Smart Cities – State and Comparison between Czech Republic and Austria

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ABSTRACT

Nowadays, there are many initiatives across Europe, which help to deploy the Smart City solutions in urban areas. This paper shows the actual state of Smart Cities in Czech Republic and Austria.

1. INTRODUCTION

The urban population is expected to double by 2050, And by 2030, six out of every then people will live in a city. As the planet becomes more urban, cities need to become smarter in order to address urban issues.

In this paper we will describe the overview the actual state of Smart cities in Czech Republic and Austria. Also we will see a brief comparison between medium sizes cities in both countries regarding the European ranking of Smart Cities.

2. Definition of Smart Cities

What is a Smart Cities? It is very difficult to define. A smart city is defined as the ability to integrate multiple technological solutions in a secure fashion to manage the city's assets – the city's assets include, but not limited to, local departments information systems, schools, libraries, transportation systems, hospitals, power plants, law enforcement, and other community services. The goal of building a smart city is to improve the quality of life by using technology to improve the efficiency of services and meet residents' needs. Business drives technology and large-scale urbanization drives innovation and new technologies. Technology is driving the way city officials interact with the community and the city infrastructure. Through the use of real-time systems and sensors, data are collected from citizens and objects - then processed in real-time. The information and knowledge gathered are keys to tackling inefficiency. Technology can be used as an enabler to tell what is happening in the city, how the city is evolving, and how to enable a better quality of life. [1]

A smart city uses information and communication technologies (ICT) to enhance quality, performance and interactivity of urban services, to reduce costs and resource consumption and to improve contact between citizens and government. Sectors that have been developing smart city technology include government services, transport and traffic management, energy, health care, water, innovative urban agriculture and waste management. Smart city applications are developed with the goal of improving the management of urban flows and allowing for real time responses to challenges. A smart city may therefore be more prepared to respond to challenges than one with a simple 'transactional' relationship with its citizens. Other terms that have been used for similar concepts include 'cyberville, 'digital city'', 'electronic communities', 'flexicity', 'information city', 'intelligent city', 'knowledge-based city, 'MESH city', 'telecity, 'teletopia'', 'Ubiquitous city', 'wired city'. [1]

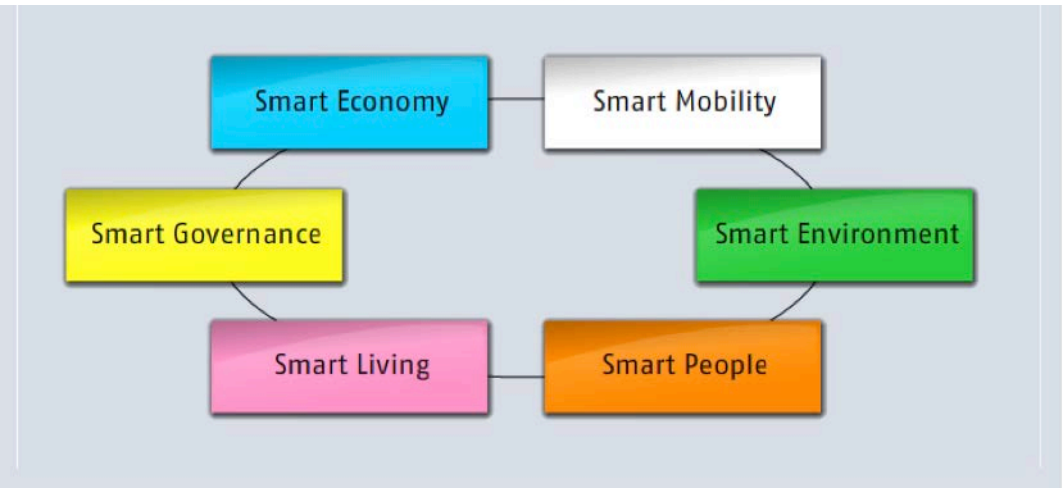

Figure 1. Smart Cities enable six characteristics [2]

3. Smart Grids in Czech Republic

Cities must in the next years to prepare for new threats related to extreme surge in population. While now lives in cities, half the population, in 2050 it will already be 70% of the world population. The huge concentration of people at only two percent of the earth's surface will bring about environmental pollution, traffic problems and safety hazards eg. In relation to the availability of drinking water [3] [4] [5].

Experts in Czech Republic sees a solution in a smart city, smart city management advanced technologies that are used in transport, energy, ecology and other fields.

Czech Republic to the concept of Smart City has already signed when the agreement between the EU and the Czech Republic on EU financing sources for 2014-2020 stated: "The Czech Republic is among the countries with above-average energy intensity of the economy within the EU. On the side of energy consumption and associated pollution is therefore beneficial to the conceptual solution of this issue through the concept of Smart City, interconnected energy saving measures at the municipal level. "

Towards Smart City has already started to move hundreds of sites worldwide. In the Czech Republic it now joins Písek. Schneider Electric enters the game as a pioneer of the concept of Smart City, which annually invests in the development of smart-technology 1 billion.

3.1 City Písek will be first

Schneider Electric has in Smart City over two hundred successful implementations worldwide. Now in this field and initiates collaboration with Písek. It has become the first intelligent city in the Czech Republic, which uses smart-technology complex and systemic way.

"Out of the currently solved projects I want to mention reconstruction of the park, which will be equipped with a guidance system for automobile traffic to designated parking areas. In the city will soon be charging stations from Schneider Electric for electric and hybrid vehicles, "says Josef Knot, Deputy Mayor of Pisek, adding:" Furthermore, we plan reconstruction of public lighting and its transfer to the Smart system. We act also omožnostech use of sensor networks

throughout the city, whose aim will be to analyze and evaluate obtained data on transport and the environment. "

3.2 Positive impacts

Smart City project at Písek is also involved Písek Technology Centre. The positive impact of technological solutions for city residents is convinced Radovan Polansky, executive director of the center. "Smart technology will provide us with data about the real load of road, which is very helpful when planning investments to repair roads. Or you can watch the usability of urban transport, which the town of Pisek is worth more than ten million a year. Information about parking places along with information on traffic intensity can be used not only to guide drivers to free parking, but also to effectively decide where to build new parking spaces and how much. All this will have a positive impact on the environment and air quality in the city. "

3.3 Situation in Czech towns

Priorities, Strategy

- strategic development plans, IDP, policy statements
  programming documents (Prague OPPK OPPA)
- thematic conception, information strategy (infrastructure, agenda)
- Competence Council (Councilor for Informatics)

Use of ICT

- Infrastructure
  - Metropolitan Network (offices, schools, libraries)
- Data
  - Economic agenda, records management, property
  - Data on the territory (GIS)
- Service
  - Web, information according to the law, new services for citizens
- Organization
  - ICT component in office, service company, outsourcing
- Management and funding
  - Projects - preparation, management, reporting (the experience of drawing SF)
  - Use SF - IOP, OPLZZ
  - Co-financing
- Domestic cooperation, participation
  - The cooperation with utilities
  - The region, with neighboring communities
  - Quality management - CAF, ISO, etc.
  - Benchmarking, joint projects
- International cooperation
  - Official partnership
  - International projects, participation in competitions

3.4 IBM solutions for Smart cities[1] [6]

The world inhabited by more than 50% of the population in cities in the EU is almost 80% This corresponds to the economic potential of cities (urban areas EU is 75% of GDP), but also urban problems (limited land use, unavailability and public transport, high unemployment , population aging, social exclusion, high and rising crime, the creation of ghettos, environmental pollution, the need for secure energy supplies, etc.), UN Habitat, State of the World s Cities Report, London 2008 European Commission, State of European Cities Report, Brussels MMR 2007.

