Smart city models and energy efficiency related to the metropolization of the city of Reggio Calabria

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Keywords: mobility, environment, people, living, governance, economy

Abstract

Smart cities are those well performing cities that create, through structural and technological innovation, the ideal conditions for setting up socio-economic enhancement and energy efficient values, with the aid of renewable energy and smart grid orientated smart sectors. A Smart City, in brief, is a city which combines and harmonizes specifically six characteristics, mobility, environment, people, living, governance, economy, based on the "intelligent" combination of the resources provided by the city itself and by the activities of the self-decisive, independent and aware citizens (in the case of a smart community).

Challenge for the city and the local authorities. However which are the cities eligible for this role? What are the characteristics and the city size?

This paper provides a tour of the possible candidates focusing in particular on the prerequisites, on the spheres involved, on the existing and feasible strategies needed to set up a Smart Project. The second part of the document focuses on the possible application of smart features to the reality of metropolitan cities and specifically to the forthcoming metropolitan city of Reggio Calabria.

Many different ways of being smart, some best practices

According to the "European Smart Cities" Paper compiled good by Vienna University, Smart city identifying and measuring parameters are to date, given the strong technological innovation which is being adopted within cities, the optimization at urban level of the interaction between technological progress and sustainable challenges. The centre of Regional Science of Vienna University of Technologies identifies the essence of the smart city, which is therefore something that goes beyond a digital or high technologicaly advanced city: it is an organic and multidimensional pooling of the physical, economic, intellectual and social wealth of the city. Focusing on human stock highlights the importance citizens play in promoting the growth of the city, the more liveable the city the higher the level of "smartness" (competitiveness, creativity) of its citizens and therefore of the development of the city itself.

Smart cities are among the instruments to attain the Eu2020 goals. Europa 2020 aims at stimulating and harmonizing the action of cities, and the Smart City, being closer at a local level, manages to organize the city according to its strong points, to the motivation of the stakeholders, to the cultural background, to the partnership among governance, enterprises and citizens, to the strong demand for energy consumption reduction. The Smart City initiatives are seen as tools to better tackle specific issues and to set up a community of world interest at a European level.

"Smart Cities" is an initiative promoted by the UE within the framework of the SET-Plan for the reaching of the Agenda 2020 targets, deadline 2050. The objective is to reduce CO2 emissions by 40% within 2020. The UE intends to invite at least 25 cities/ metropolitan areas to take part in pilot projects. Smart Cities is one of the pillars of the Italian digital agenda and the central Government is ready to support it with significant funding. The most significant examples of smart cities are: Singapore- MIT Alliance for Research and Technology (SMART); IBM Smarter City; Global Program "Smarter Cities Challenge" 2012; Amsterdam Smart City; New York Talk Exchange Project; LIVE Singapore; European Smart Cities project; TAPE-Turin action Plan for Energy; Turin Smart City project.

With reference specifically to the concept of Digital City, the most innovative projects are: New York Digital City, Icheon-Korea DIGITAL CITIES Project, Cisco Digital Smart City at the Milan expo 2015.

The many initiatives underway also include the SMARTiP project (led by Manchester City Council), it aims to use open innovation initiatives to help 'smart citizens' co-produce innovative Internet-enabled public services within emerging 'smart' cities.

The aim of this project, is to enable the adoption of open platforms for the co-production of citizen-centric Internet-enabled services in five sites (testing): Cologne, Bologna, Manchester, Ghent, and Oulu. The objective is to enhance the ability of the cities to grow and sustain a 'smart city' ecosystem which can support new opportunities emerging for a dynamic co-production (urban) process resulting in more inclusive,made higher quality and efficient public services which can then be made replicable on a larger scale.

This will focus on a series of pilot projects, covering three thematic areas: Smart environments, Smart mobility and Smart engagement. Bologna Smart City, among the majority of activities has realized the Iperbole Civic Network – Iperbole users community and the portal of the Municipality was set up in January 1995 as a «telematic bridge» between the virtual community and the real city in order to build a «digital information society at local level». It is an operating project employing Internet to open a public doorway to the connectivity and to state a leading role for local Public Administration in the creation of an informatic and knowledge society[1].

