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Smart City Transition for Urban Planning. Case studies from the Smart City projects in Bolzano and Trento

Ferrara, 04.03.2019
Palazzo Rovella

Interreg CENTRAL EUROPE
CitiEnGov
European Union
European Regional Development Fund

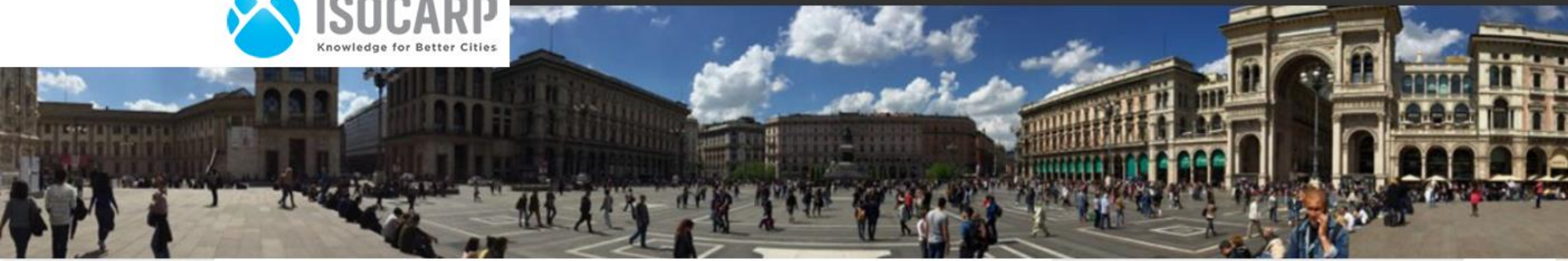
STARDUST
Enlightening european cities

Sinfonia

Daniele Vettorato

Credits: BLS – NOI TechPark Bolzano

ISOCARP
Knowledge for Better Cities



ISOCARP Institute

Centre of Urban Excellence

With over five decades of accumulated knowledge and expertise manifested in both our members and within the society, ISOCARP has initiated "The Institute" as a platform and formal body for generating and disseminating knowledge for better cities.

MEMBER LOGIN

Join our Global Network!

ISOCARP is the International Society of City and Regional Planners. Founded in 1965, we are a global association of over 700 experienced professionals, bringing together recognised and highly-qualified planners from more than 85 countries worldwide.

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Eurac Research – fondato nel 1992 a Bolzano, Alto Adige

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research

11 Applied Research Institutes – 450 Collaborators

onal Development

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ency Medicine

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Renewable Energies

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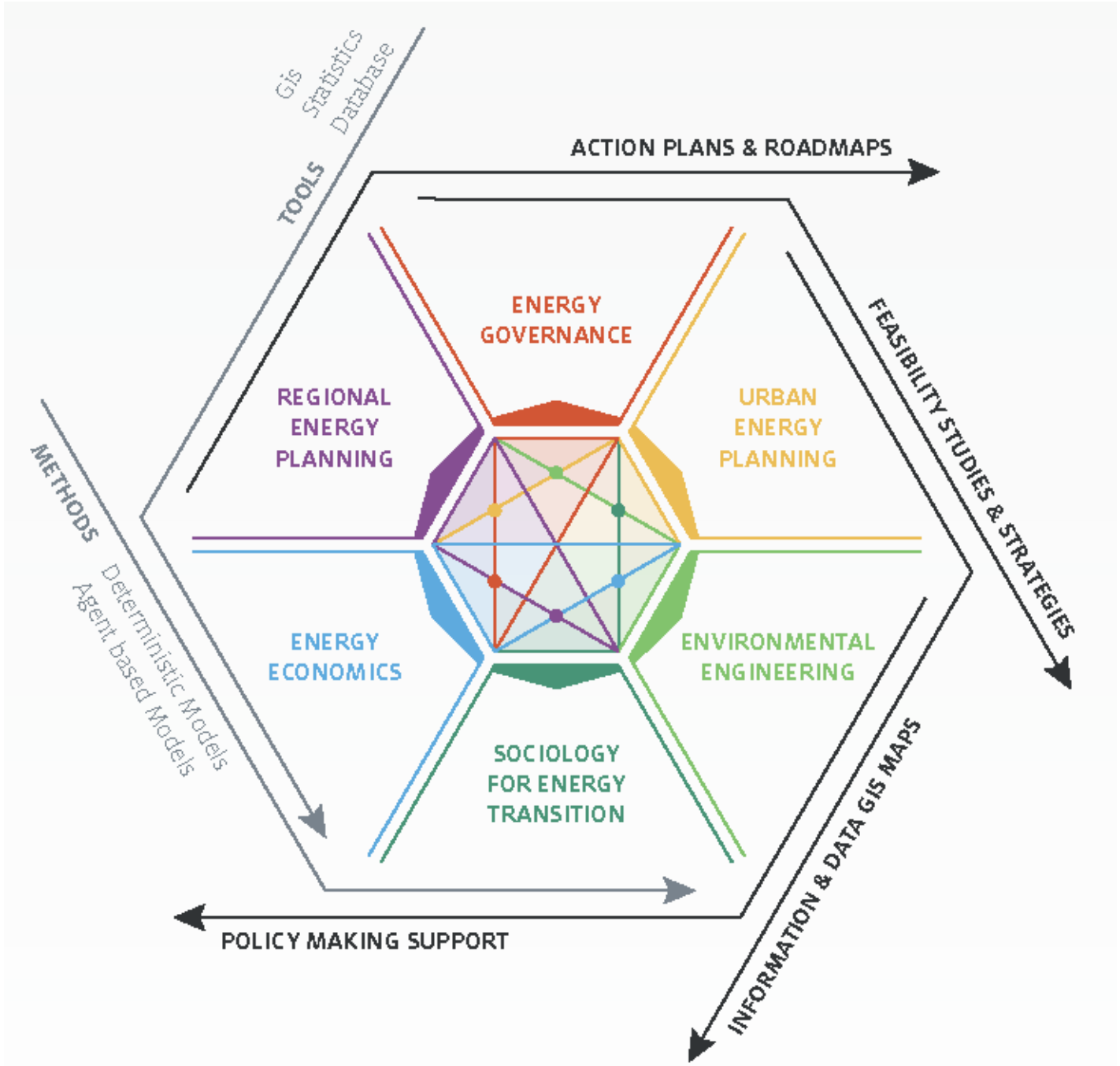


