

## **Smart Cities Workshop: Inputs for a Roadmap towards Smart Cities in Austria**

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## **1 ABSTRACT**

### **Background on EU level**

Not least since the “Smart Cities” European Industrial Initiative (EII) within the framework of the European Commission’s Strategic Energy Technology (SET)-Plan and the implementation of the SmartCities-Workgroup within the European Energy Research Alliance (EERA) at the end of January 2011, chaired by the AIT, the topic ‘Smart Cities’ has reached a European dimension.

### **Smart Cities – what are they?**

The term ‘Smart Cities’ is used by persons with very different professional backgrounds. Due to the wide variety of topics in the field of Smart Cities it is very difficult to clearly define the future strategies in these areas.

Based on a definition of the term and focussing on energy relevant aspects this paper will provide an overview of current research topics related to Smart Cities, will present the current state of the Austrian research and approaches proposed by different scientific disciplines as well as focus on the very broad and complex research field Smart Cities. These topics will be discussed at the workshop.

### **Smart Cities Workshop at the CORP conference**

The workshop will be held within the framework of the CORP and will be chaired by ÖIR and AIT. Both partners will first present the state and actors of the Austrian research on Smart Cities. The major part of the workshop will be devoted to moderated discussions concerning the state of the art and future focuses of research on Smart Cities which will include the contributions and ideas of the audience. The results of the workshop will be used to elaborate roadmaps and action plans for political stakeholders.

## **2 MOTIVATION**

### **Research on Smart Cities – the SmartCitiesNet project**

To date, research in the field of Smart Cities has been carried out mainly in different research institutes with different scientific focuses and the exchange of knowledge was restricted to scientific conferences. Furthermore, there has been no overview of which actors are dealing with which topics and problems in the field of Smart Cities. This project brings together the Austrian Smart Cities actors for the first time.

Within the SmartCitiesNet project ÖIR and AIT are elaborating recommendations for a consolidated and focused research in Austria within the field of Smart Cities for political stakeholders.

The aims of the project ‘SmartCitiesNet’ are:

(i) Definition of the scope of ‘Smart Cities’: What are Smart Cities? – Survey on the state of research in the field of Smart Cities in Austria with consideration of international activities

(ii) Constitution of a network of Smart Cities-actors from research, industry and politics (in the framework of two workshops) and elaboration of a competence matrix

(iii) Evaluation and assessment of future research topics as well as elaboration of policy recommendations in the field of Smart Cities

### 3 APPROACH

SmartCitiesNet deals with the approaches of different scientific disciplines as well as a focussing of the very wide and complex research field Smart Cities. The elaboration of research questions for the cities of the future is carried out in several steps:

- State-of-the-art-research: literature review of Austrian research and demonstration projects; categorisation of research topics; definition of scope of ‘Smart Cities’
- Identification of actors in research on ‘Smart Cities’ and interviews with selected actors; elaboration of a competence matrix; first workshop with actors
- Validation of results with stakeholders in two workshops and a round table
- Deduction of future research topics from the first workshop; discussion of these research topics in a second workshop
- Elaboration of policy recommendations and action plans for and discussion with political stakeholders

### 4 SCOPE OF SMART CITIES TOPICS

We consider the aim of Smart Cities initiatives to be the transition of our cities towards a “sustainable urban post-fossil society”. This transition has to happen at three levels. First, changes are necessary at a structural level, i.e. at a general planning level. Urban structures (built environment and related urban planning framework, supply, disposal and transport infrastructure) are to be adapted towards a smart city development, considering in particular the interrelations between different fields of activities (socio-economic, transport and energy issues). These structural changes are enabled by technologies on one hand and processes on the other hand.

The three main categories “Technologies”, “Structures” and “Processes” are represented in Fig. 1 with, in its centre, the overall goal of Smart Cities – a “sustainable urban post-fossil society”. The blue circle shows the scope of the Smart Cities Initiative within the SET-Plan of the European Commission, which has its focus clearly on the technological side.