How many and which cities

Before identifying the metropolitan city and its requirements, it is essential to focus on the concept of "city" meant as a portion of territory with a high density characterized by an intense and compact development around the existing old city (the wider area surrounding the city is the result of productive and residential expansion in the neighbouring territories). The phenomena of expansion is alarming: in UE and not only (eg in UK) it is necessary to help support cities in becoming smarter. In the UK alone, 7 out of 10 people now live in cities, and the United Nations predicts cities will grow by 60 % by 2050. As they become more complex, an intelligent standardized structure for using and sharing existing data and resources, becomes vital, how to improve performance, reduce risk and achieve sustainable growth.

The UE ITRE Commission for industry, Research and Energy published the document "Mapping Smart Cities in the UE" (Table 1) which provides not only a detailed map of the most successful cities in Europe, but also a detailed analysis of the present situation in terms of a intelligent city. According to the study, smart cities tend to be small in scale, though there are exceptions like a few metropolitan areas (Helsinky). In 2011 the cities with at least a 100.000 inhabitants, or experiencing at least one "Smart City" Project or endowed with characteristics which would enable them to take part in a "Smart City" project were at least 51% of the total. Speaking in terms of geographical distribution the countries with the largest number of Smart Cities are the United Kingdom, Spain and Italy; although the highest percentage are in Italy, Austria, Sweden, Estonia, Denmark, Norway and Slovenia. A large part of the Smart City initiatives have received funding from different sources, namely the government and private enterprises. Quite a few projects have been carried out thanks to the active participation of the public and private sectors and by a shared and strategic governance. Intelligent traffic systems and Smart City neighbourhood units are the initiatives which have attracted the greatest percentage of public funding. Energy, climatic change and resource managing systems receive the greatest quota of shared funding while participation platforms receive less interesting funding.

Table 1 – Overview of success factors for the solutions for some smart cities (by: MAPPING SMART CITIES in the EU, Study, Policy Department-Economic, European Parliament-2014).

City and solutions	Success Factor		
	Vision	People	Process
Copenaghen	+	+	+
Cycling	+	+	+
Integrated public trasportation	+	+	o
Barcelona	o	+	+
Control of lighting zones	+	o	o
Smart parking	+	+	+
Media-tic Building	o	+	-
E-governance	o	+	+
Amsterdam	o	+	+
Climate Street	o	+	+
Ship to grid (Green Economy)	o	o	+
Smart building management syystem (ITO Tower Project)	o	+	+
Healt lab	o	+	+
Helsinki	-	-	+
Open data platform (Helsinki Region Infoshare)	o	+	+

1. http://www.comune.bologna.it/english/

The Helsinki example

The global increase in urbanization brings enormous challenges: the concentration of a large share of the population in urban areas requires new solutions and integrated approaches. Transnational Nations, such as the United Nations and the European Union, to multi-levell of organization, as well as national actors, launched initiatives to promote the development of sustainably organized urban areas.

Amsterdam, Helsinki and Florence are among the cities listed in the "Mapping Smart Cities in the UE"[2] document which seek to identify citizen participating platforms for the development of the ICT cities. The strategic objective of these projects is to develop better public services through "interactive fruition city platforms", namely the Smart City Platform of Amsterdam, or to collect public data for the development of applications, useful data mash-up o new services. The town of Helsinki, in Finland, is seeking a new means to encourage the creation of technological devices, digital services, and citizen oriented applications. The Helsinki project believes in transparency which enables a better feedback from citizens to civil servants. The metropolitan area of Helsinki needs to streamline and reorganize the offer and the fruition of the city given that it is the most highly populated area of the nation. The metropolitan area encompasses Helsinki, Vantaa, Espoo and Kauniainen, and is situated in the southern part of the country, on the shores of the Gulf of Finland. In 2008 it had 1024347 inhabitants, around one fifth of the population over an area of 765 km^2 ,equal to around 0,2% of the total Finnish surface. The Helsinki-Vantaa area which welcomes 18 of the Finnish universities, most of the country's firms and the largest Finnish Airport, has become an urban laboratory for testing all the necessary technologies for improving the life of its citizens. Open data, Living Labs, crowdsourcing and internet networks are four of the topics developed in the projects outlined by the Forum Virium Helsinki's Smart City Project Area. The aim is to develop urban digital services accessible by mobile devices, so as to improve the quality of life and of work. A strategic experiment which integrates everyday life with the surrounding urban environment by 2015. The Forum Virium strategy intends to make Helsinki and its metropolitan region a forerunner at international level for the digital services offered. The operation strives to transform Helsinki and the metropolitan area into fertile ground for investing time and money. A good portion of the Helsinki project refers to ubiquitous technologies, technologies which are fully integrated in the life and daily activities of the people. Real-time traffic data, open public data, active participation of the citizens to paramount changes in the urban setting.

