European cities characterization as basis towards the replication of a Smart and Sustainable Urban Regeneration Model

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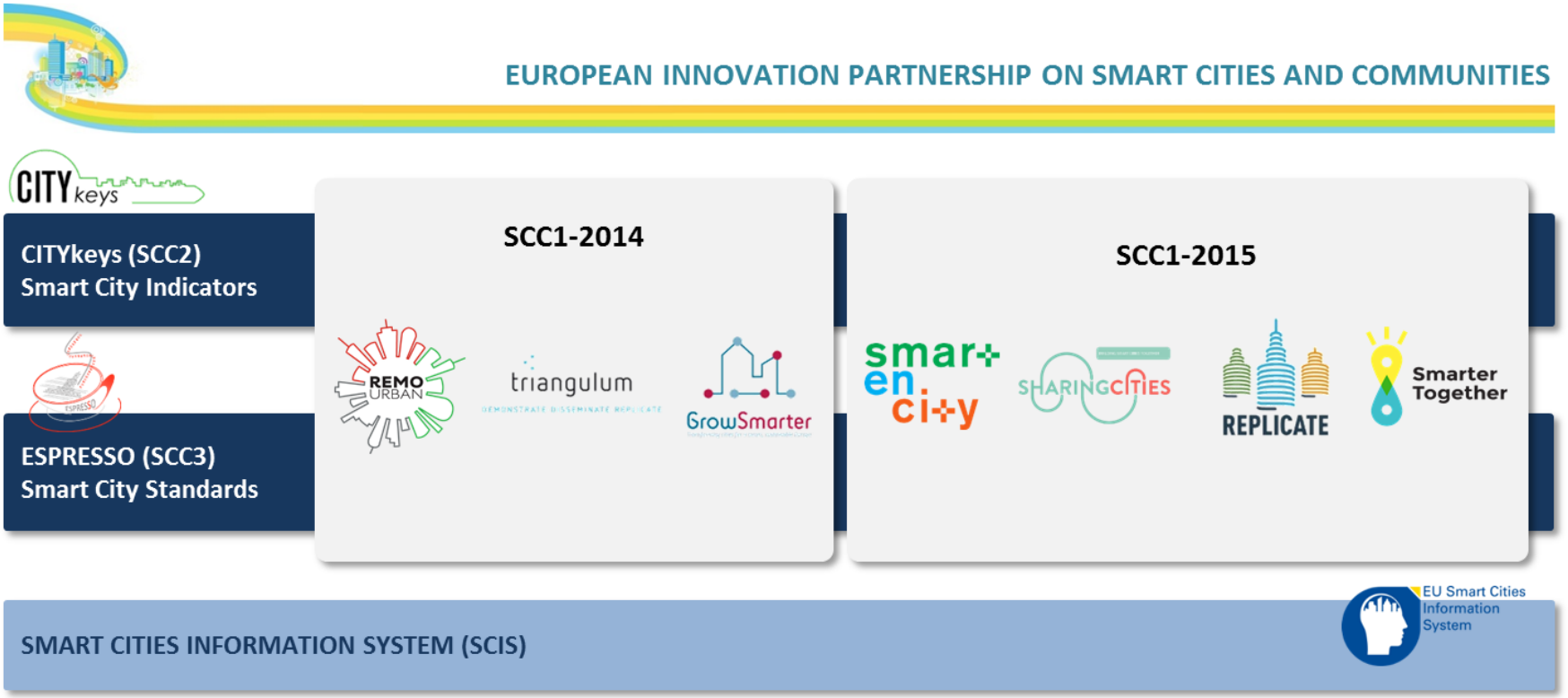
EU roadmap of SCC projects



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REMOURBAN PROJECT

Total REMOURBAN budget: **23.8M€**
Total investment in REMOURBAN actions: **14.2M€ (90% 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)

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International conference on:
Sustainability in Energy and Buildings (SEB2016)

