission zones in urban areas, using regulation at a city level, in order to ensure electrict vehicles are used by both commercial and private owners

Low energy districts

Following current tendencies, by 2050 the building sector alone will be responsible for all the global emissions that the 2ºC increase scenario allows.

It is impossible to reach desirable climate change scenarios with the current building sector.

"*Building a common home. A Global Vision Report*"
Global Vision Area within the WSB14

Challenges:
Improve energy efficiency
Changing energy resources

Low energy districts

MONITORING TOOLS FOR ENERGY

Develop and deploy monitoring tools to achieve performances related to energy efficiency and financial viability

DISTRICT SCALE RETROFITTING

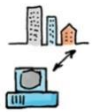
Systemic implementation of passive and active technologies to improve comfort and reduce the energy consumption

RENEWABLE HEATING AND COOLING

Use of heating and cooling from RES and implementation of innovative DH technologies (Low Temperature District Heating)

ELECTRICITY DISTRIBUTED GENERATION

Electricity generation from small scale energy sources located close to where the electric energy is being used



ADVANCED BUILDING ENERGY MANAGEMENT SYSTEMS

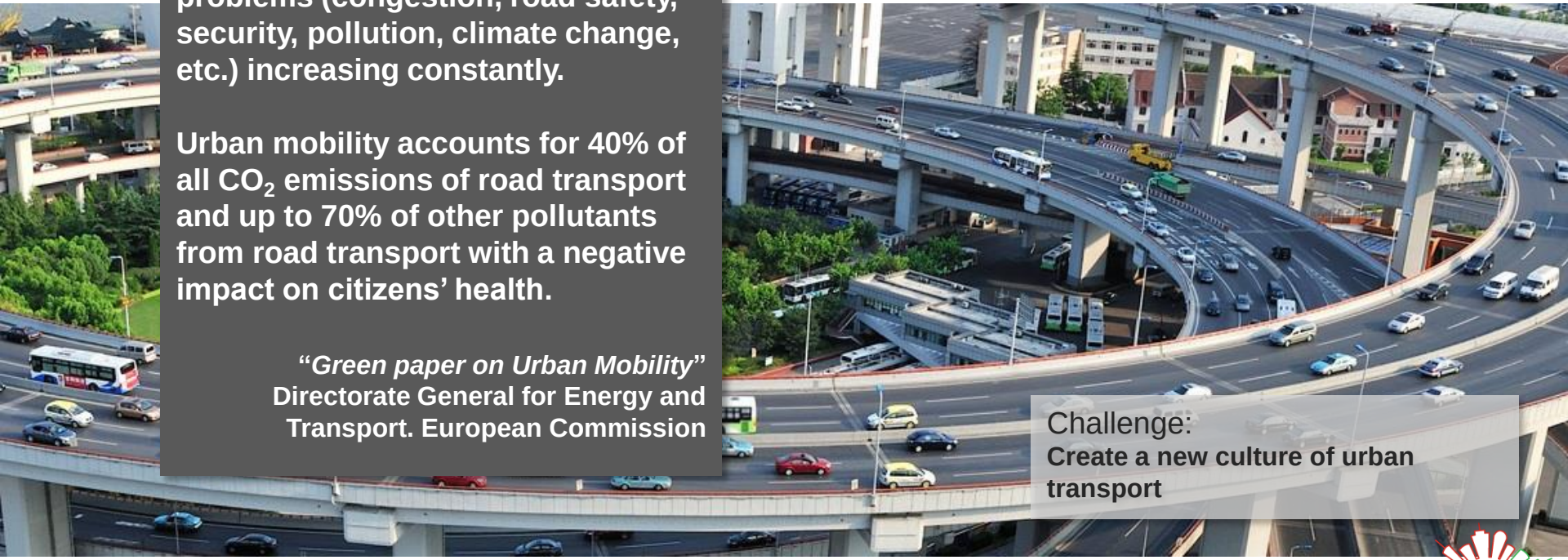
Integration of advanced monitoring and control strategies for thermal and electric energy uses

Sustainable urban mobility

Cities all over Europe face similar problems (congestion, road safety, security, pollution, climate change, etc.) increasing constantly.

Urban mobility accounts for 40% of all CO_2 emissions of road transport and up to 70% of other pollutants from road transport with a negative impact on citizens' health.

"*Green paper on Urban Mobility*"
Directorate General for Energy and Transport. European Commission



Challenge:
Create a new culture of urban transport

Sustainable urban mobility

IMPROVE CLEAN POWER FOR TRANSPORT: e-Vehicles
Use of electric or hybrid technologies to ease a mass-shift to cleaner forms of transport

IMPROVE CLEAN POWER FOR TRANSPORT: INFRASTRUCTURE
Use the charging infrastructure related to electric and plug-in hybrid vehicles to make easier a mass-shift to cleaner transport

FOSTER SEAMLESS D2D MULTI-MODALITY IN URBAN TRANSPORT
Achieve better connecting transport modes, nodes and mobility services

FURTHER CLEAN LOGISTICS
Enhance the logistics supply chain inside the cities (last mile delivery)

OPEN UP INTELLIGENCE IN URBAN TRANSPORT SYSTEMS
Supporting alliances that use open data – eases the development of demand-responsive and integrated mobility services

PROMOTE USE OF CLEANER VEHICLES
Incentive schemes provided by the cities to stimulate collective transport, clean logistics, sharing of goods and distribution

Integrated infrastructures and processes

An integrated and intelligent approach to urban development is needed to address the complexity of a smart sustainable city, aiming at improving the quality of life of all its citizens.

