Transformation Agenda Vienna

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Executive Summary

Main objectives of this Agenda are:

- **Decision support** for policy makers and operative managers in Vienna. Additionally for policy makers in Buddy cities and national and European networks.
- Building up **know-how** within the city for needed topics of Smart Energy City[1] (SEC) transformation and the tasks to be organized.
- **Bringing together international Stakeholders** of different public entities, researchers and consultants. During different international as well as local workshops and working groups deeper insights and awareness has been shared between the involved parties. This will be continued in the local project Transform+. It's important to see the ongoing process and amplifiers along the Agenda.
- Reaching an **integrated and cross-sectoral perspective** on urban energy flows. In short, the content and competence wise linkages along with Stakeholder Governance.
- **Sharing** actual challenges, figures and needed activities with various European partners, and within dissemination of TRANSFORM[2]. This is not only a display of current examples and good practises, but also an exploration of future to-dos.

With these objectives three **target groups** of the Transformation Agenda Vienna can be pointed out:

- Decision makers, operative mangers and experts with the municipality and the cities companies (cf. illustration on page 29).
- Stakeholders on local level working with citizens, on urban and energy planning or in research.
- European institutions, networks, partner cities or other associate parties.

The Transformation Agenda Vienna was created just after the approval of the Smart City Wien Framework Strategy. The 2014 adopted Framework Strategy is an umbrella for a broad range of Smart City related activities in Vienna till 2050, and provides new targets and outlines for the SEC Transformation. Therefore integrated strategy approaches and Governance aspects are essential. The surplus of TRANSFORM is the integrated view on simultaneous established strategies and action plans.

The officially status of this Agenda is a **study within a European research project**. Moreover it's a Statement of challenges and to-do's by the city for the city. Commitment from decision makers for the following content is envisaged within the Memorandum of Understanding of TRANSFORM.[3]

[1] The project TRANSFORM has made a definition with 8 key elements: Resource system integration, Access to energy services, Resilience, Energy Efficiency, Renewable Energy, Active and engaged users, Sustainable Economy, Smart Governance

[2] While finishing this document an online Handbook is under construction. For latest Info see https://transform.siemens.at/TransformYourCity.html

[3] This MoU is currently (March 2015) in the final phase and fine-tuned by the TRANSFORM cities, and will be signed by the cities in June 2015.

Smart City has raised energy and climate issues, as well as the future usage of resources, even more on a high level and cross-sectorial agenda within the cities. Vienna now has to evaluate how the existing concepts contribute to the new goals, where the main gaps are, and how to reach more ambitious goals (implementation). Therefor an assessment of relevant strategies was made, and unclear aspects or gaps for improvement were outlined. It's also necessary to have the most important figures on the table. That's why the charts and descriptions for actual and projected futures energy consumption are integrated in this agenda.

The TRANSFORM team has chosen two key themes which have been specified during the work process. One theme is Participation and the question how to involve citizens in Smart City Wien implementation. The second is integrated energy and urban planning. This means planning processes for binding agreements on local implementation of energy systems (grids and production of mainly renewable power and heat infrastructure) and energy data evaluation within the analysis on energy typologies. Ongoing focus groups were established to work on the selected themes, which were additionally supported by subcontracts.

Illustration 1. Imagine Vienna © baskohler.nl

Main outcomes for the case of Vienna:

- The **energy and climate goals are within range**. For the next years we can estimate how to reach the transformation path and were energy and CO_2 saving could be made, even if we don't know the full path till 2050. This should give us motivation for the upcoming implementation. Especially in the fields of traffic and existing building stock we have to continue our efforts and push profitable energy efficient investments.

- Participation is inevitable to get people active for the transformation process. The local working group experienced that a translation and transmission of the objectives is necessary for **key actors on the ground**, which are directly working with citizens or end users. These key actors could be social services, education facilities, local municipal offices or local NGOs.

- Adopted energy and climate goals and Smart (Energy) City **objectives have to be translated into criteria** for Smart Urban Labs (district level) and building sites, to be considered in tenders, master plans, zoning regulations, etc.

- The specific local context is more and more important when it comes to area based renewable energy systems. Therefore the **city has to extend its abilities in integrated energy and urban planning** and implementation, to steer and consider energy in different urban development procedures.
- **Energy relevant data** of the city and public enterprises have to be shared more easily. Especially all datasets were no privacy concerns or mayor public interest are affected should be available to all Stakeholders to improve transformation abilities.
- **Financing strategies and investment agendas** have to be specified, to raise certainty for public and private actors. This helps to commit and support on certain measures, and to work out responsibilities and timeframes more detailed.

Rough overview of the Agenda

Chapter	Content
Part A Vision and Goals for Vienna's transformation	⇨ **Vision and goals behind the Transformation Agenda.** (Smart City Wien Framework Strategy) ⇨ **Actual Baseline and current challenges** o Stakeholder Mapping
Part B: Evaluation of the city's strategy and transformation scenario	⇨ **Strategy assessment** o Assessment of strategy along guiding questions o Presentation of relevant strategies o Gap analysis of strategies o Governance and Monitoring o Quantitative scenario projections
Part C: Improving abilities for Transformation	⇨ **Action Plan** o Tasks of the Smart City Wien Framework Strategy o 42 Actions of the Action Plan 2012-2015 ⇨ **Participation and Stakeholder Management as key enabler** o Preparatory work on participation: project My Smart City Wien. ⇨ **Integrated energy planning** o Spatial energy typologies: data assessment for energy planning o Processes approach for integrated energy and urban planning
Part D: What has been achieved so far?	⇨ **Results and Success within TRANSFORM**

Introduction and mission statement

"The Transformation process is based on willing actors and existing local processes, and not a sketch on white paper."

This document is a summary of a European project and a study for Vienna's Transformation in English. Along with the document also the process behind the chapters of this Transformation Agenda is important. It's the exchange between local and international working groups, working on different levels, on different thematically areas. This is happening during the TRANSFORM period and will be continued in future. This TRANSFORM story has begun and was spread in a cross-sectoral manner in Vienna. Along with the **identification of future benefits, willingness of the needed actors** through a long-term transition is the key issue.

The aim is to activate knowledge to support the committed targets of Vienna, defined to reach the 2020 till 2050 goals. Confronted as a city with these huge efforts, local Stakeholders and 'change agents' in Vienna have to become partners of the transformation process. This needs a vibrant discussion within the city – connected to the European level of exchange between different partner cities. So the main task for sustainable energy and climate transition is cooperation with all needed and affected Stakeholders. The actions we are thinking about need commitment and suitable sharing of cost and benefits from European till concrete building level.

This Transformation Agenda is a study of the actual status and challenges Vienna is facing for the next steps of climate and energy transformation as **Smart Energy City** (see also Executive Summary). It was established on the basis of a local consultancy through the Intake Workshop[4], local working groups and on the basis of the Status Quo Report and the Transformation Agenda Template which was discussed in the last two years by the TRANSFORM consortium. TRANSFORM directly supports the development of Vienna as Smart Energy City through international exchange within the 6 partner cities, energy utility companies, industrial partners and research institutions. Furthermore it systematically enriches the climate-relevant strategies with expertise, gives orientation about the tasks cities have to go through and prepare integrated implementation. All six cities have worked out an agenda like this one, based on the specific local context.

This Transformation Agenda is dedicated to support the Smart City Wien process, connected with different strategies and various actions. The focus is on most actual fields of transition and key actions, like integrated energy and urban planning or participation. In this sense the following document of Vienna's Transformation Agenda is a result of local working groups and local experts, which were working the different parts and topics of this Transformation Agenda.

The Transformation Agenda is a Statement of the city for the city. The aim is more on the involvement and support of local processes by combined know-how than one credible scientific research.

[4] 2 day session in September 2013 with 50 mainly local Stakeholders

Part A: Vienna's Story

1. Vision and Goals for Vienna's transformation

> *In Vienna 2050 is a vibrant and attractive Metropolis. It's a place where people like to live and different possibilities of development and co-creation are provided. This includes all groups of society. Affordability and participation are appreciated and well-practised aspects. Vienna is quality of life on highest levels, based on an innovative atmosphere and a prosperous economy. The central European city is meeting its energy requirements to a large degree by renewable sources, offering a resource efficient mobility system and performs high environmental and energy awareness.*

This is a short summary of the 2050 vision of Smart City Wien. The TRANSFORM project is supporting the city in their ongoing Transformation effort to become a Smart Energy City, which is only a certain part of the Smart City Wien Strategy. Starting point of this city level Transformation Agenda is the Smart City Wien Framework Strategy[5], which was adopted by the City Council in June 2014. It has a guiding character for Smart Energy Goals of the city and the city's different periodically reworked and new generated strategies and action plans. Focus of TRANSFORM is decision support for Vienna's Transformation process and on **interchanges between strategies and action**. This Agenda acts as guidance and policy support for this interchanges. It's about setting the right context for implementation that climate and energy objectives can be enabled, and about chosen spotlights of implementation wherever the cities have direct abilities to take action.

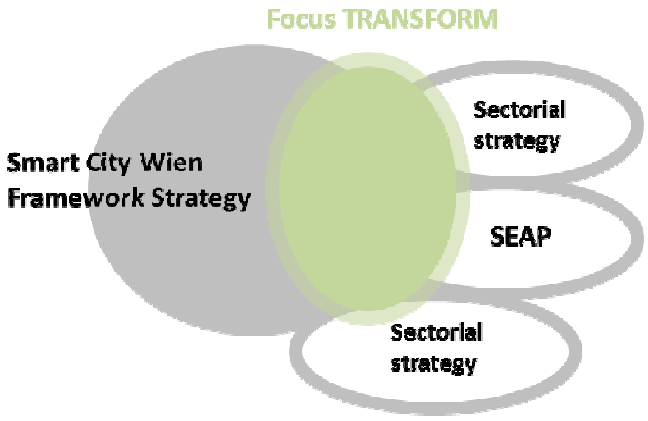


Illustration 2. Vienna's strategic TRANSFORM Context

[5] https://smartcity.wien.at/site/files/2014/09/SmartCityWien_FrameworkStrategy_english_doublepage.pdf

Framework strategy: Objectives for Vienna

Core element of Smart City Wien is the importance of a **balance between efficient use of Resources, Quality of Life and Innovation.** No field can perform smart without respecting the other categories. This means that also the Smart Energy City and focused thematic frame of TRANSFORM have to integrate Quality of life, social inclusion and Innovation aspects. At the end this means affordable housing, access to infrastructure and energy services for all parts of society and an economic environment open for innovative solutions what we call Smart City.

Illustration 3. Key topics Smart City Wien Framework Strategy

A main objective of the Smart City Wien Framework Strategy is the highest quality of life, which includes the main triggers Social Inclusion, Participation, Environment and Health. These enabling key issues to fulfil a Smart City approach. This requires intelligent usage of resources and energy efficiency in Mobility, Buildings, Urban Infrastructure (Waste, Water and ICT) and the Power and Grid Section. Innovation is another key factor for enabling the vision. This includes topics like education, economic prosperity, science and technology as vital drivers for the Transformation process. This setting and connection of themes is a clear statement for an integrative approach. The Framework Strategy is **reaching beyond the TRANSFORM Smart Energy City (SEC)** Focus. However, the part on resources in the Smart City Wien Framework Strategy provides some main goals which are in line with the SEC definition. But to be successful as a Smart City Innovation and Quality of Life are essential aspects in Vienna which have to be integrated different activities. The **"umbrella strategy"** gives orientation for different activities and strategies of the city. This needs a translation of the objectives for local development processes. Translation in the sense of definition what is needed, how we can achieve it, and what pull and push factors is part of the game.

Illustration 4. Bringing the strategy on the ground © baskohler.nl

The following main objectives have been adopted by the city council:

‘Smart City Wien’: Objectives

- **80% reduction of CO_2** emissions per capita till 2050 (1990 reference), at least **35% till 2030**
- **energy efficiency** to reduce energy consumption **per capita by 40%** in 2050 (2005 reference)
- 50% gross energy consumption coming from **renewable sources** 2050, 20% already in 2030
- Most innovative City in **Open Government** by 2020
- broad **Wireless Network** and 100 new **Apps** in the next 3 years
- **2000 Watt** steady power supply per capita, **1 ton CO_2** per capita.
- **motorized traffic:** 20% share of all trips till 2025, and 15% till 2030
- **motorized traffic:** new engine technologies till 2030 (e.g. e-mobility), and no more internal combustion engines till 2050
- **city logistic** 100% CO_2 -free till 2030
- nearly zero energy standard new buildings 2018/2020
- building efficiency: refurbishment leads to **1% annual energy reduction** in building stock
- 10% energy reduction for external **commuter traffic** till 2030
- Continuation with highest standards of Vienna's infrastructure in future
- ICT-Infrastructure showcases with

Ressource Part = Main SEC Focus

- Highest **quality of life** and highest **happiness** of all European cities
- Keeping todays **50% of the City as green space** despite growth
- **Affordable housing** and **attractive residential environment**
- **Healthy conditions** and health competences for all people
- Top and efficient **healthcare**, in public ownership
- **Diversity and social inclusion** for all groups of society. Living together whether or not origins, individual orientation or physical or psychological constitution might be different.
- **Suitable wages** for all employees to be able to meet needs of life
- Considering **Gender aspects** in all processes of decision, planning and implementation
- Satisfaction with **spare time** – quantitative and qualitative
- 270.000 saved tonnes of **CO_2 in waste system** till 2020

- Part of the 5 main cities in **science and innovation** by 2050
- Additional **research headquarters** till 2030, and magnet for top-science and international students
- **10.000 new founded companies** per year
- Twice as much **direct investments** from and to Vienna
- **Innovation region Vienna-Bruno-Bratislava** one of the most prospering in Europe by 2030
- Still one of the **top 10 wealthiest cities in Europe** in GDP
- Vienna strengths it’s position for **head-quarters** for middle and south-east Europe.
- 80% share of **technology on exports** by 2050 (from 60% in 2012)

Illustration 5. Smart City Wien Framework Strategy Objectives

2. Status Quo and current challenges

Vienna population development

Vienna is the most densely populated of Austria's nine federal provinces. In 2014, almost 1.8 million people were living in the City of Vienna. Since the early 1990s, the number of inhabitants has been constantly on the rise. This growth poses major challenges for the municipal government, both with regard to urban structure and design and with respect to the city's technical and social infrastructure. **From 1990 until 2030 the population growth is estimated by 30 % plus** - that means that nearly 2 Million people will live in Vienna by 2030 (cf. Bevölkerungsvorausschätzung 2000 bis 2030, Wien 2002). This is a big effort to handle for the City of Vienna, also in terms of infrastructure, energy or urban planning, but also a chance for transformation. Close to 50% of Vienna's residents either have parents who were born abroad or were born abroad themselves (31%). This is leading to major efforts in energy efficiency and smart solutions for a combination of existing and new urban structures. Big investments have to be made. They are smart when a long term positive social and economic payback can be achieved.

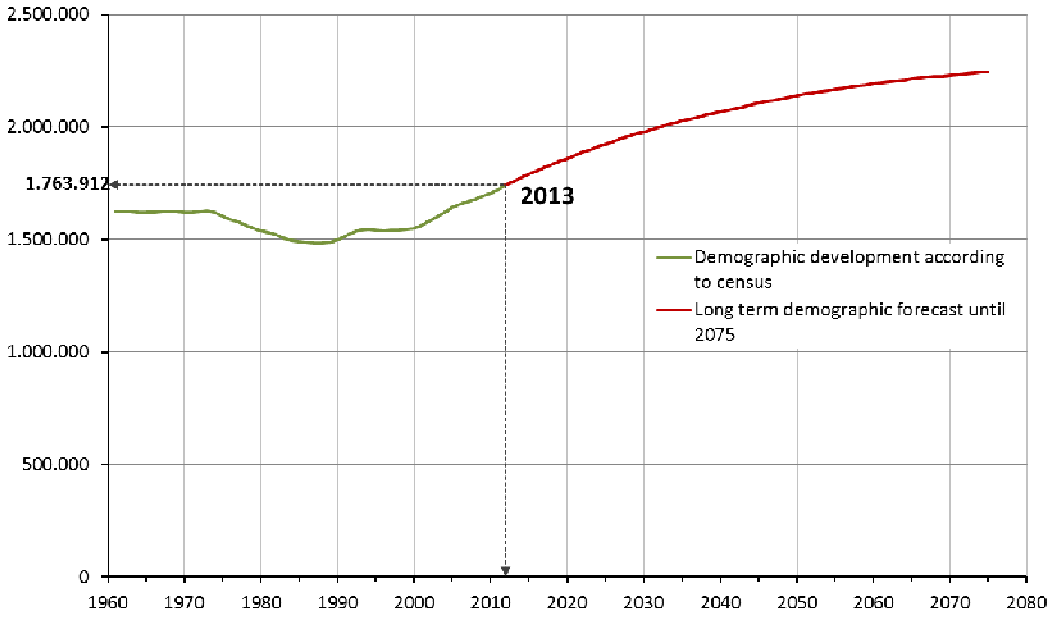


Illustration 6. Population growth of Vienna after historical low in late 1980s

Source: Statistik Austria 2014

Energy consumption

In 2013, gross domestic consumption of Vienna was 43,073 GWh or **24.6 MWh per inhabitant** (with fuel export and offside consumption). Transport accounted for the biggest share of energy consumption (36%), followed by private households (32%), the service sector (22%), and industry and agriculture (10%)[6]. Natural gas covers with 41% the highest part of the gross energy consumption. Renewable energy sources are approximately 11% of all energy production within Vienna. This is much lower than the Austrian average (31%).