Cities in the Czech Republic with their problems:

- Population aging and population decline in the cities (migration to larger centers)
- Increase in automobile traffic, congestion and poor transport
- Impaired (disturbed) the quality of the environment
- Existence of brownfields and contemporary urban sprawl
- Insufficient use of modern technologies

Problems can be solved:

Administrative way (control regulations, rules, prohibitions) = shrinking freedoms + administrative expenses + negative externalities force (expansion of infrastructure, increase capacity) = mass investment and high operation costs, resource depletion clever way to put bodies in the cities of information and tools which themselves regulate their behavior = optimize their activity (costs necessary) and increase the efficiency of the system (a system of systems).

The strategic context of financing the development of cities and regions:

- Cities and counties to invest in development activities that meet the needs of citizens (public service) and simultaneously lead to increased competitiveness of the city
- For these types of projects serving the financial resources and resources from national budgets, in particular from EU programs (Community funds, Structural Funds)
- Consistency focus and impact Smarter Cities solutions with the objectives of EU policies (cohesion policy) and the development strategy (EU 2020 Digital Agenda) IBM methodology helps to formulate development projects that directly meet the objectives of the EU 2020 and lead to increasing the competitiveness of cities and regions (in the global context) Preparation for the European agenda urban dimension now

[1] IBM (International Business Machines) is by far the world's largest information technology company in terms of revenue ($88 billion in 2000) and by most other measures, a position it has held for about the past 50 years. IBM products include hardware and software for a line of business servers, storage products, custom-designed microchips, and application software. Increasingly, IBM derives revenue from a range of consulting and outsourcing services. With the advent of the low-cost microchip, the personal computer, distributed computing, open rather than proprietary standards, and the Internet, IBM has seen its position of dominance challenged as the world of information technology no longer revolves around a single company. Yet investors and competitors continue to be impressed by IBM's long-established base of customers among middle-sized and Fortune 100 businesses and its ability to adapt its products and services to a changing marketplace.

Urban dimension:

- Tools of strategic and integrated programming
- Special priority for cities
- Emphasis on sustainable urban development
- Innovative actions
- Urban development platform

3.5 Tools for the European Commission

300 EU cities sharing of good practice, the creation of urban policy EU Innovative Action for Sustainable Urban Development: Research on problems of urban areas (socio, economic, enviro) funding for pilot projects [7].

Completed projects:

- Smarter traffic and parking solutions: intelligent systems for charging, parking systems, card systems for public transport systems for vehicle maintenance goal: reduce congestion, traffic congestion, environmental pollution, solve parking, streamline public transport References: Stockholm, Eindhoven, Plzen, Washington
- Smarter Security Solutions: Systems for analysis and evaluation of data from Sec. cameras and other security systems aim to enhance the safety, reduce crime, protect people from the elements References: New York, Edmonton, Chicago, Rotterdam
- Tourism smarter solutions: portals for tourists to navigate, information kiosks and other systems to support tourism goal: to develop tourism reference: Venice, Beijing

3.6 Triangulum - The Three Point Project / Demonstrate. Disseminate. Replicate

The Triangulum project will demonstrate how a systems innovation approach based around the European Commission's SCC Strategic Implementation Plan can drive dynamic smart city development. We will test the SIP across three lighthouse cities: Manchester, Eindhoven and Stavanger, which represent the main typologies of European cities. They will be complemented by our follower cities Prague, Leipzig and Sabadell.

3.7 IBM activities in cities in 2015

"With some towns in the Czech Republic we have been cooperating and helping them become smarter newly implemented TC ORP according challenge 06 Egon intensive cooperation with the Association of Towns and Municipalities optimized solution combination of hardware and software solutions, services, favorable pricing and unique technical solutions (Storewize V7000 announced as product of the year) continuity solutions IBM on central projects (central registers, archive digitization, guaranteed and nonguaranteed repository, Identity managment ...)" says IBM experts.

This powerful combination reflects an urban population of between 100k and 1,2m inhabitants across six different countries, allowing us to demonstrate successful replication across a wide range of typical urban areas in Europe. Each city has already made significant progress towards the transition of becoming a smart city; developing their own individual approach reflecting

specific local circumstances. These inherent strengths will now serve to accelerate the smart city development across proposed demonstration sites within Triangulum. The suite of projects developed will be based around zero/low energy districts, integrated infrastructures and sustainable urban mobility designed to deliver a range of cross-cutting outcomes across different sectors and stakeholders. This will provide the basis to 'road test' the SIP and provide recommendations to the Commission on how it could be improved to facilitate wider replication.

The Triangulum goals target a series of direct impacts around; reduced energy consumption of buildings, increased use of renewable energies, increased utilization of electric vehicles, deployment of intelligent energy management technologies and the deployment of an adaptive and dynamic ICT data hub. The design and implementation of innovative Business Models and the activation of citizens as co-creators are core cross-cutting elements to base the technologies in real-world city environments and facilitate replication."

Objectives: The main output of the project was a methodology for Czech cities how to develop the concept of Smart cities.

Methodology: The project defines requirements and indicators for all the three levels of smart cities concept in several technical domains. The political level focuses on picking-up exemplary European cities and their activities that can make the city and its investments more efficient and multi purpose (e.g. the city of Vienna with its energy consumption, citizens´ participation or dedicated public space for testing smart systems). The social level brings the tools for better communication to citizens and their active involvement into the city development. The indicators for crowdsourcing and crowdfunding tools are worked out for both mobile and web forms as well as model programs of investments into public space. The new phenomena "sharing economy" indicators and the potential of the city support are monitored as well. The technology level contains business models of smart technologies including technical requirements for public procurement, identification of potential European co-funding schemes, definitions of required expertise for project management and relevant purchase costs. All the known smart systems in the world are to be tackled as smart on street parking, smart waste management, smart public lights, smart monitoring of water, energy and gas consumption, intelligent transport systems and smart diagnostics of vehicles, smart buildings, smart social inclusion and social care, engineering buildings monitoring, smart monitoring of pollution and electric and telecommunication electromagnetic radiation, fire detection systems, environment conditions monitoring, smart grids, and others.

3.7 IBM activities in the cities of social responsibility:

IBM donated to Ostrava nurseries 68 and Jihlava 26 special computer stations KidSmart Young Explorer educational program designed for children ages 3-7. Learning healthy access to information technologies and playful way to promote computer literacy of preschool special software programs for the development of language skills, mathematics science and humanities computer workstations are ergonomically tailored to children of preschool age and meets all standards psychohygienic. Since 2002, IBM has donated 471 children's computer stations a total of 360 nursery schools and child stacionářům in all regions of the Czech Republic.

Smarter Cities Assessment (For urban development strategy and focus on investment IBM offers several methods to help identify priorities for development, namely):

- integrally inspect the services rendered cities evaluate development strategy based on collected data suggest opportunities to improve one of the City's assessment methodologies
- Sophistication cities
- Analysis Tool parameters of urban development strategies - The tool was developed by IBM Global Location Strategies Based on proven methodologies for evaluation of geographical areas for the purpose of business plans tool measures the performance of towns over a wide range of indicators in various areas to be evaluated tool allows you to compare the current status and services the city against similar cities or the best examples (best practice) the tool identifies areas in which the city is facing substantial challenges and where improvements are possible.

