

# “Smart City Wien”: Vienna’s Stepping Stone into the European Future of Technology and Climate

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## 1 ABSTRACT

In the past few decades, Vienna became an international forerunner with regard to environmental quality and quality of life. Vienna’s decade-long efforts to build this reputation successfully culminated in the top positions Vienna scored in the international city ranking of the Mercer surveys in the last two years. The challenges on global energy and climate issues ask Vienna to continuously participate in the research of technologies, systems and strategies. The combination of high regional economic power, above-average knowledge capital and concentration of latest technologies makes the city best suitable to act as an urban test site for future demonstrating sustainable and climate-friendly (urban) lifestyles.

Addressing the global challenges within the “Smart City Wien” initiative, the city wants to take the opportunity to position itself as a leader in research and technology in Europe. Therefore the City of Vienna is project leader of the “Smart City Wien” project, which was proposed for the Call “Smart-Energy Demo - Fit for SET” program by the Austrian Climate and Energy. The project includes a sequence of three forums building the main framework of a stakeholder process and producing the following outputs:

- (1) a long term vision of Vienna’s city-wide energy system (“Smart Energy Vision 2050”)
- (2) a “Roadmap for 2020 and beyond” that will enable the city to fulfill this long term vision while meeting its mid-term (2020) energy targets and
- (3) an “Action Plan for 2012-2015” developing a plan for the implementation of measures that will form the roadmap.

During these forums the stakeholders will receive expert support regarding the technical and non-technical solutions that are at their disposal to meet their targets.

In a first project phase a structured overview on the latest available technologies is elaborated in order to analyse their impact in the scenarios designed within the forums. This includes the adaptation of simulation tools in order to allow a rapid and quantitative scenario evaluation. Further important goals of the project are also the identification and supervision of demonstration projects.

A particular asset of the “Smart City Wien” project is its focus on the spatial development of the city oriented towards energy efficiency and climate protection objectives. For this reason, the “Smart City Wien” process, the vision for Vienna’s energy and climate protection future to be developed thereunder and the related demonstration projects staking out a “smart” development path for Vienna will be closely linked to the preparation of the new Urban Development Plan. This will also ensure that the city’s diverse spatial, social and economic structures have been taken into account. Another key issue is the involvement of users in the implementation of new technologies.

The “Smart City Wien” project as described here is one part of a broader “Smart City Wien” initiative. The project consortium under the lead of the City of Vienna enables the partners to share a joint “Big Project Picture”, fosters a good communication between the project partners as well as a common understanding of the links between activities, reporting and payment of funds. Communication plans on various levels are set up in order to facilitate harmonized communication towards the various types of target audience.

## 2 STARTING POINTS FOR “SMART CITY WIEN”

### 2.1 Cities are setting the course for solving the energy and climate issue

It is quite obvious that the world’s current energy and climate policy challenges will be primarily and most efficiently solved in the cities. The combination of a high regional economic strength, above-average intellectual capital and a concentration of state-of-the-art technologies make cities a test area for future, highly environmentally-compatible and climate-friendly economic systems and lifestyles.

## **2.2 Vienna is the international leader in urban quality of life**

In the past few decades, Vienna became an international forerunner with regard to environmental quality and quality of life. Vienna’s decade-long efforts to build this reputation successfully culminated in the top positions Vienna scored in the international city ranking of the Mercer surveys in the last two years.

## **2.3 Europe is increasingly faced with economic and technological modernization pressure**

Having to compete with the emerging countries and markets of Asia, the European cities (and the European economic and social system as such) are faced with a growing pressure for modernization. Starting in the 1980s, large European businesses transferred their production into “cheap production countries” and in the 1990s this trend also spilled over to small and medium-sized enterprises. In the past few decades, the new Asian growth centres, above all China, India and Korea, rapidly developed from “extended workbenches” into technology centres. In consequence, European companies increasingly transfer not only their production sites but also their research and development departments to these countries, thereby contributing to a loss of high-quality jobs in Europe.

## **2.4 The SET Plan as a program to promote European cutting-edge technology**

Alerted by the rapid quantitative and qualitative growth of the new international technology centres, the European Union tries to protect its technological leadership in certain traditionally European competence fields. These include the fields of energy and environmental technologies as well as transport issues, the technological development of which will be advanced under the SET program and will be tested in Europe’s cities.