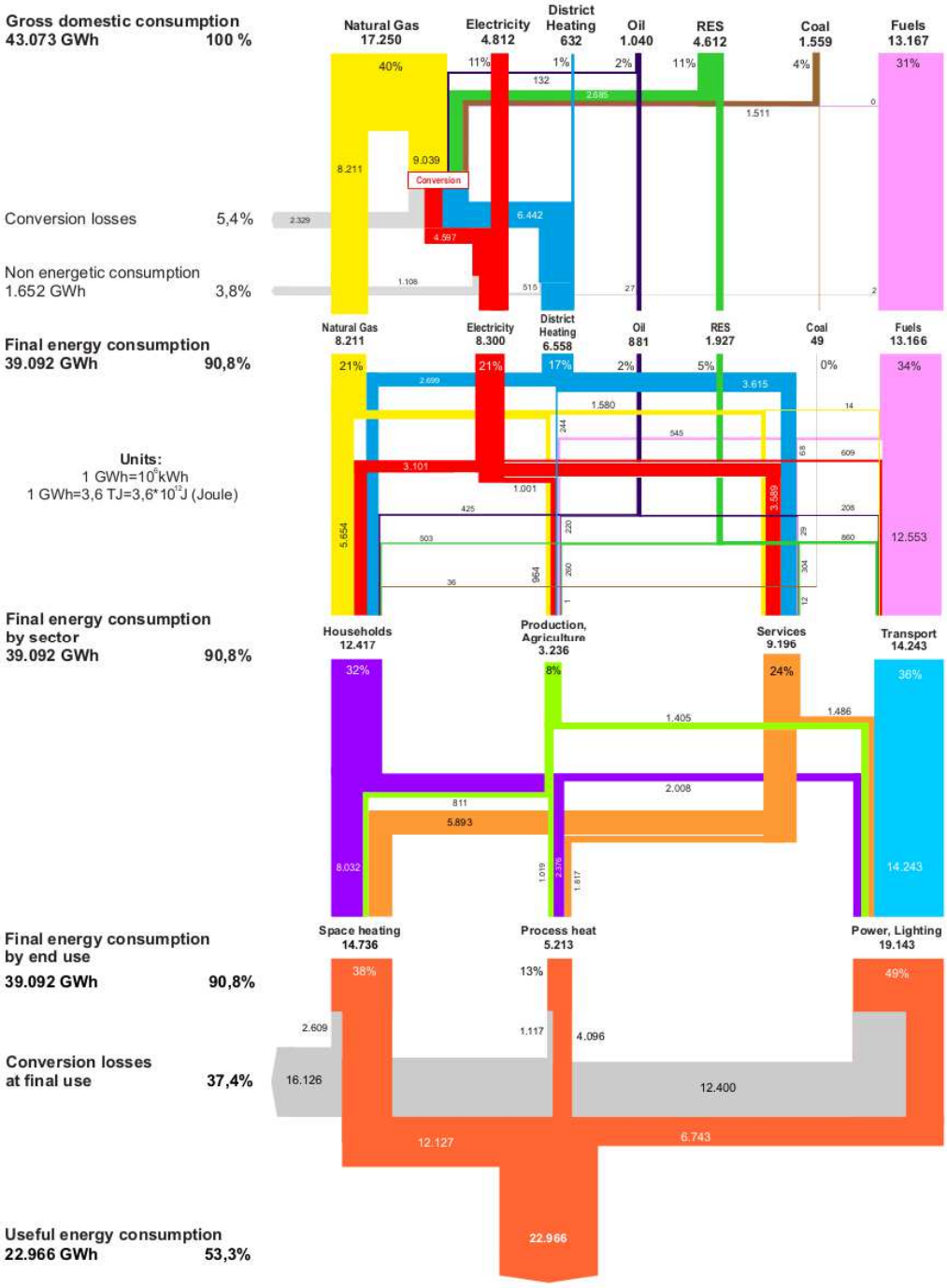


Illustration 7. Energy Flow Vienna 2013 (Data as of Dec. 2014)

[6] Figures of the year 2013, dated from December 2014. Source Statistik Austria, Wien Energie

Business as usual energy scenario

This chapter gives insights about the main figures and trends along with the development process till 2050. It is showing the current status. Here the expected development of CO_2 emissions and energy consumption is shown per capita. It is the baseline for setting up the Transformation scenario. The business as usual-scenario (BAU) is based on the status quo, taking into account development trends and already ongoing measures.[7] This is checked against the defined goals of Vienna, showing the gap between transformation objectives and the current development perspectives until 2050. Along with the description of CO_2 and energy balancing methods this should give a foundation for further work on Transformation scenarios as well as an opportunity for exchange in TRANSFORM.

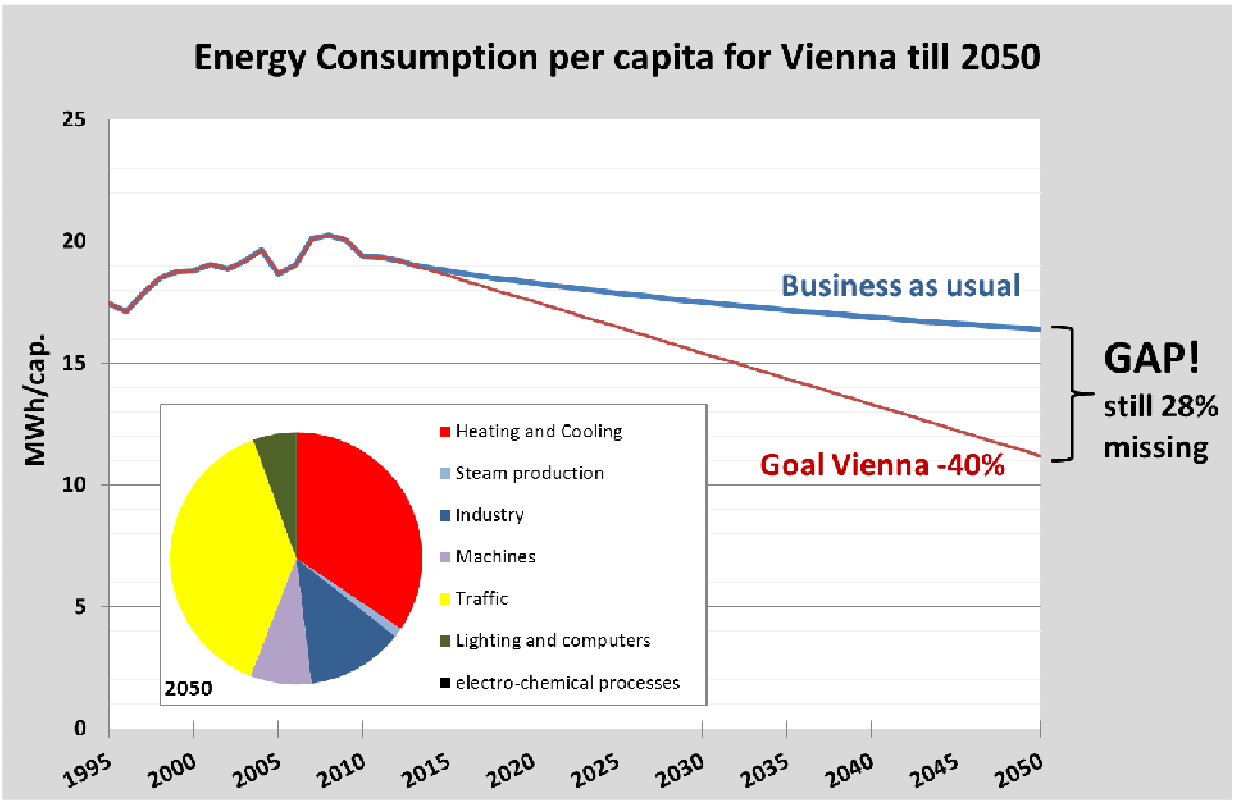


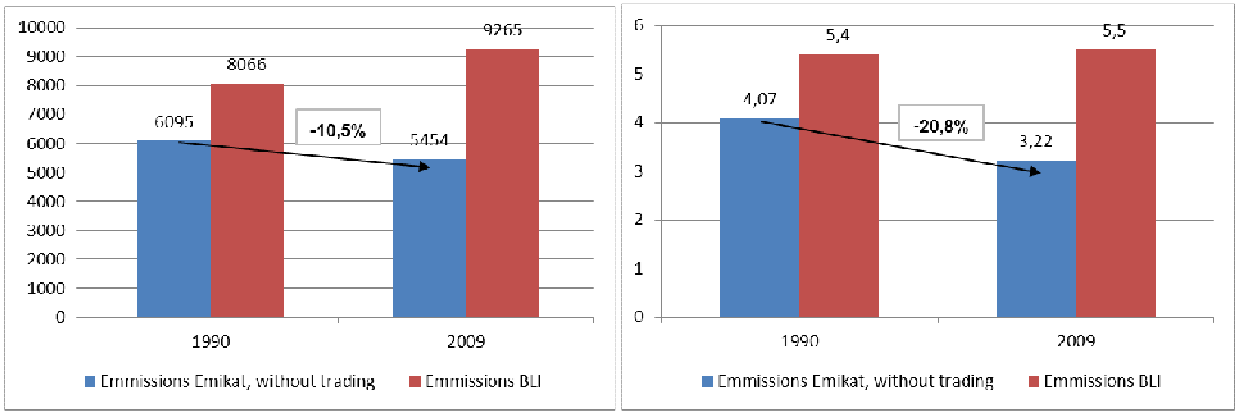
Illustration 8. Future energy consumption according to the 'Smart City Wien'-Objectives and a 'business as usual'-scenario

For energy consumption the model is showing an **actual trend of -12% reductions per capita for 2050** compared to 2005. This means there are needed additional actions towards -40% to fulfil Vienna's Transformation targets. The figures are based on a statistical tool with different data-sources. The calculation model was developed by the Austrian Energy Agency applied by consulting Viennese experts and stakeholders to provide an estimate for the business as usual-scenario on behalf of the Energy Planning Department of the City of Vienna.

CO_2 emissions are determined with two different methods in Vienna. (see Status Quo Report in TRANSFORM). In the first case the emissions are calculated according to their production (BLI). In the second case emissions are balanced according to the pollution actually occurring on Viennese

[7] Some main assumptions for BAU: low refurbishment rate of buildings: 0.4% residential, 0.2% businesses. 0.2% rise of motorized traffic every year. Growing of population, which means more new houses with better energy standards. 3.3% modernization rate of old heating and cooling systems. Slowly shrinking industry and higher service sectors. Same energy consumption for freight traffic (in scenario this is rising instead), and same energy standards for vehicles (in scenario this was shrinking distinctly).

territory (EMIKAT). The main deviation between these methods is caused by vehicles which are fuelled in Vienna - due to their local company headquarter - but operated outside. Another reason lies in the trading of emission certificates. Figures from the last comprehensive evaluation from 2010 show a reduction of 10.5% in total and 20.8% per capita. In **2011 CO_2 emission were 3.1 tonnes per capita**, which leads to a reduction of 23.8% from 1990.



1,000 tonnes of CO_2 equivalent

tonnes of CO_2 equivalent per capita

Illustration 9. Emissions development in Vienna based on EmiKat (excluding emission certificates trading companies) and BLI – in absolute figures and per capita

One actual prognosis on CO_2 emission refers to all of Austria and is given by the Umweltbundesamt 2014. There were 3 scenarios made, one with existing measures and ongoing trend, one with additional measures, and one with extra additional measures (see Illustration 10). This gives an impression how business as usual is far not enough to deal with future challenges and achieve to climate objectives. From 1990 total emissions were raising 8% till 2010. Even with the most ambitious scenario emissions will be reduced just -2% by 2020 and -16% by 2030. And yet, although Vienna is performing better than Austria major efforts have still to be made. Progress towards climate and energy targets is going on quite slowly if we want to stop climate change. We are more and more confronted by the fact that efficiency alone isn't a major alternation, also because of rebound effects, and sufficiency needs to be discussed complementary.

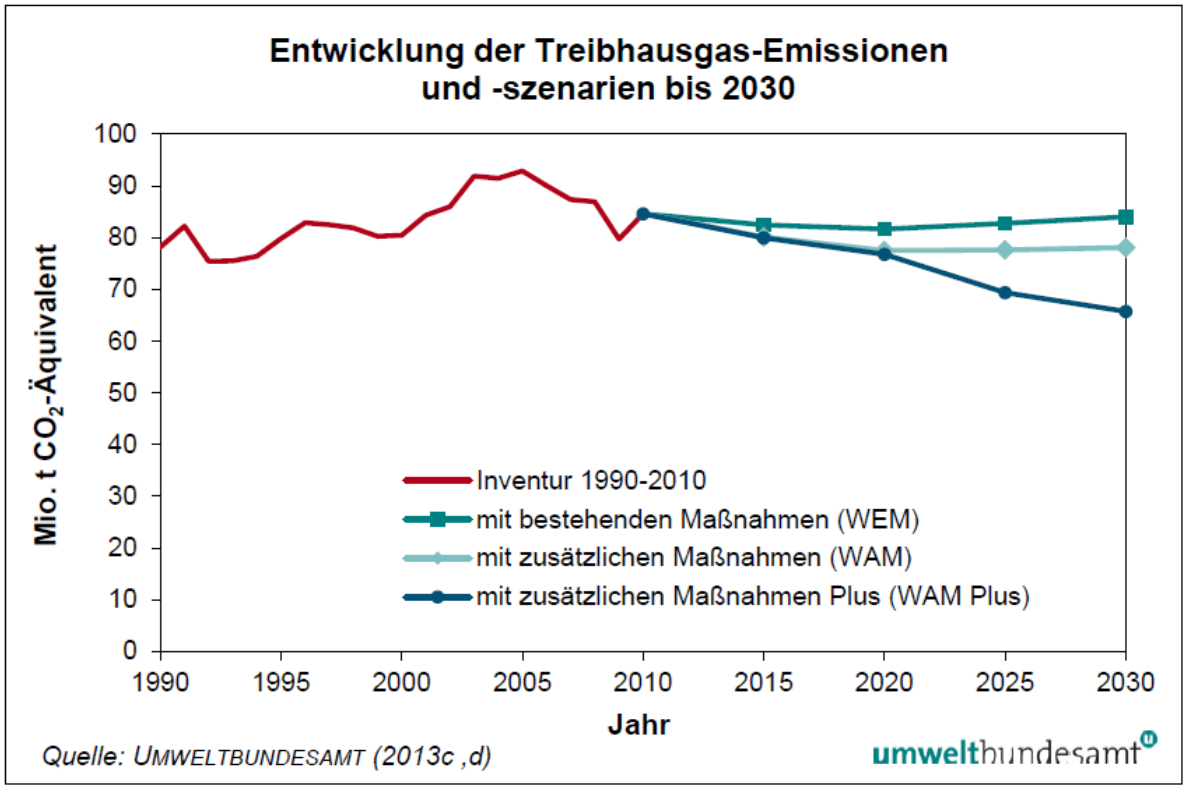


Illustration 10. CO_2 emissions according to Austrian scenarios

Description of Illustration: WEM – existing measures, WAM – additional measures, WAM Plus – even more additional measures

Priority areas for energy transformation and challenges

Within the project TRANSFORM the Transformation Strategy for Vienna focuses on four thematic areas, **Energy, Buildings, Mobility.** These are similar to parts of the Framework Strategy, infrastructure is subsimazied with energy and mobility in this case. In September 2013 the Transform **Intake Workshop** was held in Vienna with around 50 participants (ranging from Stakeholders of municipality, the city, external experts, TRANSFORM experts), to emphasise the most relevant aspects. TRANSFORM provided the PESTLEGS[8] sheme for common analysis, and different SWOT analsis have been caried out. Additionally a Status Quo Report was written to combine essential information. The following chapter gives a short summary, aspects of this explatory work have been involved in the different aspects of this Transformation Agenda.