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

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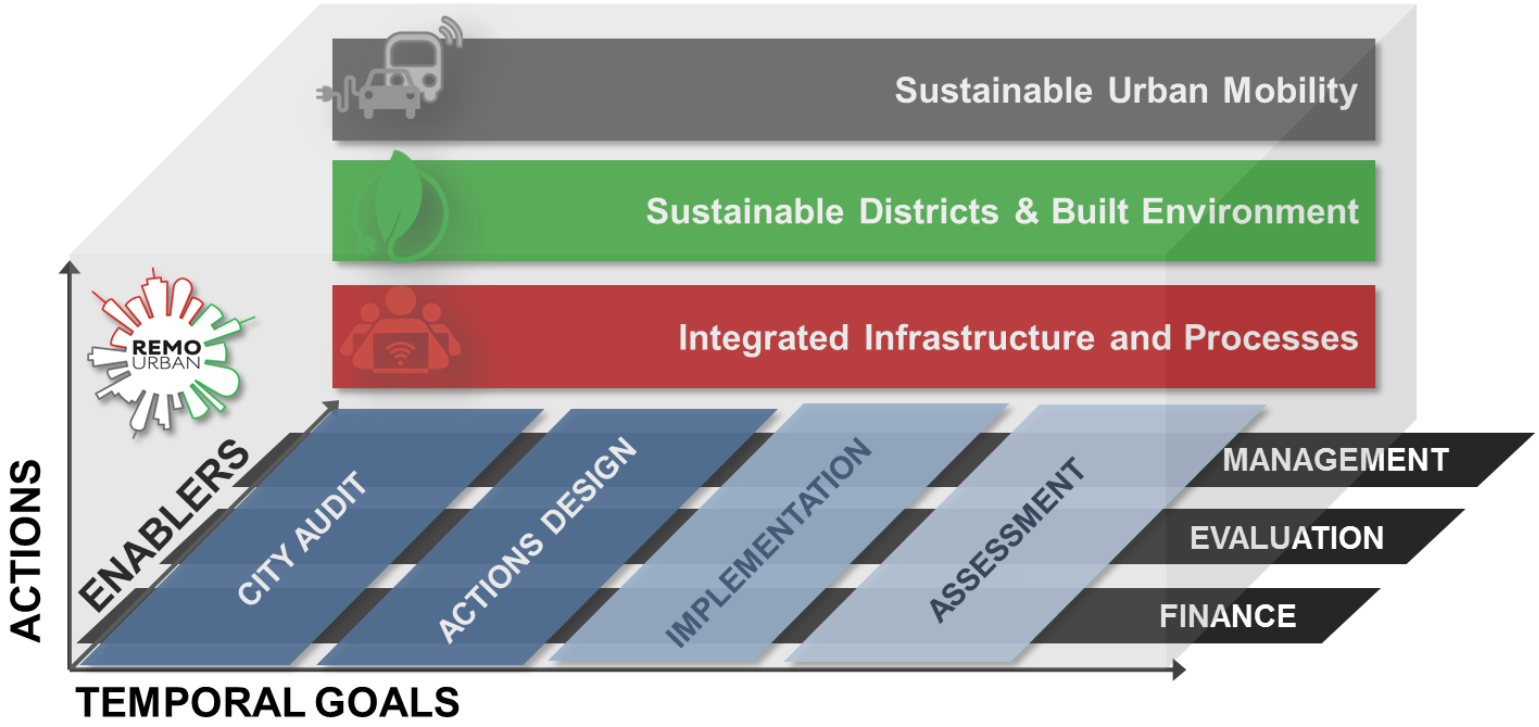
URBAN REGENERATION MODEL



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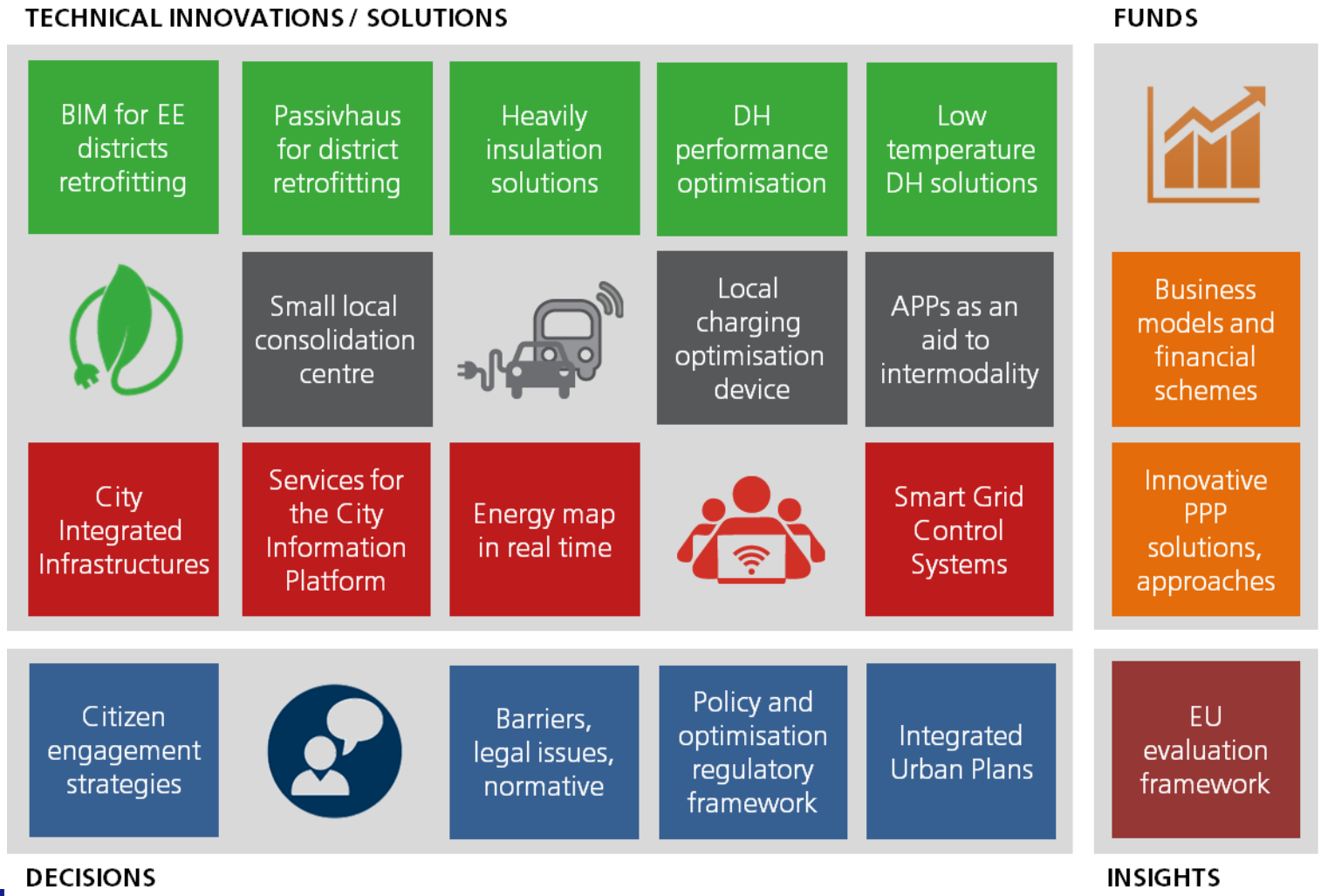