The Forum Virium Helsinki's Smart City Project Area, through totally integrated technologies in objects and daily activities (real-time traffic data, access to public data and e-governance participation, new and versatile services created by individuals and companies) promotes the development of digital urban services which makes living in an urban environment much easier.

The transition from smart city to smart metropolis

Cities and utilities need to find ways to make it easier to deploy innovative products and services. Cities should look for ways to attract capital and create organisational structures which have the apacity to deliver innovative programmes. In all the cases listed, the smart city offers a group of services to reduce the structural gap present in the city, like quality life creating the urban intelligence.

The smart city puts on the market a new instrument of intelligent community management with a hi-density of technology (thanks to the participation of citizen and the application of smart technologies). Smart urban technologies can provide an important contribution to the sustainable development of European cities. The 68% of the EU population lives in urban areas, a proportion that is growing as the urbanisation trend continues in Europe and worldwide. The EU has developed a shared European vision of sustainable urban and territorial development. European cities should be places of advanced sociale Progress and environmental regeneration, as well as places of attraction and engines of economic growth based on a holistic integrated approach in which all aspects of sustainability are taken into account.

Cities have always been places of opportunity and even more so now. Recent estimates say that 80% of global GDP is generated in cities. People are attracted to cities to find jobs, friends, culture and enjoy the excitements of urban life. The current megatrends of rapid urbanisation, climate change and resource depletion need to be acknowledged and understood by cities. Cities are starting to address the challenges of this new urban context.

This underlines that cities are also the sites of tremendous innovation. Cities can be great proving grounds for technologies, providing opportunities for people to invent new things, and opportunities to test and sell them. Cities therefore present an opportunity for suppliers and consumers of smart technologies. Smart technologies could help address some of the challenges of urbanisation by helping to optimise resource consumption and improve services through better management of demand and supply.

2. MAPPING SMART CITIES in the EU, Study, Policy Department-Economic, European Parliament-2014.

Smart factors for the metropolitan city of Reggio Calabria

But what can change if the *smart* city is a *metropolitan* city? The metropolitan phenomenon has not gained ground only in Europe but it has taken root all over Italy. It results not only from the need of wider urban facilities but above all from interrelation and relationships among the different functions and activities within it.

The italian metropolis is concentrated with 36% of Pil, 35% of occupated, 32% of italians and 3% of foreign people. Italian metropolis will be a motor of organisation and strategic planning, like the best european practices, Barcelona, Lion, Munich and Stockolm, able to locate resources, time, subject and methods of implementation of the projects, with a shared vision of development. The metropolitan cities have taken an increasingly important role in global economic geography, this form of supra-municipality government must be an opportunity to modernize the public administration and urban structure.

The approach adopted instead by ABB to build and monitor the smart city model focuses on three thematic areas of particular importance in terms of influence on the level of smartness and, consequently, also on the competitiveness of the urban environment:

Mobility management, because it is obvious the centrality of the choices in the area of mobility for citizens, but equally interesting are the potentials – in terms of impact on the lives ‚smart' cities – related to technological development and innovations in the regulatory/ management of flows and services.

Management of resources, because of the efficiency in the use and sustainability in the generation/ availability of resources are an important measure of the intelligence of an urban system , where the critical issues may prove dramatically .