Urban and Regional Energy Systems

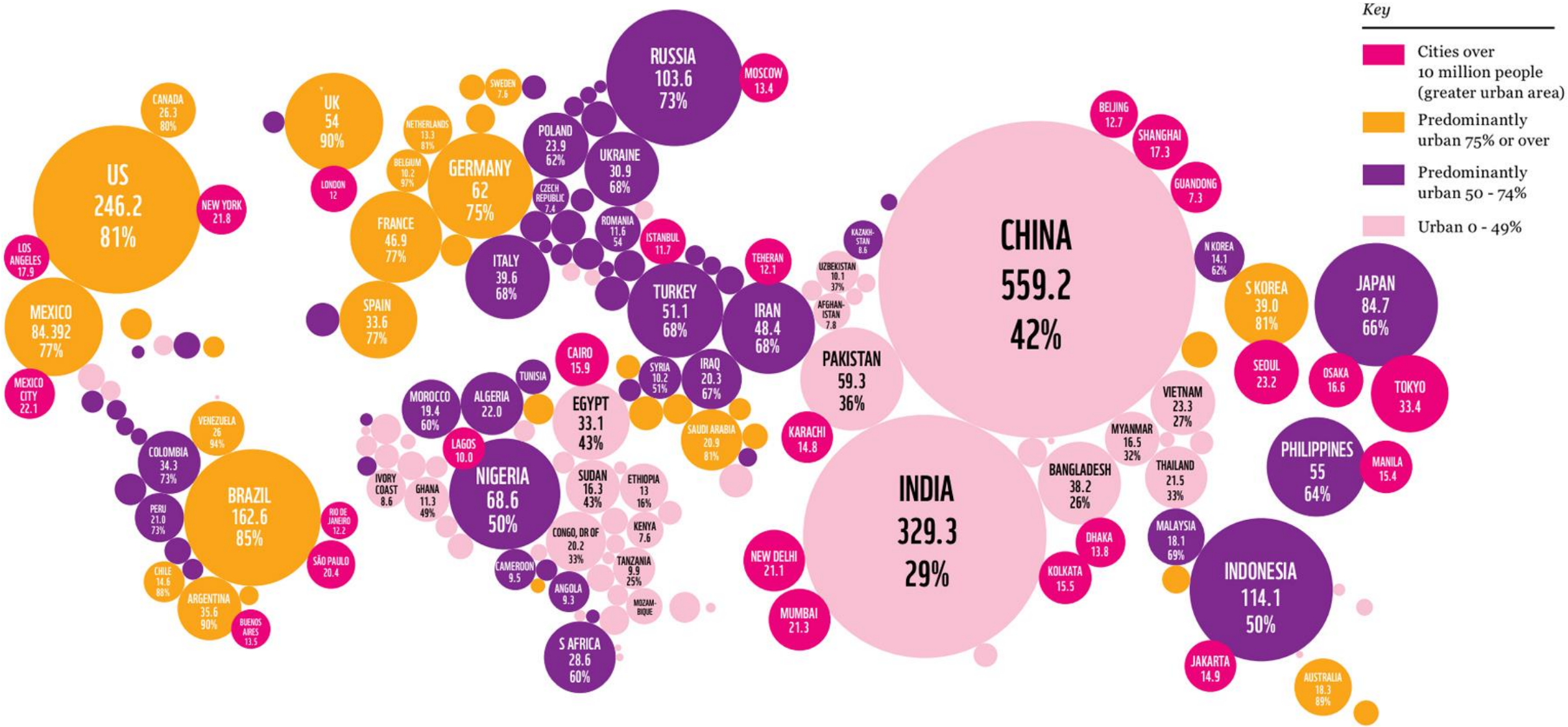
eurac research

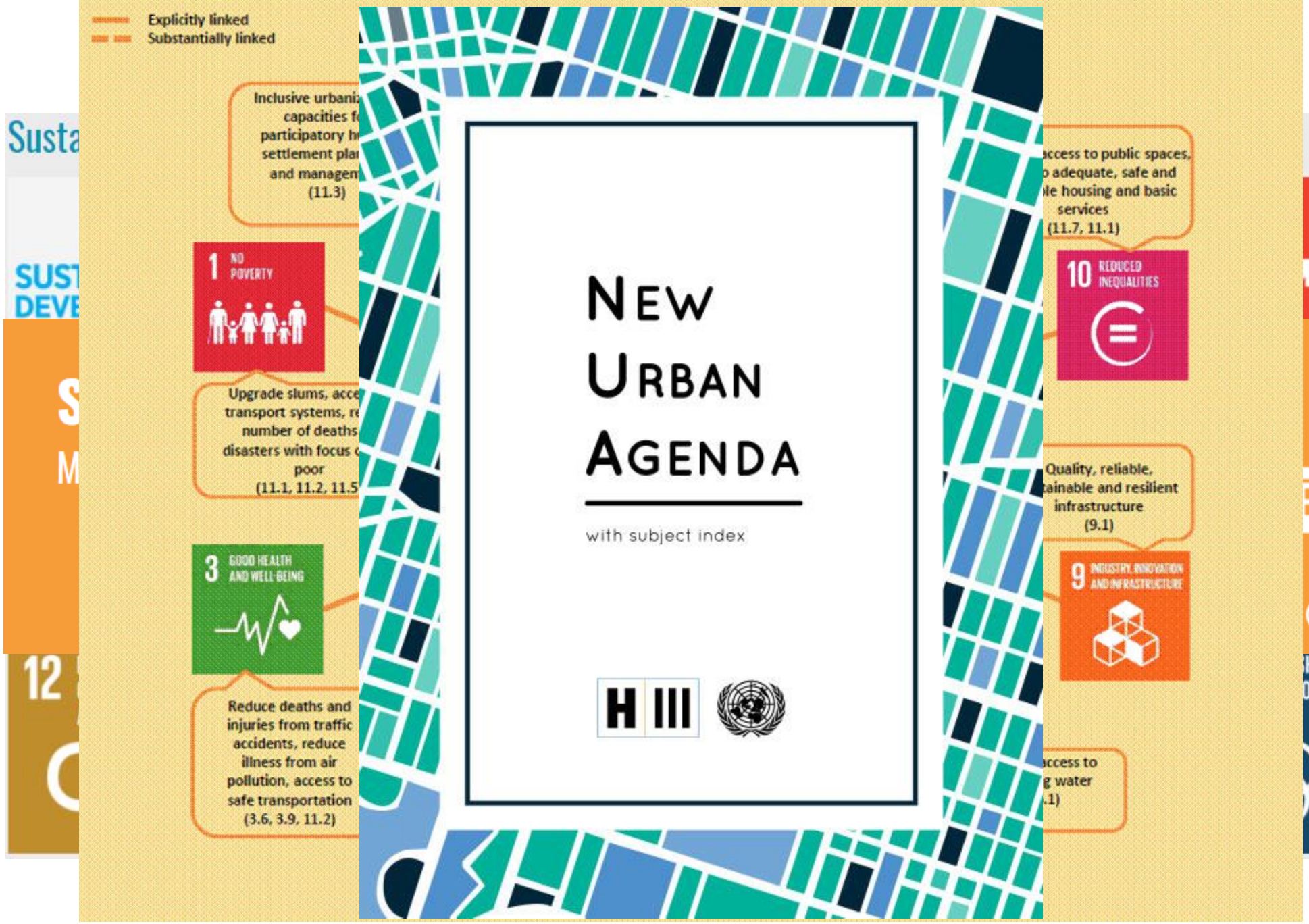
Smart Cities and Smart Regions

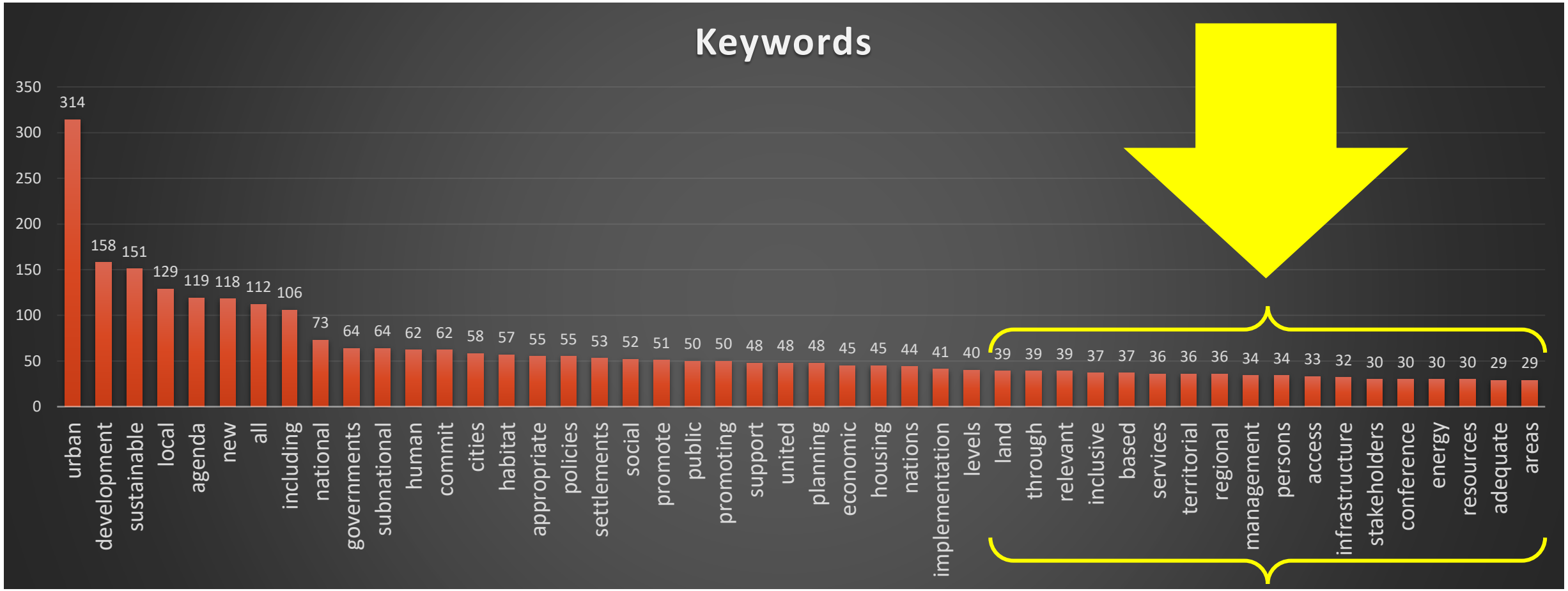
The context

IDM Alto Adige, Clemens Zahn

more than 50% of world population lives in cities

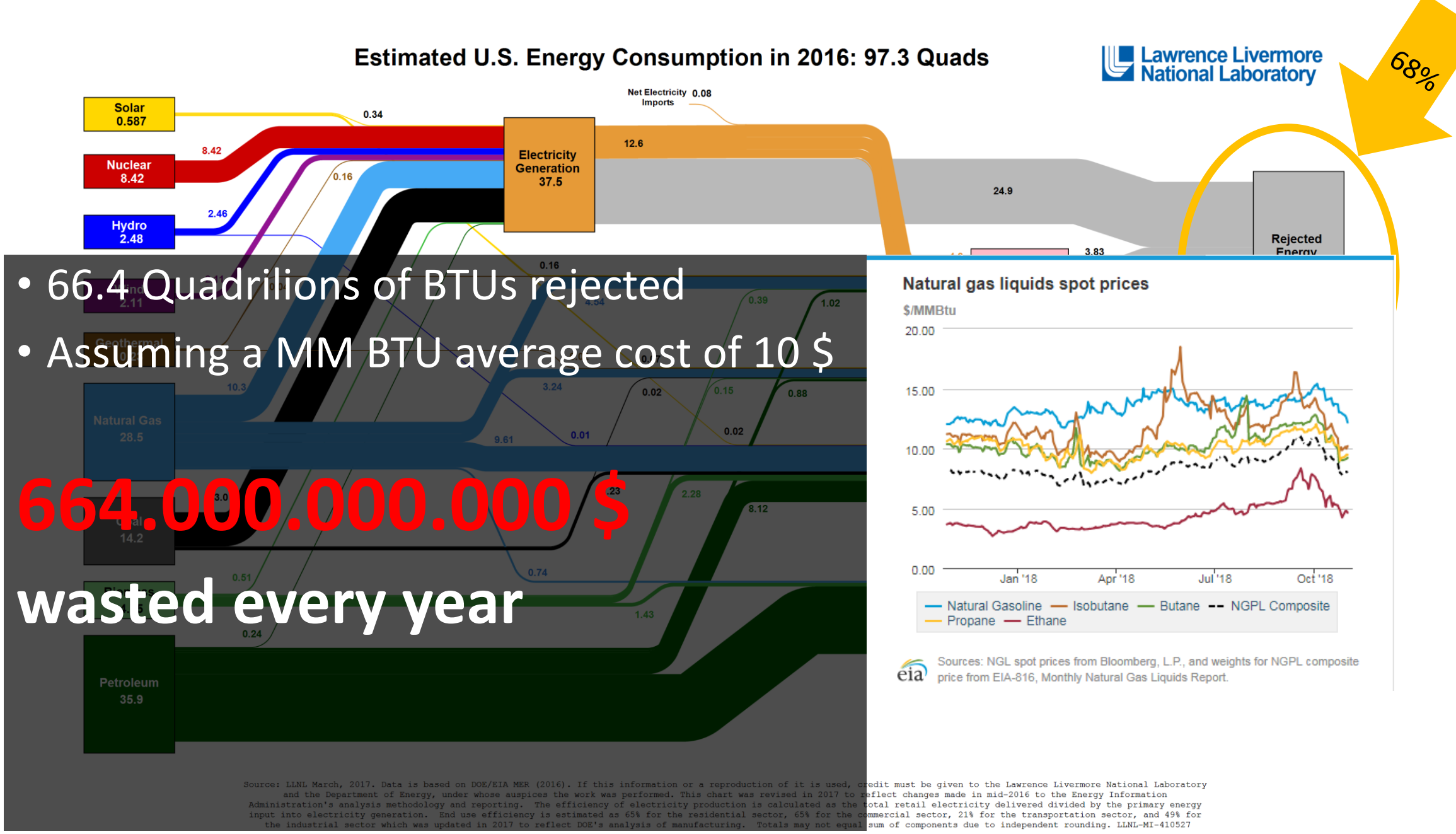



Explicitly linked
Substantially linked
Inclusive urbani
capacities f
participatory h
settlement pla
and managem
(11.3)
1 NO POVERTY
Upgrade slums, acce
transport systems, re
number of deaths
disasters with focus
poor
(11.1, 11.2, 11.5
3 GOOD HEALTH AND WELL-BEING
Reduce deaths and injuries from traffic accidents, reduce illness from air pollution, access to safe transportation (3.6, 3.9, 11.2)
ccess to public spaces,
adequate, safe and
le housing and basic
services
(11.7, 11.1)
10 REDUCED INEQUALITIES
Quality, reliable,
ainable and resilient
infrastructure
(9.1)
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
ccess to
g water
.1)
NEW URBAN AGENDA
with subject index
H III



(Source:Vettorato, 2018)

RESOURCES EFFICIENCY



- 66.4 Quadrilions of BTUs rejected
- Assuming a MM BTU average cost of 10 $

664.000.000.000 $

wasted every year

(Elaboration:Vettorato, 2018)

What is a Smart City?

SMART

CITY

SMART:

- Different
-
-

Smart cities are a leading manifestation of the internet of things (IOT): they involve the use of sensors – either standalone or added to physical devices – to generate data that can be communicated, integrated and analyzed to enable some aspect of city life to function better in some way. Data flows may be used singly or in combination with other flows, or in combination with historical (ie accumulated) data from the past.

News room > News releases >

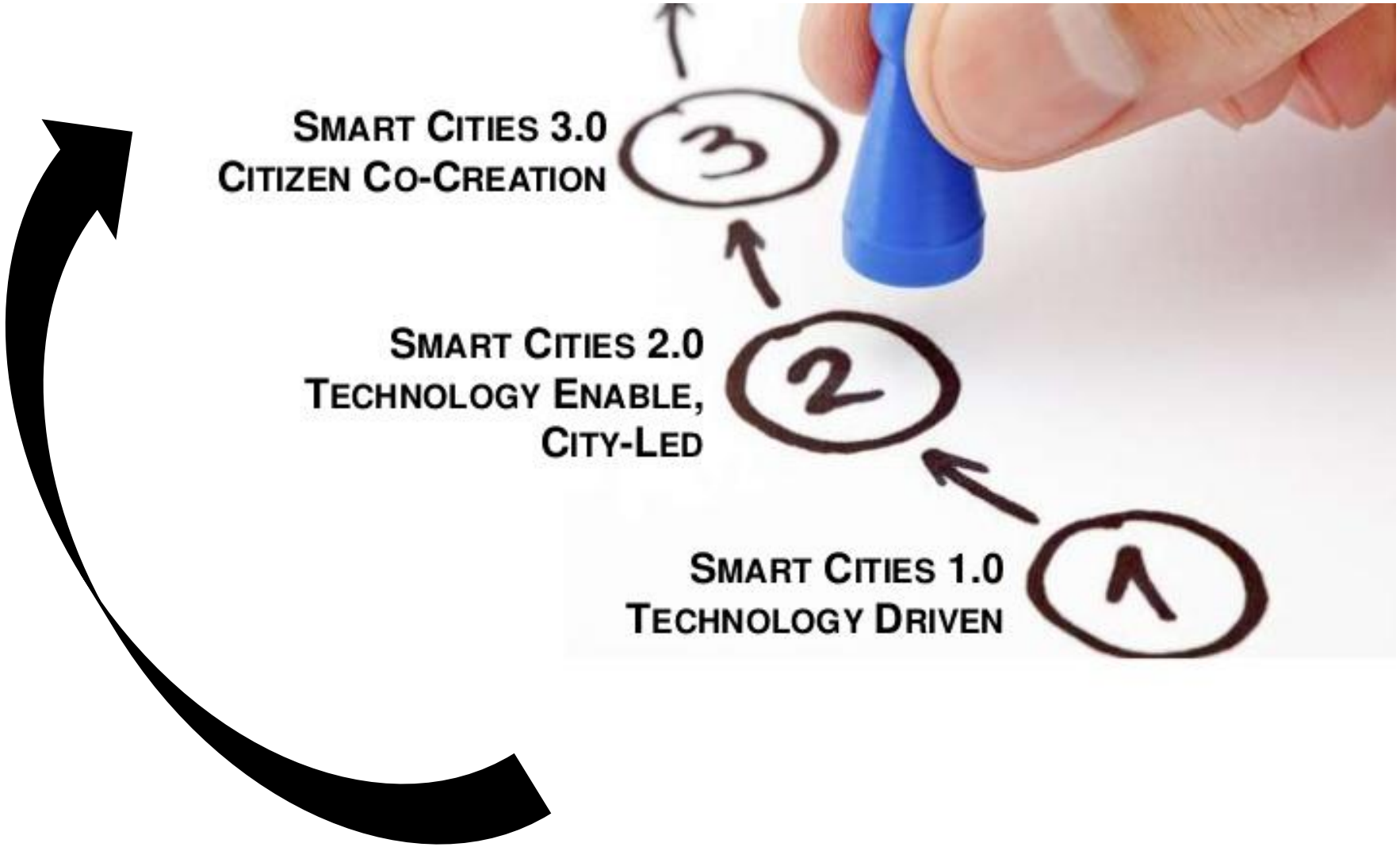
IBM Opens Smarter Cities Technology Centre in Ireland

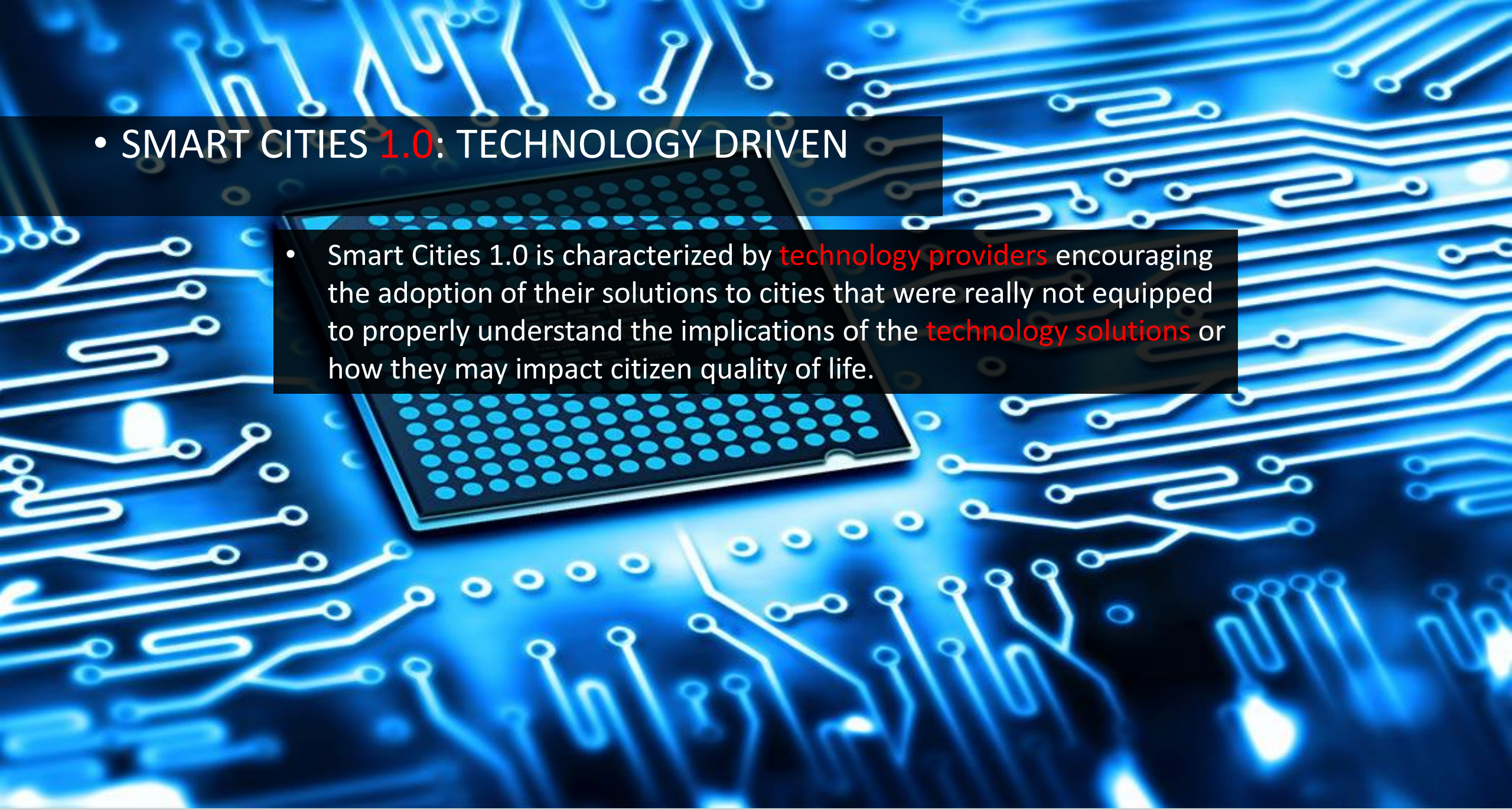
subject matter experts will work with city authorities, universities, small and large businesses as well as experts from IBM Research and the company's Software Development Lab in Ireland to research, develop and commercialise new ways of making city systems more connected, sustainable and intelligent.