"*Workshop: Smart Sustainable Cities and Regions*"
Paul Bevan, Secretary General, EUROCITIES, Brussels

Challenge:
Integration across infrastructures and their related operational processes

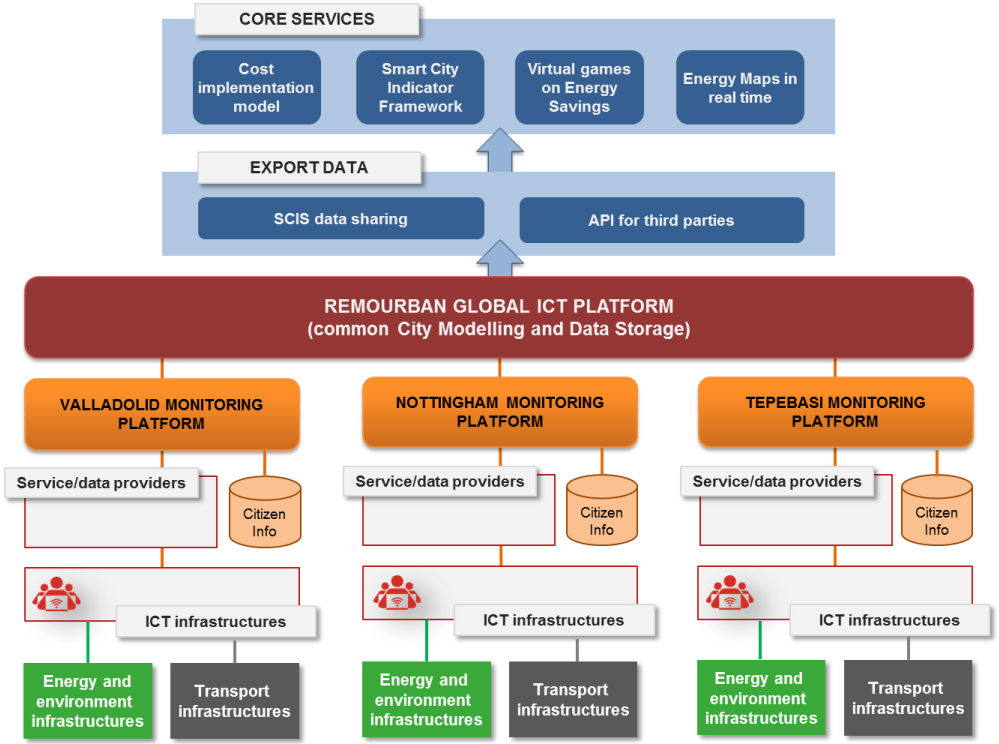
Integrated infrastructures and processes

City Information Platform:

- Added-value services (big data adaption, taxonomies, export data services, etc.)

Core Services:

- Smart City Indicator Framework
- Cost implementation Model
- Virtual games on Energy Savings
- Energy maps in real time



Enabling factors for urban transformation

Developing integrated solutions throughout Europe will allow industry to deliver what cities and regions need, with better quality and at lower costs to the benefit of, and with the involvement of, society.

"*Strategic Implementation Plan*"
European Innovation Partnership on Smart Cities and Communities

Challenges:
Ensure citizens engagement, improve framework conditions to be able to become smart, and develop new market-oriented and strategies of Public-Private cooperation

Enabling factors for urban transformation

Empower and co-create

Active and evolving dialogue
Equal power to decide outcomes at one or many parts of the process

Include and collaborate

2-way
In person, collective meeting

Inform and consult

1-way
'distance' – by mail, Internet

Good communication ≠ Citizen engagement
But citizen engagement NEEDS good communication

Enabling factors for urban transformation

STRENGTHS

- Wide portfolio of channels operated by the Municipality
- Experience in implementing neighbourhood refurbishment projects
- Good co-operation with NGOs
- Visible projects
- Routine in reaching citizens

OPPORTUNITIES

- S&G engagement plan foreseen for the whole city
- Longer time for engagement before deploying new projects
- MIS to become a flagship project in Modern Cities Programme (national)

S O W T

WEAKNESSES

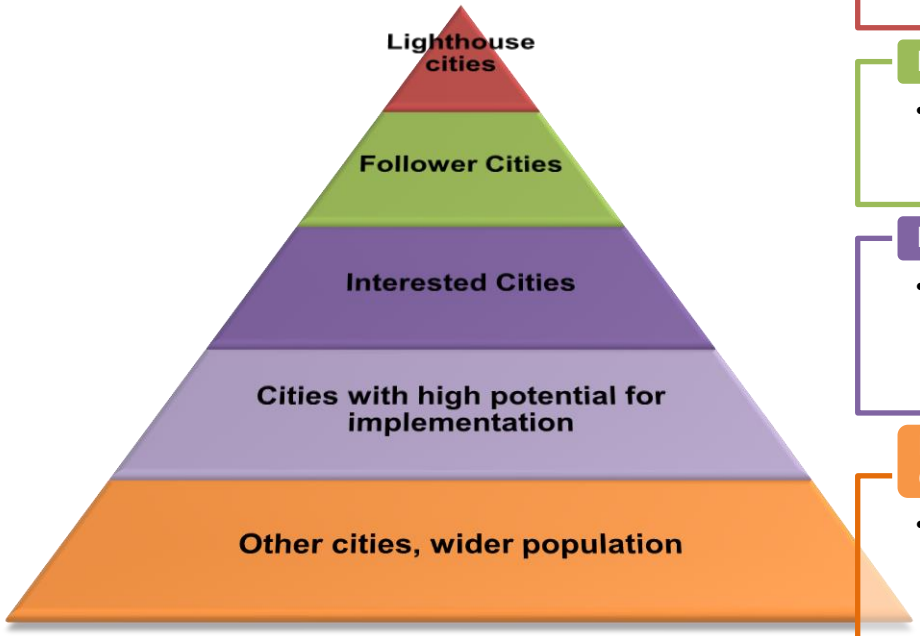
- Low number of citizen supported NGOs
- Low awareness on smart urban development
- Lack of interest and effective demand for e-vehicles
- Lack of approved municipal smart city strategy to align REMOURBAN