According to the EU, the Strategic Energy Technology (SET) Plan is the technological pillar of the EU’s climate and energy policy, which will lastingly shape European energy policy in the next 10 years. With the SET Plan, the EU wants to increase strategic investment in R&TD. The ultimate goal is to create a “low carbon economy” characterized by:

- (1) A reduction of CO<sub>2</sub> emissions by 80 % by 2050, with the aim of limiting global warming to 2°C
- (2) An increase in the safety of supply by significantly reducing dependence on fossil energy sources, which currently still meet about 80 % of primary energy demand
- (3) Economic growth and creation of jobs: Europe is to become the leader in the world-wide rapidly growing sector of “green technologies”

## **2.5 “Smart Energy Demo – FIT for SET” Program of the Austrian Climate and Energy Fund**

End of March 2011 the City of Vienna applied for the call for proposals of the Austrian Climate and Energy Fund entitled “Smart Energy Demo – FIT for SET” with the “Smart City Wien” project. The “Smart City Wien” project is a process planned to be implemented over several years, in which the key players relevant to the city’s development (institutions, businesses, single initiatives and research institutions) will design and implement a road map for 2020 for Vienna’s energy-efficient and climate-friendly urban development. This vision for the future of the city is to be turned into reality by 2050 by means of demonstration projects which will be or already have been created around this application. The “Smart City Wien” project constitutes the framework for project partners and stakeholders wanting to submit and implement their projects with the support of the City of Vienna under the “Smart Energy Demo” and “SET Initiative” programs.

The City of Vienna sees these programs as an opportunity to further advance Vienna’s development into an ecological, technological and economic model “smart city” at European level. Major stakeholders of the city administration as well as large businesses have cooperated to prepare the application.

Initiatives and projects which are able to contribute to the issue of “Smart City Wien” or plan to submit a proposal under the above-mentioned programs are invited to join the “Smart City Wien” project and initiative as stakeholders without affecting their independent project development and submission, in order to increase the overall chances for a successful application of the City of Vienna – particularly at European level – and to bundle innovative forces and ensure coordinated implementation of high-quality individual projects. “Smart City Wien” thus offers a framework for research and business initiatives and know-how holders which want to submit projects under future programs of the Austrian Climate and Energy Fund and the European Union.



### 3 “SMART CITY WIEN” PROJECT IN DETAIL

#### 3.1 Partners and organization of “Smart City Wien”

The “Smart City Vienna” consortium of applicants, headed by the City of Vienna, includes the following partner institutions for project phase 1 (submission under the call of the Austrian Climate and Energy Fund):

- Municipal Department 18 – Urban Development and Planning (applicant), supported by TINA VIENNA Urban Technologies and Strategies GmbH (project management)
- Municipal Department 20 – Energy Planning
- Wiener Stadtwerke Holding AG
- Wien 3420 Aspern Development AG
- Siemens AG Österreich
- AIT Austrian Institute of Technology GmbH
- Österreichisches Forschungs- und Prüfzentrum Arsenal Ges.m.b.H
- raum & kommunikation GmbH
- Vienna University of Technology (Institute of Power Systems and Energy Economics, Institute for Energy Systems and Thermodynamics, Institute of Building Construction and Technology, Institute for Production Engineering)
- Energieinstitut der Wirtschaft GmbH

In a first step, the consortium of applicants is responsible for preparing and organizing the submission of the “Smart City Wien” framework project which is structured in five Working Packages:

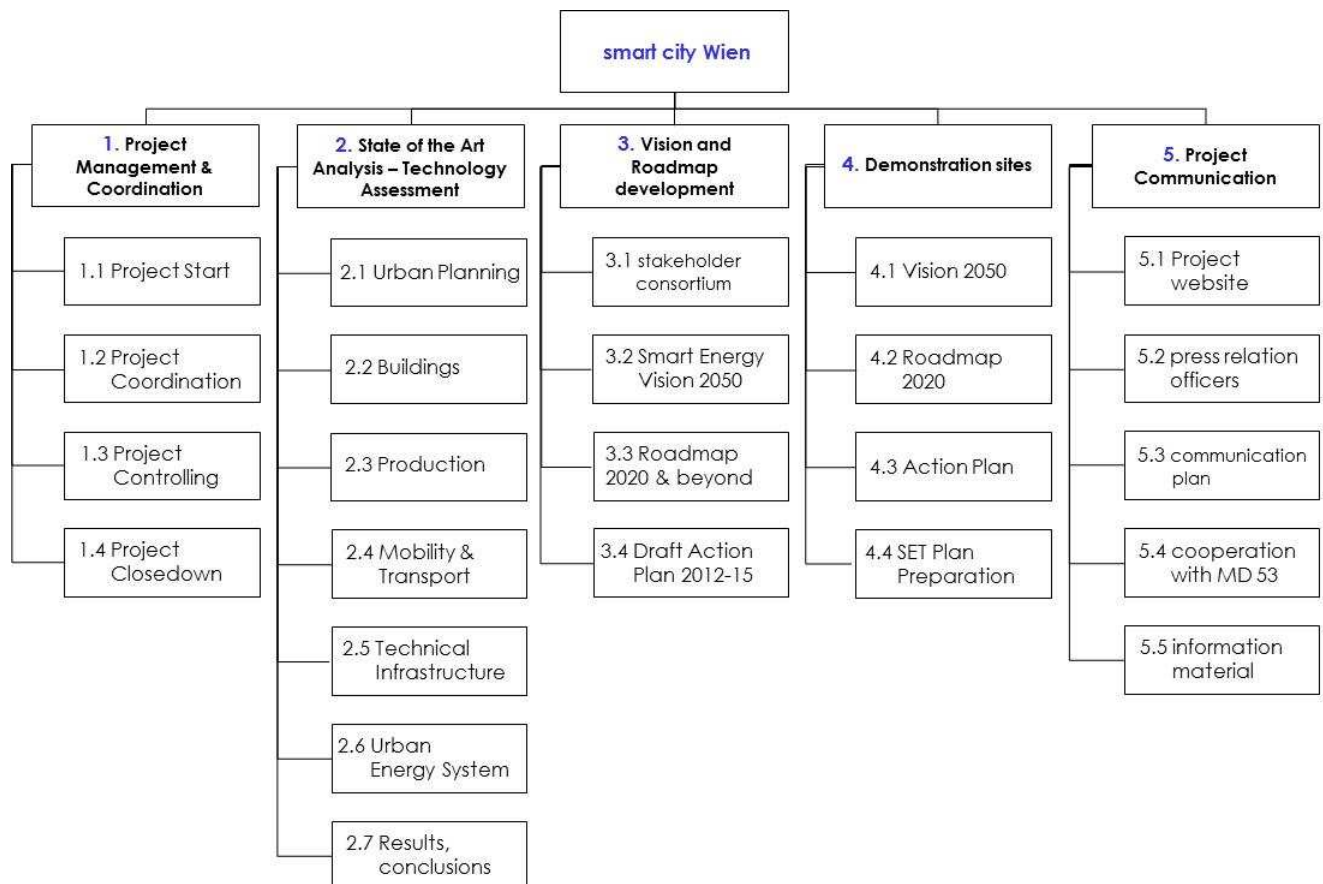


Fig. 1: „Smart City Wien“: Work Packages Structure

## 3.2 Introduction to current situation of the city in relevant project fields

### 3.2.1 Urban Planning

The city’s framework for long-term development is the 2005 **Vienna Urban Development Plan (STEP05)**. This plan is based on the theme “Think European – act regionally – develop Vienna” and focuses on creating attractive areas for living and working. The STEP05 plan targeted 13 key areas ripe for (re)development. The plan focuses on each area’s essential needs, tackling specific problems and capitalizing on particular opportunities. The idea of “Smart City Wien” is to link the genesis of the next Urban Development Plan 2014 with the “Smart City Wien” project, thereby binding urban development to energy and zero carbon technologies of tomorrow.