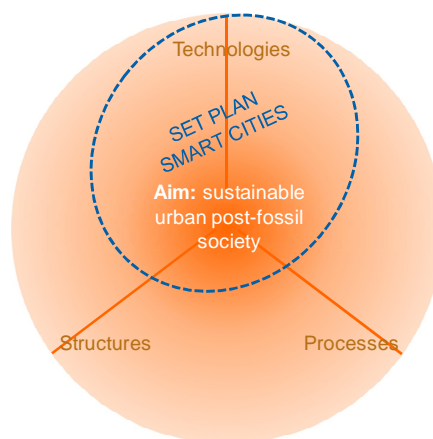


Fig. 1: Scope of Smart Cities topics

Within these three main categories, the research topics were grouped as follows:

#### Structures

A smart city development first requires further research work on integrated spatial, urban and energy planning. More knowledge is needed concerning the relationships between these different fields and the implications of related planning activities on resource needs in cities. Socio-economic factors also need to be considered more deeply in this context. Therefore, there is a concrete need to further develop assessment methods, modeling and design tools as well as implementing other research activities (e.g. field tests and



living labs, surveys...), all aiming at providing decision makers with more knowledge on these complex interactions.

### **Technologies**

Enabling technologies for a smart city development can be classified in building technologies (demand side as well as building integrated energy generation and storage technologies), energy technologies which are particularly suitable in an urban context, mobility technologies as well as information and communication technologies. Further research is needed both at component level (e.g. energy storage technologies) and at energy and transport system level, considering in particular the interactions allowed by network infrastructures (e.g. Smart Grids).

### **Processes**

A smart city development can only be ensured if supported by the common processes taking place at urban scale (decision-making, political and economic processes). There is a need to better understand these processes and point out at which level specific interventions would be needed (participation, consultation, subsidies, directives etc.). Research is needed for modelling these interactions, developing business models, applying and demonstrating new mechanisms. To do so, aspects like consumer and user behaviour analysis as well as understanding the implications of lifestyles, education, ageing society and social skills are to be considered.

Furthermore, the term ‘smart’ was discussed within the project team, in order to clarify our understanding when speaking of ‘Smart Cities’, a term which so far has had no clear definition and which is used and understood in many different ways by different actors.

### **We recognise ‘smart’ approaches and solutions as having the following characteristics:**

- Focus on interfaces and integration
- Integration and coordination between topics and research fields
- Significantly higher increase in efficiency compared to separate approaches
- Lowest possible use of resources with highest possible benefit

## **5 VALIDATION OF RESULTS WITH STAKEHOLDERS (RESULTS FROM THE FIRST WORKSHOP)**

The team has opted to organise two workshops during which they will use the inputs of experts to validate current results and collect new results by: (I) completing and complementing the topics from the state-of-the-art research, subsequently deducing research topics and realization potentials, and (II) evaluating the topics and potentials for future research topics to elaborate action plans for political stakeholders and funding organizations.

The first of two planned workshops took place on 3rd of March, 2011 in Vienna. After an input from the project team about the results from the state-of-the-art-research and the definition of the scope of topics, the experts present were grouped into five main categories according to their background – Energy, Buildings, Mobility, Urban Planning and Other. The participants from the energy sector were distributed amongst the four other groups, in order to have representatives with energy background at every table. The discussion then took place within the four work groups ‘Energy & Buildings’, ‘Energy & Mobility’, ‘Energy & Urban Planning’ and ‘Energy & Other (Resources, politics, society etc.).

The work groups were then asked to discuss the interactions and the obstacles between their research field and the field of energy research and vice versa and then elaborate technological, structural and process-oriented solutions to overcome these obstacles and strengthen the interactions.

In the following, the results are summarized:

### **5.1 Urban planning**

Urban Planning influences the energy required by different types of housing and settlement structures. In this context, density is the most important factor regarding energy efficiency. In addition, built structures form the basis for production and use of renewable energy within these urban environments. Local conditions,

availability of land but also maintaining living standards have to be seen as essential factors for areas of higher density. Multidisciplinary teams are necessary to cope with these complex questions.

An active transformation of urban structures should consider social change and the change of lifestyles. Investment in the built environment including infrastructure determines urban structures for years to come; therefore, planning has to compare the effort for changes and the flexibility of those structures together with options for achievable energy savings. An optimisation of urban structures as well as improving living conditions in an urban environment can be seen as overall aims together with behavioural changes.

Additionally, urban planning has to consider the context of urban-rural relations and the cities' size. Depending on urban structures and local conditions, cities have the opportunity to gain renewable energy within the city. Large cities are dependent on renewable energy production in the hinterland, but the extent of this dependency can be influenced. The question of energy consumption versus energy production calls for a "new" dialogue between urban and rural areas. The adaptation of solutions for cities of different sizes leads to different approaches considering also questions of centrality and urban functions.