Experiences from Europe:

Based on the assessment center initiatives arise:

- economic development which industries / sectors develop improvement
- detailed analysis of individual systems
- Pilot operation of smart technologies

For example:

- Gothenburg- new transport planning
- Mons - strategy for the city
- Aarhus-innovative workshops
- Stockholm-framework contract for the supply of smart projects
- South Band-detailed analysis and pilot on smart metering

Comparison between the cities themselves is beneficial for the following reasons:

- Compared to other cities in central European cities is an important indicator of the city's competitiveness on a global scale
- Differing assessments of the cities in the region (region, national) is an important source of knowledge - enable effective communication and transmission or inspiration about possible solutions, it provides independent comparisons with the development of European cities and can serve as a guide for forming other activities
- Evaluation of the city shows the opportunities: Improving urban life (citizens, businesses)
- Systems integration of cities and regions
- Linking into logical Euroregions
- Financial savings
- Savings on administrative and management functions

- The cost savings on infrastructure operation
- Operational cost savings, and investment management through intelligent asset management

3.8 Mapping Smart Cities in Czech Republic

The figure below shows the actual distribution of smart cities across the whole Czech Republic. From figure we can observe that only 2 regions still not develop smart cities solutions.

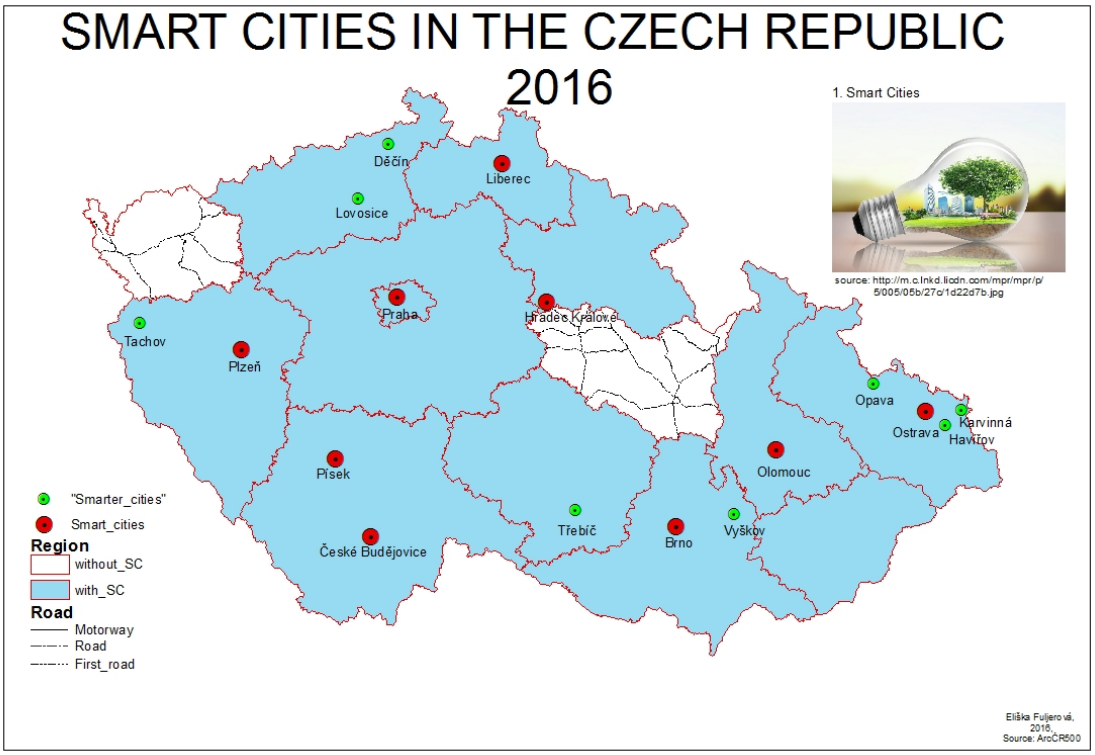

Figure 2. Smart Cities in the Czech Republic 2016.

4. Smart Cities in Austria

In 2012 Fraunhofer Institute found that Austria is a pioneer in terms of smart city technologies. At least one in ten European smart city projects were in Austria. Also the Austrian smart city technology has been exported to other countries, like China. [8] [9]

Smart Cities in Austria are a set of initiative, with a portfolio of project in different focal areas, modalities, and stakeholders. This relationship between smart cities initiatives and projects is shown in figure 3.

4.1 Smart Cities Funding: Initiative of the Climate and Energy Fund

The vision of the smart cities initiative in Austria is to turn neighborhoods, towns and urban regions into zero emission cities/urban regions using Information and Communication

Technology. This initiative considers the following the most important factors in making urban regions smart:

- Increasing energy efficiency,
- Increasing the share of renewables, and
- Reducing greenhouse gas emissions.

For this purpose, cities require solutions that combine:

- Integrated energy planning,
- Intelligent planning and operation of thermal and electrical grid,
- Energy-efficient interactive buildings, and
- Optimized renewable energy supply technologies [9]

Since 2010, the Climate and Energy Fund of the Austrian Federal Government started with annual "call" in order to invite applicants to submit their smart projects for consideration and gain access to funds via competition. This Initiative was the first of a kind in whole Europe. [9] [10] The Maximum funding amount for each project is 200,000 euros.

From 2010 to 2015 the Smart Cities Initiative authorized 29 Million euros in funds to be implemented in 26 cities or urban regions, in 57 individual projects. [11]

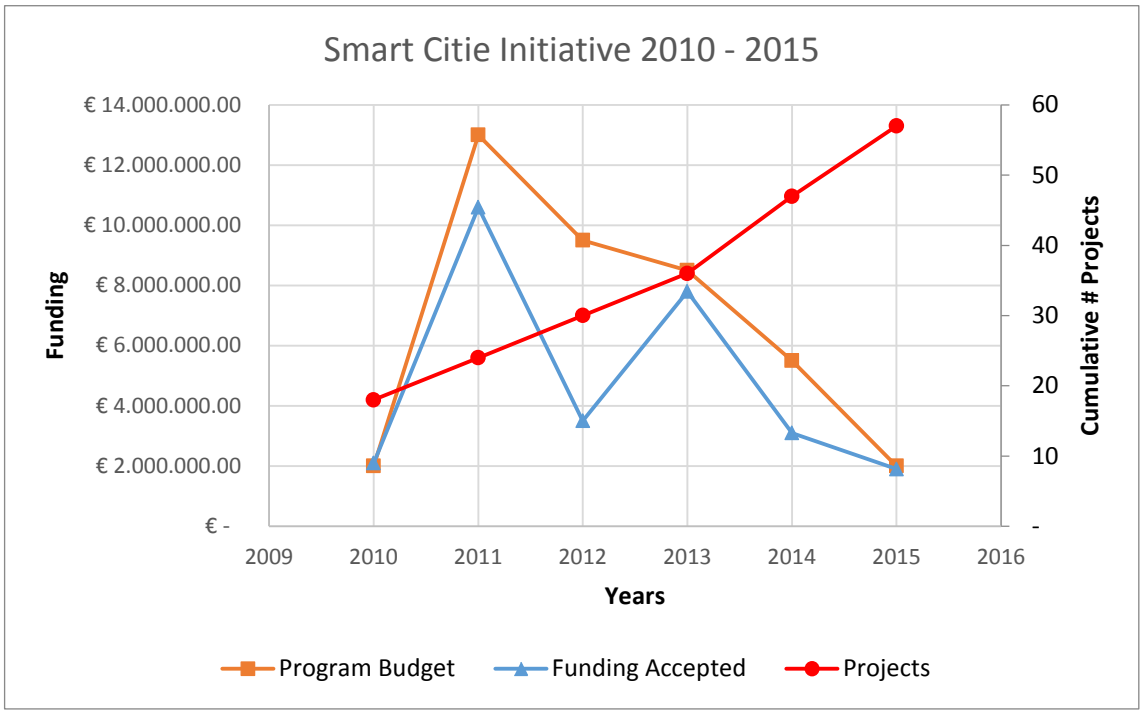

Figure 3. Smart Cities Initiative Budget and cumulative projects 2010-2015 [11]

Each call is focused on the following projects:

i) **Smart city entry-level project:** the project should present preparatory work for future smart city demonstration projects, for example: 1.) Vision 2) Roadmap 3) Action Plan 4) Options for future implementation.

ii) **Smart city demonstration project:** This kind of project is focused on demonstration of interactive Integrated solutions.

iii) **Further Funding:** This part of the fund is intended to use in in transnational projects in order to support development projects and cooperative research.

iv) **Accompanying Measures:** An accompanying measure could be accompanying research on smart city projects or creating standards for sustainable development.