Due in large part to the enormous modeling complexity and intensive computing resources required to build truly integrated systems, urban planners and local governments have traditionally

CITY:

- “a place where people live that is larger or more important than a town…”
- cities might be defined as social, economic, religious or cultural centers
- Thus, we can refer more easily also to “communities”

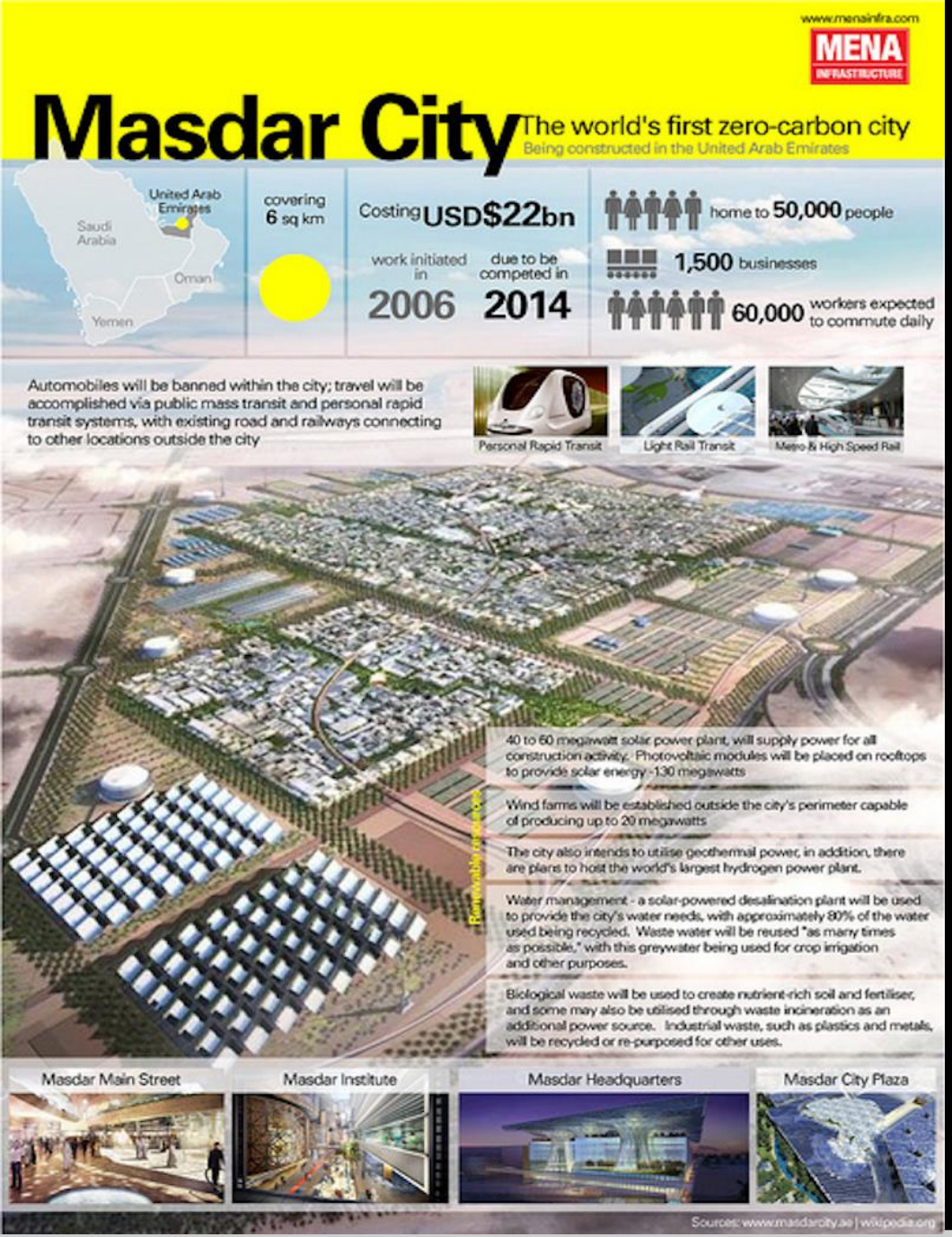

SMART CITIES 3.0
CITIZEN CO-CREATION
3
SMART CITIES 2.0
TECHNOLOGY ENABLE,
CITY-LED
2
SMART CITIES 1.0
TECHNOLOGY DRIVEN
1



• SMART CITIES 1.0: TECHNOLOGY DRIVEN

- Smart Cities 1.0 is characterized by technology providers encouraging the adoption of their solutions to cities that were really not equipped to properly understand the implications of the technology solutions or how they may impact citizen quality of life.


Why here?
Why this?
Citizens part of a larger efficient machine…



Masdar City to become the world's first green and net-zero energy in the world by 2016

Only about 5% of the original six square kilometer building area has been developed.

Developers expected 50,000 permanent residents and 40,000 commuters

In 2016, there are only 300 permanent residents of Masdar City and 1700 commuters

- SMART CITIES 2.0: TECHNOLOGY ENABLED, CITY-LED

  - This phase has been led by cities, as opposed to technology providers. In this generation, the municipality–led by forward-thinking mayors and city administrators–takes the lead in helping determine what the future of their city is and what the role is for the deployment of smart technologies and other innovations.


CityBikes app, App&Town, SOS info built thanks to **Open Data** of the City
ioT trash cans report their real-time status
ApparkB and Bicing encourage **smart mobility**
Smart City Campus Innovation Area to promote synergies and **innovation in urban solutions**
SMARTCITY
EXPO WORLD CONGRESS


BARCELONA Virtual Situation Room powered by CITYZENITH 5D Smart City
25 JUL 2014
BUILDINGS
ENERGY
DAY LIGHT
CAMERAS
100-80%
80-40%
40-20%
all layers

• SMART CITIES 3.0: CITIZEN CO-CREATION (COMMUNITIES) AND MULTIPLE BENEFITS

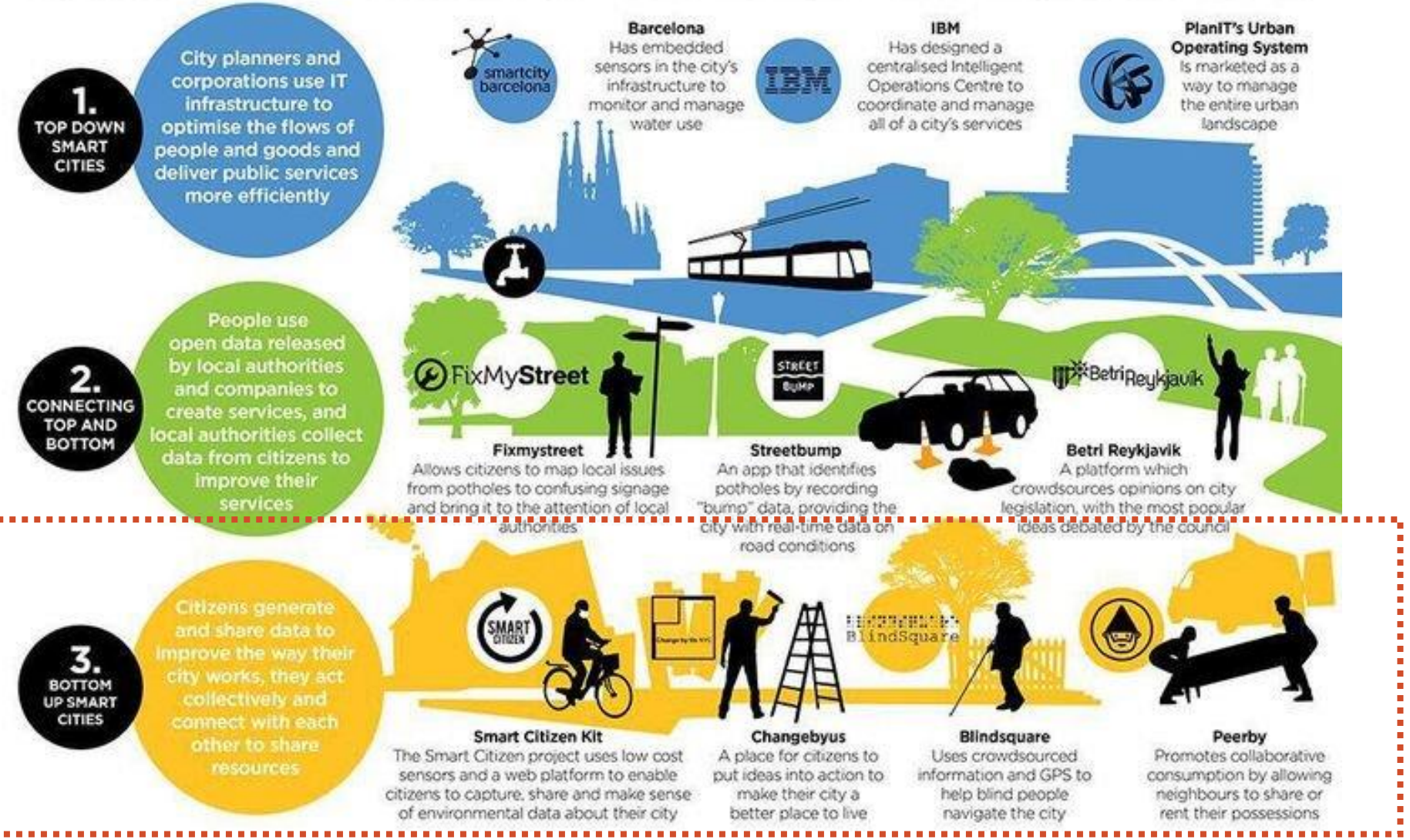
- smart cities are beginning to embrace citizen co-creation and multiple benefits models for helping to drive the next generation of smarter cities

- A living lab is a research concept. A living lab is a user-centered, open-innovation ecosystem, often operating in a territorial context, integrating concurrent research and innovation processes within a public-private-people partnership.

- The concept is based on a systematic user co-creation and multiple benefits approach integrating research and innovation processes. These are integrated through the co-creation, exploration, experimentation and evaluation of innovative ideas, scenarios, concepts and related technological artefacts in real life use cases.

SMARTER SMART CITIES

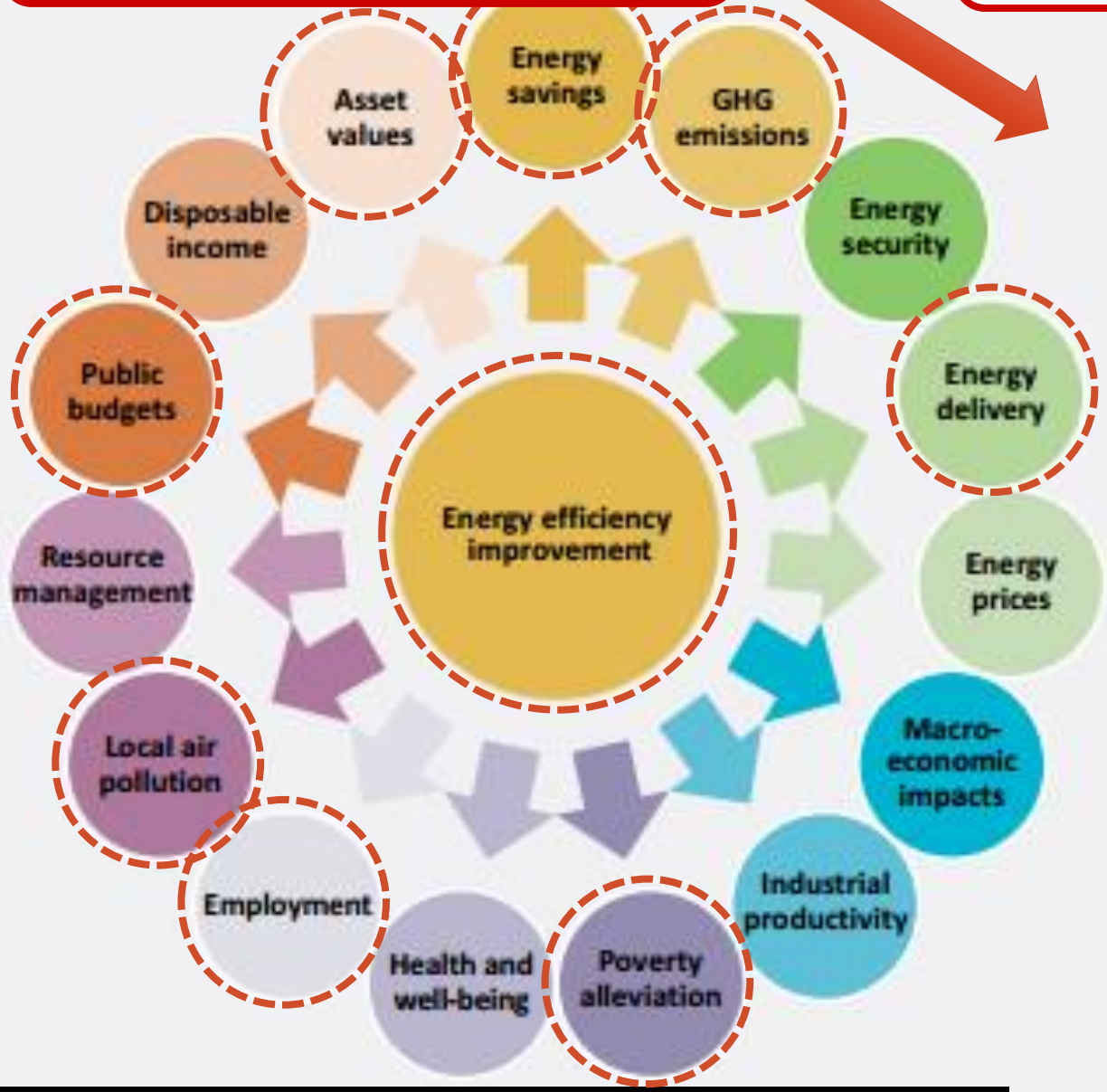
The "smart cities" agenda is mainly focused on top down technological initiatives (embedded sensors, data integration and analytics).
The real smart cities of the future will mobilise human intelligence as well as artificial intelligence, bottom up creativity as well as top down control.




QUADRUPLE HELIX MODEL
ACADEMIA
GOVERNMENT
INDUSTRY
USERS

ONE PROJECT

ONE GOAL



SEVERAL CO-BENEFITS

A co-benefit is any socio-economic and environmental positive effect related to the execution of a project, exceeding the primary goal, regardless if intentional or not.

Bisello & Vettorato 2016

Source: International Energy Agency (2014)

Source: http://www.powerpointninja.com/

MAIN TARGET

CO_2 (tons)
Energy (kWh)

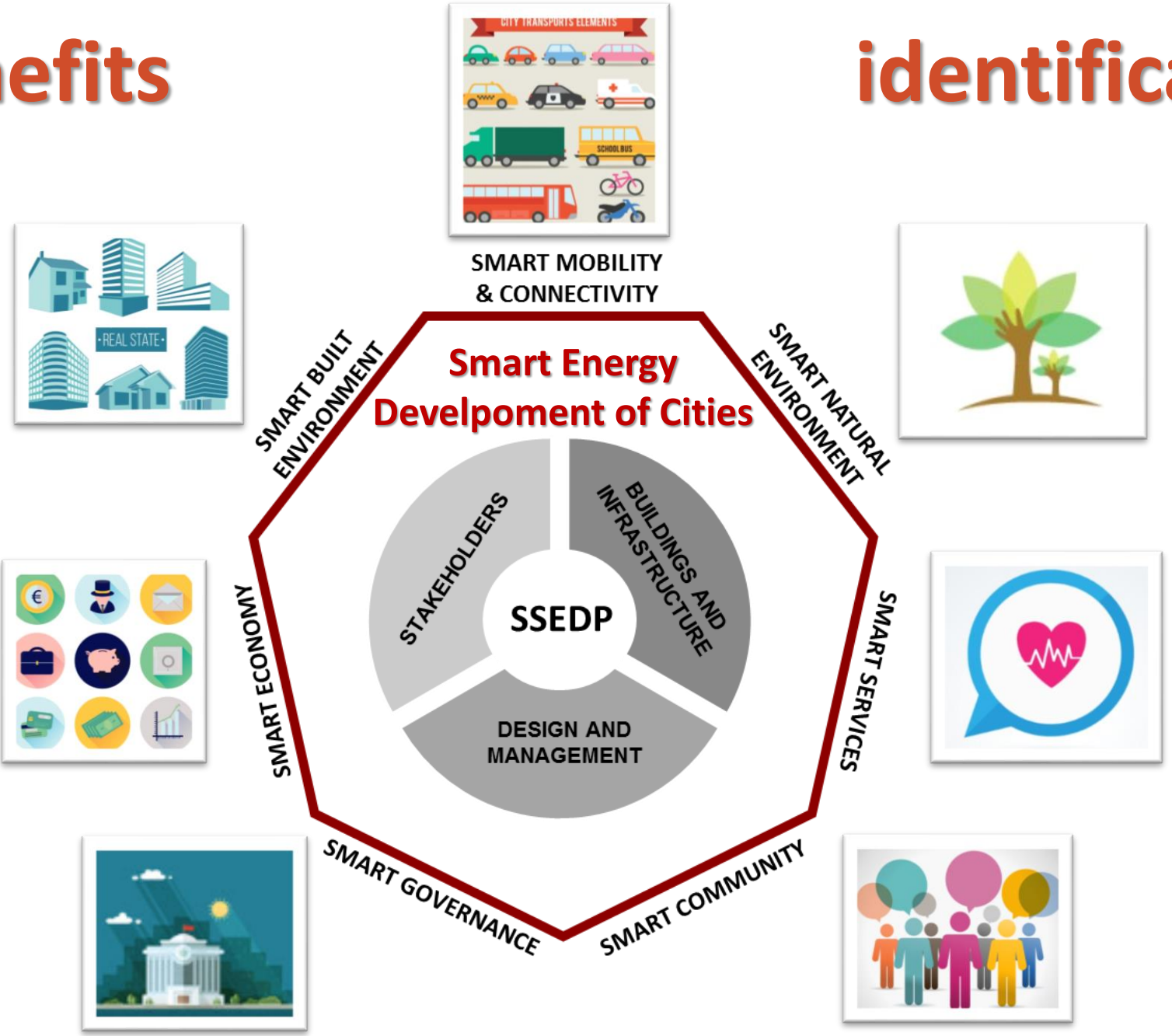
CO-BENEFITS

.....