THREATS

- Delay in Modern Cities Programme
- Rejected domestic and EU proposals,
- Missing capital for comprehensive urban regenaration
- Political change, low committment of leadership
- Lack of purchasing power

22%

Scale-up approach to maximise the impact



Demonstration

- Directly involved in project as demo: training, technology transfer

Replication

- Directly involved in project as replication: workshops, replication activities, implementation plans

Exploitation

- Attracted during the project lifetime: exploitation activities, transfer activities, feasibility plans, study visits, webinars about solutions proposed

Dissemination and communication

- e.g. articles, LinkedIn communication, press releases, presentations, conference, social media (appropriate), website, leaflet or flyer, general awareness raising

INTENSITY OF ENGAGEMENT


ctrico


Quiet
Clean


BUS
26 BU 543

Valladolid lighthouse city

Valladolid Smart City

Population = 310.000 inh (415.000 metropolitan area); **City area** = 197,9 km2

Strategies and plans

- INNOLID 2020 – Sustainable and Integrated Urban Development Strategy
- Sustainable Urban Mobility Plan (PIMUSSVA)
- SEAP – Covenant of Mayors (2011)
- Smart City Strategy Valladolid y Palencia (2010)
- Local Agenda 21 (V Action Plan – dic 2016)
- PGOU

Networks

- RECI
- Red INNPULSO (Cities of Science & Innovation)
- CTN 178 (Comité Técnico de Normalización)
- Automotive Intergroup
- MetropolRegion MHBGW - European Network: Regions promoting eMobility
- CENCYL Network
- CELSIUS Network
- EuroCities

Valladolid Smart City

REMOURBAN

H2020-SCC-2014-2015: Smart Cities and Communities solutions integrating energy, transport, ICT sectors through lighthouse (large scale demonstration - first of the kind) projects

URBAN GREEN UP

H2020- SCC-02-2016-2017-Demonstrating innovative nature-based solutions in cities

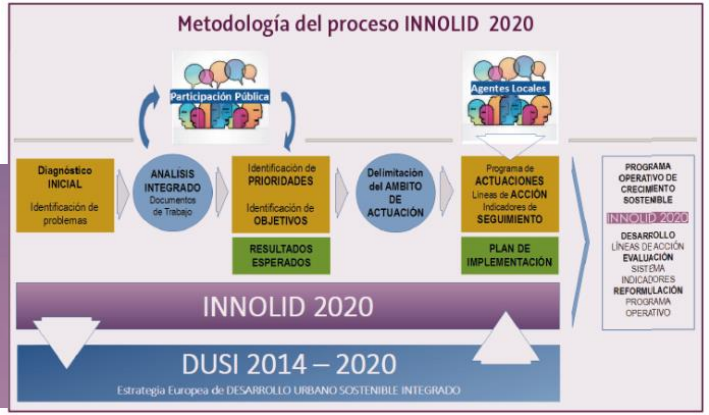
TO2. Enhancing access to, and use and quality of information and communication technologies (ICT)

TO4: Carbon Economy

TO6.Sustainable Urban Development

TO9. Promoting social inclusion, combating poverty and any discrimination

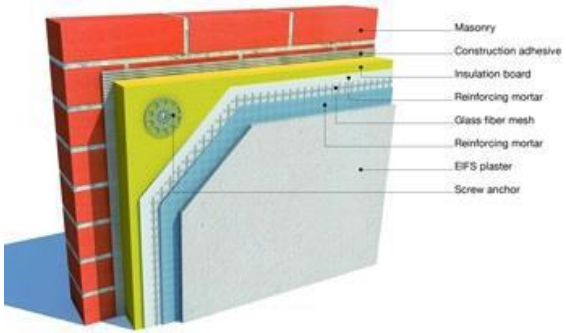
Innolid2020



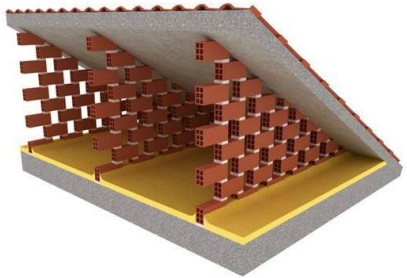
Energy retrofitting – FASA residential district

Energy retrofitting – FASA residential district

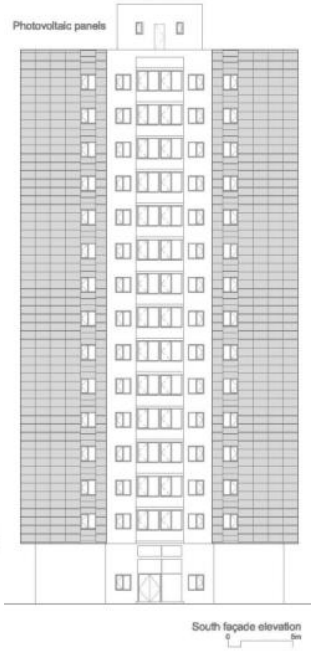
Façade insulation



Roof insulation

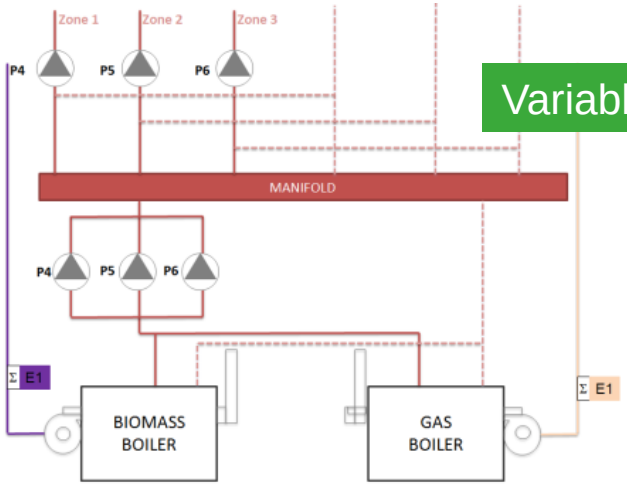


PV façade (BIPV)