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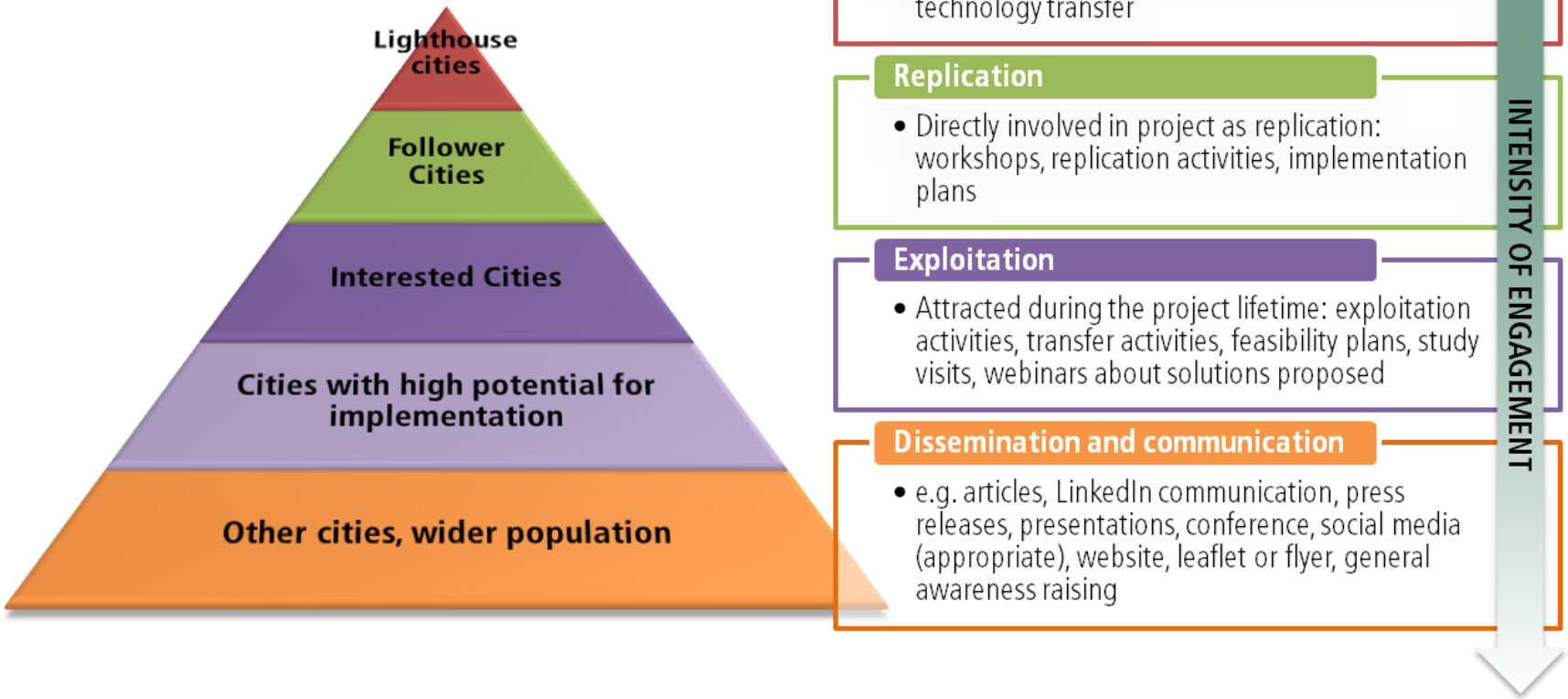
SCALE-UP APPROACH TO MAXIMISE THE IMPACT