.....

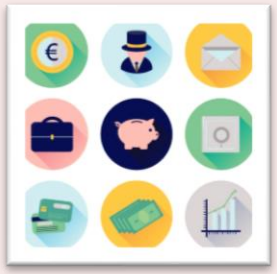
.....

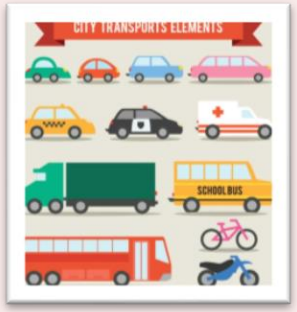
Co-benefits identification



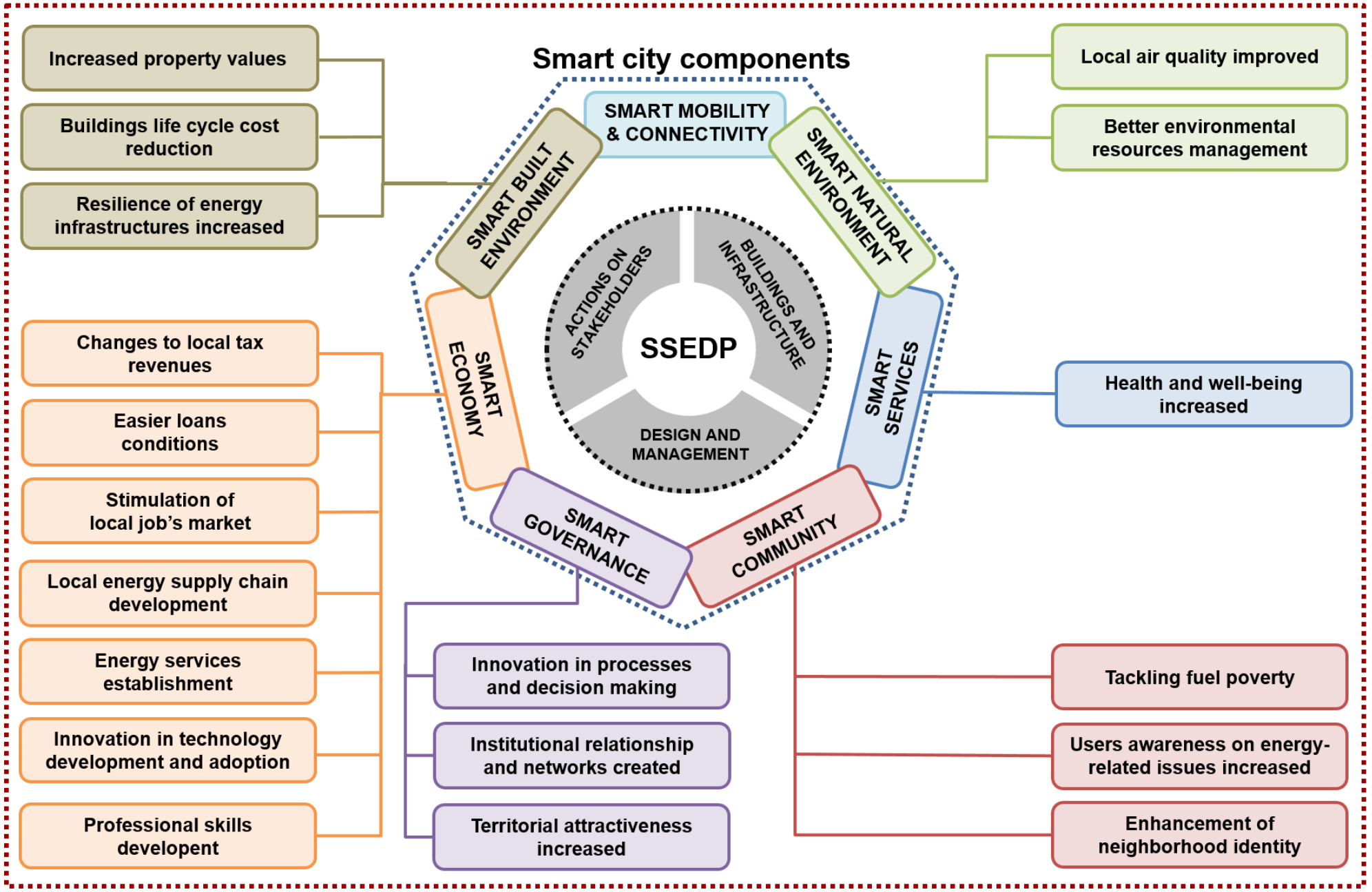
Bisello, Vettorato at al. 2016

	Smart natural environment	**Local air quality improved**
		Environmental resources management improved
	Smart services	**Health and well-being of residents increased**
	Smart community	**Fuel poverty tackled**
		Users awareness on energy-related issues increased
		Neighbourhood identity enhanced

	Smart governance	**Innovation in processes and decision-making**
		Territorial attractiveness increased
		Institutional relationship and networks created
	Smart economy	**Local labour market stimulated**
		Positive change in local tax revenue
		Softer loan conditions
		Local energy supply chain established
		Energy services developed
		Innovation in technology development and adoption
		Professional skills development

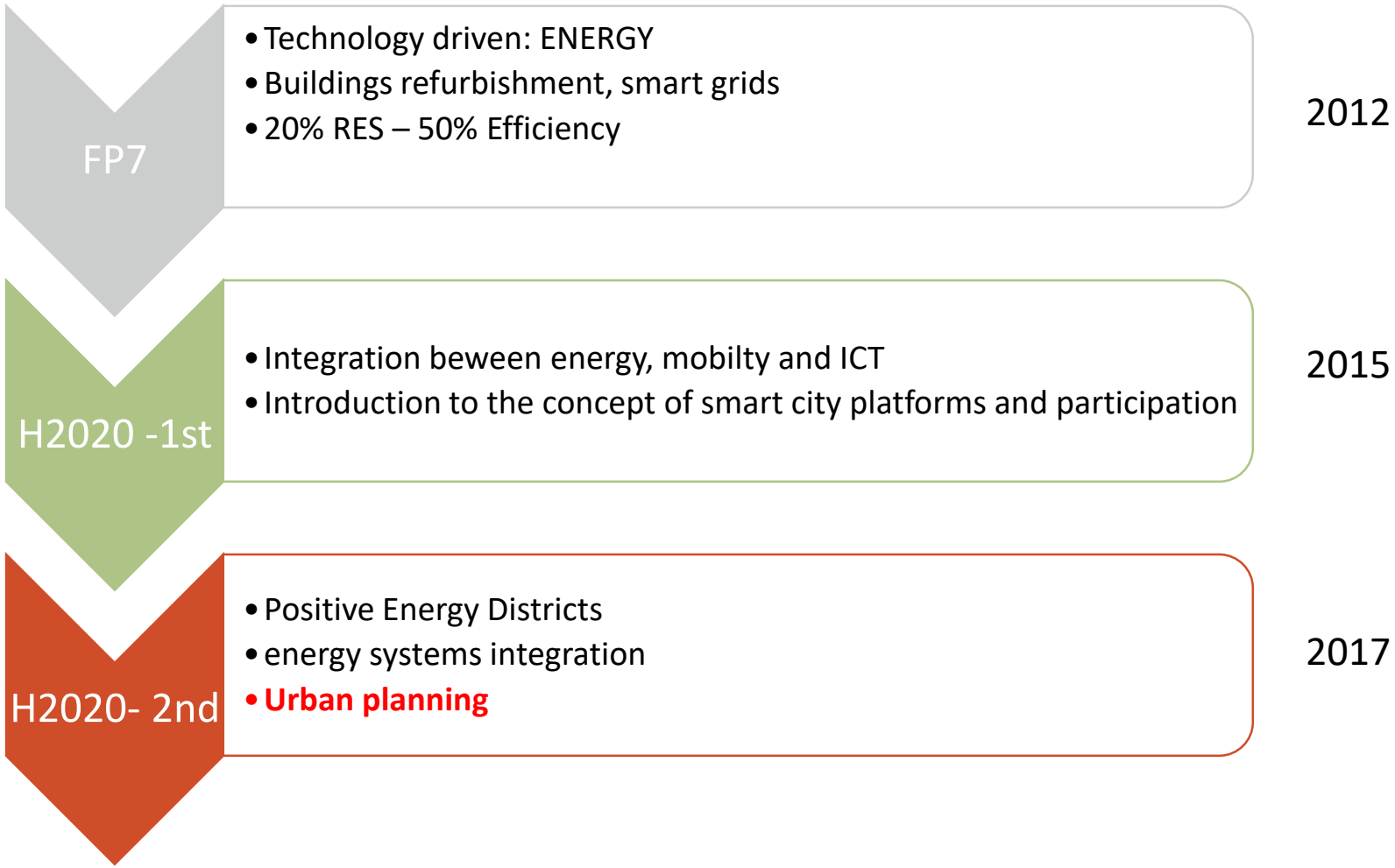
	Smart build environment	**Property value increased**
		Costs reduction of buildings life cycle
		Resilience of energy infrastructures increased
	Smart mobility & connectivity	**Reduced pollutant emissions** **Reduced numbers of veichles** **Optimized and integrated transport system**

Urban co-benefits framework



Bisello, Vettorato at al. 2016

THE EUROPEAN COMMISSION APPROACH TO SMART CITIES


FP7
• Technology driven: ENERGY
• Buildings refurbishment, smart grids
• 20% RES – 50% Efficiency
2012
H2020 -1st
• Integration beween energy, mobilty and ICT
• Introduction to the concept of smart city platforms and participation
2015
H2020- 2nd
• Positive Energy Districts
• energy systems integration
• Urban planning
2017

The 2 Smartcity projects in Eurac Research

SINFONIA

Financed by EU FP7 Program
Started in 2014 | **will end in** 2020
Web sinfonia-smartcities.eu

STARDUST

Financed by EU Horizon 2020 Program
Started in 2017 | **will end in** 2022
Web stardustproject.eu

eurac research

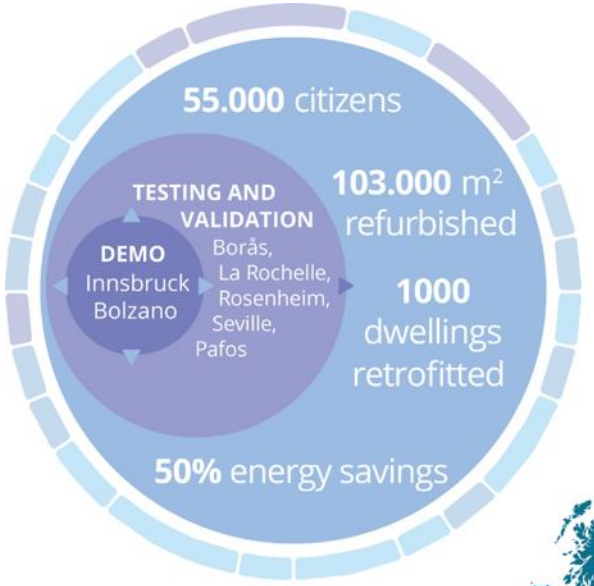
Demo sites

2 pilot cities:

- **Bolzano**
- Innsbruck

5 Early adopter cities:

- Borås
- Pafos
- Sevilla
- La Rochelle
- Rosenheim



Project numbers

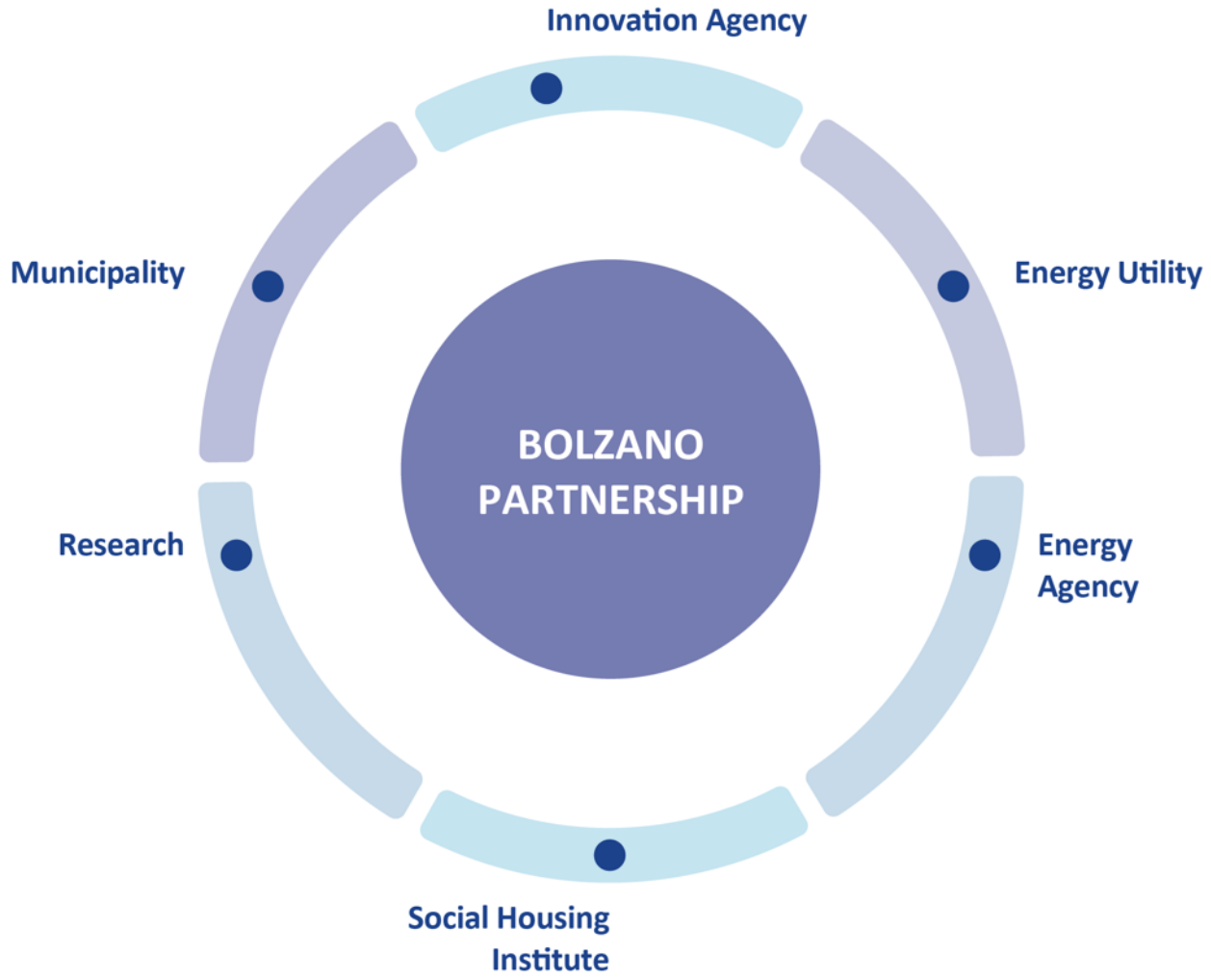
Total budget

- 43 million €

Co-financing by EU

- 27 million €

Overall investment in the region is over 30 million € as building efficiency measures are running in parallel with a massive extension of district heating in Bolzano.