Energy retrofitting – FASA residential district

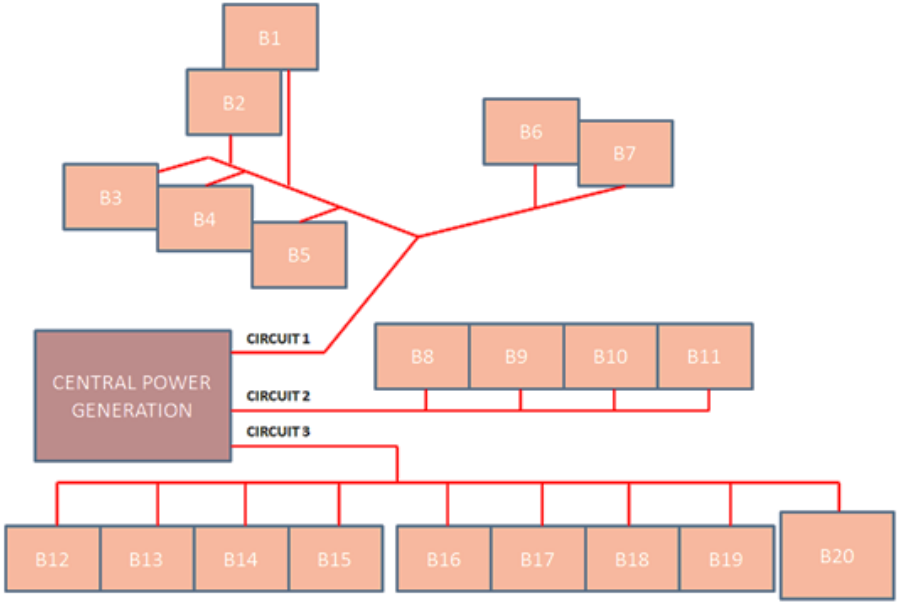
Biomass based DH (1000 kW)