Energy

In Vienna, natural gas covers a 41% share of gross energy consumption. In recent years, the district heating grid was significantly enlarged; it is basically supplied by waste-heat from combined heat and power production (mainly gas-based, few percent biomass and sewage sludge) and partly by the heat from waste-treatment. In this way, 39% of Vienna's space heating demand is covered with district heat.

[8] The PESTLEGS approach is combining political, economic, social, technical, legislative, environmental, Governance and spatial aspects of urban transformation.

In light of the ambitious environmental and energy objectives renewable energy sources are going to play a greater role for municipal energy supply in the future. Towards this purpose geothermal heat extraction and use of solar power are key factors. The Vienna Solar Potential Register highlights the possibilities and surface potential presented by Vienna's roofage for solar energy utilisation. The corresponding theoretical photovoltaic potential is 4,300 GWh per year, while the theoretical solar heat potential is around 27,300 GWh annually (source: City of Vienna).

Main challenges:

- Exploiting the potentials of renewables and waste heat
- Setting short and medium-term targets and corresponding means for adaption of the energy system
- Finding new eco-friendly sources for the district heating system
- Finding alternatives for gas-fired boilers in existing buildings
- Possibilities to raise connection density within existing district heating network
- Clarifying how centralised and decentralised energy storage units can be integrated into the plans for new buildings and infrastructure facilities.
- Finding adequate answers to the decentralisation of energy production through area-specific integrated spatial and energy planning.

Building and built environment

As a historically evolved city, Vienna boasts a high share of historic structures from many different eras, especially those built pre-1945 and between 1960 and 1970. The existing building stock[9] is characterised by high energy consumption (for space heating and air conditioning) equalling approx. 15 TWh (useful energy, 2010). This corresponds to 1.4 million tonnes of CO_2 annually. Residential buildings consume 9.9 TWh of energy annually for space heating and air conditioning, which equals 117 kWh per square meter and year (source: presentation by Chr. Pöhn, Zero Emission Cities 2012). Due to its size, the municipal housing sector harbours great potential for energy savings in this respect: a total of 220,000 flats are municipally owned, and another 200,000 dwellings were subsidised with public funds (non-profit owners, co-operatives).

In the field of new buildings, Vienna boasts a share of passive houses and estates that is rather high by European standards (3,000 subsidised passive housing units are in place; projects for another 8,000 are being constructed or planned). For new construction projects, public subsidies entail standards agreed on contractually by the Federal Republic with the federal provinces, which will be gradually tightened to attain a nearly zero-energy standard in housing construction by 2020.

Main challenges:

- Data Improvement in regard to the current quality of buildings, energy consumption and for the heating and cooling systems of the building stock

[9] The last complete census of 2001 recorded a total of 910,745 dwellings; estimates for 2011 assume a volume of 980,000 dwellings (WBP 2012). Due to Vienna's demographic growth, it is assumed that the number of flats will increase by approx. 95,000 units until 2025 (demographic forecast of ÖROK 2010), which equals approx. 8,000 new dwellings per year, including new buildings replacing demolished stock (WBP 2012).

- Resolving regulatory issues for the governance of eco-friendly building technologies and retrofitting measures
- For new buildings, organisation and facilitation of the autonomous generation and use of energy in multi-unit buildings and the encouragement of small decentralised networks based on renewables and waste heat

Mobility

In 2012, Vienna's modal split was as follows: public transport – 39%, pedestrian traffic – 28%, motorised individual traffic – 27%, bicycle traffic – 6%. A remarkable characteristic of Vienna is the high mode share of public transport, which is to be further increased: an ongoing enlargement programme for the Vienna Underground, tram and bus networks is to safeguard and improve the future service range both quantitatively and qualitatively.

In the field of bicycle traffic, Vienna harbours a still largely untapped potential: the update of the Transport Master Plan 2003/2008 duly defines a planned mode share of 8% by 2015. The share of eco-friendly means of transport in trips taken in Vienna is currently around 73% but should be further increased (possible targets: 80% and 85%, for 2025 and 2030), which will also significantly reduce energy use and CO_2 emissions.

In 2010, traffic and transport accounted for 35% of Vienna's greenhouse gas emissions and hence constitute a key sector with regard to energy efficiency, climate protection and renewable energy sources. 37% of Vienna's final energy consumption in 2011 was traffic-induced, with the following classification of energy sources: 60% diesel, 25% petrol (compared to 50% in 1993), 6% bioethanol, biodiesel (admixed), approx. 9% electricity, gas, other biogenic liquid fuels (corresponds to 50 PJ or 29 GJ/inhabitant).

Main challenges:

- Satisfying sufficient capacity and quality of public transport service in a growing urban agglomeration (long-term financing for public and publicly subsidised transport between Vienna, region and federal level)
- Increasing Multi-modal split , planning for better points of intersection between available means of transportation
- Increasing share of bilking and walking.
- Improve data basis for traffic planning.

Stakeholder Mapping

A Stakeholder Mapping for Vienna was done within several sessions in 2014, with the methodology developed by the Austrian Institute of Technology (AIT). During a Workshops all relevant actors in the field of Smart Energy City where collected within the different PESTLEGS categories. The task of Stakeholder Mapping was undertaken in the following four steps: General screening of actors, identification of present driving stakeholders, identification of the gaps of involvement of "required" stakeholders and identification of the main stakeholders for transformation. AIT wrote an report about the mapping, done for 3 of the TRANSFORM cities.

Illustration 11 is showing the actual driving Stakeholders in the Smart City Wien process, which were differently involved in the Framework Strategy development. This is showing a Stakeholder environment with strong shares of public, municipal actors or public enterprises.

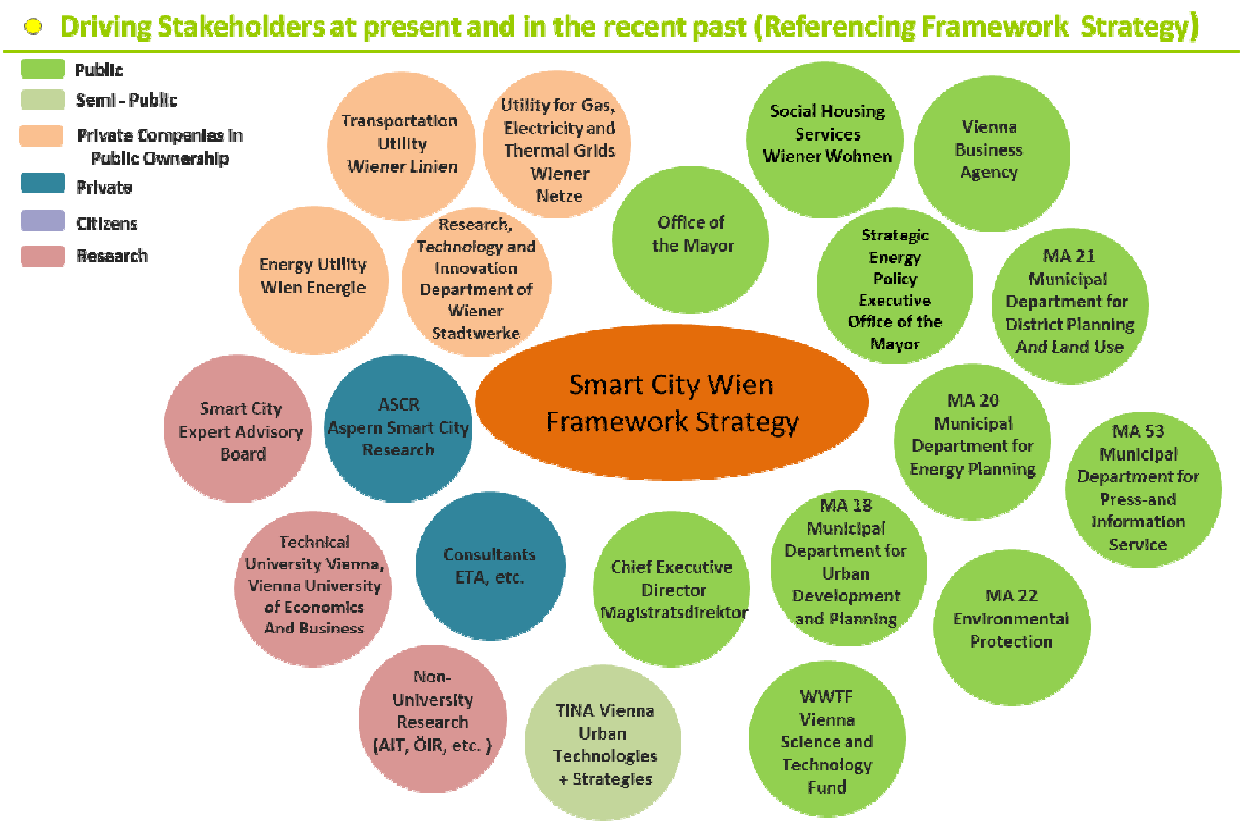


Illustration 11. Actual driving Stakeholders. Output from the Stakeholder mapping done with AIT (illustration by Daiva Walangitang, AIT)

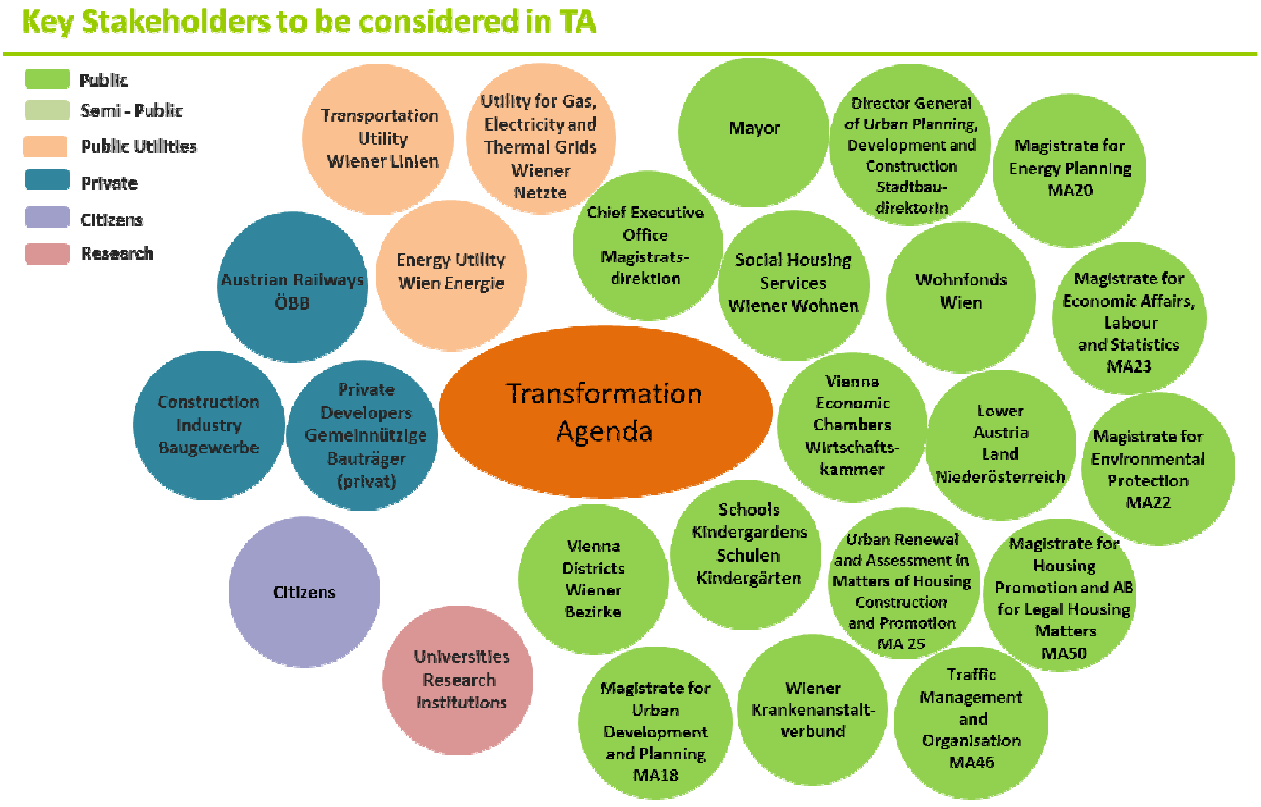


Illustration 12. Important future Stakeholders. (illustration by Daiva Walangitang, AIT)

First findings of needed roles for selected stakeholders

The following points are a summary of the additional stakeholders and their roles within the transformation process, as identified in the Stakeholder Mapping. They are needed additional key Stakeholders for the Transformation Agenda tasks, so they were added in the results of the Stakeholder Mapping sown in Illustration 12. Of course there are more stakeholders needed for the certain fields of action, like Consultation or Implementation, but these stakeholders are currently the most needed in the transition from strategy to action.

Citizens: The energy and climate transformation as a huge effort for the city needs all groups of society for consultation and coordination. At the end the people should profit on a long term from new energy systems or sustainable building technologies. Awareness and acceptance are major issues for implementation. This is connected with the important role of residence or costumers when it comes to financing and making implementation possible.

Developers, real estate and construction industry: For all Stakeholders involved in construction and real estate development new development on energy supply and production brings change of the known business as usual. This means adaption of proven business models and new approaches in planning and realization. One major issue therefor is awareness about the needs and chances. Funding and financing for Smart Energy City solutions is also a necessary role of these Stakeholders (in connection with banks and public funds).

Districts: The districts are important when it comes to local commitment for traffic solutions and streets, public and green space or urban renewable. The districts are also relevant for various communal infrastructures and public services. The districts are also an multiplier when it comes to translating the Smart City Wien objectives into concreate measures and actions.

Region: Lower Austria is the federal state next to Vienna. Federal cooperation and the Smart Region are highly relevant for Smart Energy City objectives when it comes to comprehensive mobility infrastructures, regional energy markets and renewable energy production. Especially the communes next to Vienna need to be considered as needed Stakeholders which have common interest in Smart City infrastructures. Integrated energy planning and installation of renewable energy sources and grids need to be considered in the ongoing boards and platforms. The Region is substantial in different roles, from decision making and coordination till implementation and funding.

Urban Renewable, Social housing and wohnfonds Wien: Social housing plays an important part in the existing building stock and for new development. In Vienna 60% of all people live in houses owned (Wiener Wohnen) or subsidised by the city. Beside mobility this is the biggest field for CO_2 and energy targets. The municipal Stakeholders like MA25 and MA50 are important for execution and strategic tasks. Wohnfonds Wien is a public fund for urban renewable and also highly engaged in new developments when it comes to competitions and tenders. Again, it's about awareness for the Smart Energy City objectives and how to implement them. For wohnfonds also monitoring of renewable and retrofitting is relevant. A close cooperation between these actors, energy utilities and developers for more ambitious objectives has to be ensured.

Wiener Krankenanstalten Verbund (KAV): KAV is an enterprise of the City of Vienna, responsible for hospitals and health care services, with around 30.000 employees. Awareness and implementation of smart energy solutions and sustainable working processes is a needed role for this Stakeholder. The company should also be involved in coordination of energy planning.

Schools and Kindergartens: The energy performance of school and Kindergarten buildings, the smart technologies used by the children, locally installed renewable energy sources and available smart mobility solutions at schools can contribute to the energy and climate objectives of Vienna. But more than this, Stakeholders here can do very great contributions for building awareness for the next generation.

Part B: Review of the city's strategy and transformation scenario

3. Strategy assessment

The strategy assessment is leading to recommendations how improve the strategic part of the actual policies by focusing on the challenges. Methods and Inputs are shared with TRANSFORM partners as well as local stakeholders.

Facing the huge Transformation effort, a critical and constructive (self-)assessment is a major step. One Method of strategy assessment was provided by Hamburg. This section contains an evaluation through different categories of urban policy making and implementation, which are needed during a periodically rolled out transformation cycle. Guiding questions have been designed to get a comprehensive and comparable qualitative understanding about the current situation. In a first step the questions have been filled along predefined answers titled with A (~ already on board and defined) or B (~ to be extended). The assessment describes the situation after the finalization of the Smart City Framework Strategy (June 2014).