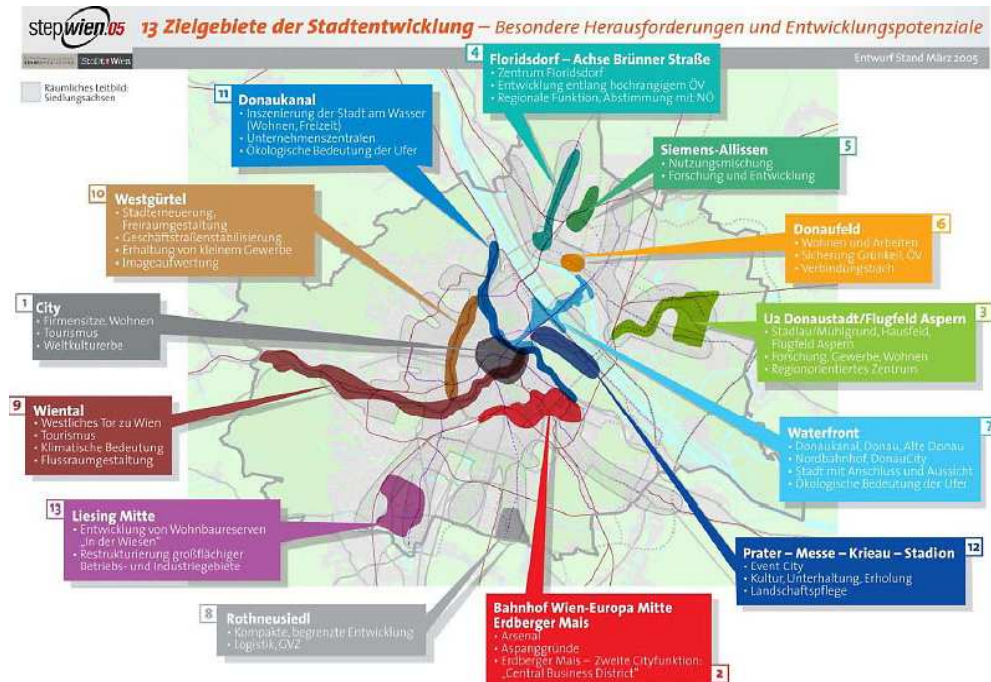


Fig. 2: Vienna Urban Development Plan – Key Areas (City of Vienna – MA 18)

The most relevant current challenges to be faced within urban development in Vienna are population growth and a highly differentiated society:

**Population growth** and the changing age structure of population increase the quantitative and qualitative requirements for housing and infrastructure. The population of the city has grown to 1,713,957 people until January 2011 (Statistik Austria). The latest projection (ÖROK, base year: 2009) foresees an **increase of 13 % until 2030 and 22 % until 2050**. However, in 2010 the population growth was stronger than expected: while the current forecast identified an increase of only 8,000 residents, there was a growth of actually 15,135 inhabitants, almost twice as many.

In 2050 Vienna will be the youngest region in Austria: Future demand for new housing units will not depend solely on the quantitative development of the resident population, but also on changing expectations regarding the quality of housing. Today some 22 % of all inhabitants of Vienna are older than 60. According to latest projections, **Vienna will turn from the “oldest” region in Austria to the youngest until 2050**. This is one of the most relevant aspects to be respected when planning the future of the city towards energy-efficiency and is seen as a big chance for the city.

Ensuring environmental quality and optimizing the energy consumption is already on top of the agenda in Vienna’s urban development planning: The recent **evaluation of the STEP05** points out the relevance of climate protection and environmental quality for future oriented urban development. This has to be realized through actions promoting energy efficiency, attractive urban design and by green and open space provision. Some of these actions are already in process and implemented by the municipality with success.

The **spatial structure** of Vienna offers two development paths towards a Smart City: Firstly, urban transformation towards a Smart City Wien will be realized through implementing new technologies within

existing structures as complementary elements to the basic technology. Secondly, Vienna has the unique opportunity to develop new demonstration projects in new expansion areas. For example “seestadt.aspern” (Aspern Lakeside) as the largest development area in Austria and one of the largest in Europe as well will be a key demonstration project.

### 3.2.2 Environmental Programs already implemented by the City of Vienna

The „**Climate Protection Program**” (KLiP) is the most comprehensive environmental program ever launched by the City of Vienna. The first implementation period (KLiP I) was enacted in 1999 by the city council and was valid until 2010. The goal of preventing an increase in annual emissions of CO<sub>2</sub> equivalents by 2.6 million tons by 2010 was already achieved in 2006. In fact, the city has thus far successfully avoided the annual emission of 3.1 million tons of CO<sub>2</sub> equivalent. Based on the experiences of the first implementation period the city council of Vienna enacted the update of the climate protection program (KLiP II) in December 2009, which will be valid until 2020. KLiP II consists of 37 sets of measures with a total of 385 individual measures in the fields of energy supply, use of energy, mobility and town-structure, procurement, waste management, agriculture and forestry, nature conservation and public relations.

The “**Viennese municipal energy efficiency program**” (SEP) was enacted by the city council of Vienna in June 2006. The SEP provides guidelines for the consumer oriented energy policies until 2015. It comprises more than 100 energy efficiency measures addressing all important consumption sectors (households, public and private services, as well as industry and manufacturing industry are the most relevant ones). By implementing the energy efficiency measures the energy consumption growth would only rise by +7 % in an energy saving scenario, compared to +12 % in a business as usual scenario.

### 3.2.3 Buildings

**Two thirds of all the buildings in Vienna are privately owned.** Almost half of the buildings in Vienna are residential buildings with only one or two apartments, although the proportions distributed in the districts are very different. In the city outskirts, the number of one- and two-family houses is naturally much higher; the largest proportion is found with 76 % in the 22<sup>nd</sup> District.

Vienna has about 940,000 dwellings. Thereof more than 220,000 are owned by the city of Vienna and 180,000 are owned by non-profit housing companies. **The huge number of communal and non-profit housing stock has been an important prerequisite for an ecologically oriented sustainable housing policy.** Building and environmental standards in housing construction and refurbishment are among the highest worldwide.