Variable flow pumps

Energy retrofitting – FASA residential district

Distribution network retrofitting

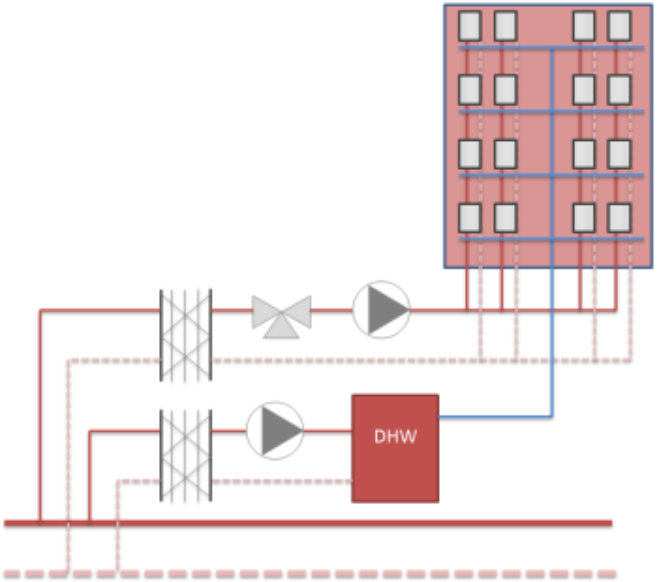


Replacement of substations

Energy retrofitting – FASA residential district

Thermal storage

DHW centralisation



Energy retrofitting – FASA residential district

Installation of heat allocators

Installation of thermostatic valves

Retrofitting of FASA residential district

Political Support

Dissemination & Communication Activities

Technical Support

Financial Support

Retrofitting of FASA residential district

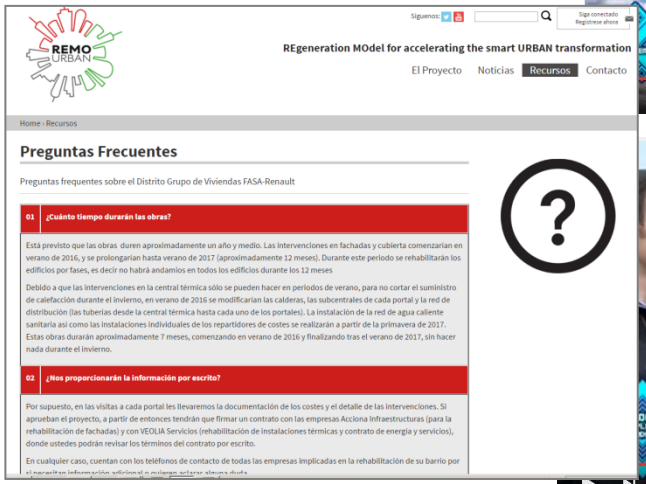
Political Support

Dissemination & Communication Activities

Technical Support

Financial Support

Leaflet



Spanish Web /FAQ

Local TV

Retrofitting of FASA residential district

Political Support

Dissemination & Communication Activities

Technical Support

Financial Support

Consulting Office in the district

More than 50 meetings

Multiple doubts resolved

Follow-up Commission

Periodic communications

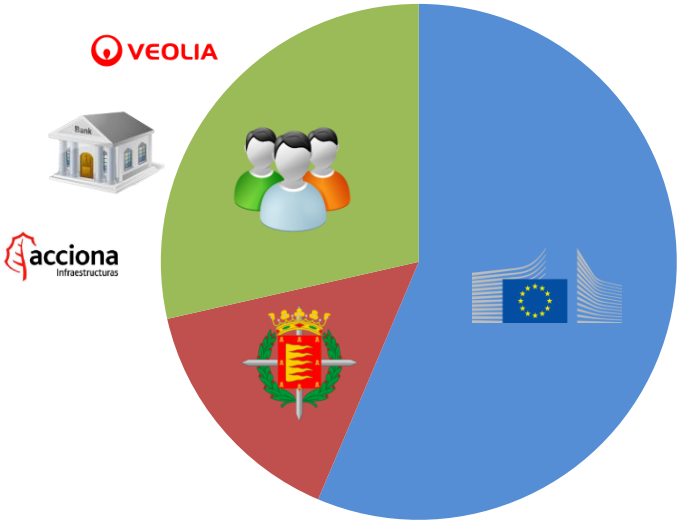
Retrofitting of FASA residential district