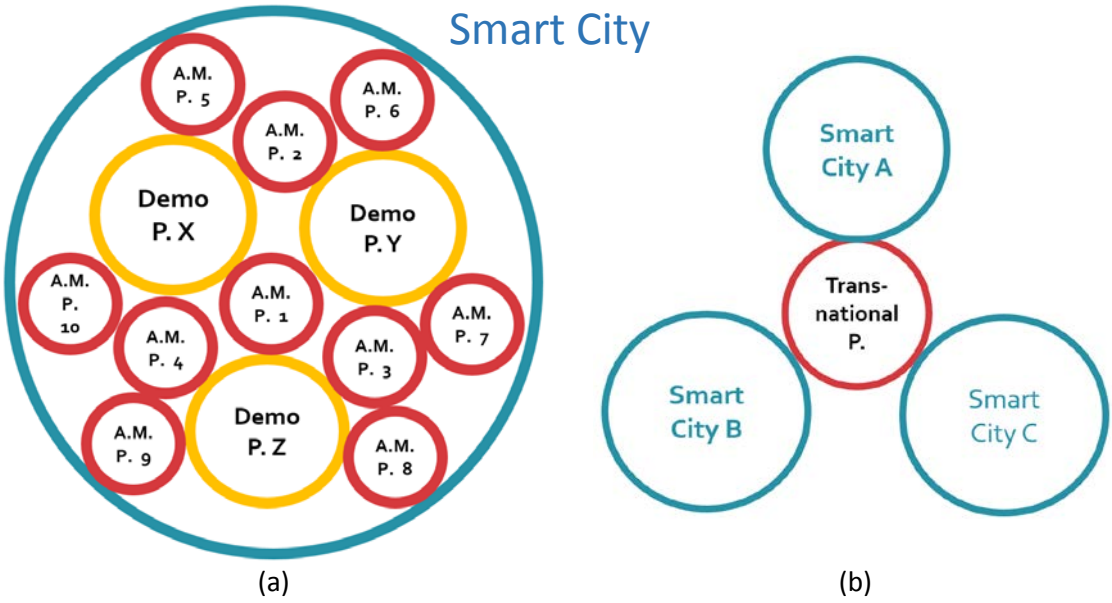

Figure 4. The relationship between projects, and smart cities [12]. (a) Smart City—Demoprojects - Accompanying Measures (b) Smart Cities – Transnational Project (Further Funding)

4.2 Mapping Smart Cities in Austria

The Smart cities entry-level and projects are implemented all across Austria. The figure below shows the districts, urban regions and cities where the initiative is working to implement energy supply and energy management.

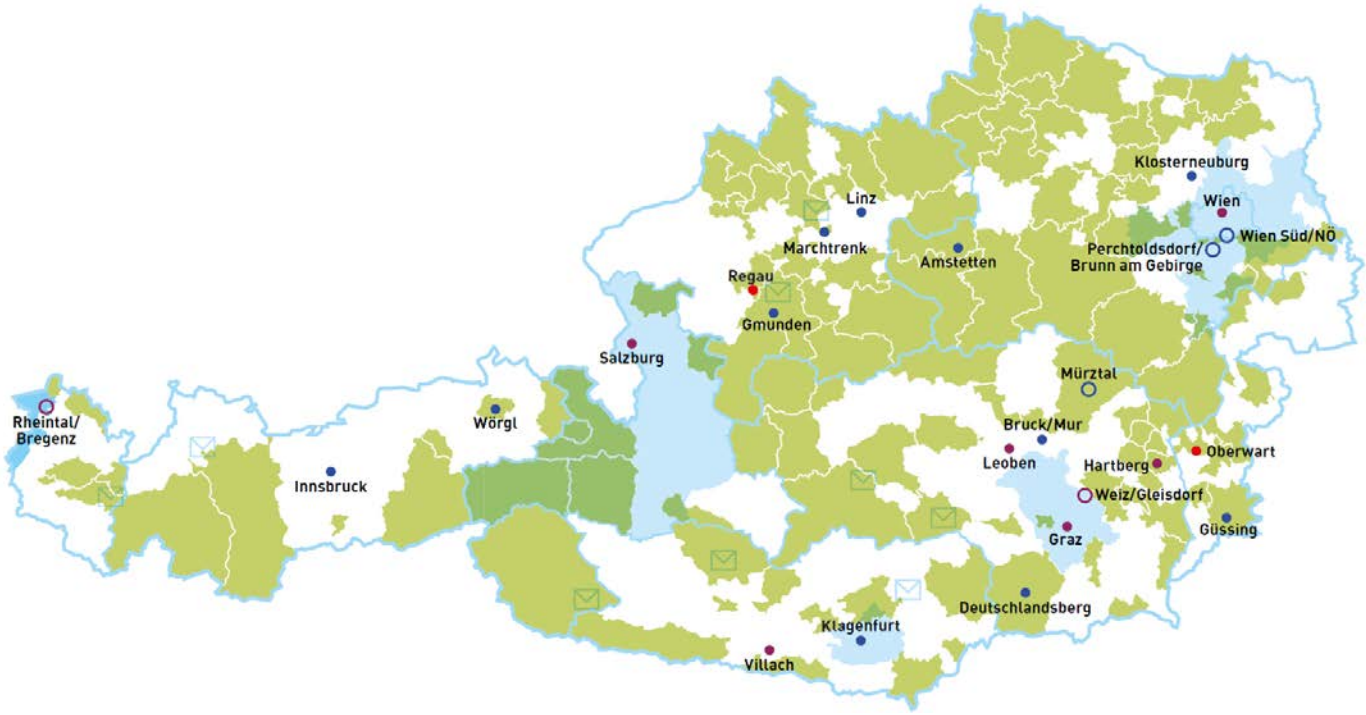

Figure 5. Map of Smart Cities in Austria

Legend	Description
	112 climate and energy model regions
	7 e-mobility regions
	Overlap of climate and energy model regions and e-mobility regions
	The model region e-mobility Post is active in many Austrian cities and municipalities
	Smart Cities - Entry level
	Smart Cities - Project implementation
	Smart Cities - Entry level and project implementation
	Smart Urban Regions - Entry level
	Smart Urban Regions – Entry level and project implementation

Based on map above, in the following sections we will describe the most relevant Smart Cities –entry level, -project implementation and smart urban regions in Austria.