Question	Vienna
1 Definition of objectives	A
2 Philosophy of the plan	A
3 Specific timeline	A/B
4 Monitoring	B
5 Technical and social innovation	A
6 Spatial differentiation	B
7 Integration in other political themes	A
8 Role of Stakeholders	A
9 Participative Elements	A
10 Coordination in administration	A/B
11 Integration in budget-plans	B
12 List of energy themes	Gross-domestic energy consumption
	Energy consumption per capita
	Primary energy consumption per capita (Watt/c)
	Proportion of renewable energies
	Energy consumption for regional traffic
	Energy standards new buildings
	Energy reduction from refurbishment buildings
	CO2-free city logistic
	Modal Split with less cars and new engine-technologies

Illustration 13. Topics of guiding questions for strategy assessment

The conclusions from the questions need to be specified for next steps the City of Vienna has to take. First results showing needs in integrated **Monitoring** with appropriate data and information, **spatial differentiation** of goals which also means localised measures and projects and **Governance** for organisation and management structures for the city as a network of different actors. This is showing needs on Participation and Stakeholder Management, which is now a topic in Vienna's Transformation Agenda. In the context of Governance and responsibilities, the question of financing and integration in budget-plans comes up. So, in a first conclusion **financing and funding** could be defined as a forth topic.

In Part C the topics Participation and integrated energy planning were chosen to deepen spatial differentiation and Governance. Participation is important to involve local societies in the transformation process. This has a direct spatial aspect when it comes to implementation. Governance comes in when public and private actors are working together on concepts. Integrated energy planning is highly relevant for the Smart Urban Lab level. Local planning processes are connected to the spatial level and Governance processes as well. It's about bringing overall objectives on the ground and translating them into concrete projects (see Illustration 4).

Strategy screening Vienna – strategies in the context of a Smart Energy City

Up until now, several different thematic strategies have been in place in Vienna in order to deal with the issues of a Smart Energy City (without naming it as such). As smart city relevant competencies are located in different departments, many of these thematic strategies had been elaborated separately by the departments in charge, nevertheless usually supported by other departments. Overall there are four main thematic areas of strategic development in Vienna dealing with the smart energy city – energy supply and energy demand/use, mobility and urban development. The Smart City Wien Framework Strategy represents a guideline to these different strategies, which has also an implication on Governance. The comprehensive (but not exhaustive) long-term strategy gives orientation for the next generation of strategies, urban plans or even local master plans. The commitment and discussion caused by the elaboration of the Framework Strategy raised a common perspective and the need for joint action.

Illustration 14. Framework strategy as guideline for existing and future strategies © typischbeton.com

The city´s **Energy Efficiency Program (SEP)** concentrates on energy demand and energy efficiency whereas the topic of the new **Renewable Action Plan** (**RAP**, not officially adopted yet) clearly is the potential of renewable energy production, mainly within the municipal borders of Vienna. Overarching these two strategies, an overall **Energy Strategy** has been in discussion for some time, laying down main infrastructural decisions and dealing with the topic of energy security of supply. The actual Energy Efficiency Program has been approved in 2005, so a new document is already in preparation to set the next measures for energy efficiency in all relevant sectors. TRANSFORM has the chance to support this parallel process.

The **Masterplan for Mobility** (**MPV**) lays down the planned outline of transport infrastructure and the envisaged development of mobility, including mobility behaviour and environment-friendly modes of mobility. The new **Mobility Concept** (following the MPV) has just been approved (December 2014), which has a time perspective until 2025. Part of the concepts are new and clear goals for mobility, 50 actions (dealing a lot with mobility management, urban space, Governance) and joint chapter of the Federal States Niederösterreich, Burgenland, Wien. In addition, a new strategic document is currently under internal discussion: The e-mobility strategy was elaborated recently in order to include the aspects of electric vehicles in the mobility strategy of Vienna, but has not been adopted so far.

In terms of urban development the new **Urban Development Plan** (**STEP 2025**)[10] has been adopted in June 2014, comprising overall strategic guidelines for future urban development and planning and forming the basis as well as the initiative for elaborating further, more detailed strategies, e.g. the new mobility strategy or new procedures for integrating energy and spatial planning.

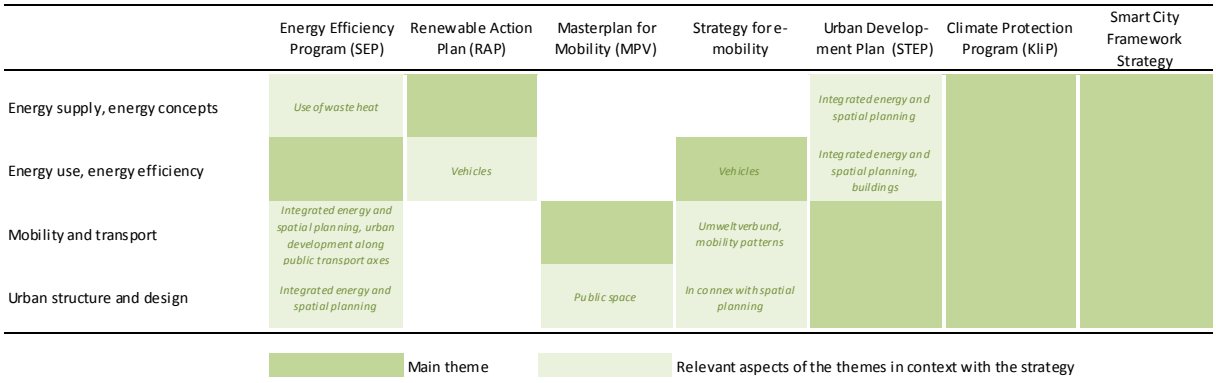


Illustration 15. Thematic strategies dealing with Smart Energy Cities issues

In terms of **time perspectives**, the thematic strategies cover a period of about 10-15 years. Due to spread competences of the responsible departments and different timelines, these strategies have been coordinated in terms of general content, but are less coherent in timelines. Thus they are based on the knowledge and (energy related) market and legal conditions in different points in time, causing some differences in analyses, viewpoints and recommendations.

[10] https://www.wien.gv.at/stadtentwicklung/studien/pdf/b008379d.pdf

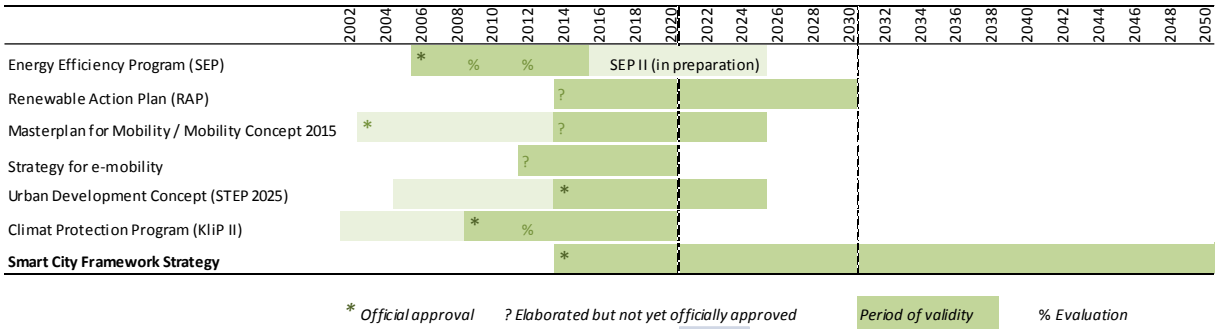


Illustration 16. Varying periods of validity of SC-relevant thematic strategies in Vienna

With this historical and organisational background, the contents of the named thematic strategies, and particularly the **definitions and orientations of quantitative objectives** ("who is expected to achieve what") is varying considerably and not consistent.

Although content-wise the SEP is covering a broad spectrum of measures referring to energy demand and energy efficiency in the city of Vienna, quantitative targets are defined mainly in terms of the reduction of energy demand in the city-owned building stock, appliances, lightning and vehicle fleet (within the municipalities´ own sphere of action). In addition, the RAP is focusing on the increase of the share of final energy use from renewable sources, which is in accordance to the overall ambitions. In line with the overall energy and CO_2-aims, the quantitative targets set by the MPV relate to the reduction of emissions caused by transport, particularly by reducing the share of private car-traffic. In addition, the e-mobility strategy lays down specific targets for a nearly full coverage of e-mobility for (inner city) goods transport and b2b-service.

Finally, the new STEP does not define any quantitative targets but lays down qualitative principles and sets the basis for new initiatives and further work to be done by the municipal authorities (e.g. several thematic concepts or sub-strategies to be elaborated). Most relevant is the creation of new integrated planning procedures, linking urban development with smart energy planning.

In order to overcome the disadvantageous situation of parallel strategic development, there are **two overall strategic documents** in place relating to most of the relevant sectorial programmes and aiming at the coordination of Vienna's efforts.

The **Climate Protection Program of Vienna (KliP)**[11] is a thematically horizontal 10 year-programme adopted in 1999, the period of the current second KliP from 2009 is ending in 2020. The KLIP were elaborated under the lead of the coordination unit for climate protection, involving in a joint effort all relevant departments. As such, the programme includes and integrates strategic outlines of all relevant thematic strategies, estimates and monitors the impact of the measures to be taken on the overall target of climate protection, esp. the reduction of CO_2 emissions. The actual plan defines 385 measures for CO_2 reduction, and is presented as the actual SEAP document of Vienna. Thus, as the KliPs have been formed on the basis of existing strategies from different departments, in terms of objectives and time frames they have not been able to raise the individual ambitions and set targets from the sectorial strategies included under the KLIPs´ umbrella.

In contrast, the new **Smart City Framework Strategy**, was an initiative of the Mayor and elaborated under the strategic guidance of the head of the magistrate and coordinated by the new Smart City Initiative Group of the department for urban development. It refers to a medium term (2030) and a long term perspective until 2050, aiming to serve as an umbrella strategy to all relevant sectorial sub-

[11] http://www.wien.gv.at/umwelt/klimaschutz/pdf/klip-folder2012-kurz-eng.pdf

strategies to be elaborated and re-worked from now on. The Framework Strategy has been elaborated by a working group of experts from different professional backgrounds and departments and it was agreed between all cooperating departments in an intensive discussion process. In terms of the smart energy city it goes beyond existing strategy documents and aims at more ambitious quantitative medium and long-term targets especially for the reduction of energy demand and energy efficiency and for an increased use of renewable energy in order to reduce CO_2 emissions (see chapter 1 Framework Strategy).

With its long-term perspective and the Mayors "backing" it shall provide with an agreed overall framework and the strategic basis for the elaboration of future thematic strategies (of shorter perspectives), which will have to be in line with the Framework Strategy. This requirement forms both, the backbone and the challenge for future strategy definition. The first strategies to be agreed soon are the new mobility strategy followed by the new energy efficiency program.

Up until now, a coherent assessment of impacts of existing strategies in terms of energy demand, energy production and CO_2-emissions does not exist. In order to achieve a stringent implementation of the Smart City Framework Strategy and to be able to monitor the development over time, it will also be necessary to define the share of contributions from the various sectorial strategies and measures. To be able to reach the ambitious quantitative targets, a quantitative assessment of the measures taken and a recurrent evaluation of (sub-)strategies will be needed. With technologies and market conditions changing fast, the forthcoming implementation processes in Vienna will have to be monitored closely and strategies may have to be adapted at a faster rate than in the past.

There is no specific plan on buildings and housing projects, although big public investments or subventions are shaping this sector considerably.

For strategy assessment the previous mentioned sectorial strategies are compared with the objectives of the Smart City Framework Strategy referring to resource-use till 2050. This shows ongoing activities in Vienna, but also crucial points where strategy and implementation has to be clarified or improved. According to this analysis of the actual status of the strategies 16 points for needed improvement have been identified (see Illustration 17).

Objectives Smart City Wien Framework Strategy	Climate Protection Program 2010-2020	Energy Efficiency Plan 2005 - 2015	Renewable Action Plan (missing now)	Mobility Concept 2025 (in approval)	Urban Development Plan 2025
-80 % CO2	385 measures for CO2 reduction towards -21% till 2020. district heating (source + coverage). Co-working with companies 2	efficiency and non-fossile Heating systems - less CO2	RES insteat of fossils 1	CO2 objective for Mobility	
E-Efficiency, -40%	ecological acquisition ("Öko-Kauf"); consultation and awarness	38 activities in different sectors. F.e.: e-efficient devices and heating systems. Public lightning. Security of supply plan 3		Energy objective for Mobility	Micro climate, green space - passive cooling
50 % RES	Renewable production, climate friendly distribution		local RES concepts (esp Waste Heat, Solar, Ground, Geothermal) + import from Region 4 16		Integrated energy planning (process clearification) 5
CO2-free transport modes (< 15% by 2050)	managment:urban structures and mobility, sustainable transport		RES in public transport	Incentives and infrastructures for pedestrians, bike and p.t. Mobility Managment. Reorganization of urban space and financing services/infrastructures. Smar solutions and Governance. Innovation. Region 15	Compact and mixed used structures
New propulsion technologies	Main Focus of Strategy / Imortant for other areas / unclear, to be improved, lacking behind			2013 just 0,5% alternative drives (electro, hybrid, gas) 6	priority for sustainable transport modes
CO2-free commercial traffic			RES for E-Mobility	Logistic hubs, small logistic solutions, e-Mobility for businesses 7	
Commuter Traffic				Joint strategy with neighbor provinces, public transport incentives and infrastructures. Commitment for regulations, external costs 8	city-hinterland-partnerships, Metropolitan Region
Building standards	Checklist and Criterias for new districts. Building efficiency - refurbishment, regulations, public buildings 9	low energy and passive house, subsidies			
1% Energy reduction of existing buildings	Refurbishment standards (Data, Monitoring on Refurbishment) 10	Building efficiency and subsidies. Promoting energy systems with refurbishment 11			Action Plan for certain areas, typologies/ social accepted renwable programms
high standards of infrastructure facilities	New main sewage plant - self-sufficient 2020				
Open (E-)Government	Different activities. Like on Data: https://open.wien.at/site/. Apps based on open Data + various services for citizens. Provision and Integration of Data (esp. Energy, Mobility) 12			Open mobility Data. Smart intermodal solutions (ticketing)	
differentiated spatial level (not direct mentioned in Framework Strategy)	Criterias for Urban Development Zones (to be improved) 13	Objectives for local energy standards (to be improved) 14		local mobility concepts, Governance	

Illustration 17. Highlights of different strategies and the Smart City Framework Strategy objectives, showing demands for further action (red coloured)

The overview of the Smart City Wien goals along existing and upcoming strategies indicates needed actions in various aspects. First of all, there are municipal concepts still to be approved as a basis for further steps (renewable action plan, security of supply plan, overall energy strategy. **1** and **3**). For

energy systems and infrastructures more integrative policies between the city and its own utilities[12] (energy production, energy grids and district heating) and commitment on political level are

In line with the outcome of the assessment along guiding questions, this overview suggests a major need for action in the field of local integrated urban and energy planning (**5**). In order to overcome this gap activities have been started already, including the assessment of different aspects as e.g. a typology of Vienna's built up areas in terms of energy issues (see Part C), building structures and socio-economic parameters, the analysis of existing approaches of integration of urban and energy in the current planning process of different departments, a pilot study on energy concept options for a specific area in Vienna as basis for further agreements and the evaluation of the legal framework for the necessary agreements between stakeholders in Vienna (**16**). These points are in line with the needed criteria on site level and spatial differentiation of the Smart City Wien strategy (**9, 13, 14**). This means different benchmarks on mobility, energy and buildings to be fulfilled in future, like it is done already by different certification tools.

Furthermore, a number of challenges are stated in the context of mobility ranging from data and information lacks (**12**) and the need for the use of new technologies, to the organization of public space in the city, financing sources on sustainable mobility solutions (**15**) and the question of co-ordination of transport flows from outside the city borders. Commitments to regulate internal and external costs of motorized car traffic which are still paid by the society are crucial for a long-term sift (**8**). From catalysts to parking regulation till the upcoming European vehicle standards, regulations where a key driver in the past. In the field of traffic clear objective for CO_2-free commercial traffic (**7**) and new propulsion technologies (**6**) have been set, which are in line with European targets. This task remains outstanding as long as a broad roll-out of alternative engine technologies is not top of the agenda in comparison to public transport, cycling and walking.