Vienna has a **very high penetration of district heating** from combined heat and power generation, thermal waste recycling, industrial waste heat and biomass.

The total **energy standards** in new residential construction sites represent one of the absolute top standards around the world. Vienna is the city with the highest number of flats in passive houses (completed or under construction).

Vienna is **a leader in comprehensive thermal-energy-saving renovation** of existing buildings. About 10 % of Vienna's housing stock was renovated in the past 15 years under the funding program THEWOSAN. The program is also making a major contribution to climate protection in Vienna.

Vienna's policy is to turn flat roofs into **green roofs** in the long run. Anyone who is interested in a green roof project can benefit from the city administration's expertise in this field. Roof-top gardens offer a number of benefits, such as new habitats for plants and animals, an improved micro climate, and a cooling effect in summer based on increased evaporation.

### 3.2.4 Production

Vienna accounts for 27 % of total added value generated in Austria, some 23 % of all workplaces and some 25 % of all employees. This makes Vienna the economic and job centre of Austria. Vienna has the highest level of economic development of all Austrian regions and holds a leading position in European comparison. More than 80 % are employed in the tertiary sector; the qualification level of employees is much higher in Vienna than the Austrian average.

The lack of big industries and large-scale production sites in Vienna causes a relatively low share (12 %) in the overall energy consumption of the city.

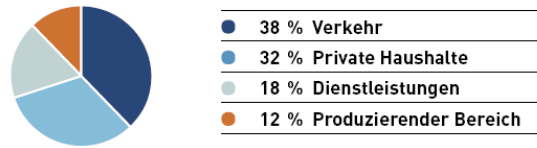


Fig. 3: Overall energy consumption in Vienna (Wiener Stadtwerke Nachhaltigkeitsbericht 2009)

Since more than 15 years Vienna has a program supporting an ecological-oriented municipal procurement and a support-program for environmentally friendly businesses. The **Vienna EcoBusinessPlan** is a program of the City of Vienna which supports local enterprises in the introduction of environmentally sound management practices. Its overall goal is to promote a sustainable local economy through efficient and economical business practices. Enterprises participate in the program and implement recommended business practices on a voluntary basis.

The **"EcoBuy Vienna"** project, which was launched in 1998 based on the "KliP Vienna" climate protection program, is aimed at making procurement activities in the Vienna municipal administration and its affiliated enterprises more ecologically sustainable. As the City of Vienna’s spending on products and services amounts to some five billion EURO annually, this field of activity is strongly relevant in terms of energy efficiency.

### 3.2.5 Transport and Mobility

Vienna has one of the world's densest **networks of public transport** with an underground network of 75 km (5 subway lines), 172 km of tramway network (28 tram routes) and more than 500 buses (85 bus lines). The public transport authority „Wiener Linien“ provides quick, safe and eco-friendly mobility for 839 million passengers a year (over two million people per day). Regarding the modal split, Vienna is increasing its performance continuously in favour of environmentally friendly modes of transportation. Public transport, cycling and walking represent already 2/3 of the modal split.

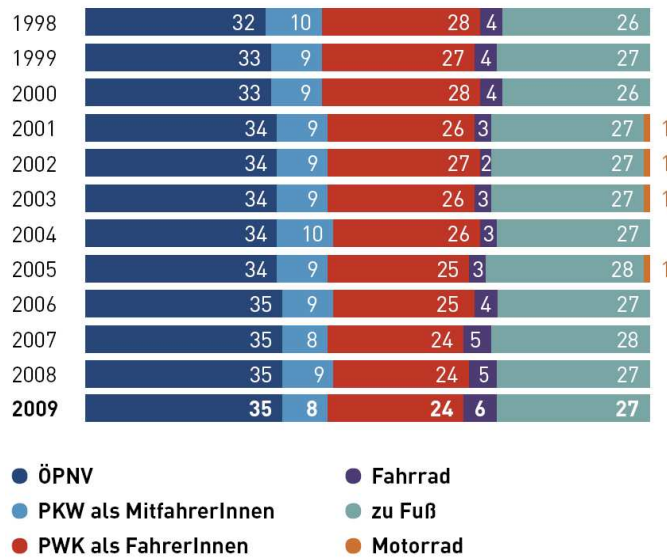


Fig. 4: Modal Split 1998 – 2008 in Vienna (Wiener Stadtwerke Nachhaltigkeitsbericht 2009)

The **Transport Master Plan** is the City of Vienna’s strategic transport concept, setting clear transport policy priorities considering local, regional and global developments. It is open to the “New Europe” and identifies Vienna as a business location of the future. Managing and handling long-range transport and traffic flows, without adversely affecting the quality of life of the Viennese, are further priorities. The current aim is the broad implementation of the 2003 Transport Master Plan for Vienna over the next 20 years.