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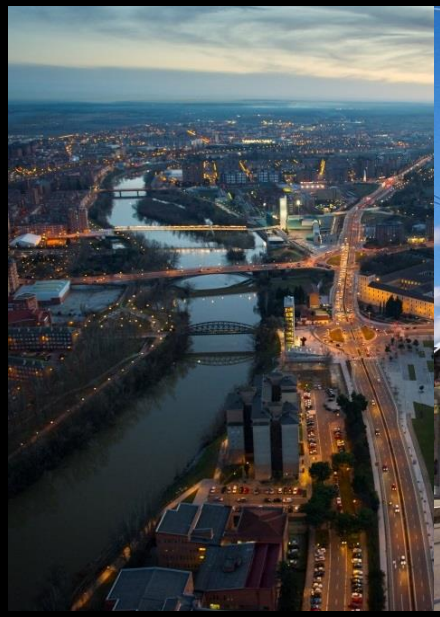
DEMONSTRATION



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DEMONSTRATION: VALLADOLID (SP)

Population of 310,000 (city urban area of 415,000).
Administrative capital of Castilla y León.

Smart City strategy for Valladolid and Palencia (2010).
Integral Plan for Urban Mobility, PIMUVA (2005).
General Plan for Urban Development, PGOUVA (2004 – under review).

Energy Management Systems
(ICT for thermal system monitoring and control)

City Information Platform
(ICT measures for mobility and city management)

Building envelope retrofitting
(24,700 m2 of cond. area)

District heating and DHW systems
(biomass for energy)

Electric vehicle
(50 new electric vehicles)

Transport infrastructure
(29 new charging points)

Intermodality
(buses, bicycles, and car sharing fleets)

Citizens' engagement and empowerment

Smart city strategies

EU smart city indicator framework

50% Energy savings
80% CO_2 emissions avoided
5,700 citizens directly involved

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DEMONSTRATION: NOTTINGHAM (UK)

Population of 306,000 (city urban area of 730,000).
One of the major cities in East Midlands.

City 2020 Energy and Carbon strategy (2010).
Sustainable Energy Action Plan (SEAP) for the EU Covenant of Mayors (2010).

Integrated Infrastructure City ICT Model
(connecting and integrating infrastructures together)

ICT Monitoring tools for the users

Renovation of building envelope
(28,300 m2 of cond. area)

District heating and cooling and distributed generation
(connected to the city network)

Alternative fuel vehicles
(electric buses)

Transportation infrastructures
(electric drive-lines and fast charging technology)

City Car Club Nottingham

Citizens' engagement and empowerment

Smart city strategies

EU smart city indicator framework

50% Energy savings
26% CO_2 emissions avoided
8,100 citizens directly involved

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DEMONSTRATION: TEPEBASI (TK)

Tepebaşı district (population of 315,00) is part of Tepebaşı (population of 800,000).
Modern urban region, second biggest in Middle-Anatolia after Ankara.

Metropolitan Municipality Strategic Plan (2015).
Sustainable Energy Action Plan, SEAP (on going).

City on Cloud
(city management system for energy and mobility)

Monitoring and control of e-bike and e-vehicles

Smart control of the district heating

Energy efficient building retrofitting
(9.110 m2 of cond. area)

Central district heating/cooling and DHW
(biomass for energy)

Expansion of the cycling lanes
(6.2 km + 50 e-bikes)

Alternative fuel vehicles
(4 e-buses + 7 hybrid cars)

Citizens' engagement and empowerment

Smart city strategies

EU smart city indicator framework

85% Energy savings
79% CO_2 emissions avoided
6,000 citizens directly involved

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REPLICATION: SERAING AND MISKOLC

Miskolc. The fourth biggest city in Hungary. Regional centre and capital of Borsod-Abaúj-Zemplén. 168,075 inhabitants (2011).

Very ambitious urban plan centered in:

- Growing economic potential
- Protection of natural environment, regeneration of ravaged environment
- Improving life quality, development of urban potential
- Development of built environment, harmony between artificial and natural environment
- Strenghend security, equality and social cohesion

Seraign. Lieja province. Industrial City of 61,237 inhabitants.