Sinfonia

eurac research · Città di Bolzano Stadt Bozen · WOBI IPES · alperia · KlimaHaus CasaClima · IDM Südtirol Alto Adige

A city is changing

Building Passeggiate dei Castani, Comune di Bolzano. Credits: Eurac Research

Comune di Bolzano: Passeggiata dei Castani

236 kWh/m² year

Credits: IDM, Michelangelo

Before refurbishment

22 kWh/m² year

Credits: Studio Mellano

After refurbishment

The shown figures include energy consumption for heating, domestic hot water and lightning and consider renewable energy production onsite after refurbishment

Passeggiata dei Castani building after refurbishment, Comune di Bolzano. Credits: Eurac Research

Comune di Bolzano: Via Aslago

264*
kWh/m²
year

Credits: IDM, Ivo Corrà

Before refurbishment

26
kWh/m²
year

Credits: Area Architetti Associati

After refurbishment

The shown figures include energy consumption for heating, domestic hot water and lightning and consider renewable energy production onsite after refurbishment

Via Aslago in an advanced phase of refurbishment, Comune di Bolzano. Credits: Eurac Research

IPES: Via Brescia-Cagliari

220 kWh/m² year

Credits: IDM, Ivo Corrà

48 kWh/m² year

Credits: Studio Tecnico Vettori

Before refurbishment

After refurbishment

The shown figures include energy consumption for heating, domestic hot water and lightning and consider renewable energy production onsite after refurbishment

Via Brescia after refurbishment, IPES. Credits: Eurac Research

IPES: Via Similaun

211 kWh/m² year

Credits: AREA Architetti Associati - Andrea Fregoni - Roberto Pauro

Before refurbishment

45 kWh/m² year

Credits: AREA Architetti Associati - Andrea Fregoni - Roberto Pauro

After refurbishment

The shown figures include energy consumption for heating, domestic hot water and lightning and consider renewable energy production onsite after refurbishment

Via Similaun in advanced phase of refurbishment, IPES. Credits: Eurac Research

IPES: Via Palermo

204 kWh/m² year

Credits: Eurac Research, Ivo Corrà

Before refurbishment

47 kWh/m² year

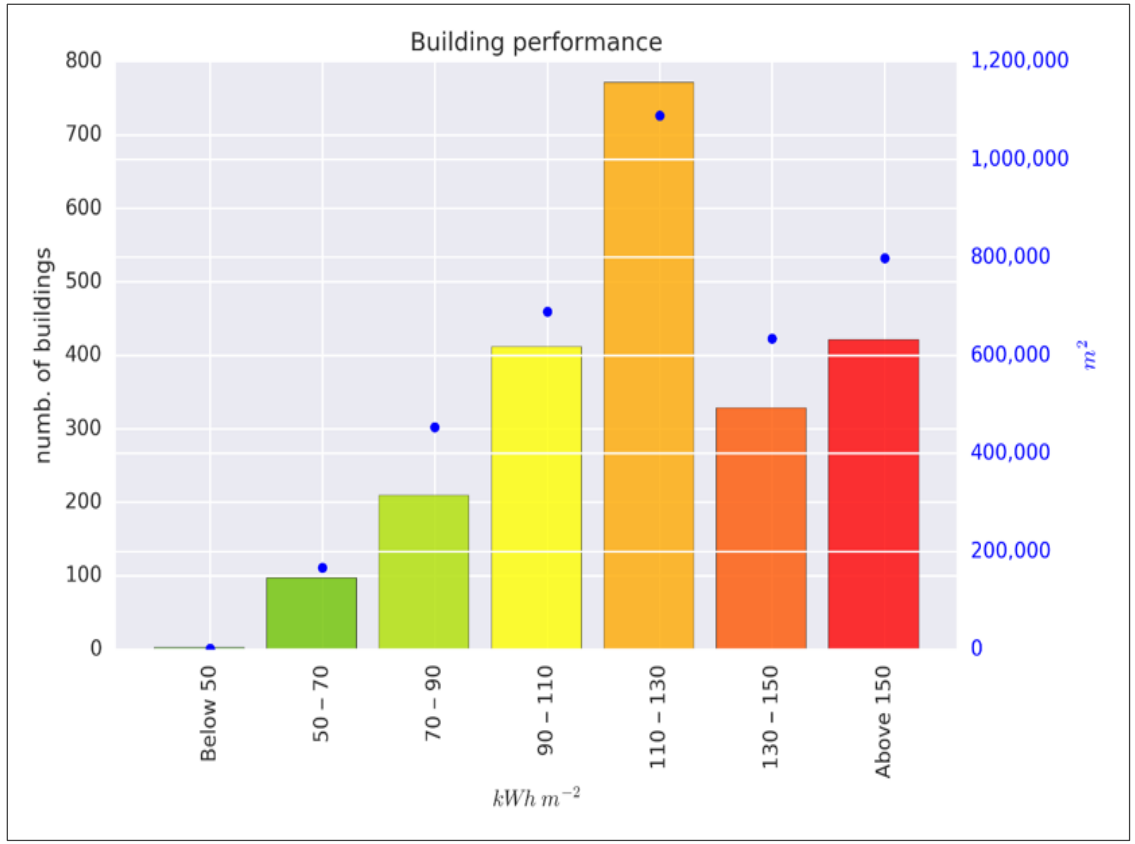
Credits: Laboratorio di Architettura

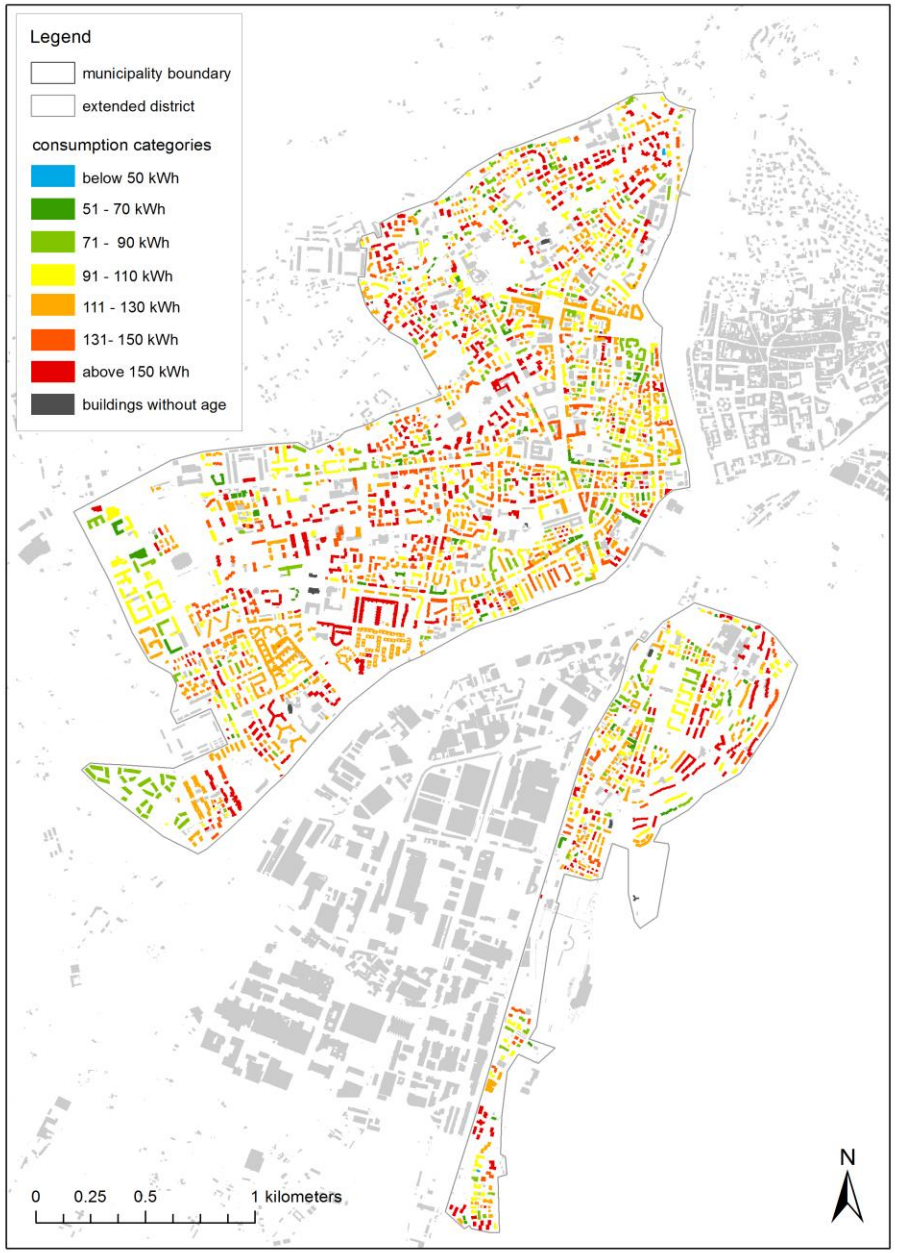
After refurbishment

The shown figures include energy consumption for heating, domestic hot water and lightning and consider renewable energy production onsite after refurbishment

Via Palermo refurbishment works ongoing, IPES. Credits: Eurac Research

The thermal (in)efficiency of the buildings of Bolzano

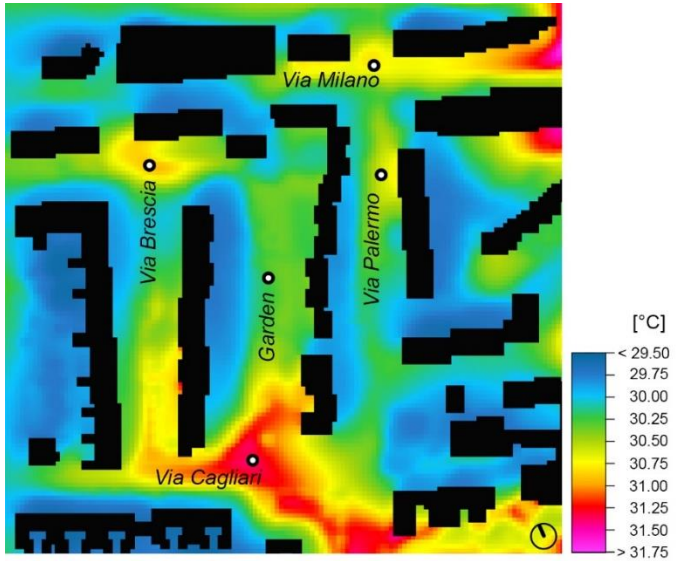


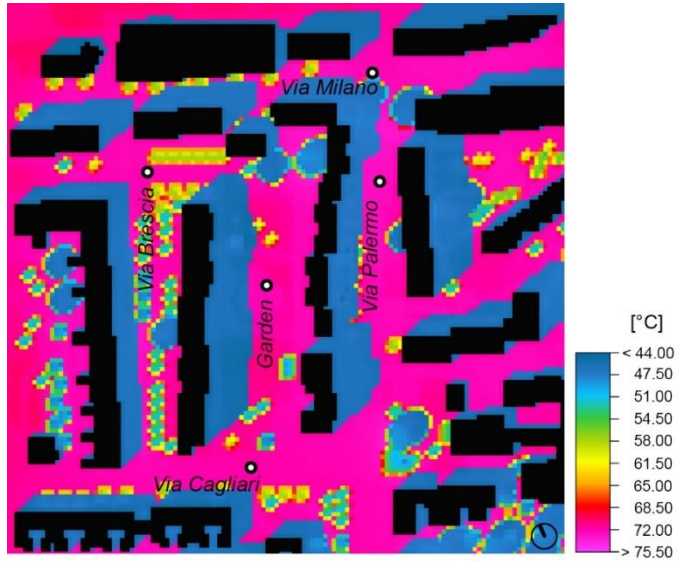


Thermal energy consumption of the buildings in single districts in Bolzano. Credits: Eurac Research

Current environmental conditions

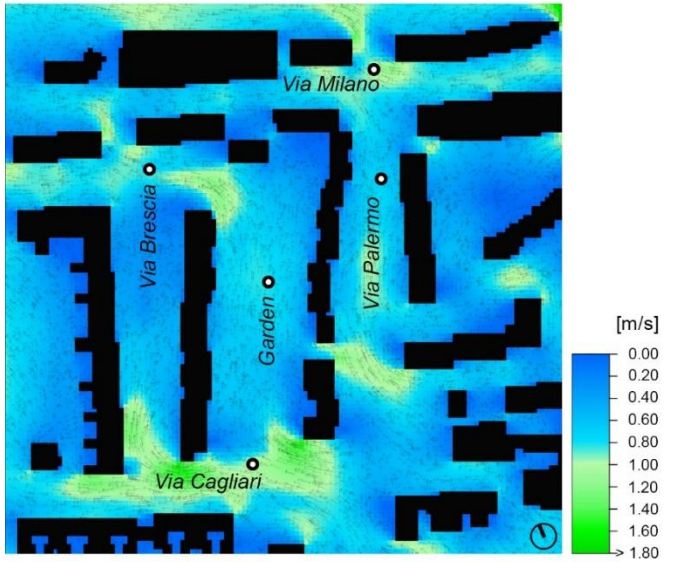
Air Temperature

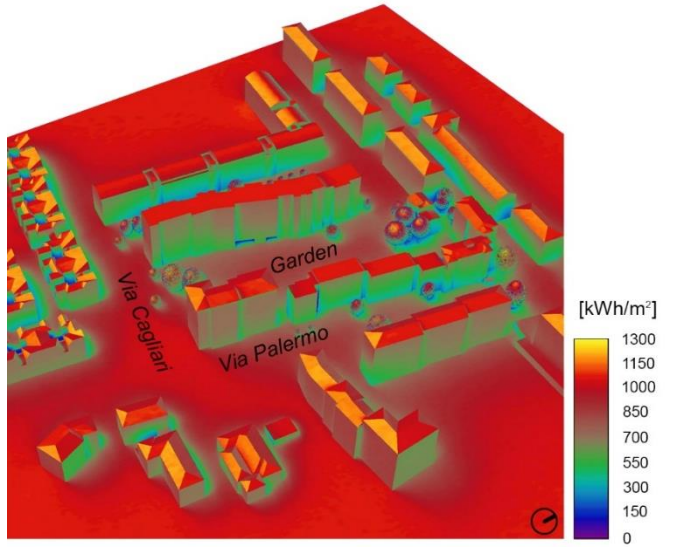




Mean Radiant Temperature

Urban Airflow





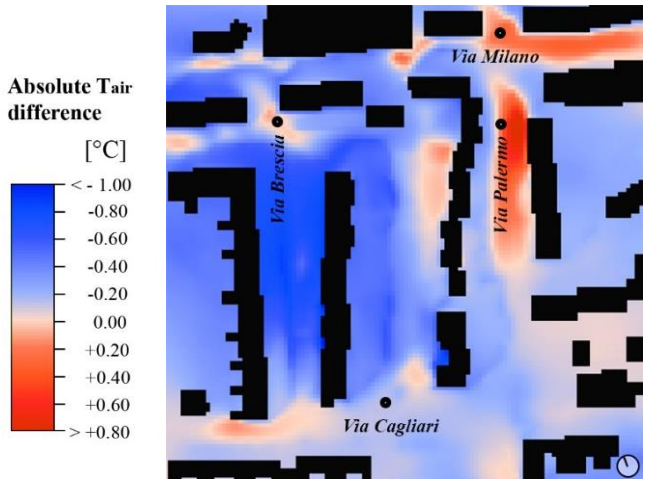
Annual Solar Irradiation

Current environmental conditions

Green Solutions

Façades: vertical greening

Roofs: horizontal greening

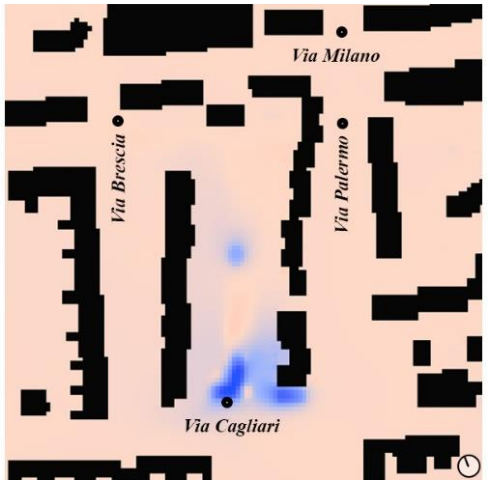


T_{air} reduction up to – 0.95 °C

Due to the reduction of W_s in proximity of the buildings (ΔW_s = - 0.80 m/s), T_{air} increases in *Via Milano* and *Via Palermo* hotspots (ΔT_{air} = + 0.90 °C)