Vienna is already strongly **strengthening environmentally friendly modes of transportation** involving public transport, cycling and walking. The attractiveness of new pedestrian areas and bike lanes will make an important contribution to reducing greenhouse gas emissions.



Vienna's strong public transportation system could be added in the future with new "Mobility-on-demand public transportation offerings", especially in connection with electric vehicles. Vienna is a model region in the program "**Elektromobilitäts-Modellregionen**", a unique European support program for e-mobility of the Austrian Climate and Energy Fund.

### 3.2.6 Technical Infrastructure

The high quality network infrastructure of Wien Energie (Viennese energy supplier) guarantees outstanding security of supply. The **electricity network** of Wien Energie is 22,275 kilometres long and made up primarily of underground cables (83 %). The remaining 17 % consists of overhead power lines. Wien Energie offers 99.99 % security of supply.

The network operated by Wien Energie Gasnetz, with a total of 3,480 kilometres of **gas mains**, has been upgraded in recent years and continues to be constantly optimized in order to incorporate the very latest developments in gas infrastructure and to make it one of the safest and most reliable gas networks in Europe.

The **district heating network** operated by Wien Energie Fernwärme currently includes 1,118 kilometres of pipes and is also constantly upgraded and expanded.

The **telecommunications network** owned and operated by Wien Energie currently consists of around 4,800 kilometres of telephone and signalling cables in addition to 1,200 kilometres of fibre optic cables.

### 3.2.7 Energy

Although Vienna's population represents 20 % of the country's total population, the consumption of end-use energy Vienna's share is only 12-14 %. This is due to the energy efficient structure of urban agglomerations in general and the lack of energy-intensive large-scale industries specifically in Vienna. However, the total use of energy is increasing on the national and urban level since 20 years dramatically.

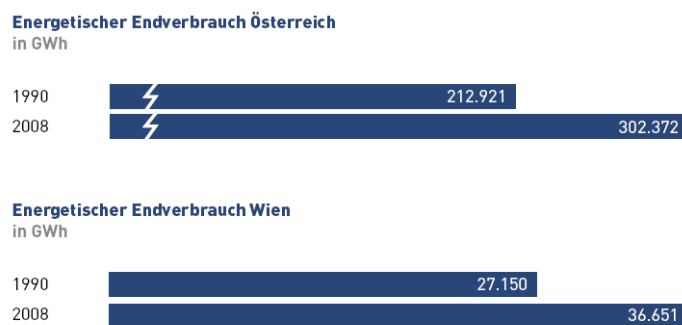


Fig. 5: End-energy consumption in Austria and Vienna (Wiener Stadtwerke Nachhaltigkeitsbericht 2009)

Vienna has a relatively sophisticated mix of power supply, but with a relatively small share of electricity from renewable sources in the indigenous production.

**District Heating:** Vienna's traditional waste management approach is to use solid wastes and sewage sludge as input materials to generate energy. The city's waste incinerators are fitted with state-of-the-art combustion and flue-gas treatment technology to supply energy for space heating and hot water while reducing CO<sub>2</sub> emissions and the need for landfills.

**District Cooling:** The production of district cooling responds to the growing demand for air-conditioning of buildings. Wien Energie Fernwärme, a subsidiary of Wien Energie, operates district cooling plants providing an environmentally friendly and economic solution. Large hospitals and office complexes are hooked up to the district cooling grid and use the resource-saving district cooling.

**Renewables:** So far renewable energy sources do not play a significant role with regard to the total energy production of Vienna. Measures to improve this situation will be a priority in an intended project submission at the EU-level. Wien Energie aims to promote the use of renewable energy sources in energy supply. On the one hand, the aim is to secure energy supply both in the long term and in an environmentally friendly way and on the other hand to reduce dependence on fossil fuels. The focus is on the use of modern technologies, a range of various energy sources and an innovative approach to meeting customer needs. Besides hydropower plants, wind parks and solar installations Wien Energie operates one of the largest forest biomass CHP power plants in Europe. Moreover the construction of a geothermal power plant (50 MWth) is projected.