4.3 The Initiative "Smart City Vienna":

Vienna is one of the most successful cities where quality of life, infrastructure and innovation are concerned. The main objectives of the authorities in the federal capital Vienna is to secure and improve its ecological, economic and social performance. [13] Also, the city expects to growth until three million inhabitants in the course of the coming 25 years. This development will demand more energy, affordable and functional housing and a need for strong traffic concepts. For this reason, the authorities create in 2011 the Initiative Smart City Vienna. The key element of the initiative was a stakeholder process in the course of which all stakeholders inside and outside the city administration were asked to participate in either general consultation teams or teams focusing on specific issues. The six themes addressed were: **population development**, **environment**, **administration**, **economy**, **energy** and **mobility.**

4.3.1 Objectives:

The objectives of the initiative are [14] [15]:

- Significantly reduce the emissions greenhouse gases (e.g. from currently 3.1 tonnes per capita to 1 tonne per capita) and with this, achieve the EU climate protection targets. Long-term objective: a zero emission city, zero emission building as standard.
- Reduce the energy consumption. Long-term objective: reaching close to zero energy in new and existing building by 2020. Primary energy input should drop from 3,000 to 2,000 watt per capita.
- Significantly increasing the use of renewable sources of energy. By 2050, the 50% of Vienna's gross energy consumption will originate from renewable sources.
- Raising awareness in the wider public about responsible use of resources (energy, water)
- Giving citizens an active role by providing opportunities for actively controlling additional areas of daily life.
- Promoting multi-nodal transport systems by improving the public transport network, enhancing networking between individual transport carriers, and significantly reducing individual motorized transport, from currently 28% to 15% by 2030. By 2050 all vehicles within the municipal boundaries run without conventional propulsion technologies.
- Positioning Vienna as a model European environmental city and as a leading European center for research and technological development at an international level. Also by 2030 the innovation triangle Vienna-Brno-Bratislava will be one of the most future-oriented cross border innovation regions in Europe. The share of technology-intensive products in the export volume will have increased from currently 60% to 80% by 2050.

These lead to the key objective for 2050 of the Smart City Wien: **"The best quality of life for all inhabitants of Vienna, while minimizing the consumption of resources. This will be realized through comprehensive innovation."** [15]

4.3.2 Framework Strategy:

The “Smart City Vienna framework strategy” is a long-term strategy to 2050 that will establish a long-term and structural framework that will exist alongside other documents, plans and programs. The framework is intended to facilitate goals and goal hierarchies, specific strategic approaches, project evaluation criteria for the Smart City Vienna, as well as coordinated policy action [15].

Three fields of action have been defined, as follows: **Resources, Quality of Life**, **innovation.**

4.3.3 Entry-level Projects

Currently in the initiative smart city Vienna there are 57 projects in different stages of development. Projects are grouped in 7 categories: Education & Research (12), Health & Social Services (3), Building Activity & Living (9), Transportation & Urban Planning (10), Environment & Climate Protection (13), People & Society (4), Politics & Administration/ICT (6) [16].

A brief overview of the most relevant entry-level projects will be described below:

4.3.3.1 URBEM – DK

The public utilities in Vienna and the Technical University of Vienna are sponsoring 10 doctoral students with this project. The main goal is to visualize and develop innovative energy and mobility scenarios for the infrastructure of the public utilities in Vienna. The doctoral students are encouraging to take an interdisciplinary approach and research new methods while solving complex issues [17].

Stakeholders: Wien Energie, Energiecomfort, Wiener Linien, Wiener Netze and WienIT.

4.3.3.2 CITYKeys

The aim of this program is to develop and validate, with the aid of cities, key performance indicators and data collection procedures for the common and transparent monitoring as well as the comparability of smart city solutions across European cities. It will also provide recommendations to policy makers for collecting new sources of data in order to improved territorial knowledge for local smart city planning. This Project is co-financed by European Union HORIZON 2020 Program [18].

Stakeholders: VTT – Technical Research Centre of Finland, AIT – Austrian Institute of Technology, TNO Netherlands Organization for Applied Scientific Research, EUROCITIES ASBL, City of Tampere-Finland, City of Rotterdam-the Netherlands, City of Vienna- Austria, City of Zaragoza- Spain, City of Zagreb-Croatia, HORIZON 2020 Program.

4.3.3.3 ZENEM – Future energy networks with electro-mobility

The Project will analyze the effects of a high penetration of electric vehicles on the electricity network, the conversion of a whole taxi fleet to electric vehicles along with needed charging infrastructure. The goals of this project are: i) Determination of the energy needs of future E-taxi ii) Assessment of existing electrical loads and verification based on measurements iii) formation of scenarios taking into account the feasibility of mobility iv) Synthesis of measures for the integration of the E-taxi fleet into the existing electricity network v) impact analysis of the E-taxi fleet on the selected network sections. vi) Analysis of economic and ecological aspects and conditions [19].

Stakeholders: Austrian Institute of Technology, TU Wien, Wien Energie, Austrian Climate Energy Fund.

4.3.3.4 EU-GUGLE

The EU-GUGLE project aims to demonstrate the feasibility of nearly-zero energy building renovation models in view of triggering large-scale, Europe-wide replication in smart cities and communities by 2020. Taking on the challenge of sustainable renovation in urban areas, the cities of Vienna (AT), Aachen (DE), Milan (IT), Sestao (ES), Tampere (FI) and Bratislava (SK) have committed to renovating a total of 226,000m² of living space during the 5 years of the project, with the objective of achieving 40 to 80% primary energy savings per pilot district while increasing the share of renewable energy sources by 25% by 2018 [20].

Stakeholders: University of Natural Resources and Life Scinces BOKU, alpS, iC consulenten ZT, City of Vienna.

4.3.4 Smart city project Aspern Vienna's Urban Lakeside

It is one of the largest project development in Europe is "Aspern Vienna's Urban Lakeside". The project will accommodate 20,000 people in 8,500 housing units [21]. Currently there is a demonstration project which is described below.

4.3.4.1 Model Demonstration Project Aspern

The model project has the goal of implementing a Smart City area on a large scale. An integrated approach in the areas of buildings, energy grid and ICT- based integration will be implemented in three mixed-use building areas, college student dormitories with 300 rooms, apartments with 213 units, school buildings) [22].

The goals and de desired results are divided into three levels. i) **Base level:** forms the implementation of the test bed infrastructure. The interaction between the networking of buildings and the energy grid is evaluated with a new type of ICT system. The resultshould be efficient communication along with an energy efficient implementation of the technical components that are in use. ii) **Second level:** includes flexible automation of buildings while taking into consideration volatile, renewable energy sources and different types of storage systems (electrical and thermal) as well as the operation of the stand-alone measuring and assessment systems in the low voltage network. A data warehouse solution enables flexible communication between the individual areas. iii) **third level:** in this level, users and the interface with the technical system are taken to develop user involvement [22].

The following sections will develop the 4 main research areas of the Model demonstration project Aspern.

4.3.4.2 Smart Building

The main objective of the smart building in this model demonstration is optimizing buildings' own use of energy. A smart building management systems are implemented with focus on calculating estimated energy requirement with due consideration of weather forecast and other data. Also those systems can provide information about the condition of individual building units and in that way support the forward planning of maintenance [23].

The buildings could provide energy to the grid. Because of that, an Energy Pool Manager must find the solution on how buildings can use their flexibility in the future to support local,

medium and low voltage networks, or also system could participate on the electricity market [23].

To master these challenges, aggregation levels must be created with a few buildings, and in the future even with up to several thousand buildings. At least two systems are required for this purpose. One is located in the building itself, a Building Energy Management System (BEMS), which calculates the electricity consumption of the building and any flexibility at regular intervals. The other, the Energy Pool Manager, acts as an interface between the individual buildings and the electricity exchange [23].