Referring to buildings, the most actual challenge is connected to the existing building stock and its refurbishment. Here the integration of smart heating and cooling systems must be enforced (**11**). Finally, in terms of energy issues, the difficult financial situation of district heating networks using waste heat from CHP and the way how to realize deep geothermal plants are most pressing actually (**2, 4**).

Because the field of governance is not (only) aiming at resource saving (in the smart city framework strategy), participation and stakeholder management is not mentioned as an objective in this specific field. Nevertheless, the strategy strives for the improvement of governance, co-operation and also codetermination of urban planning overall, and thus also for the field of resource efficient urban development. Due

- to the highly decisive contribution to long term targets on energy and climate protection by smart citizens and user behaviour, and
- to the fact, that actual strategies still lack comprehensive discussion of this challenge,

the topic of participation and stakeholder management in the context of a smart city development has been chosen as the second TRANSFORM key topic.

[12] Wiener Stadtwerke Holding AG is 100% owned by the City of Vienna and with its 16.000 employees by far the main player in energy and urban mobility in Vienna. For implementation of the transformation process it's one of the main Stakeholders.

Transformation Model

In addition to the guiding questions and strategy assessment a model for a Transformation process have been created within TRANSFORM: **City as complex adaptive system.** The city is seen as a changing environment, with complex interactions between stakeholder groups. This environment is going through periodically Transformation cycles were targets are set, actions rolled-out and monitoring is bringing back feedback if the transformation path is still on track. In the model one possible transformation cycles or feedback loop is done during the TRANSFORM period, but the approach has to be repeated from time to time till 2050. This means a **city as a self-learning system** which is influenced by external developments.

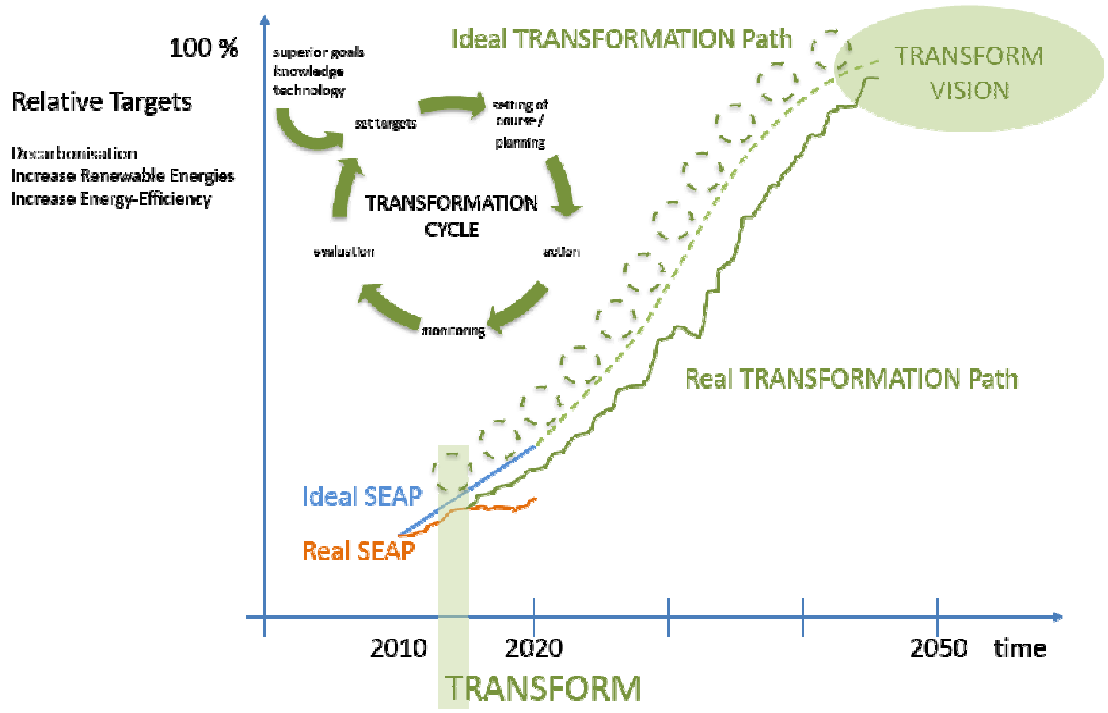


Illustration 18. Scheme of an adaptive system going through a transformation process

Governance

Many objectives of the Smart City Wien Framework Strategy cannot be tackled through individual activities or competencies but require superordinate thematic management. The strong innovation orientation that is a hallmark of the smart city concept not only affects Vienna as a hub of research, education and business but also generates new instruments and approaches that govern the way in which the municipal administration and its enterprises design processes and, above all, render services.

The smart city approach has two primary levels of implementation: on the one hand, it concerns the **political level** and hence the privilege of setting political priorities and defining policies in view of increasing complexity coupled with tight resources.

On the other hand, the smart city concept poses challenges for the **operative level**, also because many tasks can only be handled by cutting across individual organisational units. For the staff members and organisational units of the City of Vienna, this calls for even tighter co-operation within and outside the municipal administration. This “outside” harbours a particularly important aspect,

i.e. the necessity of further intensifying the consultation processes with the Federal Provinces of Lower Austria and Burgenland, for example regarding mobility and regional development issues, on the basis of existing structures like PGO and SUM.

There is an ongoing constitution of the Smart City Initiative which is involving municipal and public institutions in a Government structure, and is establishing cooperation with private and civil actors in a Government structure for implementation.

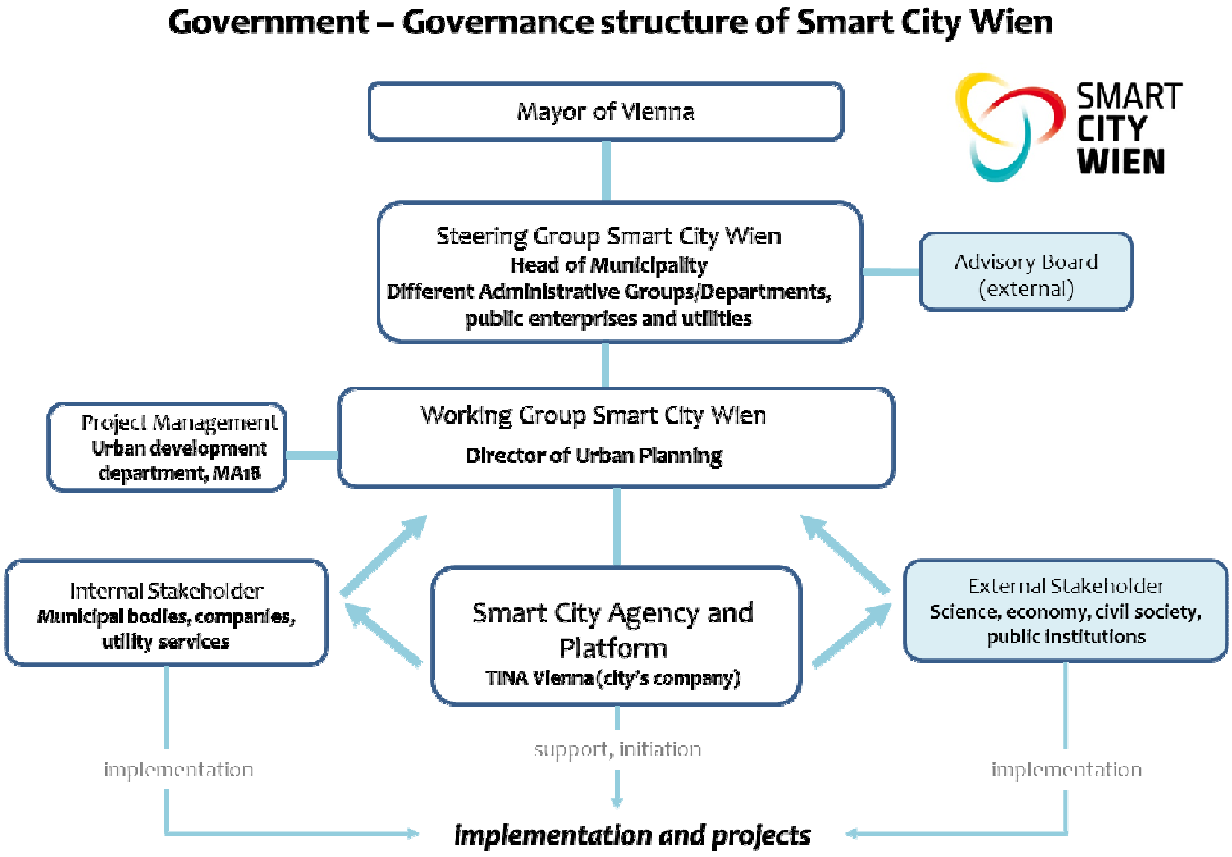


Illustration 19. Scheme of the Smart City Wien Government – Governance structure

The Smart City Wien Initiative was launched by close support of the Major of Vienna. On operational level a Steering Group has been installed, to set the main guidelines and tasks for the further process. The Steering Group consists of all relevant administrative groups and representatives of public enterprises. The Steering Groups is involving an external Advisory Board for consultation. The Working Group is the board for actual activities and coordinated actions, and is meeting every two weeks. Formal and organizational support to this working group comes from a Project Management Office at the Urban Development department, which is also working on principles and strategies for the Smart City. The Working Group is also steering and supported by the Smart City Wien Agency at TINA Vienna, which is serving as a contact point for Smart City Wien. The Agency is together with internal and external Stakeholders of the City of Vienna activating implementation and project initiation (see Illustration 19).

For more detailed information on Vienna's administrative organization see additional information[13] or the Status Quo Report of TRANSFORM.

[13] https://www.wien.gv.at/english/administration/organisation/pdf/administration.pdf

Monitoring

Perhaps the most essential task of the Smart City Wien Framework Strategy lies in the additional **assistance** it can provide **for the numerous specialised strategies underway in Vienna**.

For the implementation of the Smart City Wien objectives, a coherent **monitoring and reporting process** with a limited number of core indicators is to be established. The set of core indicators comprises status, target and policy indicators. For this purpose the established objectives and intermediate objectives with defined time axes are drawn upon. The degree to which the objectives of the Smart City framework strategy are met is measured by means of the core indicators assigned to each key objective. Detailed indicators are limited to the individual specialised strategies in the context of a fi ne-tuned process.

This includes the development of an ongoing process with

- an analysis of indicators
- the development of packages of measures and a definition of responsibilities
- decisions regarding the implementation of these packages
- continuous reporting and adaptation of the strategy, i.e. a definition of who may take necessary improvement measures, and what sort of measures these might be
- the implementation of these measures with suitable implementation monitoring

At regular, brief intervals, the status of implementation is determined. This can be done by means of mandatory, scheduled and shorter data assessments at certain moments in the form of a status report and by means of an analysis and interpretation of outcomes in strategic reports compiled at longer intervals. This makes it possible to monitor progress; it also allows for the fine-tuning and adjustment of objectives. The monitoring process involves all departments in a cross-cutting fashion. To take account of target groups, it also evaluates process data in a gender and diversity-specific style.

Monitoring is currently done mostly sectoral by different entities of the municipality and for their relevant strategies or bigger activities or urban funding programs. By bringing Smart City Wien and energy and climate issues on an integrated city-wide level, cooperation for Monitoring is needed. Usually more comprehensive Evaluations have been carried out every 3-5 years, which is similar to the transformation cycle used in transform. For the future process a Monitoring framework has to address the quantitative and qualitative indicators reasonable, take care about responsibilities and resources, consider an holistic approach and clarify the process of controlling and adaption.

4. Transformation Scenario

The Transformation scenario is describing the impacts **according to the targets of the Framework Strategy till 2050**. Impacts for CO_2 and Energy consumption are broken down for different sectors and categories, to see the key drivers and fields for action. It gives an important reference how the impacts of activities and policies are matching with overall goals. This is one frame for strategic decisions, when a City has to choose between different main actions. Of course the energy or CO_2 impact estimation can only be one aspect. Social, Economic or Ecological considerations of the local city society are other important inputs, which are influencing this scenario. **Figures are per capita**, according to goals.

Nevertheless, on first hence it's necessary to get a clear picture about set goals and the Transformation path. So the business as usual scenario will be complemented with the defined targets, simulated by a statistical simulation of different indicators till 2050. Then a city-wide and spatial break down for the overall targets towards implementation is crucial for the next steps of transformation as Smart Energy City. The following figures should provide a first insight in the quantitative framework of the Transformation process described in the Smart City Wien Framework Strategy. They are showing the impacts of the committed goals and key actions, under expected trends (see business as usual) like the growth of population. More details on the needed actions, ability to implement and concert measures are described for important key measures in Part C.

The following Illustration is showing different sectors of energy usage. It's obvious that traffic and space heating and cooling alone are responsible for 73% of all energy consumption.

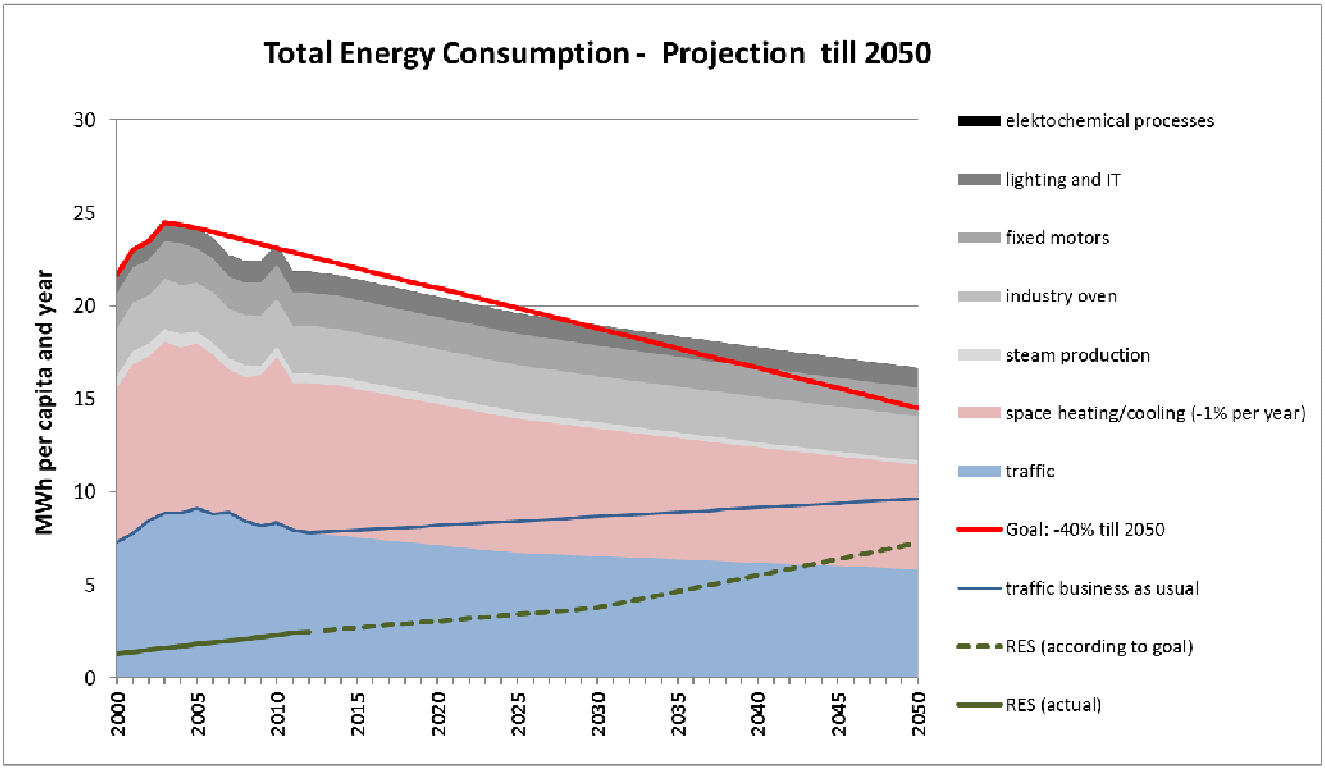


Illustration 20. Transformation path for energy consumption and rate of RES sources

(Only traffic and space heating and cooling are calculated according to specified targets. Figures from traffic are from energy competence centre of Vienna. Other sectors are from the business as usual scenario from Austrian Energy Centre. All figures are measured till 2012; afterwards they are calculated till 2050)

The main objective for energy is the reduction of 40% of the annual final energy consumption per capita from toady 22 MWh to 14.5 MWh. These figures and the objective are representing the final energy consumption. The primary energy consumption, shown as gross domestic energy consumption on page 13, should drop to 2000 Watt continuous power consumption (24 hours all over the year). The vision of 2000 Watt continuous power supply per capita is based on available and sustainable resources.[14] Today the figure for Vienna is 3000 Watt, so a 33% reduction is pursed.