### 3.3 Methodology of the “Smart City Wien” project

“Smart City Wien” project is based on the core themes of the European SET Plan Initiative. Its target systems and tasks are the following:

- Holistic view and management of urban energy systems
- Highly efficient production and supply technologies
- Intelligent networks and thermal energy supply
- “Active” buildings with very low energy demands
- Development of environmentally-friendly, highly energy-efficient and low CO<sub>2</sub> mobility systems

The lead of “Smart City Wien” project lies in the hand of the public planning authority (MA18), the institution responsible for a balanced and sustainable urban development. This guarantees, that there will be no isolated demonstration projects, but a long-term oriented process, respecting not only energy efficiency and technological oriented aspects, but also covering principles of sustainability, participation, gender mainstreaming, diversity, resource efficiency, rational spatial development and economically balanced development. Moreover, the different demonstration projects will be synchronized in a common vision ideally leading to positive spill-over effects in their respective areas. A vision “Smart City Wien” will not only define demonstration sites but also demonstration fields according to the politically determined infrastructure investments.

The approach to meet this various targets within „Smart City Wien“ initiative is the concrete combination of the project with the spatial development of Vienna. „Smart City Wien“ focuses on the combination of the programmatic contents/goals of the SET-Plan Initiative AND the programmatic content of the current and future Urban Development Plan Vienna with its spatial dimension. Therefore the initiative towards a „Smart City Wien“ with its outputs vision, roadmap and action plan will be closely linked to the preparation of the new urban development plan 2014 in order to develop a long-term oriented “smart” path for the city. Moreover, the two environmental programs of the municipality, namely “KLIP” and “SEP” will be used as basis for the development of the “Smart City Wien” project and be further elaborated within the initiative.

To guarantee the best output out of this innovative approach, the project team is aware of the fact, that there is a need to sensitize relevant stakeholders for the topic of urban development and urban planning within the process. The main asset for the synchronization of the vision „Smart City Wien“ with the urban development plan is the strong integration of various stakeholders in the process. As such, the issue “sustainable urban development” gains importance on the urban agenda. Moreover, the public planning authority clearly shows with this participatory approach, that the responsibility for a successful implementation of urban development projects lies in the hand of enterprises, citizens and politicians acting, living and performing in the metropolitan region Vienna.

#### 3.3.1 „Smart City Wien“ project matrix

"Smart City Wien" as a meta-structure is composed within a matrix respectively a three dimensional grid. One dimension (A) contains subjects, which can be found in the "hardware of the city" and as organizational structures within the municipality. This dimension comprises the areas of urban planning, building, production, transport & mobility and technical infrastructure. The second dimension (B) contains the urban energy system: energy demand, energy supply and energy networks (including information and communication technologies). The third dimension (C) is a time axis representing the evolution of the energy system, the geographical and logistical structures and the integration of citizens within the project. Demonstration sites for “Smart City Wien” will be mapped according to the specific area and the urban energy system in the constructed matrix as a node or cluster.

A ... Urban Infrastructure and Processes

B ... Urban Energy System

C ... Urban Development and Communication





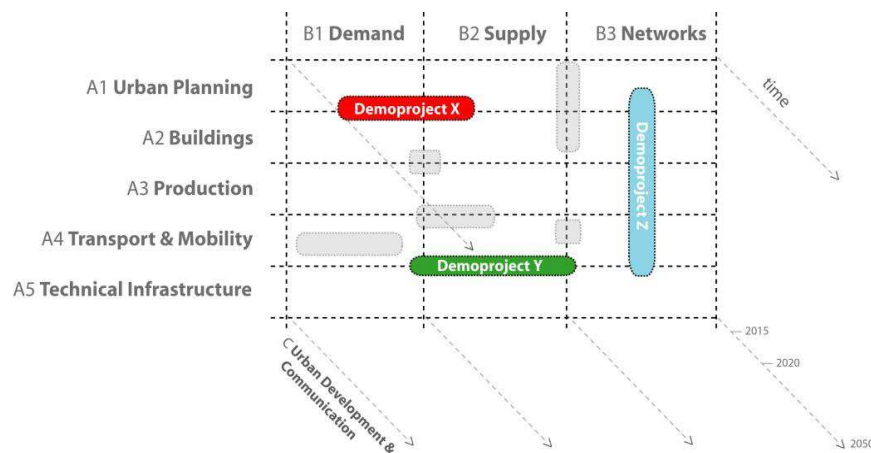


Fig. 6: Matrix structure for „Smart City Wien“

### 3.3.2 State of the Art Analysis – Technology Assessment (Work Package 2)

The components of the matrix are the starting points for Work Package 2. A Report with an analysis for each field and a cross-sectorial analysis will be made based on literature review and technology assessment. It represents the framework for the project and contributes to the understanding of the subjects of investigation.