In order to be able to participate in balancing energy markets in the first place, you need intelligent electricity networks, which not only need to know about the network status at any time, but can also forecast it. Furthermore, a new legal framework is required for this [23]

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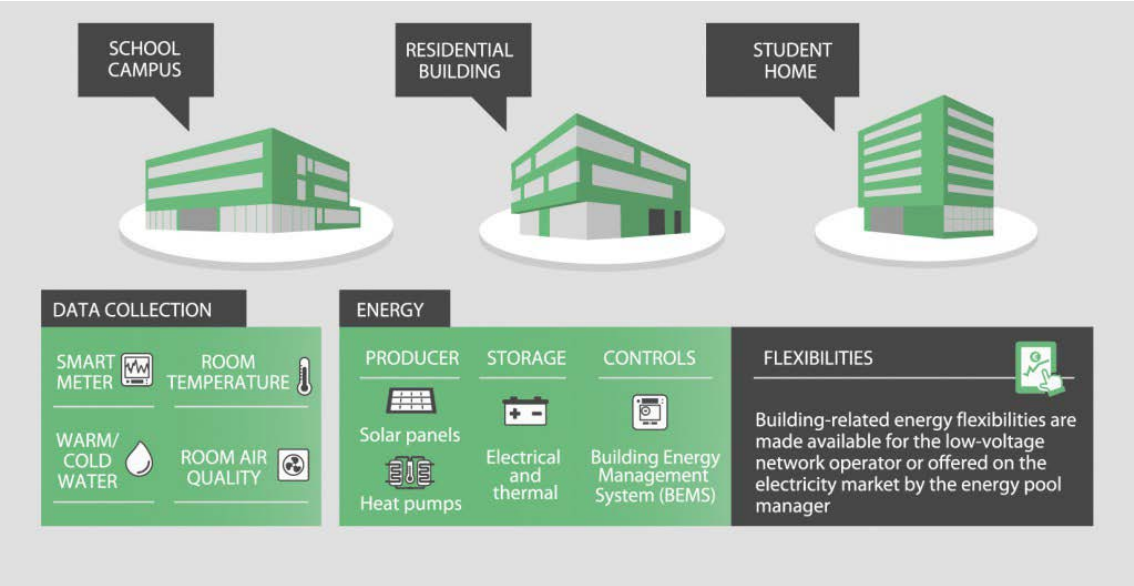

Figure 6. Smart Building concept in Aspern Smart City Project.

4.3.4.3 Smart Grid

The infrastructure of the Smart Grid in Model Demonstration Project Aspern consists of 12 secondary substations, 24 transformers and many sensors. This infrastructure alone is not enough to make the electricity network intelligent, but the model demonstration project will explore how to turn a traditional network into an intelligent network [24].

The approach adopted is based on optimal use of existing copper reserves and integrated smart ancillary technologies. This serves as a guideline for the transition from a passive distribution network to a smart grid, which stands out thanks to its bidirectional load a communication flows.

The data is acquired at the start of the migration path. The electricity network status must be made transparent. The low voltage grids are the largest part of the electricity network and are the most active areas in terms of grid dynamics and fluctuating voltages. Data collection is carried out by smart meters and self-configuring field sensors including power quality measurement devices or grid monitoring devices. Smart meters have already been tested, but

they only provide rough data. Additional measurements and sensors do generate higher costs, but they also enable a more accurate picture of the network status.

A core issue of the model demonstration is to determine the minimum required coverage with sensors that will provide a detailed enough picture of the network status for optimal network operation.

The data collected can be used to make management decisions that do not require any physical network expansion. Without active network intervention, specific network data enables infrastructure to be used closer to its physical limits and provides early warnings when thresholds are threatened to be exceeded [24].

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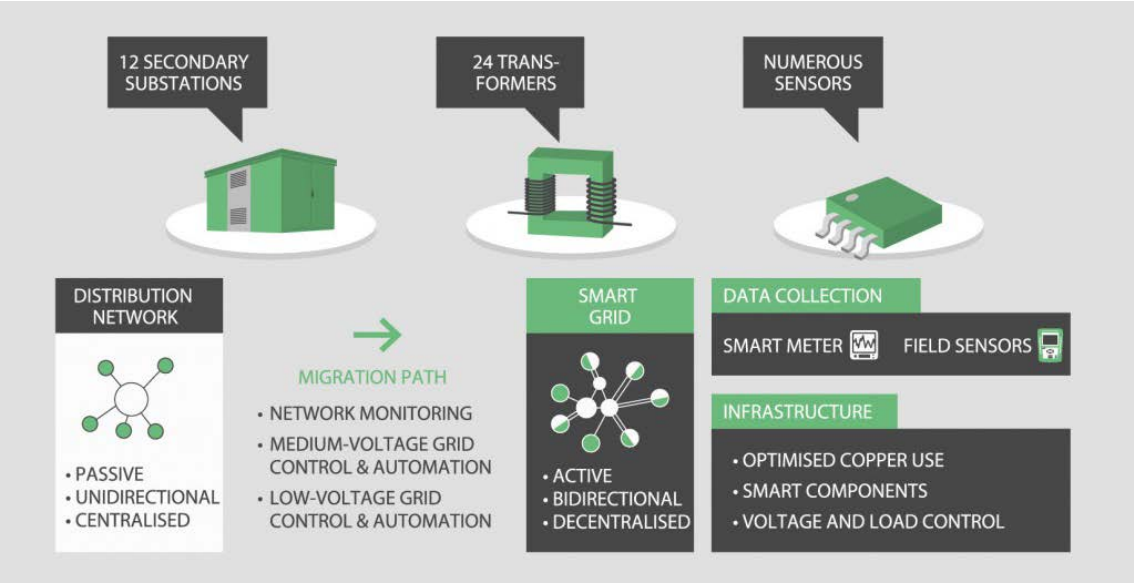


Figure 7. Smart Grid concept in Aspern Smart City Project [16].

4.3.4.4 Smart ICT

Smart ICT uses all of the data obtained from the buildings and the network (temperature, room air quality, electricity consumption, voltage) and external data (weather or related events) to analyze the interaction and the interdependencies between the network and the buildings. The essential factor is the integrated view of data from various domains [25].

Using real data from the test field, the ASCR research team creates a digital reproduction of reality in order to simulate any energy concepts as well as optimization measures. The objective here is to develop scalable and feasible solutions for urban energy balance [25].

Since building occupancy and network capacity utilization constantly change, the models on which the simulations run must be adjusted on a continuous basis. The models and thus the internal building and network control mechanisms also refine themselves by means of adaptive self-learning algorithms [25].

Big data methods are used to cope with the enormous data volumes from the various domains. Numerous different data models can be used depending on the area of application.

centralised data models as well as decentralised models in the style of the Hadoop software framework are tested [25].