[14] Cf. SCW-Framework Strategy page 44: *"2,000-Watt Society of Zurich: to attain a sustainable and just society, the City of Zurich has adopted the 2,000-watt model. According to this model, the known primary energy volume suffices to cover a continuous output of 2,000 watt per person, which corresponds to an annual energy requirement of approx. 17,500 kWh*

Renewable energy production and distribution

Renewables energy production in Vienna has risen constantly the last year to over 11% or rather around 4.200 GWh. This amount is broken down as follows: 43% for heat, 36% for electricity and 21% for traffic. RES heat sources are especially biomass (solid or gaseous) and garbage. Solar thermal and geothermal installations are a small proportion at the moment, what can be considered as a challenge for future. According to the Framework Strategy goals, RES will be 50% of the sinking total energy consumption in 2050 and 20% in 2030. These rates correspond to the -40% energy consumption Framework Strategy goal.

Space heating and cooling

The goal of the Framework Strategy is an annual reduction of energy consumption of 1% for space heating and cooling, including warm water per capita for whole Vienna. This is possible with building efficiency and building technology actions, but also with rethinking our demands, needed floor space per person or how to avoid cost and energy intensive technologies due to right planning. Also the efficiency of heating and cooling systems is important. In the illustration heating and cooling is decreasing by 30% compared to 2013, and by 37% compared to 2005 till 2050 (see red area).

Example: Annual refurbishment rate of 1.4% from 2016 till 2050 for private households: Total floor space private households Vienna: 78,451,715 m^2 (2014) to 91,848,804 m^2 (estimation 2050). This is the floor space at the beginning of the years. The energy demand of this floor space is changing every year because of demolition, then multiplied with the refurbishment rate, and afterwards increased by new constructions (with heating and cooling demand of 20 kWh/m^2 from 2020). The average heating demand for refurbished dwellings is fixed with 60 kWh/m^2 till 2050. The value is balanced with the heating periods (3176 hours) every year, which is remaining the same till 2050 to roughly include cooling periods too. Total energy consumption on heating and cooling only for residents will fall from 28,882 TJ (2014) to 20,917 TJ (2050). Annual refurbishment rate of 1,8% from 2016 to 2050 for commercial buildings: The approach is similar as the one for private households. Average heating demand after refurbishment varies from 51 KWh/m^2 for offices and hotels to 170 KWh/m^2 for industries and cultural usages. The share of floor space between different economic sectors will remain the same and the floor space itself will be nearly the same till 2050. According to EU law new buildings have to achieve certain energy targets. According to the National Plan of Austrian new buildings have to achieve higher standards with every year and will perform under 22 kWh per m2 by 2020. That's the minimum requirement and business as usual. For future smart urban districts requirements may be even higher. Although that's a huge improvement, it will not have mayor influence in comparison to the old building stock and the potentials of refurbishment. This example shows a total reduction of 27.4% or 41.5% per capita for energy consumption between 2005 and 2050.

Urban transport and new mobility systems

Today around 73% of all trips of the people in Vienna are made with this transport modes (without people commuting in from outside). According to the above mentioned goal, the share of trips by individual motorized traffic should de-crease to 20% till 2025 and clearly fewer than 15% to 2050. Currently the share is 27% for all Viennese trips, with commuter traffic it is 33%. Models from 2014 are showing 7224 million Passenger kilometres on private cars. For the year 2030 a possible Modal Split of 14.8% means 4938 million passenger kilometres. This means 32% less private car traffic. All

per capita. On its way towards a 2,000-watt society, Zurich wants to attain approx. 2,500 watt of energy consumption and not more than one tonne of CO_2 per person by 2050."

calculations taking into account a significantly growing population and more or less similar mobility behaviour in the context of the urban pattern and with respect to the average length of trips.

The calculation beyond the diagram (Illustration 21) shows the prospected energy consumption per capita for sector traffic. The figures for public transport remains the same, this means car trips will substituted by foot and bike trips only, and public transport will stay at today's high level. Energy consumption of remaining car trips is decreasing because of the European standards for vehicles. Concrete these are the 2015 (130gCO_2/km)[15] and 2020 (95gCO_2/km) targets of average emissions of new cars sold in these years. E-Mobility for private cars is already included in these targets. For the projection till 2050 a raising ratio of e-cars till 100% for 2050 is assumed. The energy consumption of the future e-cars is calculated with half of the consumption of today's cars. Today e-cars are approximately at a quarter of conventional cars, so that's a restrained assumption. The difference for the calculation is 24% or 12% of today's energy consumption per capita for private motorised transport in 2050.

Commuter traffic is responsible for 13.3% of the city's traffic. Today, the traffic crossing the city´s border is done 68% by private cars, so commuter traffic is a factor for energy and CO_2 emissions of the transportation sector. To make commuter traffic more sustainable especially better public transport alternatives are needed. In the calculation the reduction comes just for more efficient engine technologies of conventional and e-cars, because there is no specific goal for that in the Framework Strategy, which is the basis of this calculation. The -10% energy reduction goal for commuter traffic is already achievable with more efficient cars according to European standards. The calculation shows freight transport with trucks as the biggest energy consumption part for traffic in future. There is an efficiency assumption of 5% for the vehicles, but also a growing dynamic along with the economy growth rate. This again shows the urgency of new low carbon solutions for the transport sector, but more than this, also the need for another logistic system and geographical division of production and consumption. Because of the energy balancing method used as data basic, there is also a part of energy consumption which is accrues outside of Vienna. This is due to statistical fuel consumption purchased in Vienna but spend elsewhere, and can be seen the grey part of the diagram underneath.

[15] According to figures from STATISTIK AUSTRIA the average for new cars 2014 was 131g for diesel an 127 for gasoline. Beside modal split change this is the second key driver for the traffic sector.

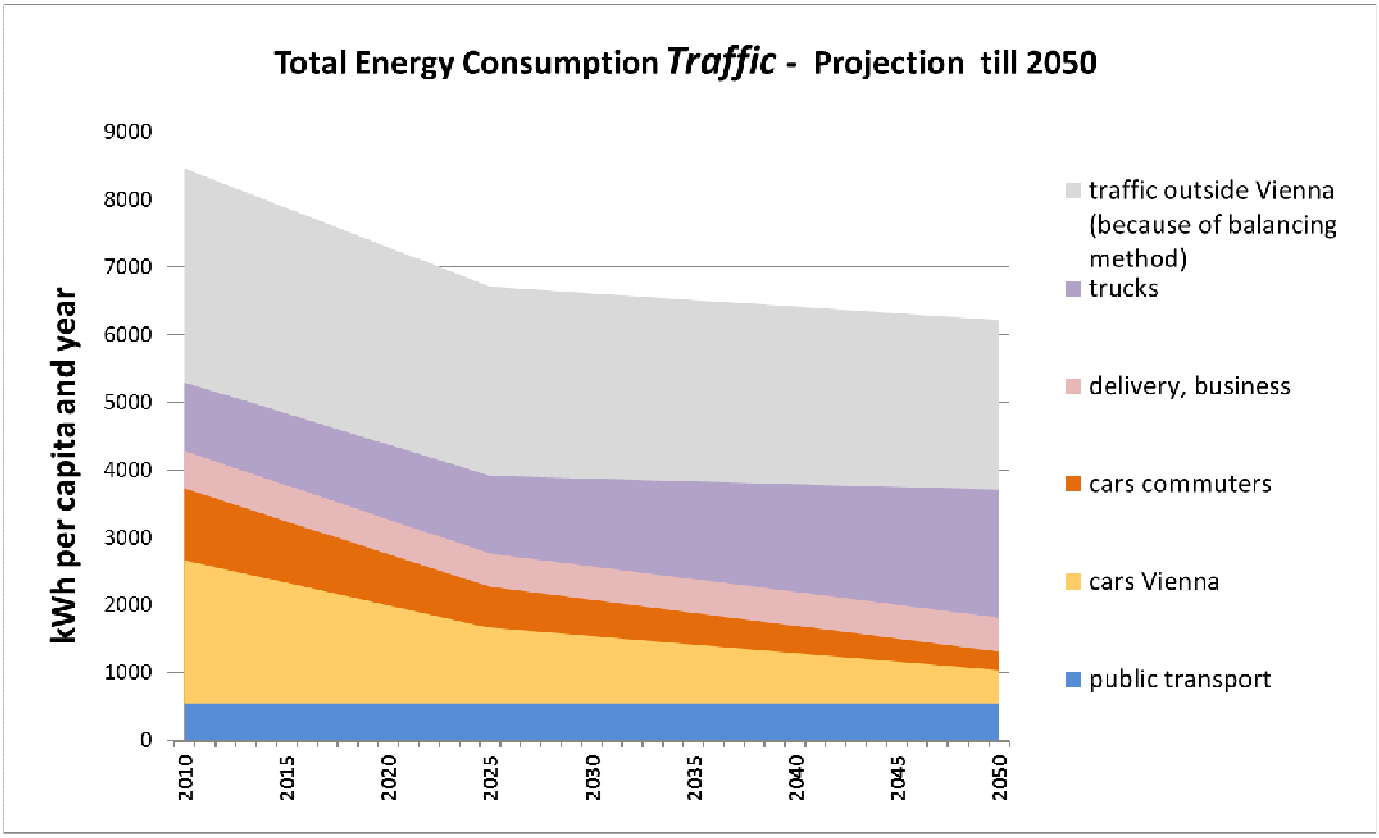


Illustration 21. Projected energy consumption for different transport modes till 2050

Part C: Improving abilities for Transformation

This chapter is dealing with the needed actions to reach the Transformation objectives. They are selected to meet the Smart Energy City focus of TRANSFORM and to have a main contribution for Vienna's energy and climate objectives as well. In the first part the **Action Plan** is summarising actions needed for Governance or Stakeholder Management. This is important to raise the abilities to implement actions and push them forward.

For the Vienna Transformation Agenda two key themes – **Participation and integrated Energy Planning** – were chosen, which have high priority according to high possible impacts but low abilities to implement yet. These topics are concrete enough to work on the level of measures, and to be able to get first results in the short time period of TRANSFORM. To objective for this chapter is getting higher abilities and enabling knowledge for concrete measures.

Both themes require contacts and coordination with city Stakeholder and needed actors. For this reason working groups are taking up the chance to elaborate the Transformation Processes in the context of the research project TRANSFORM. On local level the concept of a Smart City Working Group has been established via working on the Framework Strategy, which should be used also in future with additional focus groups and other co-working formats. At the end of 2014 the results of the local working groups will be summarised in this document. As comparable overview the tables from the Transformation Agenda Template will be used.

5. Action Plan

Principles and activities of the Smart City Wien Framework Strategy

Co-ordination and co-operation, establishment of lighthouse projects

Smart City Wien means change and the tackling of larger thematic areas going beyond narrow departmental confines. Already existing examples include the SMILE mobility card of Wiener Stadtwerke Group, ÖBB (Austrian Federal Railways) and municipal actors; ongoing Smart City calls of the Vienna Business Agency or the URBEM-DK co-operation between the Vienna University of Technology and Vienna Public Utilities in the context of a doctorate course on energy and mobility modelling. To allow for interdepartmental strategic and "smart" control that also includes municipal enterprises, a suitable organisational model needs to be developed. This contains the following elements and exemplary actions:

- Regular Smart City Wien steering rounds chaired by the Chief Executive Director of the City of Vienna with the assistance of a scientific advisory board.
- A Smart City Wien Agency as the central co-ordination point for all internal and external stakeholders. It should cover the areas of co-ordination, stakeholder management, inquiry management and communication and would record, evaluate and initiate projects on behalf of all relevant partners within and outside the City of Vienna.
- The objective lies in the interdisciplinary promotion of networking between municipal administration, research, business and industry.
- Setting-up of larger innovation projects while taking account of a broad base of different departments, municipal enterprises and third parties to cope with major challenges.
    - For ventures of this kind, it is suggested to appoint project area managers who at the same time serve as "faces" and testimonials of Smart City Wien.
    - These ventures would facilitate access to corresponding European innovation platforms and their funding in the Grand Challenges context of the Horizon 2020 framework programme.
    - Examples of such thematic project areas might include mobility management or ambient assisted living (the latter of the Vienna Social Fund).
    - Individual larger lighthouse projects with an innovative character will contribute to the attainment of key Smart City objectives.
- Strengthening Vienna's co-operation on smart city issues with universities and research institutions: setting up long-term collaborations, support in the recruitment of additional key personnel at Viennese universities and research institutions, "urban issues" as study content, research topics and testing grounds for social innovations.

Strengthening the participation possibilities of citizens and experts

Smart City Wien means creating a wider leeway for action for all Viennese. Codetermination and modern management go together, both in direct interpersonal contact and via the Internet.

Exemplary actions:

- Large-scale rollout of open government as a principle and driver of innovation.
- Regular Smart City Wien Forums (one day dialog events).
- Development of formats that transport Smart City Wien issues to kindergartens, schools and other educational establishments: a major initiative makes topics like energy efficiency, low-impact mobility, virtual worlds or coexistence in a city without poverty part of the syllabus and enables children and young people to build their own smart Vienna: "100,000 kids design their very own smart city".

Human resource development, training and recruitment

Smart City Wien projects offer a possibility for employees of the Vienna City Administration and its enterprises to learn about new things and test novel forms of co-operation. For this reason, questions relating to human resource development, training, recruitment and knowledge management are at the centre of the Smart City Wien Initiative.

Exemplary actions:

- Further implementation of the knowledge management strategy of the City of Vienna. The objective lies in making optimum use of networking and further developing the store of knowledge accumulated by staff members. A tool for self-analysis ("Self Check") enables municipal departments to meet their most urgent needs with suitable methods and to align their work with the overall strategy of the Vienna City Administration ("Strategy House"). At the same time, a strategic unit is set up and a community of practice is initiated to safeguard the coverage of cross-cutting thematic knowledge.

- Further development of the diversity-oriented human resource management methods of the City of Vienna as well as of equality between women and men in human resource management.

Alliances, lobbying and consultation processes

With regard to innovation, energy and climate issues, cities are more and more at the centre of interest and policy design. Through co-operation, cities can give more weight to their concerns, e.g. the safeguarding of the principles of public services and services of general interest or the eligibility for subsidies in important areas.

Exemplary actions:

- Intensification of city alliances in Austria but above all with other European metropolises to formulate demands useful to attain Smart City objectives.
- Active conducting of a debate with other cities and regions on how infrastructure investments could again be accorded a special role in the calculation of government debt ratios.32
- Development and implementation of three joint projects with the Federal Ministry for Transport, Innovation and Technology (BMVIT) based on the "Memorandum of Understanding between the City and Vienna and BMVIT" over the next three years.
- Systematic defence of the interests of Vienna and other big cities (lobbying, services of general interest, subsidies) on the European level.
- Canvassing of 20 patrons from the corporate sector, associations and civil society for important Smart City Wien projects over the next three years in combination with joint PR work and – where possible – financial contributions of these patrons. In general, relevant stakeholders outside the municipal administration are integrated into the processes on a long-term and binding basis.

Key Actions for the next period of Transformation

During a previous Smart City Vienna project from 2011 till 2012 a Vision, a Roadmap and an Action Plan 2012-2015 was created.[16] These documents were drafted during Stakeholder Forum workshops with different actors coming from private and public fields. The documents were not officially approved by the City Council, but played an important role in the elaboration of the Smart City Wien process. The formulated actions of the Action Plan 2012-2015 are going into evaluation by the end of this period. The actions developed in a Stakeholder process are still ambitious. Their **timeframe is 2012 till 2015.** The following chapter is the excerpt of the current status of action as input for the next cycle of transition in the upcoming years.