Water Solutions

Water body close to *Via Cagliari* hotspot

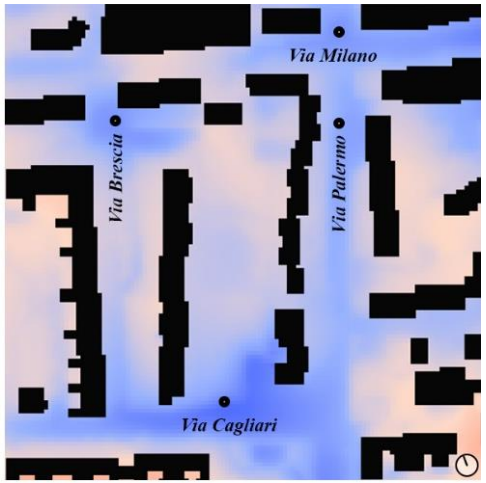


T_{air} is reduced only in proximity of the water bodies (max ΔT_{air} = - 0.70 °C)

Smart Coats

Roads: cool asphalt

Roof: cool paint



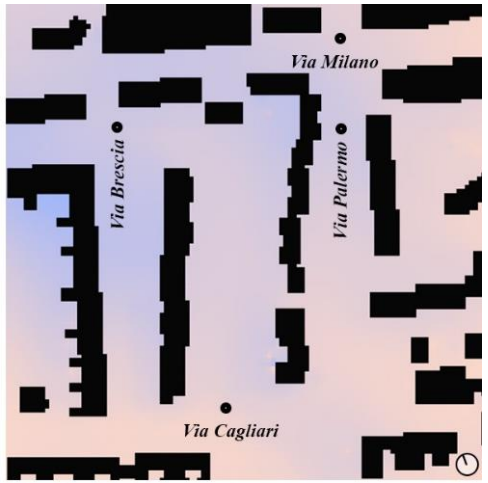
T_{air} reduced in all canyons (max ΔT_{air} = - 0.60 °C)

Roads: average ΔT_s = - 2.50°C

Solar Energy Systems

Façades: BIPV on surfaces with suitable Irr_{SW}

Roofs: PV panels



$Irr_{SW} \geq 950$ kWh/m^2 on 6 500 m^2 of building envelope

T_{air} almost unvaried (max ΔT_{air} = - 0.18 °C)

W_s unvaried

Figures: Comparison between current conditions and simulated scenarios Absolute air temperature difference

Final integrated scenario

Systemic integration of several surface usages

COOL ASPHALT

PV PANELS
on most irradiated
roof surfaces

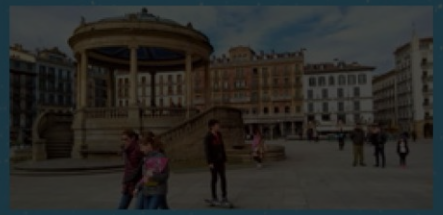
COOL PAINT
on the remaining
roof areas

Introducing STARDUST

A constellation of 7 European cities that interweaves imagination and innovation to create a brighter tomorrow

LIGHTHOUSE CITIES

Exemplary models of smart, highly efficient and citizen-oriented cities



PAMPLONA
The Spanish capital of renewable energy
Spain
198K inhabitants
25 km² of land

TAMPERE
The Centre of Finnish Industry
Finland
228K inhabitants
523 km² of land

TRENTO
The Painted City
Italy
117K inhabitants
158 km² of land

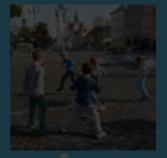
FOLLOWER CITIES

Revealing bankable and replicable blueprints for a sustainable future

CLUJ-NAPOCA
The Heart of Transylvania
Romania
300K
180 km²

DERRY
The Maiden City
United Kingdom
150K
1,245 km²

KOZANI
The City of Books
Greece
50K
1,071 km²



LITOMĚŘICE
The Garden of Bohemia
Czech Republic
24K
18 km²

STARDUST
TRENTO

The Project

eurac research

STARDUST
TRENTO

Total budget

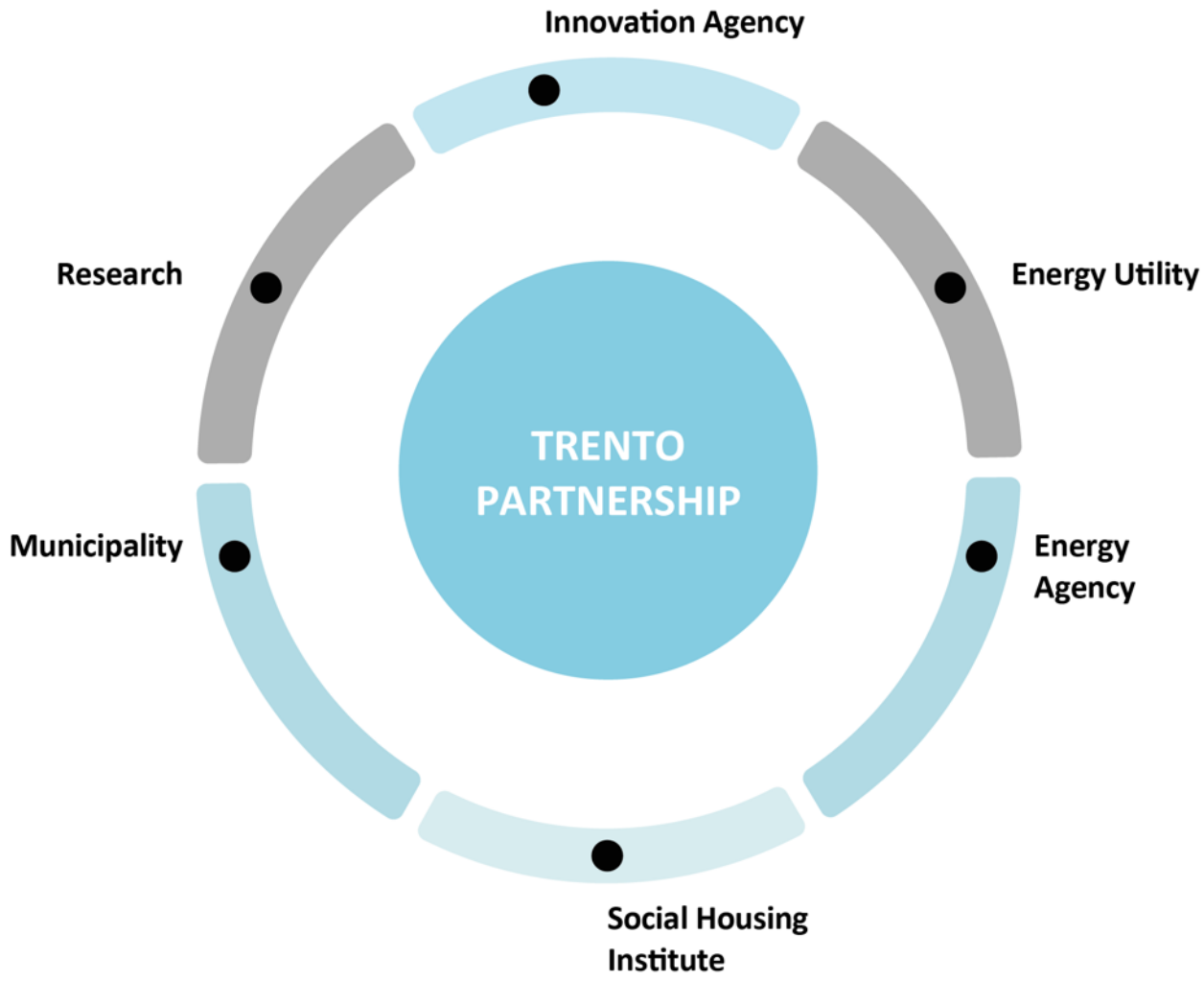
21 Milions €

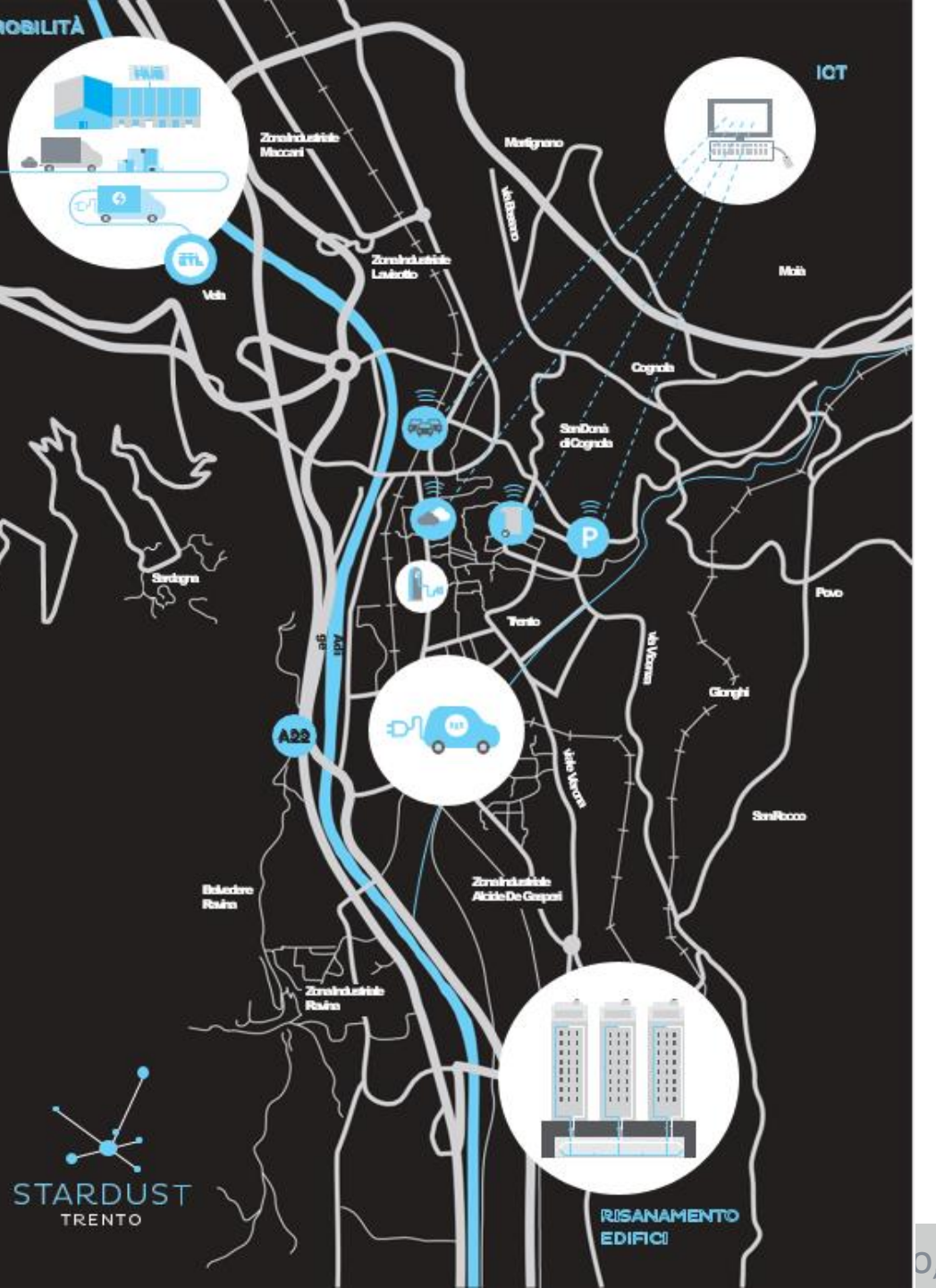
EU contribution

18 Milions €

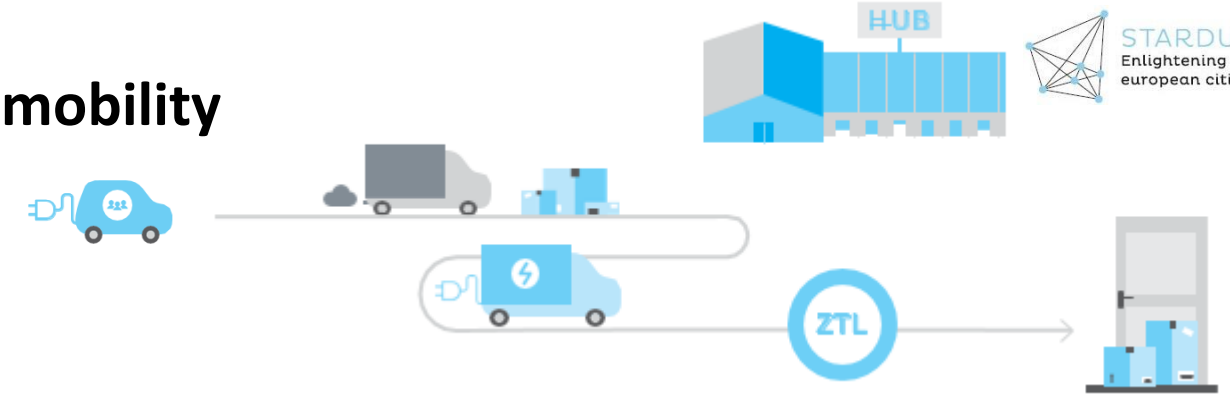
Trento budget

6,5 Milions €



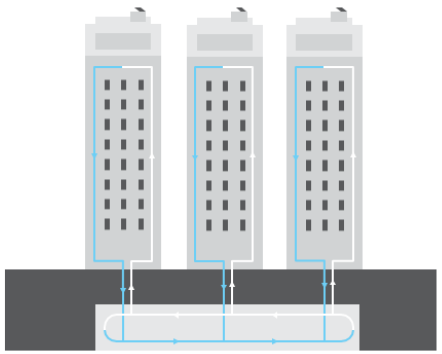


mobility



ICT

buildings



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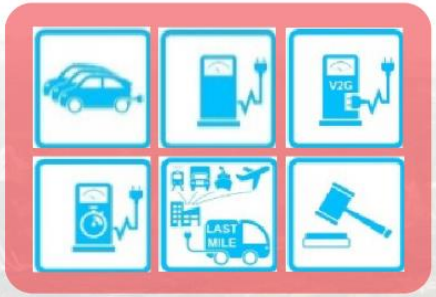