Signed the Covenant of Mayors in October, 2013. Vast program of urban reshaping promoting the development of new economic activities and improving quality of life, resulting in a Master Plan that will be the basis for all decisions to be taken, concering the urban requalification of the city, in the long term (30 years)

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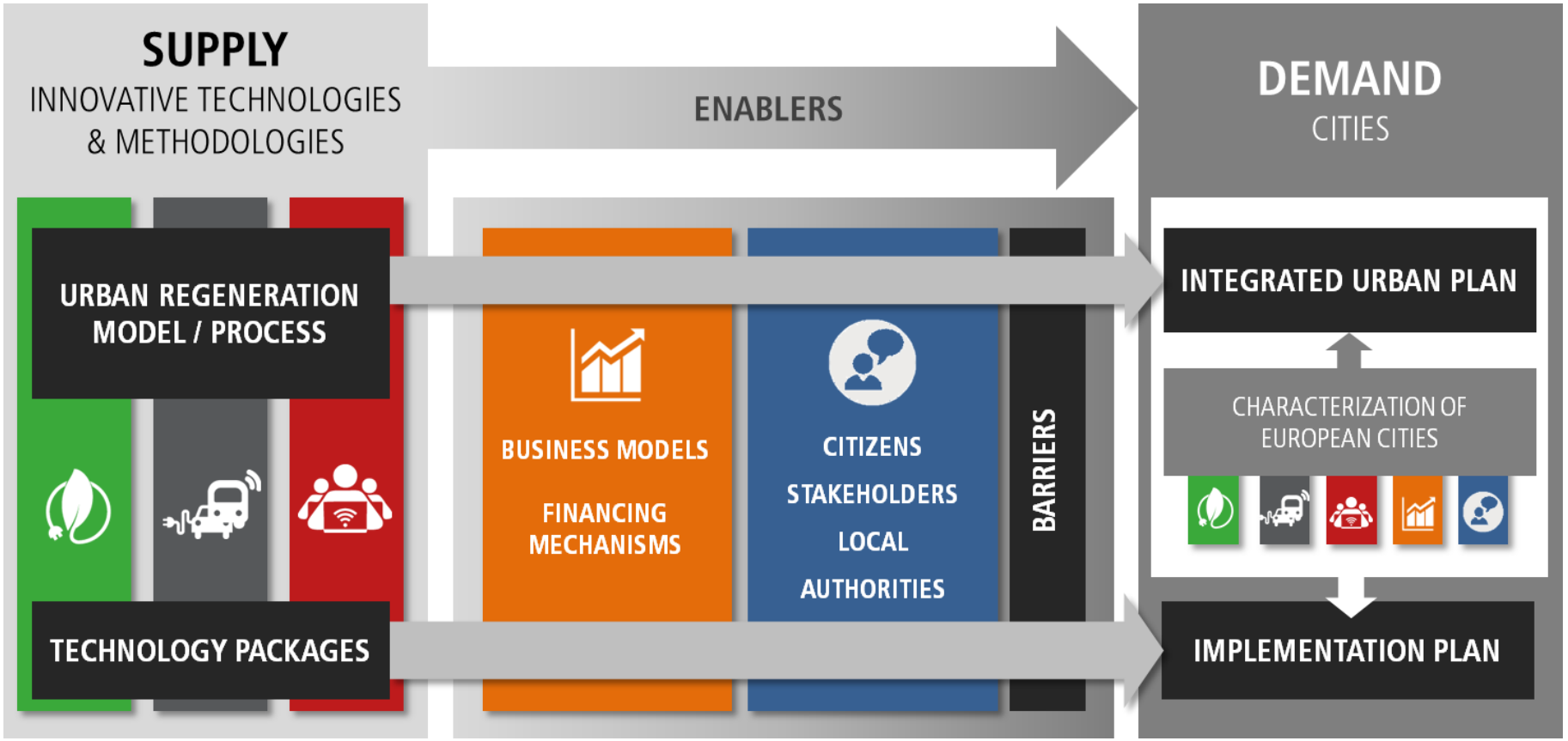
HOW TO ENSURE ITS REPLICABILITY?