1. Action package: Make the citizens partners

The City of Vienna is using the Smart City initiative to include citizens, districts, stakeholders and industry in the development of the city. Participation is an important measure to involve people and create awareness. For the implementation the following measures and actions are recommended:

Action 1.1: Create basic knowledge regarding the topic "social awareness"	
The known measures of participation are not enough facing the transformation to a smart city. There is the need to further study the	**Related objective of Smart**

[16] http://www.wien.gv.at/stadtentwicklung/studien/pdf/b008218.pdf (German)

questions, fears, needs and hopes of the citizens and the effectiveness of certain participation measures. During the CLUE project there was the initiation of a participatory process, which helped translate the terms “climate neutrality” and “Smart Cities” into everyday language through the help and input of citizens. One tool for this are “communal probes”, bringing in every-day-life perspectives of citizens. This was an important first step to drive the development of the Smart City and the realization of climate neutral cities forward. Another example is the program “Sustainability Challenge” of different Viennese universities together with personal from the City of Vienna. Here the European project CASE is also driving factor knowledge acceleration[17]. For raising competencies the community colleges are offering a program for sustainability in spring 2015 in collaboration with a Smart City Forum.	**City Wien:** • Large-scale rollout of open government as a principle and driver of innovation.

Action 1.2: Create the platform “smart citizens in a smart city”	
The platform is a possibility for exchange between local initiatives, projects, the city and local Stakeholders. This platform should provide clarification on how the city of Vienna or local Stakeholders can support projects (e.g. permissions, know-how, financing and infrastructure). A Call for creative ideas in 2014 showed to potential in society to make the transformation possible. Within one month 161 projects were submitted by various actors of civil society and small entrepreneurs[18]. The project “My Smart City Wien” of the city of Vienna plans on implementing a platform to support the exchange of locals, multipliers and Stakeholders. Together with the Smart City Wien Stakeholder Process since 2011, different initiatives have been started. One prominent and recent was digital city wien[19], launch by the ICT sector and supported by the City of Vienna, which also started a participatory process.[20]	**Related objective of Smart City Wien:** • Large-scale rollout of open government as a principle and driver of innovation.

Action 1.3: smart city participation process	
To promote a change of habits regarding energy behaviour it is important to create participation processes and innovative	**Related objective of Smart**

[17] “Competencies for a sustainable socio-economic development“; see http://www.case-ka.eu/
[18] http://cityhype.departure.at/ideen/
[19] http://digitalcity.wien/
[20] https://digitaleagenda.wien/

participations models. Inhabitants of a street or an area could work together on ideas and activities to force energy efficiency. Furthermore it needs funding and cooperative models. Over the years different kind of participation approaches are carried out by the citizens and the city. 2015 a Masterplan on participation is worked out and 2012 a manual on possibilities was finished. These are more texturing actions to support participation, but an open and inclusive habit is central. It's central to strengthen local empowerment to make transformation effective. Reserving building spots for citizen groups acting as their own developer or the mobility fund aspern with a participatory budget for smart mobility solutions are first carried out actions. Good examples in energy are Vienna's Citizens' Solar Power Plants. The Power plants are a participatory instrument based on a sale and leaseback system. The 2011 started Smart City Wien Stakeholder Process was continued over the last years. Recent topics in this open forum have been the Framework Strategy and urban ICT services. A upcoming forum will be explicit about participation. Experts of Smart City Wien have participated in projects with school classes in 2014.	**City Wien:** • Strengthening the participation possibilities of citizens and experts. • Regular Smart City Wien stakeholder forums. • Stronger involvement of enterprises. Applies both to external effects and co-funding. • Transport Smart City Wien issues to kindergartens, schools and other educational establishments.

Action 1.4: Educational offensive to sensitize the people	
Additionally to raising awareness through information campaigns and communication for citizens, there should be an early process to change habits already in Kindergarten and school. Example for an education initiative is the project "be smart". The idea is to think about a post-fossil society which achieves a reduction of resource use by innovative technologies and change of habits. This is also about same time safeguarding and ensuring quality of life. Students in elementary school and kindergarten research together with scientists and stakeholders on topics, e.g. energy efficiency, renewable resources and Smart Cities.	**Related objective of Smart City Wien:** • In 2030, over 20%, and in 2050, 50% of Vienna's gross energy consumption will originate from renewable sources. • Development of formats that transport Smart City Wien issues to kindergartens, schools and other educational establishments.

Action 1.5: Public Citizens Partnership (PCP)	
PCP is a new form of cooperation between the City of Vienna and the citizens for the collective fulfilment of the communal tasks. It gives citizens the opportunity to take on responsibility and for example run (e.g. social) institutions in cooperation with the public administration. This benefits not only the budget, but also gives responsibility to the population. Currently there is more a focus on making contracts with private investors to finance infrastructures or open and green spaces. Here	

citizens are important to formulate (local) public interest.	

Action 1.6: Communication of projects in the public space, demonstration project smart Quarter Floridsdorf	
To force awareness building it is effective to show positive, implemented projects in the public space e.g. the demonstration project smart Quarter Floridsdorf. This project is a theme trail located in the district Floridsdorf in Vienna with the theme "live and promote CO_2 reduction". The stations show ways how to improve mobility systems, energy efficiency on buildings and in companies, generating and supply technologies. This project should be used as good practise example in the future.	**Related objective of Smart City Wien:** • Reducing per-capita greenhouse gas emissions in Vienna by 80%

Action 1.7: Establishment of a "smart city Agency"	
The establishment of an information hub is essential for the further holding of Stakeholder forums and other events regarding smart city Wien. This agency is already installed at TINA Vienna, a public company of the city, and serves as contact point and organisation for events and communication processes. The agency is also contact point for project acquisition.	**Related objective of Smart City Wien:** • Regular Smart City Wien stakeholder forums. • Stronger involvement of enterprises that support the City of Vienna in its strategy with their Smart City (Wien) projects. Applies both to external effects and co-funding.

2. Action package: Force renewable energy sources in the city

The focus is on the use of solar energy (photovoltaic and solar-thermal use) and geothermal energy. Renewable energy use can be fostered by integrating the renewable energy sources in the existing structures, by combining different energy technologies, by developing adequate energy storages and by market penetration and acceptance.

Action 2.1: Create a Renewable Action Plan Vienna ("RAP_Vie")	
The renewable action plan is already drafted but not yet approved by the City of Vienna. This Renewable Action Plan will set targets for the expansion of different renewable sources in Vienna to reach the climate and energy goals. The RES potential of renewable energy sources has to be known and located. There are instruments and measures needed to activate these potentials and integrate RES in the existing energy markets. Main content of the RAP_Vie will be scenarios for RES usage, broken down for different sectors, and the definition of fields of action with envisaged measures.	**Related objective of Smart City Wien:** • Reducing per-capita greenhouse gas emissions in Vienna by 80% • In 2030, over 20%, and in 2050, 50% of Vienna's gross energy consumption will originate from renewable sources.

Action 2.2: Create and implement an action plan to force the use of solar-thermal energy in the city	
The RAP_Vie should contain an action plan to further promote the development of solar-thermal energy use in Vienna. Concrete measures should be provided to help a quick transition. The RAP_Vie is still in progress and not finished yet. Actual there is a subvention for the installation of solar thermal facilities in place, which is covering 25% of investment costs. Combined solar thermal and heat pump facilities can achieve up to 35% subventions.	**Related objective of Smart City Wien:** • Reducing per-capita greenhouse gas emissions in Vienna by 80% • In 2030, over 20%, and in 2050, 50% of Vienna's gross energy consumption will originate from renewable sources.

Action 2.3: Establish photovoltaic plants for the citizens	
Vienna Citizens' Solar Power Station by Wien Energie is the first project that allows citizens to actively participate in the foundation and construction of solar power plants in urban areas. It is a great opportunity for citizens to partake in promoting and exploiting renewable energy, especially for people who live in rented accommodation (i.e. around 80% of the population in Vienna). Citizens can buy solar panels at a price of € 950 per panel. Wien Energie builds the photovoltaic modular units for the solar plant and the buyers lease back their panels to Wien Energie with a predicted annual return of 3.1%. Every single buyer can purchase between 0.5 and 10 panels, so the buyers' profits are about € 30 per panel and year. Meanwhile there are 16 power plants producing 5,000 MWh per year (500 – 2,000 panels per plant). All of them were sold out very fast. In addition to the 3.1% yearly interest rate for private investors, there is another financial model working with coupons for a supermarket. Currently there is a demand on additional space for (bigger) PV plants.	**Related objective of Smart City Wien:** • In 2030, over 20%, and in 2050, 50% of Vienna's will originate from renewable sources.

Action 2.4: Development of geothermal energy in Vienna – realisation of the use of deep geothermic next to Aspern	
Wien Energy planned a geothermic centre next to Aspern – Vienna's Urban Lakeside for the use of district heating. The centre was supposed to open in 2014 and supply the first flats in Aspern with district heating. However, after the exploration drilling in 2012 the project was stopped due to the absence of expected rock layers and hot water (4-5 km deep). A continuation would have been too insecure and involved with high costs. The cost intensive exploration of geothermal energy needs political assignment, because it's a possible alternative with local (!) renewable energy sources for the district heating.	**Related objective of Smart City Wien:** • Reducing per-capita greenhouse gas emissions in Vienna by 80%. • 2050, 50% of Vienna's gross energy consumption will originate from renewable sources.

3. Action package: Expansion of the multimodal offer of mobility

The development to more use of CO_2-free modes (walking and cycling) and public transport, as well as the reduction of motorised individual traffic (MIT) is ongoing but needs to be intensified even more. Furthermore, new forms of mobility are developed and lead to more and better individual mobility. All forms of mobility should be linked and easy to use by citizens. To achieve these developments, the following actions are recommended:

Action 3.1: Conception of a WienMobil-Card	
The existing one-year ticket for Vienna's public transport system costs € 365, which is an intended cheap rate to promote low carbon mobility. Last figures show an increase of one-year tickets from 19% of the citizens with season tickets in 2005 to 31% in 2013. In a next step this seasonal ticket can be transferred into a mobility card, to use other mobility services like bike and car sharing systems or parking garages. The mobility card was planned by the public transport utility Wiener Stadtwerke and is available in 2015.	**Related objective of Smart City Wien:** • Maintenance of high share of public transport and decrease of MIT in the city to 20% by 2025, to 15% by 2030, and to markedly less than 15% by 2050. • By 2030, the largest possible share of MIT is to be shifted to public transport and non-motorised types of traffic or should make use of new propulsion technologies (e.g. electric-powered vehicles).

Action 3.2: SMILE – A Prototype for an information- , booking- and paying- system ("smart Mobility Platform")	
The "smile" project is aimed at developing and testing a prototype of an Integrated Mobility Platform with a Smartphone App open for all types of mobility services (public regional and long distance transport, bike rentals, car sharing, taxis, etc.). This could be a key tool for a multimodal and intermodal traffic system..[21] Furthermore it allows the costumer to buy and pay for tickets of different forms of transport with one click. The aim is to make intermodal journeys easier to handle and support public transport, sharing and non-fossil mobility services.	**Related objective of Smart City Wien:** • Maintenance of high share of public transport and decrease of motorised individual traffic (MIT) in the city to 20% by 2025, to 15% by 2030, and to markedly less than 15% by 2050. • By 2030, MIT is to be shifted to public transport and non-motorised types of traffic or should make use of new propulsion technologies (e.g. electric-powered vehicles).

[21] http://smile-einfachmobil.at/index_en.html

Action 3.3: Fleet conversion to electric vehicles	
Companies' fleets are suitable for changing to electric vehicles and therefore an important contributor for emission reduction. The goal is to include companies' fleets into an urban energy concept and to create funding programs. As until today there was no integration in an urban energy concept but there are existing funding concepts for electric vehicles. The actions of the City of Vienna for electric vehicles are concentrating on fleets and business traffic. In spring 2015 four different types of car-sharing models are tested in the industrial zone of Liesing.	**Related objective of Smart City Wien:** • By 2030, MIT is to be shifted to public transport and non-motorised types of traffic or should make use of new propulsion technologies (e.g. electric-powered vehicles). • By 2030, commercial traffic originating and terminating within the municipal boundaries is to be largely CO_2-free.

Action 3.4: Updating and further clarifying the main traffic bikeway system and upgrading of the bike infrastructure; position biking as a lifestyle-topic	
Measures to further develop and expand the bike infrastructure and bike tracks will help to improve cycling within the city. At the same time PR-measures should be taken to promote biking as modern, urban mobility form. The brand new mobility concept has included high-ranked biking roads for longer connections. There is yearly progress in improving the bike infrastructure and a lot of building operations on street level to make biking easier and safer. Here the 23 districts of Vienna are important. In the year 2013 the "bike year" was proclaimed in Vienna with a lot of events and the velo-city conference.	**Related objective of Smart City Wien:** • Strengthening of CO_2-free modes (walking and cycling), maintenance of high share of public transport and decrease of motorised individual traffic (MIT). • By 2030, MIT is to be shifted to public transport and non-motorised types of traffic or should make use of new propulsion technologies (e.g. electric-powered vehicles).

Action 3.5: Expansion and development of peripheral mobility knots to redirect commuters to using public transport	
The existing Park & Ride stations on the city boarder will be expanded and developed to further attract commuters to change to public transport. These stations should be extended to mobility points with lots of different mobility forms to offer (e.g. car sharing, bike sharing, regional trains). These goals can be found in the mobility concept as well as further objectives to improve peripheral mobility knots e.g. improving the infrastructure and the surrounding areas at bus and train stops. Also the city strives for exchange with the surrounding federal states regarding projects and initiatives. The implementation of new services on peripheral mobility knots is still in progress.	**Related objective of Smart City Wien:** • By 2030, MIT is to be shifted to public transport and non-motorised types of traffic or should make use of new propulsion technologies (e.g. electric-powered vehicles). • Reduction of energy consumption by passenger traffic across municipal boundaries by 10% in 2030.

4. Action package: smart city Business Hub

For the transformation to a smart city, the City of Vienna needs partners from the politics, the citizens, representatives of interests and the economy. To further develop Vienna as a business location there is a need to implement a "smart city Business Hub".

Action 4.1: Establish a contact for companies regarding the topic "smart cities"	
The task fields of this contact will be to help create the further process design for the smart city Vienna, help coordinate the strategic objectives for the smart city process, be the contact person for companies as well as implementing marketing activities. The companies Wirtschaftsagentur Wien (business agency of Vienna) and TINA Vienna – smart city Wien Agency are fulfilling this task.	**Related objective of Smart City Wien:** • Vienna further strengthens its position as the preferred company headquarters (HQ) city in Central/South-eastern Europe. • 10,000 persons annually set up an enterprise in Vienna.

Action 4.2: Promote development of projects regarding certain topics by municipal subsidies	
Existing funding programs will help to set a topical focus on the subject of smart urban technologies. Furthermore, financing models should be developed to guarantee the development of projects other than through public financing. In the last years four calls have been carried out, which supported companies with innovative urban products with 14 million euro. Innovation talks have been held with city institutions and businesses. Important is a public acquisition of smart products and technologies. A Platform[22] is showing smart solutions for the city which are supported by the project "WienWin". Besides funding other incentives like information, networking, permissions or shared use of resources have to be intensified to support future Smart City Wien projects. The finding of new financing models beside public funding have to be intensified.	**Related objective of Smart City Wien:** • In 2050, Vienna is an innovation leader due to top-end research, a strong economy and education. • In 2050, Vienna is one of the five biggest European research and innovation hubs. • In 2030, Vienna is magnet for international top researchers and students.

Action 4.3: Marketing activities for the positioning of the topic "smart city" in Vienna	
Organisation and hosting of events to network relevant actors, to exchange information, to stimulate projects and promote the Viennese smart urban technologies	**Related objective of Smart City Wien:** • Information and brand management for Smart City Wien.

[22] http://technologieplattform.wirtschaftsagentur.at/

(e.g. conferences, fairs, stakeholder-fora). Public relation activities by the city as well as the Smart City Wien agency at TINA Vienna have started this process intensified in 2013. There are different activities on this big topic like a current (spring 2015) exhibition[23] on smart urban development which will be mobile afterwards.	• By 2030, Vienna attracts additional research units of international corporations. • Alliances, lobbying and consultation processes.

5. Action package: space management for traffic

Action 5.1: New definition for obligatory parking spaces	
In dense cities a lot of space is used by motorized individual traffic which would otherwise be beneficial for the citizens as public space. Measures to revive this space could be to manage the available car parking space as well as implement alternative modes of transport. There is the possibility to reduce the parking space in the public space by changing the Viennese law and obligation, which asks to establish a certain amount of parking spaces when building new housing buildings. Due to law there is an obligation for new residential constructions to provide parking spaces. In the past it was one parking space per unit. After an amendment this is now obligatory per 100m^2. For most new mayor development areas lower parking space obligations are defined individually. This reduction is important for future promotion of sustainable transport modes and reduces construction costs for individual motorized transport – which can be spend alternatively.	**Related objective of Smart City Wien:** • Strengthening of CO_2-free modes (walking and cycling), maintenance of high share of public transport and decrease of motorized individual traffic (MIT) in the city to 20% by 2025, to 15% by 2030, and to markedly less than 15% by 2050. • By 2030, MIT is to be shifted to public transport and non-motorized types of traffic or should make use of new propulsion technologies (e.g. electric-powered vehicles). • By 2050, all motorized individual traffic within the municipal boundaries is to make do without conventional propulsion technologies.