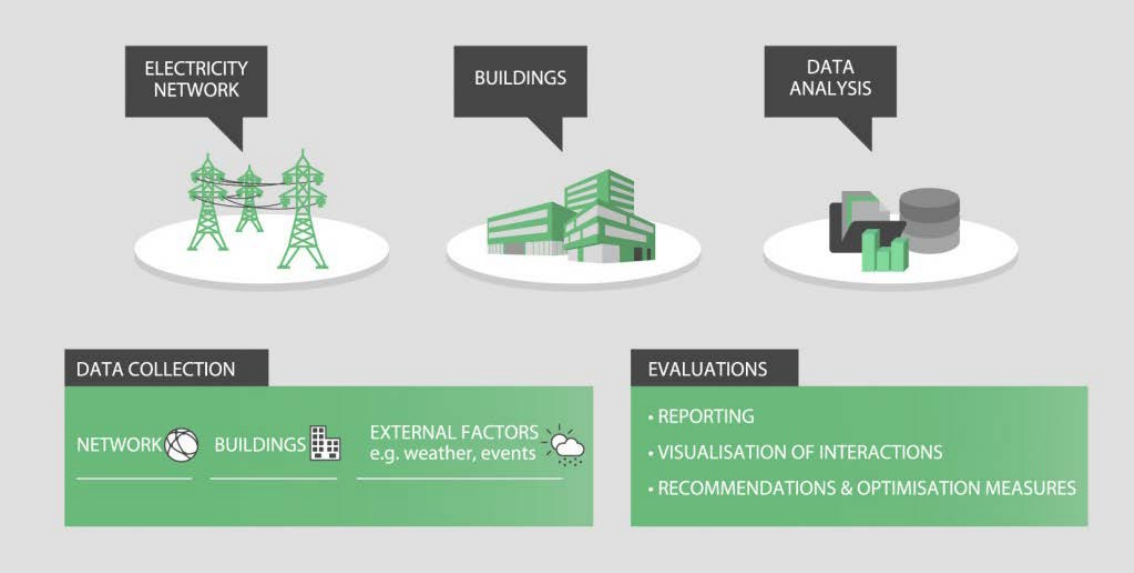


Figure 8. Smart ICT concept in Aspern Smart City Project

4.3.4.5 Smart User

This part of the Smart city Aspern project users share their energy data consumption in order to determine current utilization habits and future needs. The aim is to find out how the buildings work in an optimal way. Consequently, the cooperation with users will be continuously supported and accompanied until 2018 based on a social science approach. As the basis for home automation, smart measuring and control technology (smart MCT) is installed in the participating households and controls the air quality and temperature of the residence with an aim to optimizing the building's own consumption. Users are still always able to intervene with the smart MCT, i.e. to set air quality and temperature levels themselves, even remotely from a tablet or smartphone. Additionally, they can test innovative products and services to control their individual energy consumption (e.g. time- variable tariff models). This in turn helps the research team in developing innovations. The aim, however, is to promote sustainable, cost- and energy-efficient usage by means of incentives and raising awareness. The paradigm of today is: Generation follows consumption meaning the production is adapted to the consumption. In the future, it must be possible to adapt consumption more towards fluctuating renewable energy generation [26].

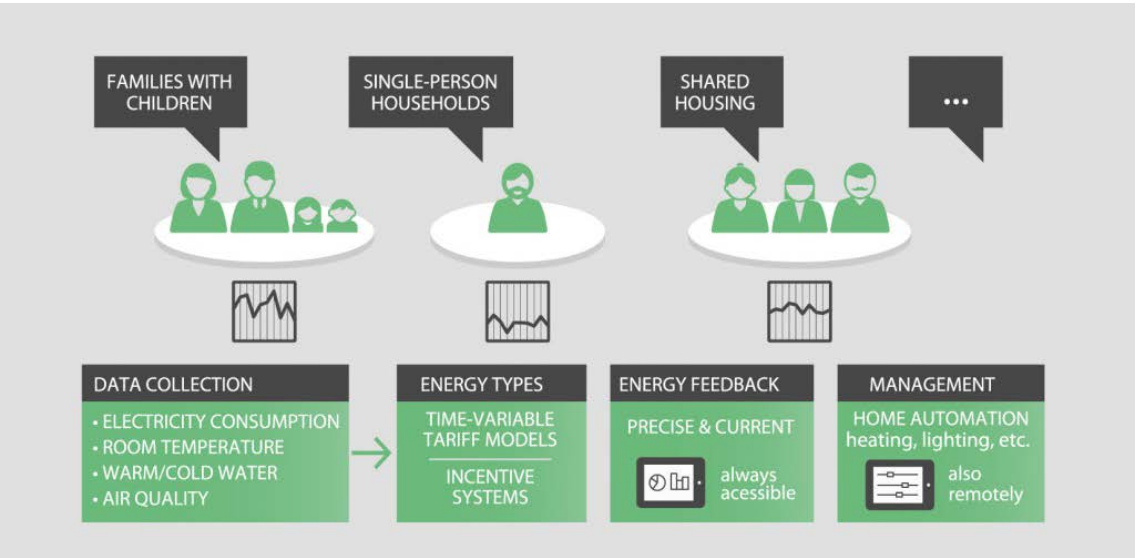


Figure 9. Smart User concept in Aspern Smart City Project [26].

5. Comparison in the EU context

Since 2008, over half the world's population in cities. UN predicts the trend of population growth to 70% by 2050. In the UK, more than eight out of ten already lives in cities.

Therefore, smart cities necessity if human civilization is to respond effectively to the critical challenges faced.

Cities are increasingly forced to work better, but at a lower cost, compete in a globally networked economy and ensuring the environment of their citizens truly sustainable way. In short, it must be intelligent.

The British Government is committed to supporting the development of smart cities. And as for social, economic and environmental benefits for the citizens of the cities, and because products for smart cities represents a significant export opportunity for businesses in the UK.

In 2012, the Department for Business, Innovation and education (BIS) therefore commissioned the British Standards Institute (BSI), to develop a strategy of standards for smart cities: the aim is to find out where standardized solutions needed to accelerate the deployment of smart systems in cities and promote British providers Smart City solutions.

Smart City Framework (SCF) is guided smart city programs designed for city governments and authorities at all levels and in all sectors. It provides practical advice "how to", based on the current general practice of representatives of public, private and nonprofit sectors involved in the process of introduction of smart cities in the UK.

BSI has prepared a draft publicly accessible publications which describes a possible framework of action. And steps that cities should do to start the process of transformation into a smart city. Publications PAS does not pretend to describe a universal model for the future of British cities that suits everyone and can be used anywhere. Rather, the emphasis is on the activation processes, innovative use of technology, together with organizational changes, which can help bring forth different visions for effective, efficient and sustainable development of British cities.

That means focusing mainly on the possibility of cities that:

- has made current and future needs of citizens driving force of urban spaces and systems;
- integrated physical and digital planning;
- identify, anticipate and respond to new challenges in a systematic, flexible and sustainable manner;
- created a fundamental change in the organizational and personnel access to interconnect the supply and innovation of individual organizations within the city.

Although many of the principles and methodologies recommended in this context are relevant in specific vertical industries, cities (smart electricity networks (smart grids), smart mobility, smart health care etc.), the ultimate goal is to focus on the problems and challenges that would link solutions one unit for the entire city. The framework will therefore focus primarily on leadership and innovation pilot, cultural and business model and active role of all stakeholders in the creation, provision and use of urban space and services.

5.1 European Smart Cities Ranking, Comparison between Medium-sized cities in Czech Republic and Austria.

The figure below shows the comparison between Austrian and Czech medium size cities in basis of an European benchmarking of smart cities in the period from 2007 – 2014. The ranking is integrated by 77 European cities, with an urban population between 100.000 and 500.000.