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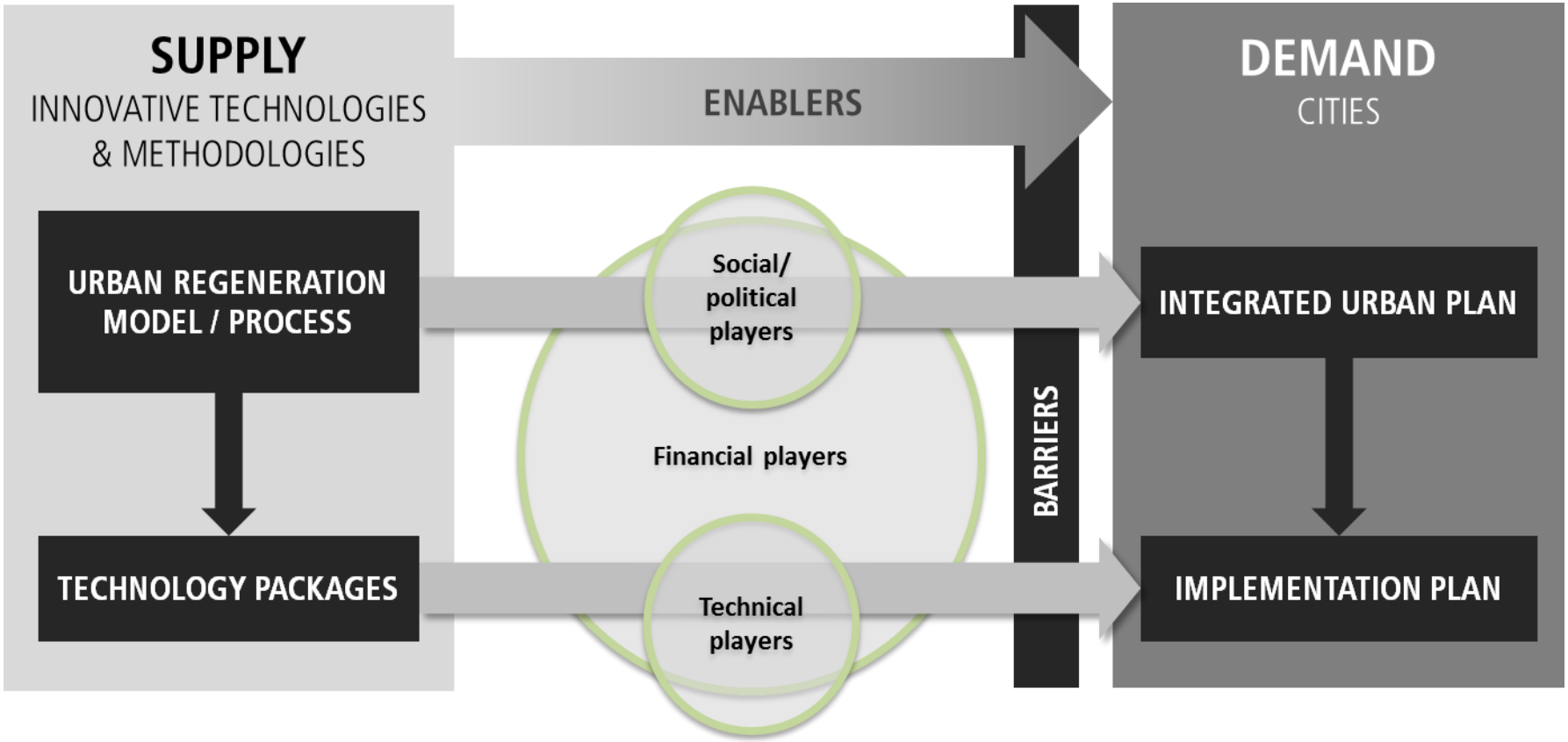
CONNECTING THE DOTS FROM "SUPPLY" TO "DEMAND"



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CHARACTERISATION AS BASIS FOR REPLICATION

Most positive values
Intermediate values
Less positive values

	People	Governance	Finance	Mobility	Energy	Infrastructures
Cluster 1						
Cluster 2						
Cluster 3						
Cluster 4						
Cluster 5						

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CHARACTERISATION AS BASIS FOR REPLICATION

KEY PERFORMANCE INDICATORS (CITY)	Identification of KPIs at City Level in the five application domains: management, finance, energy, mobility and ICTs
DATA BASES	Where to find the information for each indicator?
SELECTION OF CITIES	List of cities whose information is available in the data bases (e.g. CoM, Eurostat, Urban Audit, EIP-SCC, etc.)
COLLECTING AND AGGREGATING THE DATA	Collect and aggregate the information existing in the data bases for the cities to complete the indicators and generate the groups
CHARACTERISATION OF GROUPS OF CITIES	Generation of Groups of City Types for each of the fields (e.g. for funds cities can be characterised in FinanceGroup 1 which corresponds to the following characteristics (GDP = x, employment = y, etc.)

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Map of all cities included in the data collection process for the characterization

In Red: Ignored cities (No data available at city level in the selected data sources)

IDENTIFICATION OF INDICATORS

Applications	Number of initial indicators	Number of final indicators
Management	22	19
Financing	4	5
Energy	6	5
Mobility	7	8
Infrastructures	4	4
Total	50	41

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IDENTIFICATION OF INDICATORS

INDICATOR	KPI_ID	FORMULA	UNIT	DESCRIPTION	DATA BASE
Share of electricity in final energy consumptions in households	EN1	-	%	Energy derived from electricity related to the final energy in households	Eurostat
Share of gas in final energy consumptions in households	EN2	-	%	Energy derived from gas related to the final energy in households	Eurostat
Share of Renewable Energies in final energy consumption in households	EN3	-	%	Energy derived from energy renewable sources related to the final energy in households	Eurostat
Final energy consumption in households per inhabitant	EN4	-	MWh/inh	It covers consumption of private households, commerce, public administration, services, agriculture and fisheries	Eurostat
GHG emissions for households	EN5	1000 tCO2 eq/National Population	Mton CO_2 eq/Million inhabitant	GHG emissions from buildings (residential and public)	Eurostat