## 5.2 Mobility

The mobility sector is facing the great challenge of meeting growing mobility needs, the limited availability of fossil fuels and still not sufficiently available renewable energy sources. Hence, the aim is to achieve an energy-efficient mobility. Dispersed settlement patterns, the separation of functions (living, working, shopping, and leisure activities), environmentally counterproductive subsidies and lack of information have been recognised as current barriers to achieving energy-efficient mobility. The discussion in the mobility group led to a number of solutions to achieve an energy-efficient mobility. Urban planning plays a significant role in avoiding traffic such as mixed-used neighbourhoods, the coordination of urban development and public transport planning, the consideration of energy efficiency criteria in the planning of settlements. The goal of urban planning should be to develop a "city of short distances". Furthermore, it is proposed to establish a multimodal transport system (public transport, car, cycling, walking) that can combine the advantages of all modes of transport. In the field of transport infrastructure planning the integration of energy efficiency criteria is proposed. Research needs have been identified in user behavior, concerning demand and acceptance of energy-efficient means of transport. More information and awareness will contribute to change user behavior and to raise awareness about the energy consumption for mobility. Furthermore, the removal of access barriers has been identified as a solution for achieving an energy-efficient mobility.

## 5.3 Resources and Society

Resources and social affairs – including political and economical stakeholders – are often neglected in discussions about energy efficiency, however, they are important when developing concepts for the cities of the future. Since this work group consisted of representatives with very different backgrounds – sociology, energy technology, ICT, sustainability and facility management – the discussion was very vital and mostly dealt with interactions and problems affecting the whole society and the political framework. As the biggest challenge and chance of 'Smart Cities' the group identified the transformation of inhabitants or "users" of the city towards 'Smart Citizens', who are active participants in the energy system of a city – i.e. who are highly aware of their energy consumption, who work together in different fields of daily life and who are well educated and interested. One of the challenges with regard to this transformation are the different approaches, time lines and often 'language' of the actors in cities – inhabitants, economy and politics. The solution for these obstacles lies – amongst others – in a better communication between all actors within a Smart City and interdisciplinary projects with the participation of all actors, an approach which is now followed by the Smart Cities-Initiative of the European Commission.

## 5.4 Buildings

A significant part of the final energy use in a city takes place in buildings for heating, cooling and the operation of electrical appliances. While it is already possible to design and build highly efficient buildings that even generate more energy than they require thanks to building integrated energy generation technologies, there are still open challenges on the path towards Smart Cities. The contributions from the workshop helped cluster these challenges into the following categories: building flexibility, integrated energy



generation technologies, distributed storage technologies, ICT technologies in buildings, life cycle aspects and regulatory issues. First, buildings should offer a greater flexibility to the users in a smart urban context. This should be made possible in terms of spatial distribution of rooms but also in terms of usage flexibility, to be suitable to the current urban demographic trends. Furthermore, the integration of solar technologies in the building envelope, geothermal technologies in building foundations and urban wind turbines in acroteria or roofs, are - together with distributed small scale CHP technologies - the few possibilities for onsite energy generation in the urban context and should be considered with high priority in a smart city development. Additionally, the storage of thermal and electrical energy within buildings as well as the integration of ICT technologies into buildings are enabling technologies towards a smart city development, since they allow for efficient operation of urban energy systems (electrical and thermal networks and plants). The ICT technologies offer to the end-user a better knowledge of the current building performance and support the user (or the building operator) in managing building operation and subsequently allow network operators to better manage the operation of the energy networks ('Smart Grids'). Finally, the management of building life cycles in an urban context could be further improved, by considering for instance the potential for urban energy and resource mining, and regulatory issues related to the construction industry (building codes, structure of subsidies...) should be considered from a local point of view. If specific energy technologies are more suitable in one neighbourhood than in others, the structure of financial incentives should be adapted accordingly to encourage investors and end-users in making the recommended choice.

## **6 SMART CITY WORKSHOP AT THE CORP CONFERENCE**

These topics will be discussed at the Smart Cities workshop taking place at the CORP conference in Essen (May 20th, 2011). The Austrian Institute for Regional Studies and Spatial Planning (ÖIR) and Austrian Institute of Technology (AIT), Energy Department will start by introducing the topic and presenting related demonstration projects. The major part of the workshop will be devoted to moderated discussions concerning the state of the art and future focuses of research on 'Smart Cities' which will include the contributions and ideas of the audience.

The results of the workshop will be used to elaborate roadmaps and action plans for political stakeholders.

## **7 FURTHER STEPS**

With the workshop results, the main research questions will be deduced and subsequently discussed within the second workshop. Finally, policy recommendations and action plans for political stakeholders will be elaborated and discussed with politicians and national funding agencies.

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