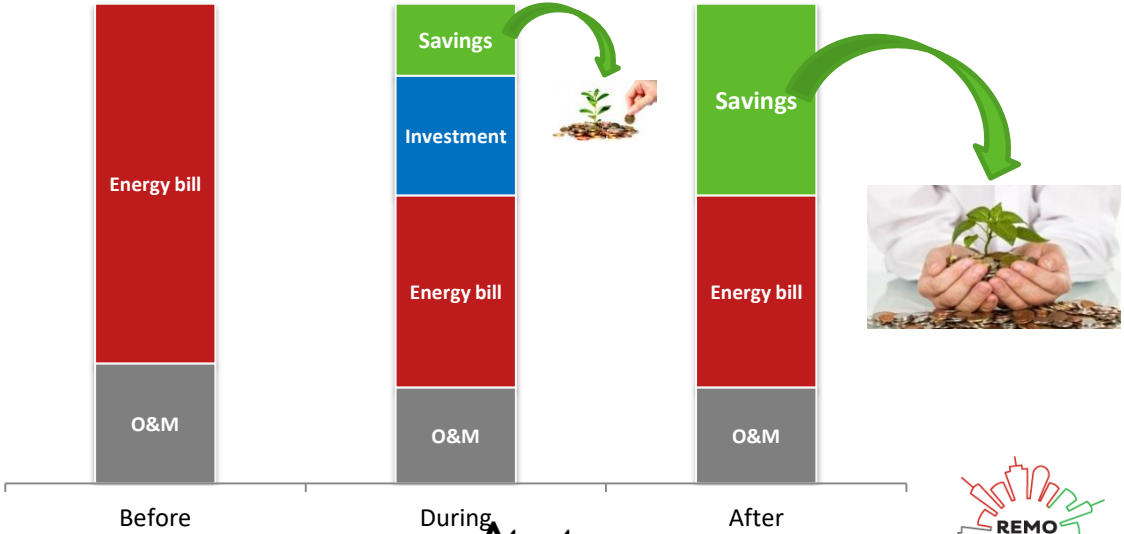
Political Support

Dissemination & Communication Activities

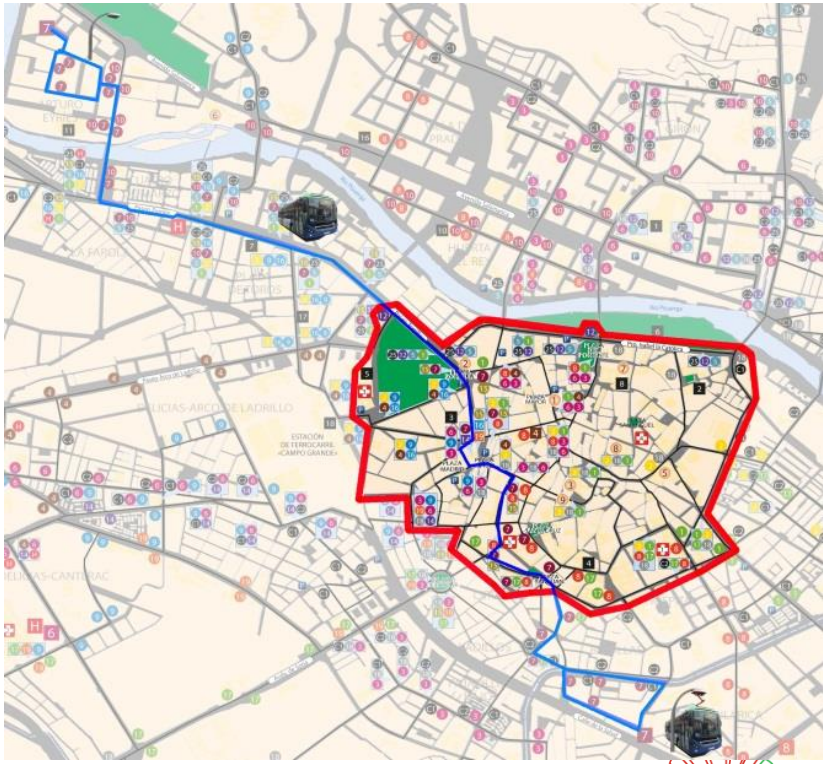
Technical Support

Financial Support





Sustainable Urban Mobility: eV



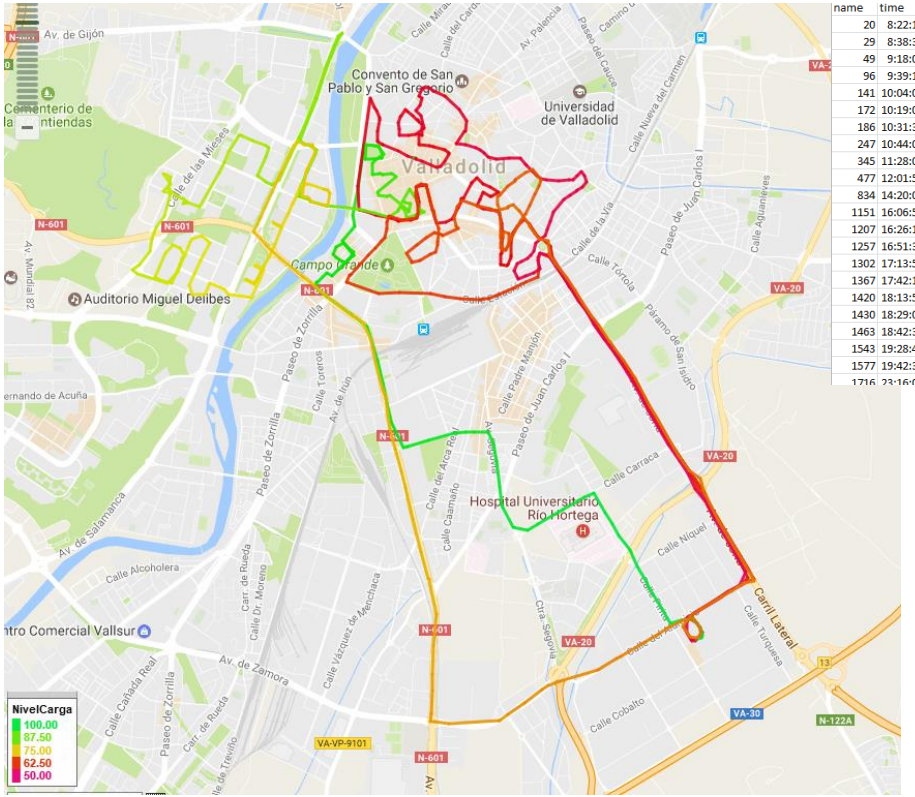
Sustainable Urban Mobility: eV

Sustainable Urban Mobility: fostering eV

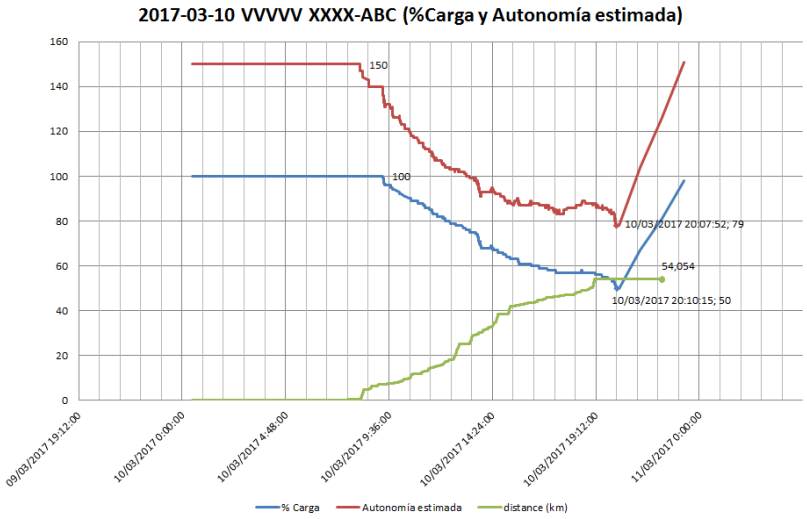
Tender for contracts to monitor eV

addressed to taxi drivers, last mile delivery vehicles and local businesses

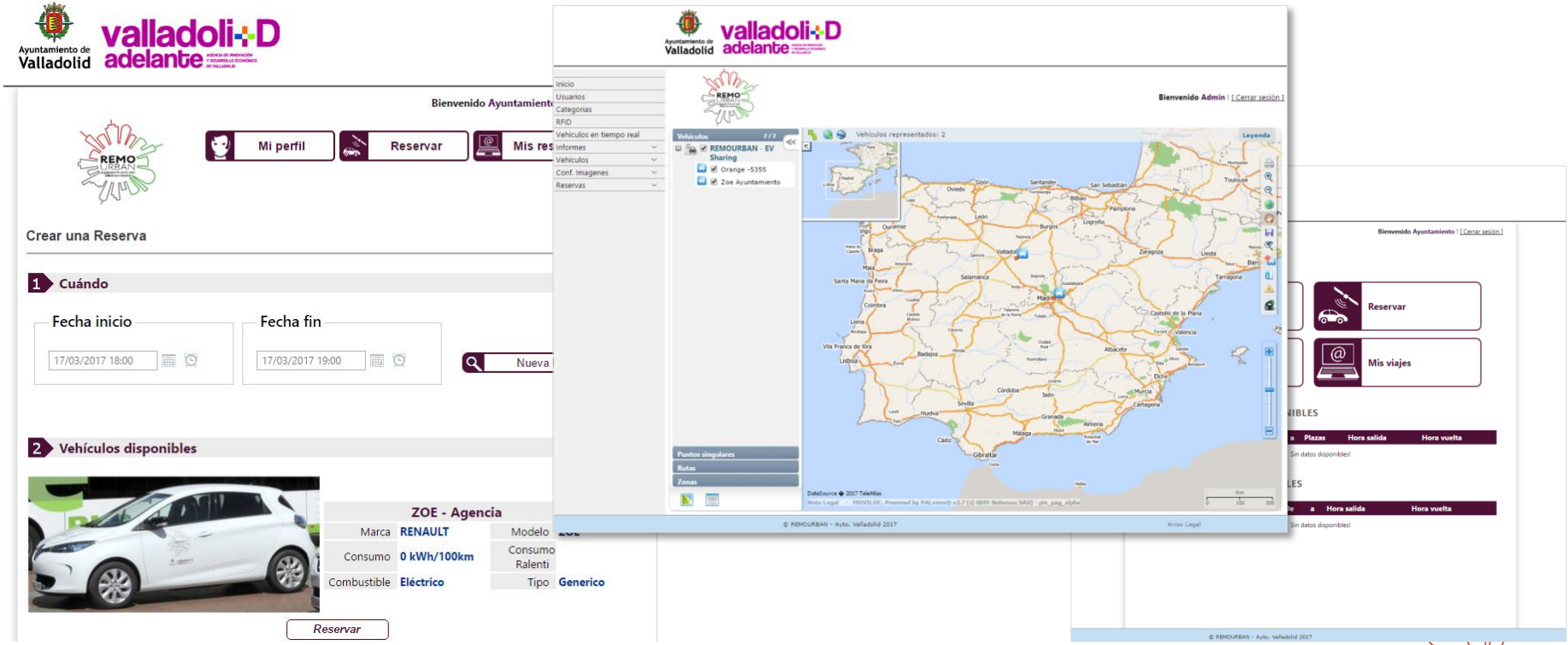
Sustainable Urban Mobility: monitoring



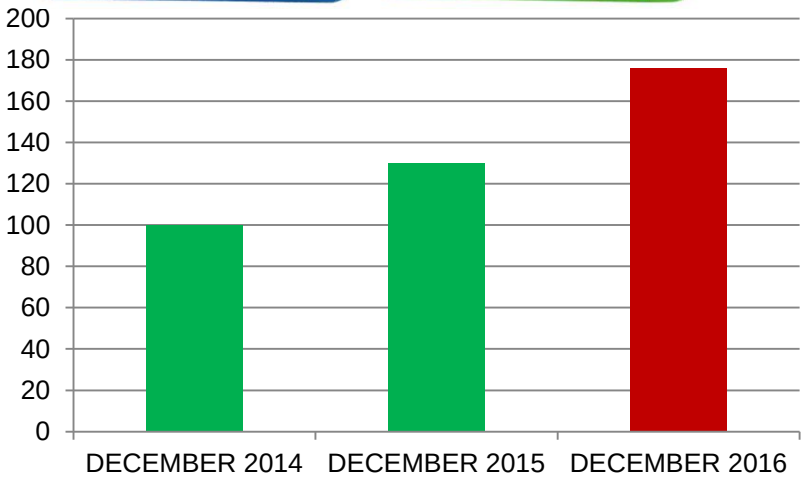
name	time	lon	lat	auton	Cargand	NivelCar	InstAux	NoMovC	tParada	EsParadi	MintParada
20	8:22:15	-4.70455	41.62285	147	0	100	0	1	7:54:53	1	474
29	8:38:37	-4.70385	41.62315	143	0	100	1	1	0:16:12	1	16
49	9:18:02	-4.70851	41.62646	140	0	100	12	1	0:37:31	1	37
96	9:39:11	-4.73579	41.64511	132	0	96	30	1	0:13:28	1	13
141	10:04:06	-4.73183	41.65276	126	0	93	0	1	0:15:02	1	15