DATA ACQUISITION

Code	City	KPI_EN1	KPI_EN2	KPI_EN3	KPI_EN4	KPI_EN5
		Share of electricity in final energy consumption in households	Share of gas in the final energy consumption in households	Share of Renewable Energies in final energy consumption in households	Final energy consumption in households	GHG emissions for households
AT-01	Graz	23.1	19	27.9	9.04	1820.16
AT-02	Innsbruck	23.1	19	27.9	9.04	1820.16
BE-01	Ghent	19	41.3	7	9.32	2387.32
BE-02	Liege	19	41.3	7	9.32	2387.32
BE-03	Brugge	19	41.3	7	9.32	2387.32
BG-01	Ruse	40.3	2	33.8	14.37	3680.39
EE-01	Tartu	17.2	5.6	40	8.21	877.74
FI-01	Jyväskylä	36.3	0.6	24.5	10.89	1083.47

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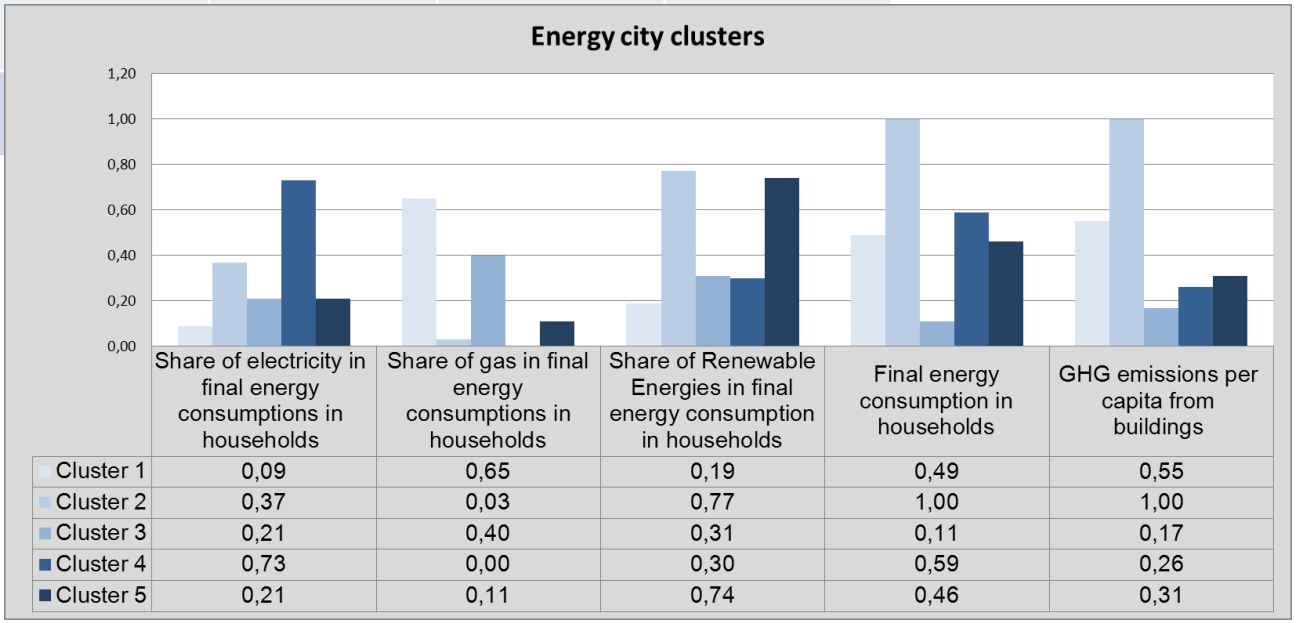
CLUSTERING

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
KPI_EN1	22,4	40,3	30,6	63,9	30,1
KPI_EN2	48,1	2,0	29,5	0,3	8,4
KPI_EN3	9,5	33,8	14,3	14,0	32,2
KPI_EN4	7,3				
KPI_EN5	2079,1				



	Share of electricity in final energy consumptions in households	Share of gas in final energy consumptions in households	Share of Renewable Energies in final energy consumption in households	Final energy consumption in households	GHG emissions per capita from buildings
Cluster 1	0,09	0,65	0,19	0,49	0,55
Cluster 2	0,37	0,03	0,77	1,00	1,00
Cluster 3	0,21	0,40	0,31	0,11	0,17
Cluster 4	0,73	0,00	0,30	0,59	0,26
Cluster 5	0,21	0,11	0,74	0,46	0,31