### 3.3.3 Vision and Roadmap Development (Work Package 3)

Work Package 3 has the goal to produce a vision, a roadmap and an action plan of a „Smart City Wien“ as a projection into the energy future of Vienna. Methodologies in this Work Package will be collecting of existing studies, strategy documents, acquiring data as a preparation for the next steps, establishing a consortium of relevant stakeholders, establishment of an appropriate architecture for the consortium, workshops, scenario building and negotiation processes between stakeholders. The backbone of Work Package 3 will be a sequence of three forums during which the stakeholders will participate in shaping the energetic future of the city.

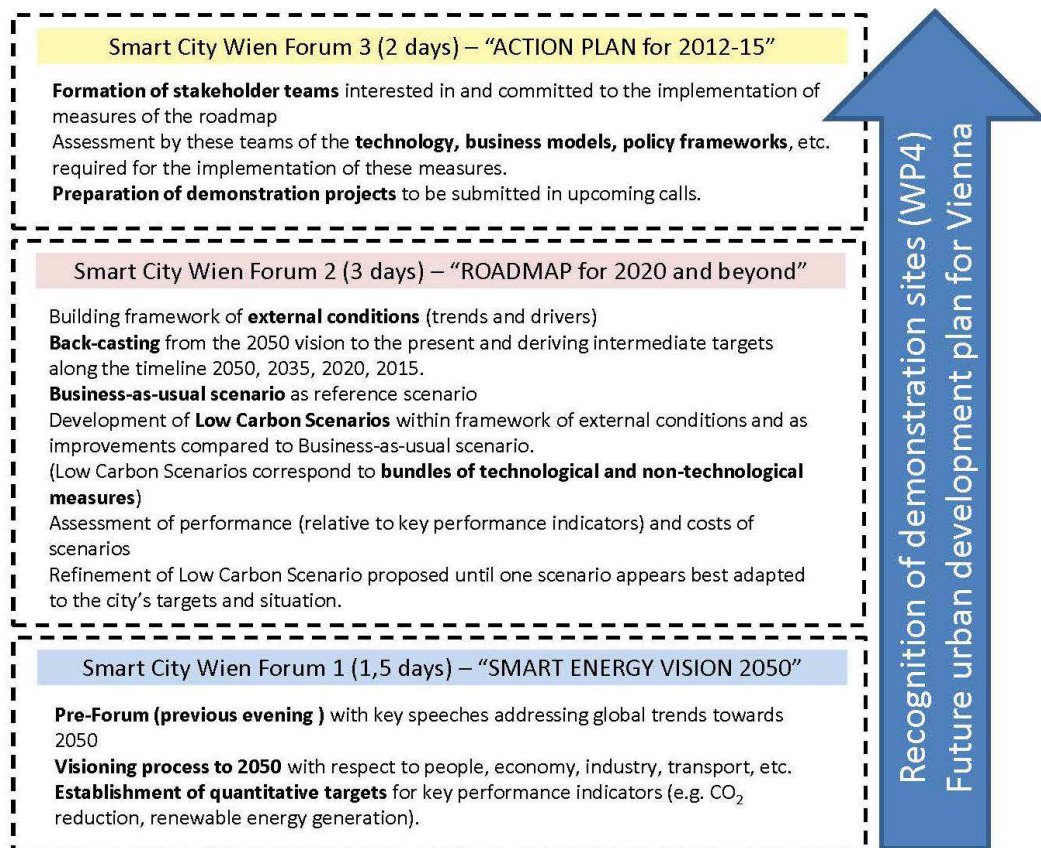


Fig 7: Sequence of stakeholder forums

### 3.3.4 Demonstration Sites (Work Package 4)

Work Package 4 will be closely linked to Work Package 3 with the goal to prepare the relevant information for the specific task within the stakeholder process. Methodologies used in this Work Package will be collection of existing and potential projects, supervision of projects applications, comparative analyses and workshops. On-going project initiatives have already shown their interest to participate in the “Smart City Wien” stakeholder process.

### 3.3.5 Main Outputs

- Overview on the current status and the potential impact of Smart City relevant implemented and available infrastructure
- “Smart Energy Vision 2050” (long-term)
- Strategic “Roadmap 2020 and beyond” (medium-term)
- Action Plan for 2012-2015 (short-term)

## 4 CONCLUSION

Within the “Smart City Wien” project, the city wants to take the opportunity to position itself as a leader in research and technology in Europe. Three forums will build the main framework within the stakeholder process, producing a “smart” development path towards energy efficiency and climate protection closely linked to the preparation of the Urban Development Plan. Further, the identification and supervision of demonstration projects to be submitted nationally and internationally are key goals of this project.

## 5 REFERENCES

Text is based on the Proposal (Form A) for “Smart Energy Demo – fit4set, 1st Call for proposals by the Austrian Climate and Energy Fund”; developed by the City of Vienna (MA 18) together with the project partners (March 2011).