172	10:19:09	-4.72957	41.65175	123	0	91	1	1	0:09:04	1	9
186	10:31:32	-4.73068	41.65045	121	0	90	1	1	0:11:40	1	11
247	10:44:08	-4.72982	41.65045	118	0	89	0	1	0:12:16	1	12
345	11:28:07	-4.73681	41.65361	112	0	86	1	1	0:10:29	1	10
477	12:01:55	-4.74007	41.65351	107	0	82	6	1	0:19:30	1	19
834	14:20:08	-4.70441	41.62302	93	0	69	1	1	0:27:31	1	27
1151	16:06:53	-4.70448	41.62283	88	0	61	8	1	0:27:02	1	27
1207	16:26:17	-4.71755	41.64795	88	0	60	0	1	0:11:53	1	11
1257	16:51:34	-4.72049	41.64766	86	0	59	0	1	0:09:24	1	9
1302	17:13:50	-4.72260	41.65154	85	0	58	1	1	0:12:12	1	12
1367	17:42:19	-4.72920	41.64892	84	0	57	0	1	0:11:53	1	11
1420	18:13:50	-4.73039	41.65358	86	0	57	17	1	0:12:23	1	12
1430	18:29:09	-4.72765	41.65274	87	0	57	1	1	0:12:11	1	12
1463	18:42:31	-4.72653	41.65357	88	0	57	2	1	0:09:36	1	9
1543	19:28:40	-4.72358	41.65442	86	0	56	33	1	0:09:09	1	9
1577	19:42:36	-4.71759	41.65167	85	0	55	0	1	0:11:19	1	11
1716	23:16:04	-4.70435	41.62292	151	1	98	0	1	3:07:21	1	187