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E-mobility + Car sharing

IL DISTRETTO URBANO
Rinnovo energetico

N

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The District In Trento

Trento

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Image source: Flickr/absoluly

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3 Buildings selection

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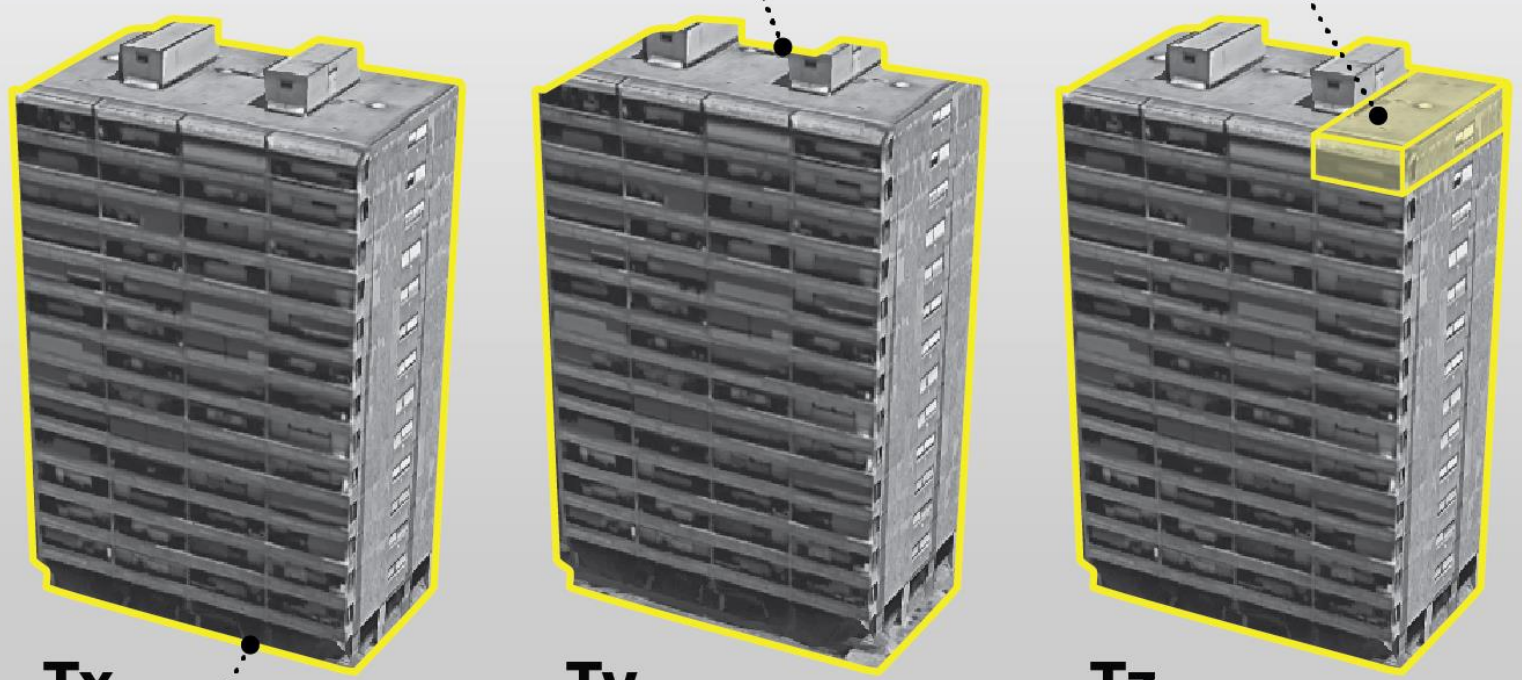
52 total apartments

89 m² each apartment



Tx Ty Tz

3 BUILDINGS 156 TOTAL APARTMENTS 15.330 TOTAL m²

A. Segata

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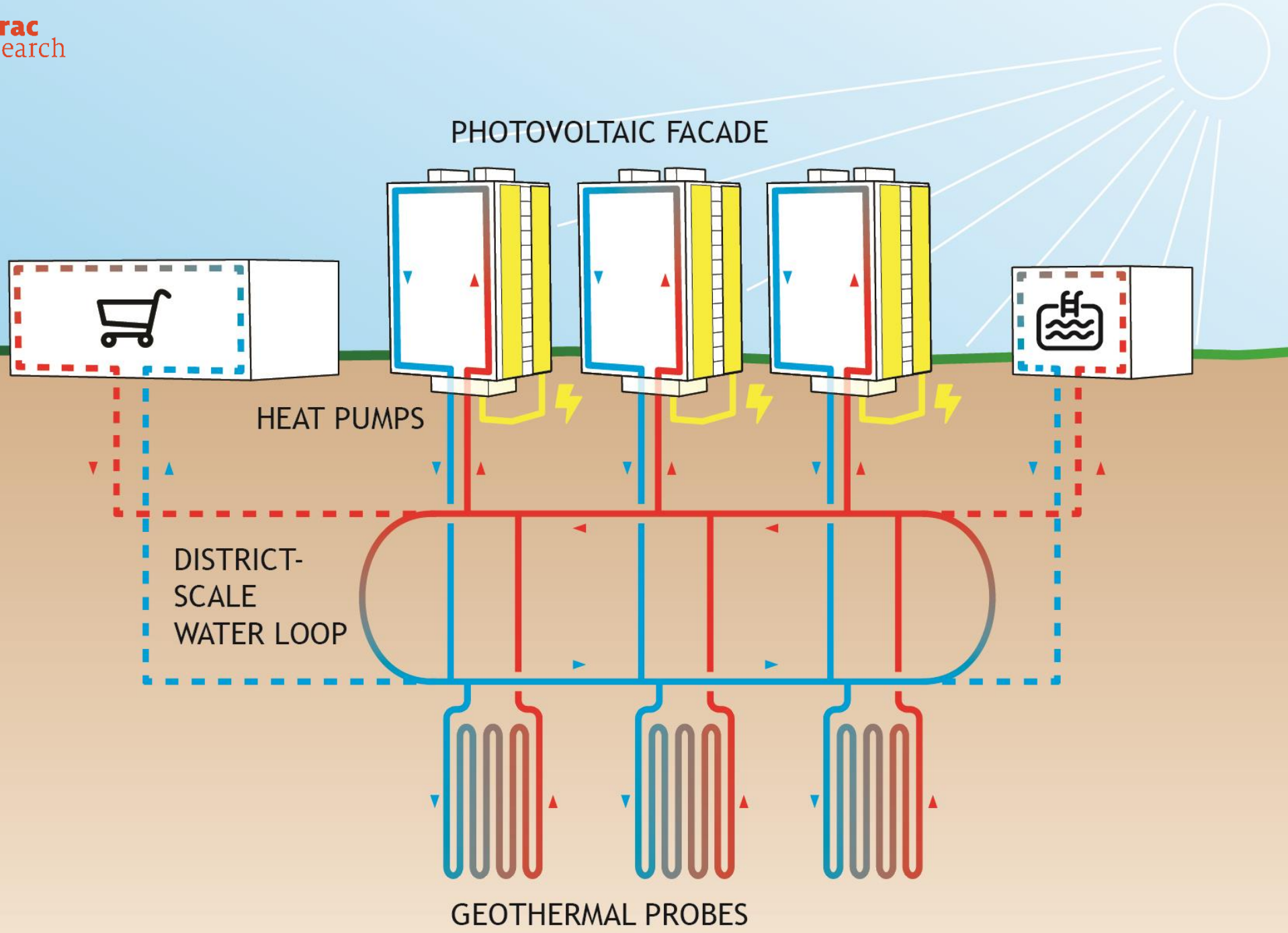

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The Energy concept

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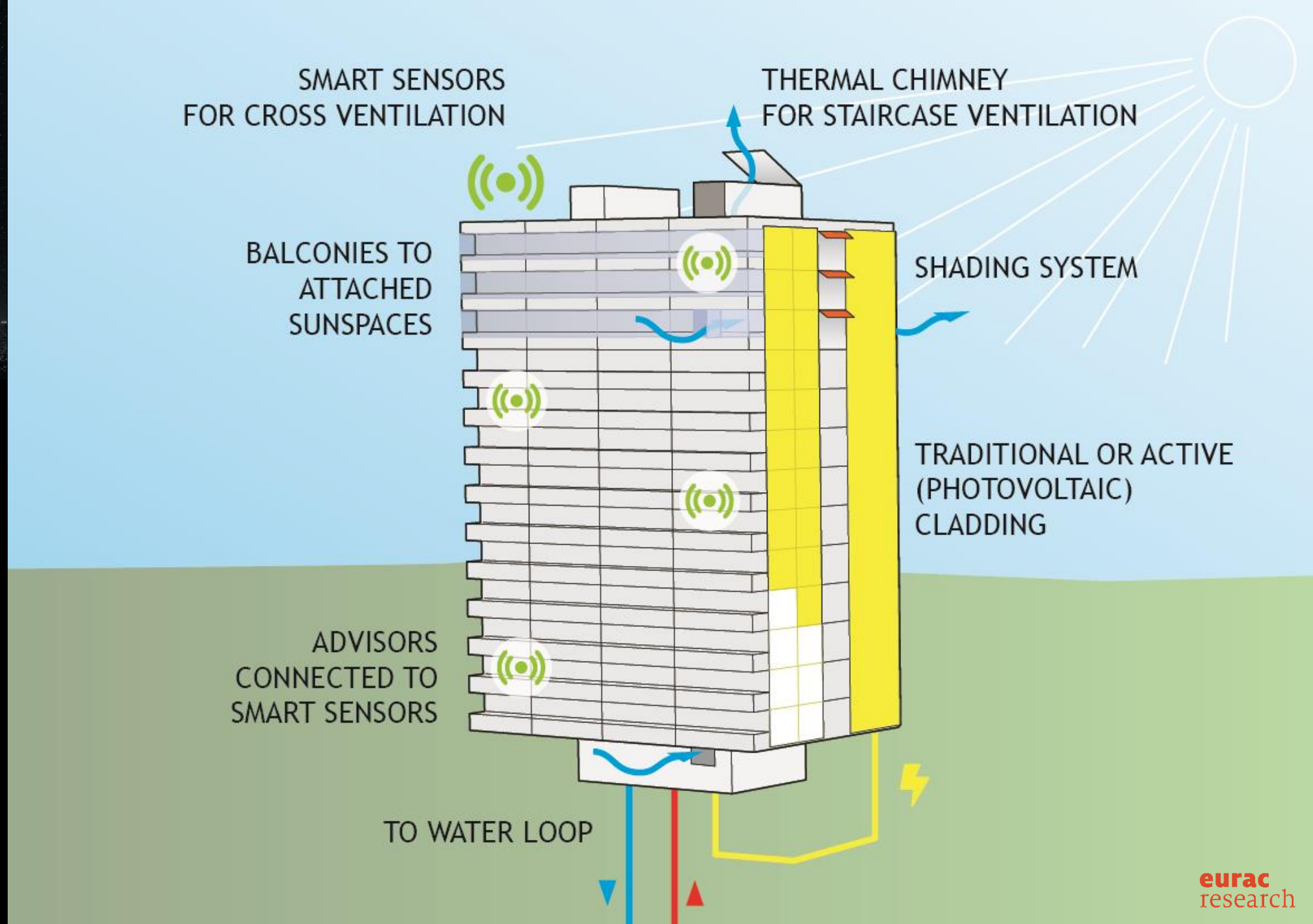
Interventions on the buildings



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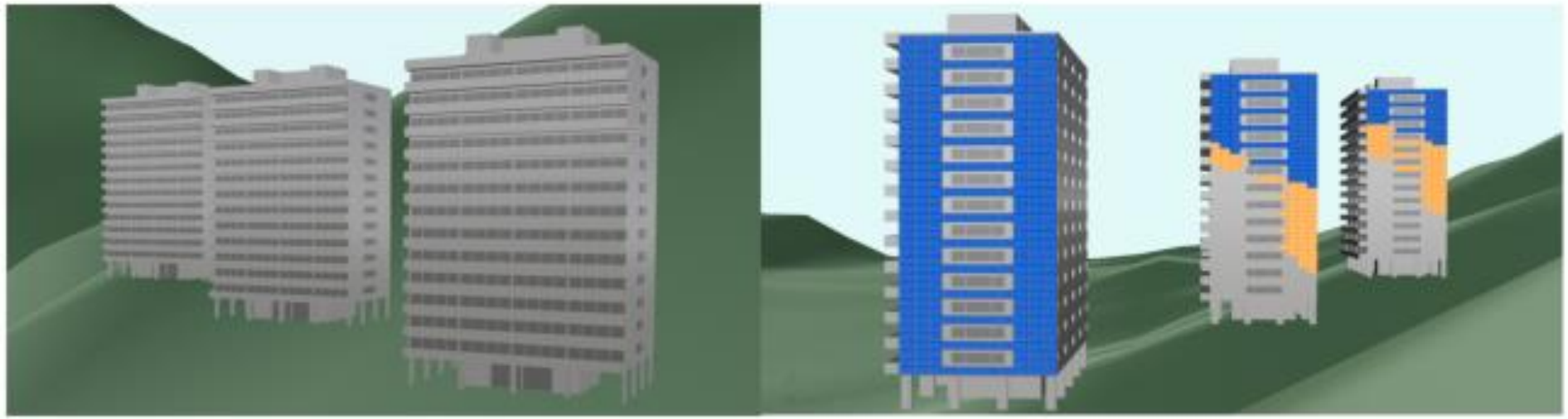
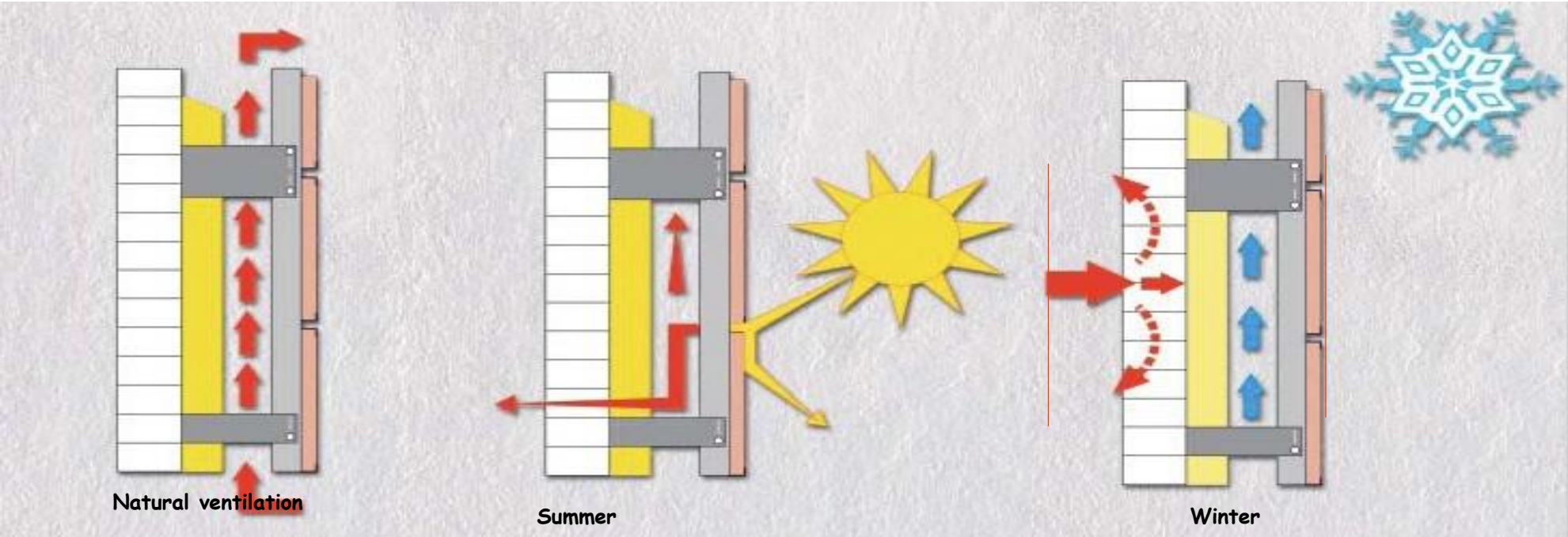


3D representation of the three high rise buildings; (right) representation of the BIPV plant with two optimal NPV solutions: if the cost of storage is 1000 €/kWh no battery is installed and the plant is limited at the blue area. If the cost of storage is 250 €/kWh, 87 kWh of batteries are installed allowing a larger BIPV plant (orange area).