Quality of life of the city, used to identify potential environmental and social activities that characterize the daily life of individuals in urban areas.

The "Manifesto of the Italian metropolitan cities" being defined by some associations active in ten metropolitan Italian cities, is aimed to affirm that they are the engines of national economies and that, once established, they will be able to achieve any decisive action for the competitiveness of the area, for attraction of investments, for to the creation of productive areas and technological centers, for to best use EU funds[3]. Such policies need to be reformulated in the following points:

- To switch to selected parameters through interactive platforms and data provided by various sources (by service providers and implemented by smart city users, (community) through interactive model that allows you to develop urban dynamics and "questions" of the city according to varied needs.
- To manage and analyze information in real time, to define the optimal solution for the better understanding of how a city works. Improve the management of natural and socio-cultural resources through the sustainable exploitation of resources and factors of regional competitiveness by developing the management skills and innovative interaction (smart planning and smart governance) in strategic sectors (water, buildings, waste, infrastructure services, security and safety ...) that contribute to the construction of the smart community.
- To encourage the rational use of energy for urban activities, therefore parameterize the production, the cycle of sorting and utilization for biogas. Pursue the realization of the theoretical models that see in systems computerization the key to obtain a "resource" energy from waste streams, and to improve the overall environmental quality of the city through the reduction of loads and pressures.

Europe's most pressing challenge is to overcome the economic crisis and thus put itself firmly on the path to sustainable development. What is required is a change in how Europe's economy operates – a change that will release the many strengths Europe can bring to bear in tomorrow's economy of high innovation, knowledge and skills.

Objectives are:

- To introduce a new concept of experience smart and prove its feasibility via a range of technological innovations beyond the existing state of the art, including virtual reality, and animations;
- To establish a research and show-case platform for demonstration, validation, and evaluation of such experiencing, and hence making the researched ideas, and implemented technologies ready for possible commercial exploitation.

This is why Europe (Horizon) 2020 places research, technology and innovation at the forefront of activities designed to help Europe exit the current economic crisis and build smart, sustainable and inclusive growth through the following objectives: Smart mobility, Smart health, Smart education, Cloud computing technologies per smart government, Smart culture e Turismo, Renewable energy e smart grid, Energy Efficiency e low carbon technologies, Smart mobility e last-mile logistic, Sustainable natural resources (waste, water, urban biodiversity).

The appellation smart, has identified the digital city, within a decade then the city socially inclusive, to the city that provides a better quality of life. Smart City equals sustainable city: this is the only factor common to main definitions proposed to date[4].

3. Nicoletta Picchio, *Le città metropolitane, una via per competere*, "Il Sole24ore", 8.2.2014.

4. ABB, Smart Cities in Italia: un'opportunità nello spirito del Rinasci-

Figure 1 – City of Reggio Calabria (Italy).

Different meanings of "smart" the most relevant one related to the case study

The project refers to the characteristics/contents of the metropolitan area and of the metropolitan city as well as to the construction of factors of metropolization for the city of Reggio Calabria through the transfer of good practice: Helsinki. It is fundamental to find new approaches to the construction of Reggio Calabria – a metropolitan city- that should take a leading role in the mediterranean context, develop all the necessary infrastructures, attract immaterial flows and relaunch them in to a network, should:

- Improving the contexts of territorial competitiveness of the smart city by highlighting its flows (flows of relationships, so even-intangible nature, extent, value, the government of the same, the ability to attract investment and capture interest) and favoring local territorial value and that of wide area through the improvement and the efficiency of services.
- To intervene in existing sensitive nodes to submit them at structural controls for all sources of risk (pollution, technological risk, social segregation ...), for a smart city-smart living. Compare the environmental performance of different districts with the human presence in their inside.
- To promote the adoption of new technologies and the integration of traditional participation forms, including the use of simple tools, easy to use, that will influence the process of drafting the policy.
- To support the participation of citizens in decision-making processes, reinforcing and extending the modalities of participation (for a smart community).
- To provide protective measures and risk control by developing a technological infrastructure aimed at the prediction of weather events particularly intense and potentially dangerous.