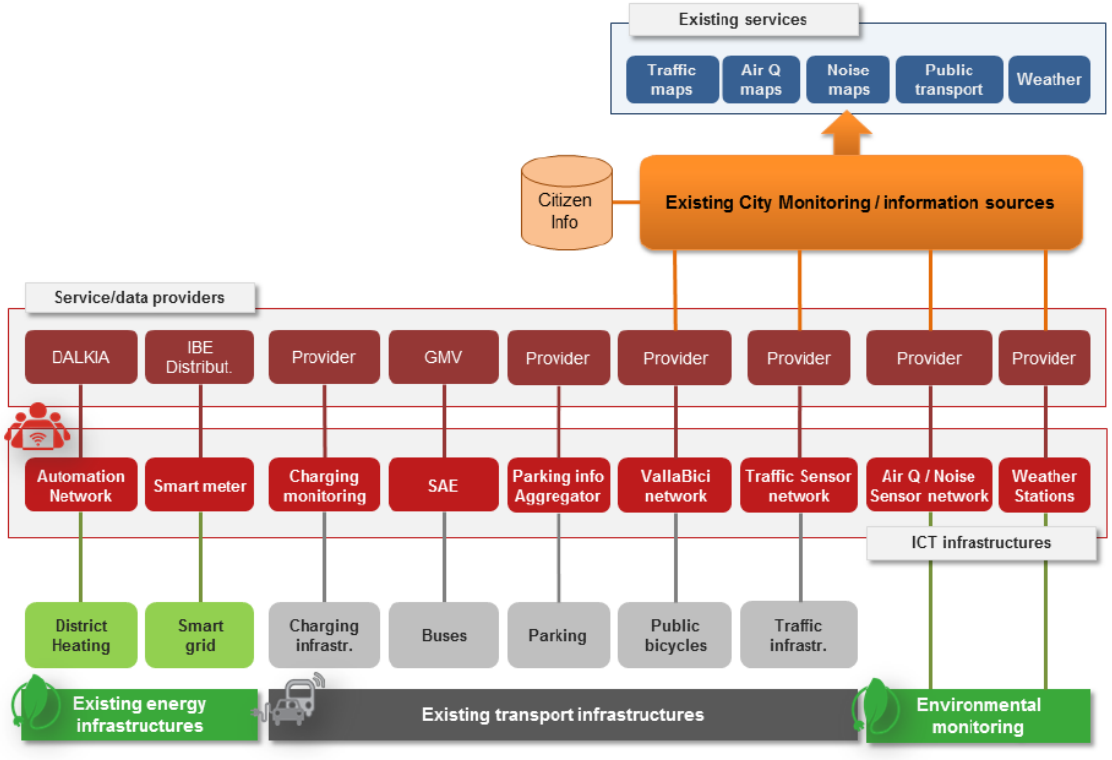
Sustainable Urban Mobility: car sharing

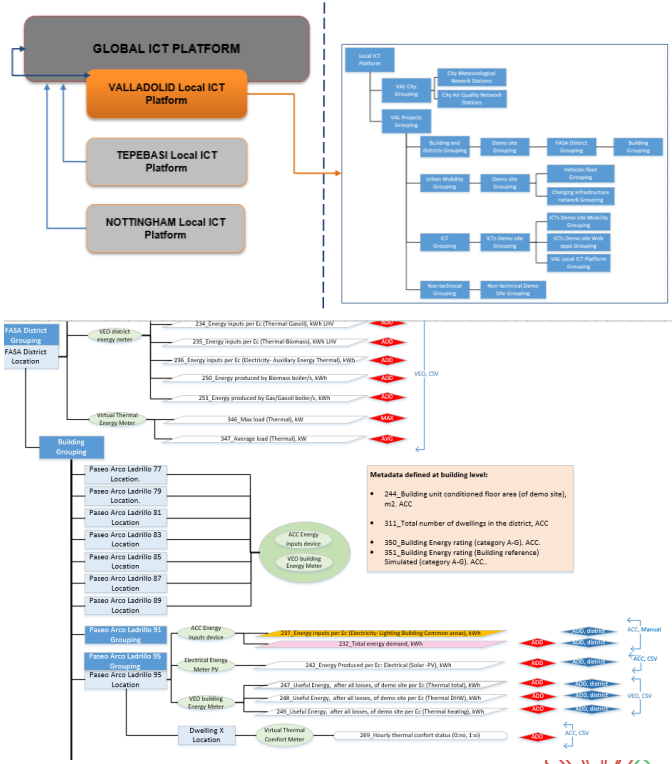


Sustainable Urban Mobility: eV incentives

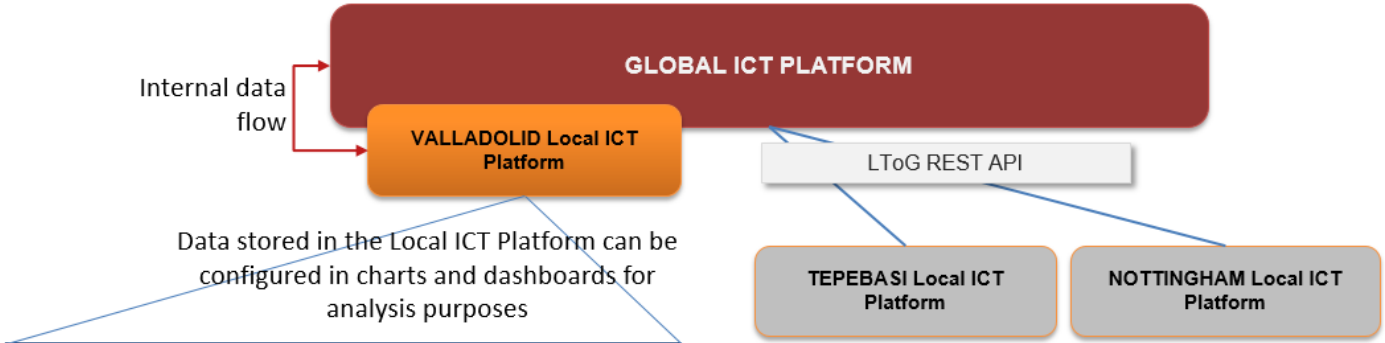


Urban platform





Urban platform



Stay tunned:
remourban.eu

REMO URBAN

Regenerate your city with
REMOURBAN!

Follow and **engage** with
REMOURBAN on Twitter
@Remourban_EU
follow us!

Thank you for your attention!

Fundación CARTIF
Miguel Á. GARCÍA-FUENTES
Coordinador proyecto REMOURBAN

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646511

contact@remourban.eu
www.remourban.eu
@Remourban_EU