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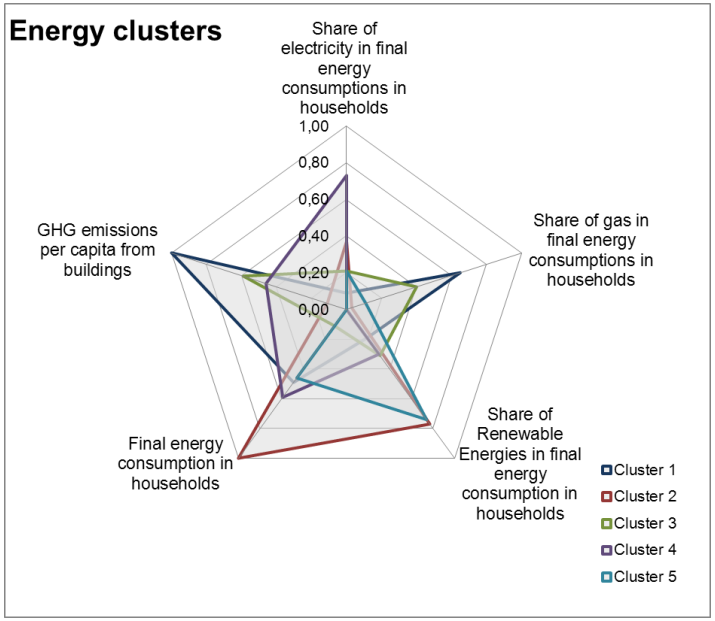
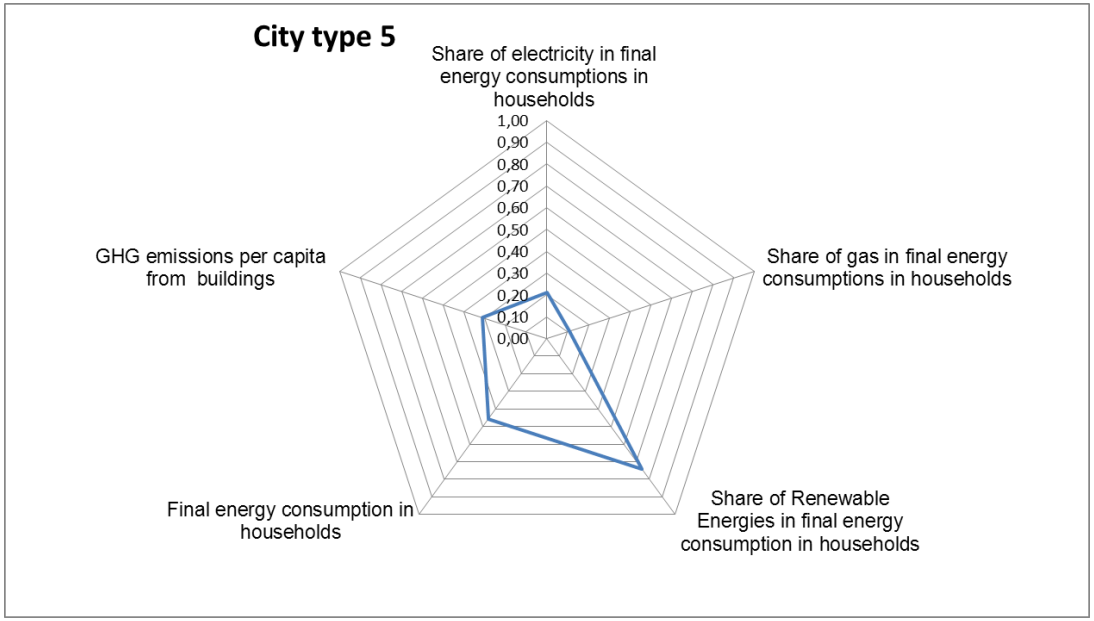
CLUSTERING

Energy city type 5

- This cluster is characterised by a rather high share in renewable energies in final energy consumption in households.
- With a low gas and electricity shares, and a good result in GHG emissions, this cluster may be considered in a good position in terms of energy efficiency.





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CLUSTERING

- Cluster 2 (10)
- Cluster 4 (10)
- Cluster 5 (10)
- Cluster 1 (7)
- Cluster 3 (3)

Cluster 1 (South)	Descriptions
People	(-) Cities which lost population. High youth unemployment ratio. Low recycling ratio (+) High ratio of population with higher education
Governance	Cities which have developed a large number of plans and strategies for a sustainable urban model
Finance	High ratio of unemployment, bad position in GDP and disposable income
Mobility	Modal split: private motor vehicle. Scarce use of bike or electrical vehicle. High private car ratio
Energy	Cities with low energy consumption in households and good position in use of RES. Electricity as main final energy consumption. Low GHG emissions.
Infrastructures	Low number of internet users. Intermediate position in Smartphone use.

Most positive values

Intermediate values

Less positive values

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CONCLUSIONS

- It is possible to identify which are the adverse conditions and potential features of the selected cities by each domain (energy, mobility, ICT) and enablers (people, governance and finance) as well as a preliminary analysis of the possibility for replicating the REMOURBAN regeneration model in these cities.

- **5 geographic areas** have been detected in Europe as a result of applying a procedure for characterizing the cities in **a global analysis** in which all the indicators are considered.

- **5 clusters** were identified corresponding with cities located in the North, Centre, South, East and Scandinavian countries.

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