We need to identify the contribution of being smart, not only

mento per una nuova qualità della vita, Ambrosetti, 2012

with reference to the environmental issues of sustainability and environmental efficiency. The Calabria region is moving in this direction by participating in various initiatives: the project "ACI. SmarT In Moto-" topic area „Smart Education" coordinated with „Smart Culture and Tourism"; the project „Staywell"-topic area „Smart Health „integrated with „Smart government „- which offers research and technological innovation activities on themes „state of the art" of Smart Health, for monitoring the lifestyle, to support the well-being and individual prevention.

How can city and community (of area slower development) meet the energy and climate challenge? What can be gained if different energy services and technologies are combined in a smart way? How do citizens of a metropolitan city benefit from the implementation of energy efficiency measures and renewables? Who needs (through urban governance, multi-level dialogue) to be involved to start the transformation towards smart city and communitiy? Is this transition affordable for Reggio Calabria?

Figure 2 – Landscape of Condofuri (RC), Italy.

Reggio Calabria, recently established metropiltan City, is a city of 190,000 inhabitants. Located in the Straits, currently does not have the economic, social and environmental factors for the advancement to the rank of a metropolitan city. The prevailing residential buildings is low quality (phenomenon of illegal buildings). The area in which action is taken will not be closely tied to the political and administrative borders, but may extend to other areas based on reasons related to functional interdependencies.

There are several ways to be smart, but only one is the common denominator to consider the city, its government[5] and its technologies to be able -through actions aimed at inclusion, innovation and interaction- to promote active citizenship, a smart communities, aimed at creating new sociale, economic and cultural opportunities with paths of

5. Decreto Legge "Ulteriori misure per la crescita del Paese" approved on the October 4, 2012 in Consiglio dei Ministri. It contains an important section (Art. 20) devoted to "intelligent communities".

"smartierization".

The analyses, carried out also on the city of Reggio Calabria, suggest that success factors (upgrading) for metropolitan cities may be identified as follows

- economic factors: from the institutions to the international quality of research and to the market;
- sociale and inclusive factors: availability of good quality accommodation, strong sociale mixity and effective policies of sociale redistribution;
- location factors: position along the axis of a corridor or a network, as a multimodal gateway for specific activities or at the junction of important railway and air transports;
- cultural factors and heritage: importance of well preserved and valued historical heritage, policies for international cultural diffusion, policies for old city and landscape;
- environmental factors: high quality landscapes, hydrogeological security prestigious and preserved environmental sites;
- urban governance, multi-level dialogue, policies of urban marketing, management of urban conflicts and of urban security, funning organization;
- to identify, develop and deploy replicable, balanced and integrated solutions in the energy, transport, and ICT actions through partnerships between municipalities of the metropolitan city and industries related with planning, energy, sociology, economics and all the new technologies and infrastructures that are the core of the functioning of the city.

The key challenges for Reggio Calabria[6] metropolitan smart city are to significantly increase the overall energy efficiency of cities, to better exploit the local resource both in terms of energy supply as well as through the demand side measures. This will imply the use of energy efficiency measures optimising the use of renewables, the sustainability of urban transport and the needed drastic reduction of greenhouse

Figure 3 – City of Reggio Calabria, Railway, Italy.

6. The city of Reggio Calabria is the biggest in the region of Calabria Situated on the toe of Italy is separated from Sicily by the Strait of Messina, the city lies on the slopes of Aspromonte. Reggio Calabria is home to important archaeological museum which details the history of strong Greek ties with the region.

gas emissions in urban areas - within economically acceptable conditions - while ensuring for citizens better life conditions: swifter transport, job creation and as a consequence a higher degree of resilience to climate impacts (e.g. urban heat islands effects).