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Active and passive strategies

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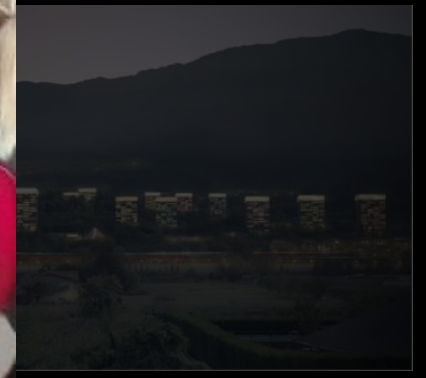
Before

221.7
kWh/m²
year

24.7
kWh/m²
year



Public-Private Partnership!

Credits: Campomarzio

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Urban Service - Oriented Sensible Grid

The backbone of the smart city


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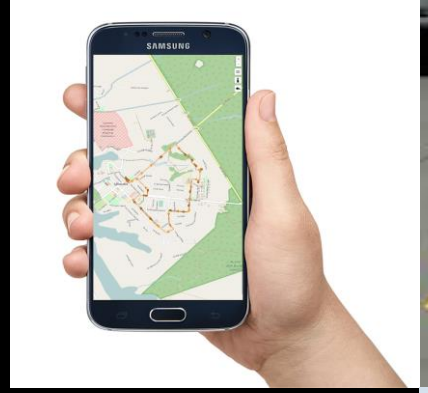

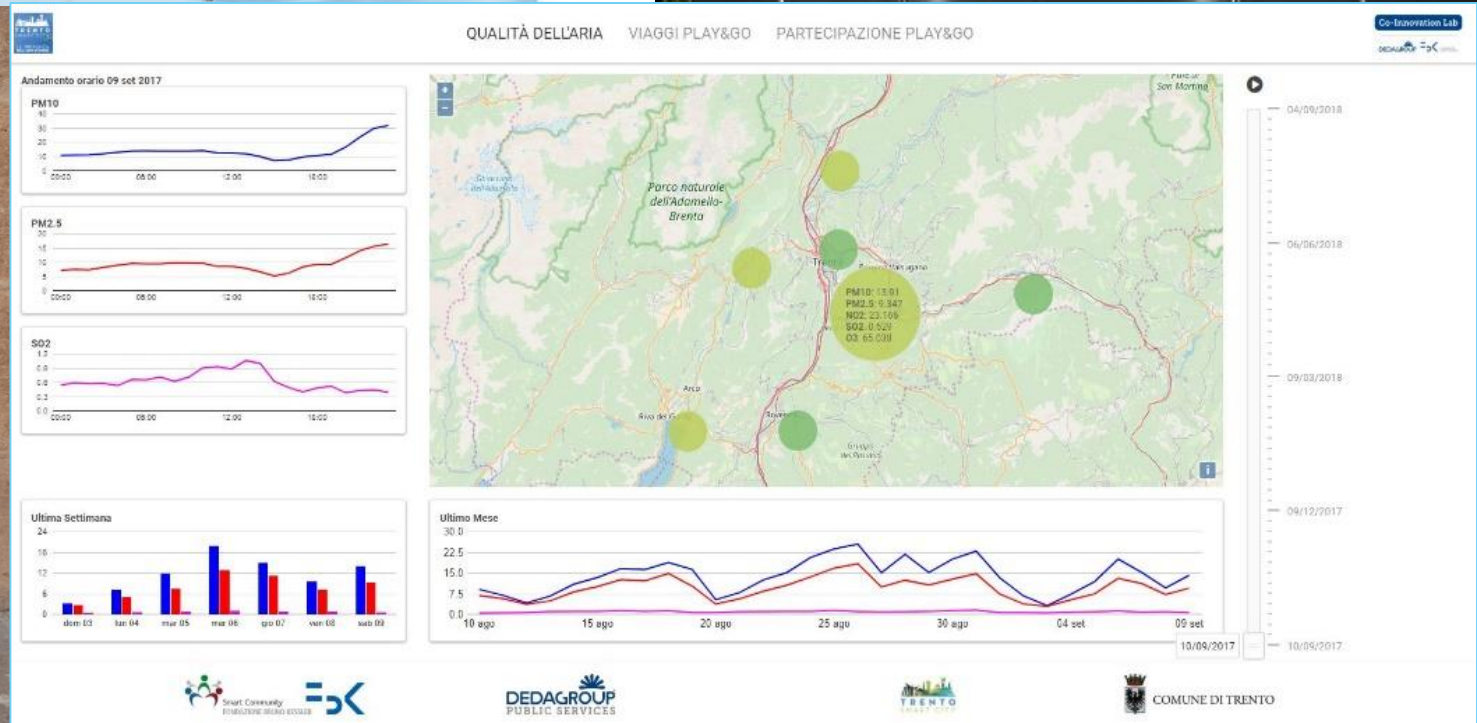

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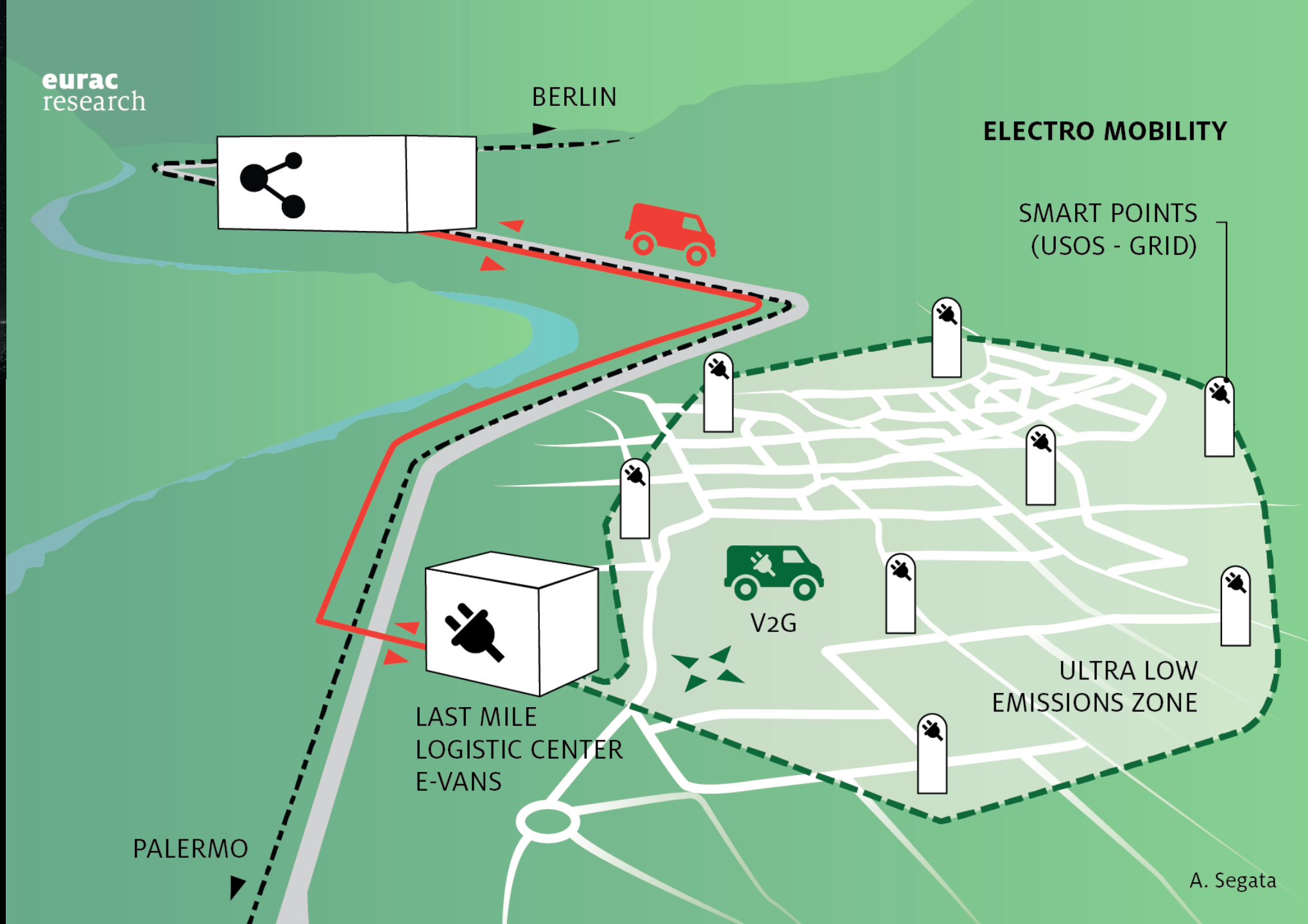
Electic Veichles
Last Mile
Logistic



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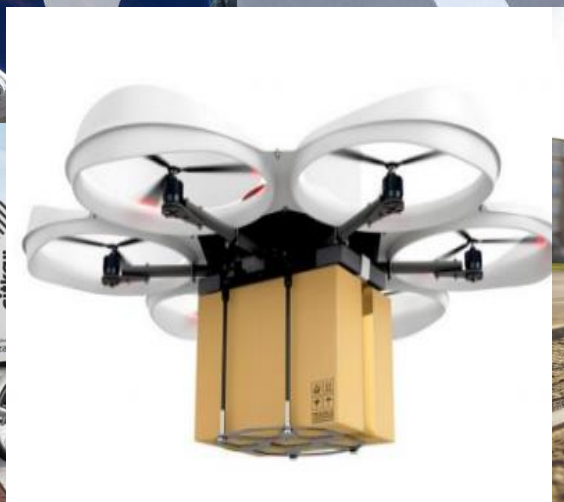
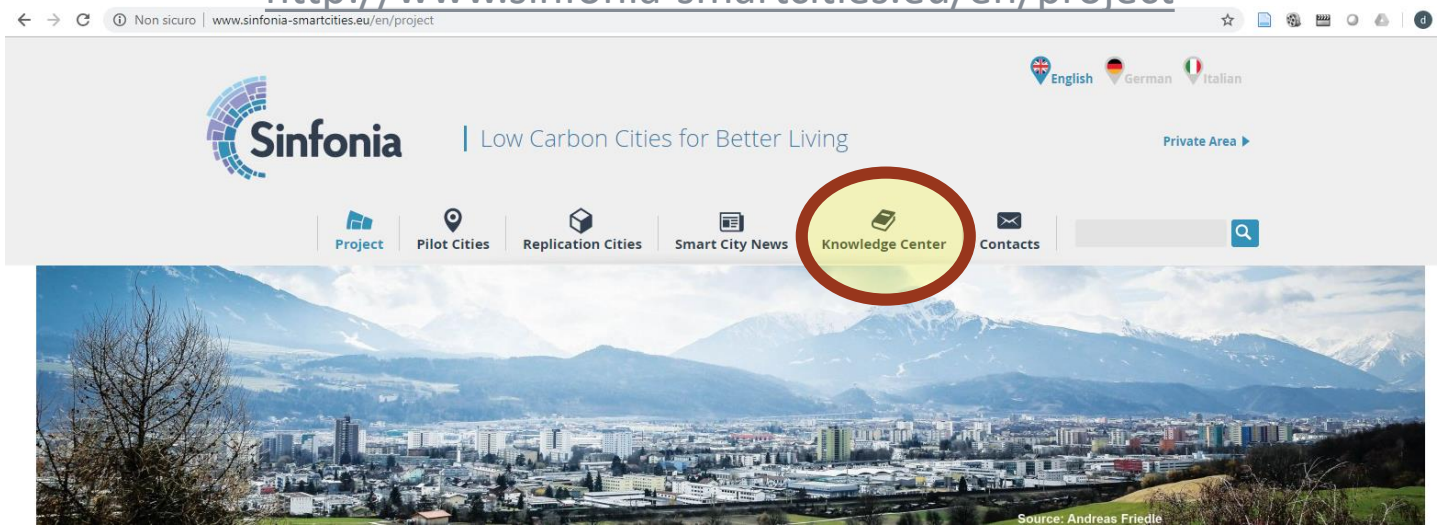
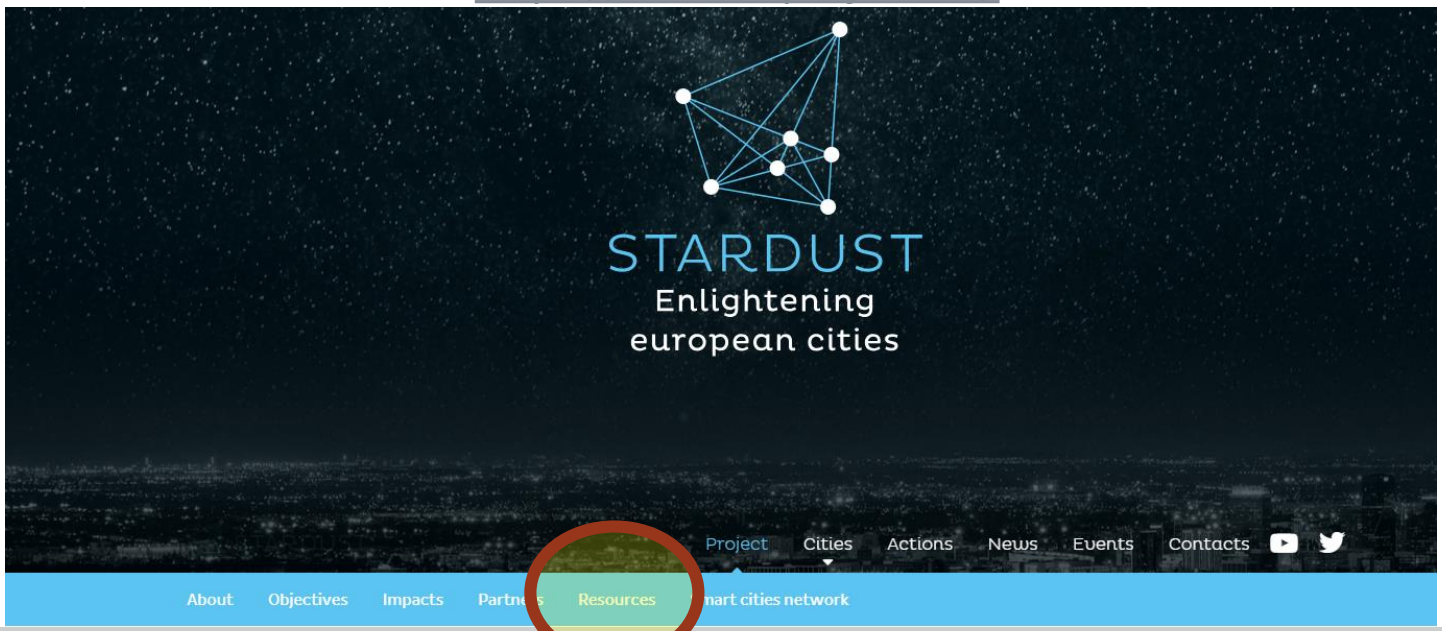
Examples of solutions for EV-Last mile logistic



http://www.sinfonia-smartcities.eu/en/project



https://stardustproject.eu/



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Thank you

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