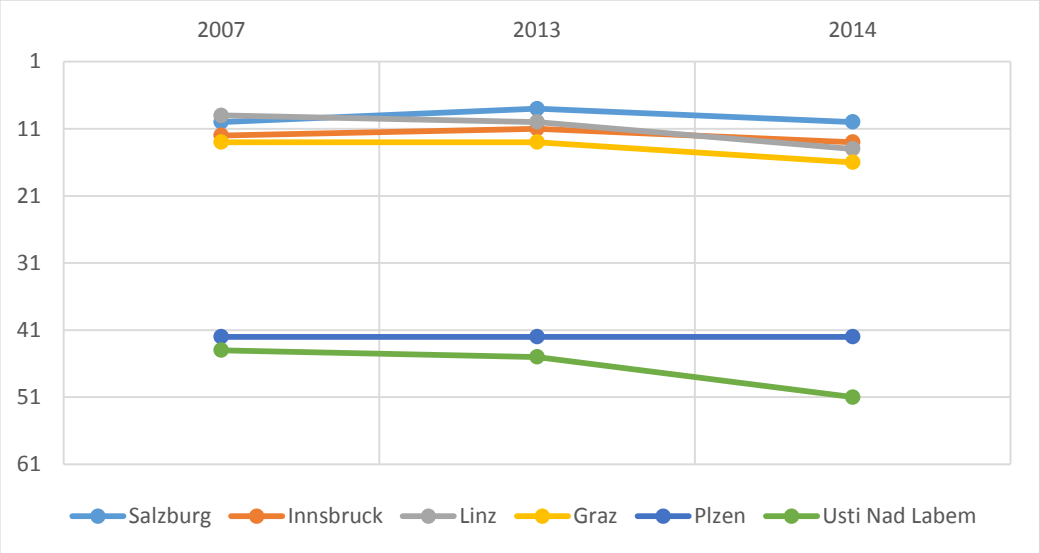
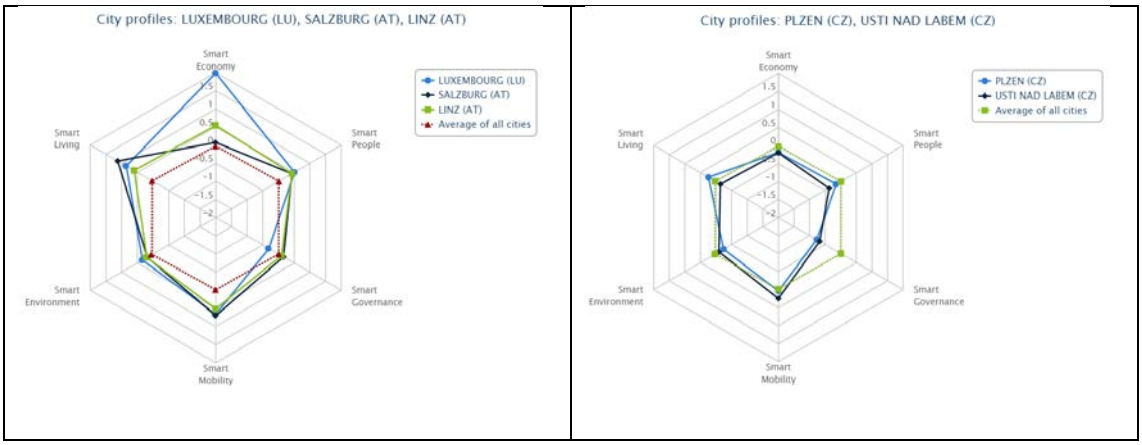


Figure 10. Czech and Austrian medium size cities-Smart cities European Ranking [27].

The Austrian Cities are ranked in the first 20 positions, and they keep the performance during the years, with a slight declination in 2014.

The two Czech Cities are ranked in between the 40th and 50th position. Only Usti Nad labem city had a notable declination on its rank performance.

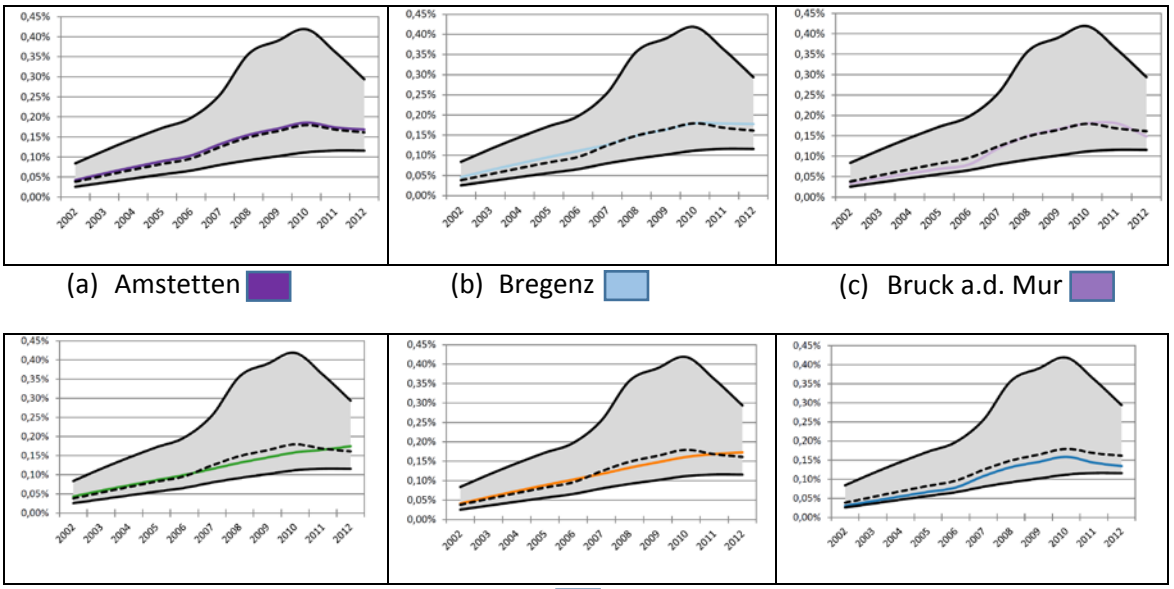


(a)Austrian City profiles (b)Czech City Profiles

Figure 11. City profiles of Austria and Czech

In figure above, the cities in Austria and Czech are compare with the average of all cities in the rest of Europe. The cities in Austria are better ranked in Smart Mobility, Environment and Living. These characteristics are better ranked in smart cities Austria due the effort on infrastructure investment, which is focused in reduce gas emission and share of renewable energy sources.

Smart cities in Czech Republic are still in development, and because of the cities profiles are ranked in the average of all cities, with lower performance on smart Governance.



(a) Amstetten (b) Bregenz (c) Bruck a.d. Mur

(d) Linz (e) Salzburg (f) Vienna

Figure 12. Building energy Efficiency in Smart cities Austria [22]

In Figures above also we can see the development of the efficiency buildings in several Smart cities across Austria in the period 2002 2012. The dotted line represents the mean value of cities with more than 10.000 inhabitants. In this sense Bregenz, Amstetten, Linz and Salzburg have efficiencies above the average. In the other end of the spectrum Vienna and Bruck and der Mur have efficiencies below the average.

6. Conclusions.

- Smart City continually seeks to become and remain self-regulating by enhancing the collective intelligence of its citizens and communities and their well-being and quality of life.
- Careful selection of new projects - projects not only because of subsidies the EU (but which realize financial benefits for public finances) of each smart city.
- Smart cities in Austria and Czech Republic are a different stage of development.
- The majority of demonstration projects in Austria and Czech Republic are in the Plan or Execution phase.
- New projects will bring new ideas, new skills and enhance the competitiveness of the population for the future
- Call for the period after the crisis that cities, regions and the central government were prepared: A skilled workforce capable of working

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