The policies and the proposals for metropolitan smart city of Reggio Calabria can address the following main unexplored sectors:

Integrated Infrastructures:

- through the integration of physical infrastructures such as core networks, street scenes, lighting, industrial sites etc to create new forms of value through re-use and repurposing. This might also imply the exploitation of synergies between smart grids, broadband infrastructures and in general poly networks;

low energy districts (or nearly zero) through the integration and management of:

- the cost-effective refurbishment of existing buildings without significant disruption for tenants (use of sustainable materials) with a special focus on residential buildings (illegal building);
- the supply of energy with predominant exploitation of local resources (e.g. waste heat, renewables) and the active participation of consumers;
- ICT solutions for the design and overall management of energy/ transport systems;

Sustainable urban mobility through:

- the integration of energy/ fuelling infrastructure with vehicle fleets powered by alternative energy carriers for public and private transport, including logistics and freight-distribution.

The metropolitan city of Reggio Calabria is afferent to the PON Metro.

It is necessary, therefore, through the instruments of urban planning (Figure 4, PSC di Reggio Calabria[7]) and programming:

- Put at the heart of urban regeneration construction of "public city" in which the service functions, service, culture and leisure, infrastructure and public spaces find integration with in the urban residence also ang gives an identity to the suburbs;
- Give priority to networks of sustainable mobility;
- Enter the new polarity in an organic way in the urban seizing of the opportunities of decentralization of functions of excellence that contribute to the formation of new urban centers.

The priorities and actions are:

- Applications in digital innovation for Public Administrations (Urban Agenda for the metropolitan city).
- Interactive Map for Smart Communities, in terms of usage of digital inclusion, online services, participation in the network to the strategic construction of the metropolitan city.
- Improve the „use" of physical and virtual city and its services through the enhancement of the demand of ICT by citizens and community involvement in the creation of the metropolitan city (Partecipation/Construction).

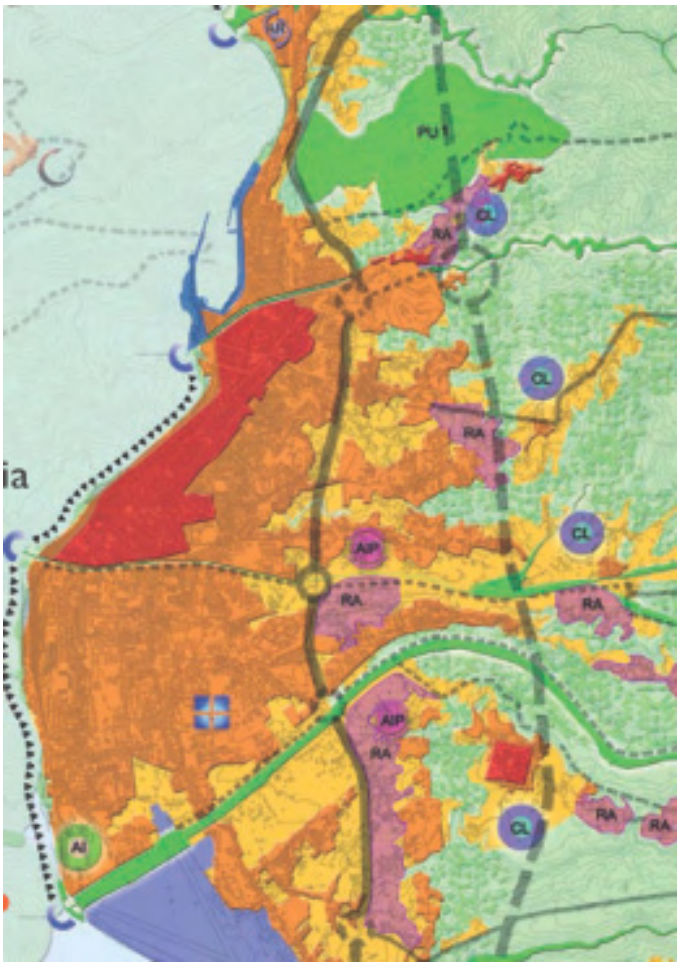

Figure 4 – PSC of Reggio Calabria, Italy.

7. PSC of Reggio Calabria (designers in RTP: Profs. Franco Karrer, Loreto Colombo, Francesca Moraci). The Preliminary Document is prepared and approvated (March 2010) in accordance with the Lur Calabria n. 19 of 2002.

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