Action 5.2: Parking space management for the whole city	
To cover the costs for using public space through stationary traffic, the parking space management is to be expanded to all city districts. The existing studies should be	**Related objective of Smart City Wien:** • Strengthening of CO_2-free modes (walking and cycling), maintenance of high share of public

[23] https://www.wien.gv.at/stadtentwicklung/veranstaltungen/ausstellungen/2015/stadt-smart/

complemented and specified with new pricing models. Additionally, combined solutions for commuters, e.g. public transport + Park & Ride-use in one ticket, should be promoted. Expansions of the toll zones for parking in the cities have been done in the last years. Studies show up to 30% less required urban space for parking just after the implementation. This caused many discussions on local level and the commitment of the districts.	transport and decrease of motorized individual traffic (MIT) in the city to 20% by 2025, to 15% by 2030, and to markedly less than 15% by 2050. • By 2030, the largest possible share of MIT is to be shifted to public transport and non-motorized types of traffic or should make use of new propulsion technologies (e.g. electric-powered vehicles). • Reduction of energy consumption by passenger traffic across municipal boundaries by 10% in 2030.

Action 5.3: Revival and strengthening of the public space	
The goal is to continuously reduce the amount of parking spaces in the public space. A formulated concept should help to monitor the annual achievements of objectives. The additional public street space should be used to create usable open spaces for the citizens who contribute to the attractiveness of the urban space and to the "city of short distances". A concept for public space will be established by the City of Vienna in the next future. Here interdisciplinary and cross-sectorial working and Governance structures are highly necessary. Public space is an important factor for sustainable mobility and also relevant for passive cooling, integration of urban infrastructure, lighting and renewable energy installations.	**Related objective of Smart City Wien:** • High-quality, affordable housing and an attractive housing environment are made accessible to the largest possible share of the population. • Strengthening of CO_2-free modes (walking and cycling).

6. Action package: Integrated energy planning

The topics climate protection and energy efficiency are important and cannot be ignored. There is still a need for additional legislative regulations, together with further cooperation and exchange of information. Clear and commonly binding principles can improve climate and energy transformation, because then all parties know how to plan and calculate. Energy-saving actions in the building sector are more present than actions regarding mobility patterns. The knowledge must be further spread and awareness has to be raised. Also the data from the municipal administration and the different energy supply companies needs to be linked and more cooperation should take place.

Action 6.1: Implementation of the topic "energy" in the urban development plan	
In the context of the creation of the Urban Development Plan 2025 the thematic complex "energy" was integrated in 2014. An example for the integration is the statement to keep	**Related objective of Smart City Wien:** • 40% decrease of energy consumption per capita by 2050 (compared to 2005).

the demand for energy to a minimum and use the local available renewable sources optimal. Also energy efficiency regarding mobility and building is emphasized. Another essential initiative is the development of the concept “integrated energy planning” and the formulation of local energy concepts.	• Per-capita primary energy input drop from 3,000 watt to 2,000 watt. • In 2030, over 20%, and in 2050, 50% renewable sources.

Action 6.2: Intensifying the dialogue with the surrounding local authorities	
The topic energy should be regularly discussed on a discussions and working platform with municipalities surrounding Vienna. Additional investigations and analyses should help understand and communicate the connections and the degree of networking. Existing institutions e.g. the regional planning group east (PGO) or the urban-rural-management (SUM) should help with these analyses. The goal of the platform is to promote joint projects, systems and networks. In future a city like Vienna can’t produce all the (renewable) energy on its own territory, and has to import energy from nearby regions. This makes regional cooperation and energy markets necessary. In the last years wind turbines were built nearby Vienna, also by Wien Energie.	**Related objective of Smart City Wien:** • Reduction of energy consumption by passenger traffic across municipal boundaries by 10% in 2030. • In 2030, over 20%, and in 2050, 50% renewable sources.

Action 6.3: Development of new planning tools	
The existing space-and energy-relevant data of the city administration as well as from energy- and mobility-providers should be analyzed regarding the possibilities to combine them, based on joint goals and questions. The necessary interfaces might have to be installed and the results should be usable for both sides. Here the Decision Support Environment Tool, developed by the TRANSFORM Partners, comes in. The tool is providing an city-wide and area based overview about relevant figures and preconditions, and calculates the impact of measures and changing framework conditions.	

7. Action package: Force city improvement and modernization

The modernization and refurbishment of the building stock is one of the most important fields to reach energy and climate goals. It’s about raising the rate and amount a refurbished floor area and complementary also the quality and energy performance which has to be achieved after refurbishment. Beside the reduction of energy consumption to integration of smart heating and cooling systems is highly relevant.

Action 7.1: Force the compact and energy-efficient existing city

Energy efficient structures, which combine compact and dense urban space, have to be supported. The Urban Development Plan Vienna should include measures that force the modernization of the compact city. The aspects densification, modernization of the existing buildings, energy supply and use of traffic areas all have to be taken into account. An Action Plan will focus especially on energy improvements of 50s to 80s building stock. Monitoring on building plots for qualitative density and urbanity.	**Related objective of Smart City Wien:** • Reducing per-capita greenhouse gas emissions in Vienna by 80%. • 40% decrease of energy consumption per capita by 2050 (compared to 2005). • Per-capita primary energy input drop from 3,000 watt to 2,000 watt.

Action 7.2: Create incentives for building rehabilitation (renovation offensive) - further development of subsidised funding for building rehabilitations	
Building rehabilitations are an important topic regarding city modernization. Therefore subsidized funding should be further developed by optimizing the framework conditions to keep the rehabilitation affordable. Actually there is a program (THEWOSAN) running funding up to 160€ per square meter depending on energy improvement of the thermal condition and the changing of heating system. Especially heating and cooling system changes have to be intensified (see challenge: densification of district heating).	**Related objective of Smart City Wien:** • Reduction of energy consumption of existing buildings for space heating, cooling and water heating by 1% per capita and year. • Reducing per-capita greenhouse gas emissions in Vienna by 80%.

Action 7.3: Market assistance for building's energy performance certificates	
Energy performance certificates for buildings should be established on the real estate market to promote transparency and to help buying a real estate. The certificates are obligatory whenever a building or unit is for sale or rent, and for nearly all new buildings and major renovations. Important parts are the total heating demand, the primary energy input for the energy system and the CO_2 factor, which is evaluated along an A++ to G ranking.	**Related objective of Smart City Wien:** • Cost-optimized zero-energy building standards for all new structures • Reduction of energy consumption of existing buildings for space heating, cooling and water heating by 1% per capita and year.

Action 7.4: Adaption of the legal framework – focal campaign on insulation of the top storey ceiling	
It should be analysed if a mandatory thermal rehabilitation of the existing buildings can be implemented. Since the rehabilitation of the existing buildings in Vienna is a great contribution to the CO_2	**Related objective of Smart City Wien:** • Reduction of energy consumption of existing buildings for space heating,

emissions reduction.	cooling and water heating by 1% per capita and year.

Action 7.5: Demonstration project GUGLE (Green Urban Gate towards Leadership in sustainable Energy)/Smart initiatives in historical urban quarters	
The focus of this project is on strategic development of how to implement the principles of sustainability and climate protection in two Viennese districts. It searches for smart, flexible and cost-effective solutions for buildings and urban quarters that are generally applicable. The project is a demo project and should be used to conclude lessons learned. GUGLE enabled the refurbishment of old city owned housing projects to reach passive house standards afterwards and also considering social standards and fewer disturbances for existing inhabitants.	**Related objective of Smart City Wien:** • Cost-optimized zero-energy building standards for all new structures, additions and refurbishments from 2018/2020 and further development of heat supply systems towards even better climate protection levels. • 1% reduction of energy for heating, cooling and domestic warm water per year.

Action 7.6: Energy-efficient Block Renewal	
Urban renewable projects have been rolled out since the 1970s in Vienna. Hundred thousands of residential units have profited from the focused actions for specific building blocks or neighborhoods. Main objective was the improvement of living conditions, architecture and indoor facilities. Also energy efficiency palyed an important part. The city's "THEWOSAN" refurbishment program has been included in renewable projects. Recent developments like the project "Smart Block" are exploring models of cross-building energy concepts, centralized heating systems or the use of photovoltaic in old building stocks. Local sustainable mobility solutions, participation of local actors, public space or SME (small and medium-sized enterprises) development are also part of the renewable programs.	**Related objective of Smart City Wien:** • Vienna maintains its quality of living at the current superlative level and continues to focus on social inclusion. • Reduction of energy consumption of existing buildings for space heating, cooling and water heating by 1% per capita and year.

8. Action package: Innovations in urban development

The combination of different building uses e.g. (housing, industry, offices and business premises) is not only beneficial for the energy demand, but also for the mobility patterns ("city of short distances"). The integration of the different aspects of life (e.g. work, living, shopping, schools etc.) in an urban district helps to reduce the individual need for mobility.

Action 8.1: Innovations in urban development (urban houses, ground floor management)	
Urban density should be considered in addition to the planning of infrastructure e.g. close to mobility points. Urban planning should consider energy criteria in regard to density or cubic capacity. Framework conditions for buildings with flexible use of the ground floor are more and more implemented (ground floor management, regulations in zoning plans). Therefore already existing projects should be evaluated for their effectiveness, costs and sustainability. Ground floor managements are driver for attractive and livable urban neighborhoods, and have been planned in development areas like aspern or Nordbahnhof. Energy Planning, efficiency and renewable aspects, have to be connected close to density and Urban Zoning.	**Related objective of Smart City Wien:** • 40% decrease of energy consumption per capita by 2050 (compared to 2005). • Cost-optimized zero-energy building standards. • 1% reduction of energy for heating, cooling and domestic warm water per year.

Action 8.2: City of short distances or delivery services	
In new development areas there should be a focus on the connection between residential area and work places to force walking and cycling. Also delivery services are a good alternative to motorized individual traffic. Furthermore, the provision of information systems helps minimize the mobility periods and hence promote the use of public transport systems.	**Related objective of Smart City Wien:** • Strengthening of CO_2-free mobility modes modes (walking and cycling), maintenance of high share of public transport and decrease of motorised individual traffic (MIT). • By 2030, commercial traffic originating and terminating within the municipal boundaries is to be largely CO_2-free.

Action 8.3: Demonstration project aspern – Vienna's Urban Lakeside	
The urban development area aspern – Vienna's Urban Lakeside provides opportunities for new and innovative ways. Through a close cooperation between the city of Vienna and property development, the first steps towards the smart city Wien are taken. A development agency and different other actors are on place, first residence moved in 2014 and ongoing research on detailed energy aspects has started. The results are valuable and should be noted for the city's future development. More detailed information can be found in the Implementation Plan for aspern, a document produced also within TRANSFORM project. Key part is the organizational and technical planning of a future area based energy system.	**Related objective of Smart City Wien:** • Establishment of lighthouse projects.

Action 8.4: Knowledge transfer from the demo-project GrünER LEBEN	
This project GrünER LEBEN works on the implementation of a low-energy building settlement with a lot of different measures to accompany the development e.g. installation of Car sharing, e-mobility or carpooling, improvement of energy efficiency and awareness building measures. An evaluation of the project should take place to analyse lessons learned and use them for future projects.	**Related objective of Smart City Wien:** • Strengthening of CO_2-free mobility modes (walking and cycling), maintenance of high share of public transport and decrease of motorized individual traffic (MIT). • Cost-optimized zero-energy building standards.

Action 8.5: Demonstration project Liesing Mitte	
This project combines three different urban development areas (brown field, green field and existing buildings). The goal is to set actions towards a Zero Emission City by using innovative solutions. The key elements of the project are energy efficiency, increase of quality of living and affordable measures. Lessons learned should be taken from this project for future initiatives.	**Related objective of Smart City Wien:**

9. Action package: Grids

Action 9.1: Pilot use and rollout-plan for the smart Metering development and implementation	
Smart Metering is necessary for the intended behavioural change. These information systems visualize the consumption and users can adapt it according to the current supply of energy. The implementation of Smart Metering is required by law. The local grid operator Wiener Netze is currently working on a pilot study with several thousand households. Wiener Netze is preparing the rollout for the whole supply area. Important focus is on the data security, data privacy, user's rights and needs. Customer feedback regarding the online consumption information and the mobile App will bring continuous improvement in usability and customers` benefits. So Smart Metering can help reducing energy consumption.	**Related objective of Smart City Wien:** • 40% decrease of energy consumption per capita by 2050 (compared to 2005). • Per-capita primary energy input drop from 3,000 watt to 2,000 watt.

Action 9.2: Study on economic and ecological evaluation of infrastructure channels in Vienna

Infrastructure channels are supposed to be an economic and ecological advantage while realizing a new urban development area. They prevent noise, exhaust gases and spatial restrictions during maintenance works. Installation or renovation of grids can be done faster and cheaper. Often infrastructure channels are not implemented because of physical reasons, high costs or lack of cooperation cable owner. This was also the case in aspern, where a planned channel couldn't be realized. Further investigations for organization and business models are necessary.	**Related objective of Smart City Wien:** • Maintenance of the high standards of Vienna's infrastructure facilities.

10. Action package: Vienna as role model

The city administration needs to set a good example regarding smart urban technologies. This should happen through cooperation and joint measures, coordinated by the smart city agency. A topic e.g. would be the pursuit of climate change objectives through measures in energy, lightning, networks, waste water treatment, buildings, living etc. The city of Vienna is in different topics already a good example and to further achieve improvements the following measures are recommended.

Action 10.1: Public buildings as role models	
Public schools, kindergartens as well as the city's administrations buildings are being renovated according to developed room books which include energetic standards for planning, built and management of buildings. Additionally, photovoltaic systems will be installed on the city's administration buildings.	**Related objective of Smart City Wien:** • Comprehensive rehabilitation activities entail the reduction of energy consumption of existing buildings for space heating/cooling/water heating by 1% per capita and year.

Action 10.2: Nearly Zero Emission mobility	
By 2020, the focus in the fleet of the city of Vienna is on non-motorized types of traffic. Also mobility service offers are expanded by innovative approaches e.g. e-mobility on demand. And all city employees should get tickets.	**Related objective of Smart City Wien:** • 40% decrease of energy consumption per capita by 2050 (compared to 2005). • Per-capita primary energy input drop from 3,000 watt to 2,000 watt. • By 2030, MIT is to be shifted to public transport and non-motorised types of traffic or should make use of new propulsion technologies (e.g. electric-powered vehicles).

Action 10.3: Efficient public lighting in Vienna	
Improvement of the efficient solutions for the public lightning in Vienna. Life cycle costs should be considered for public tenders and enhanced contracting models should be installed. In several areas of the city conventional lamps have been changed for LEDs.	**Related objective of Smart City Wien:** • 40% decrease of energy consumption per capita by 2050 (compared to 2005).

Action 10.4: Climate-friendly procurement and operation	
Intensification of measures regarding "climate-conscious procurement" – ecological purchasing, environmentally compatible event or prevention/separation/collection of waste. Here the City of Vienna has established several initiatives to save resource and energy consumption and to reduce CO_2. One of them is PUMA (environmental management in the municipality) with several measures to make working equipment and processes more eco-friendly. Ökokauf is an initiatives for raising awareness and providing hints and tools for sustainable and climate friendly consumption for private households (especially for food and commodities).	**Related objective of Smart City Wien:** • Reducing per-capita greenhouse gas emissions in Vienna by 80% by 2050.

6. Participation and Stakeholder Management as key enabler

Theme – *Participation and Stakeholder Management*	
Description of the theme	Participation is a fundamental grasp for city development, and an essential part of Open Government. It's involvement of Stakeholders (in public/private organisations) and Citizens (organized or not). Reaching the climate and energy targets is impossible without cooperation with Cities Stakeholders, and the involvement and acceptance of Citizens. This requires transparency, honesty, willingness for consensus and sharing power by the City.
General objectives	Affected groups can influence the development of their environment. Cooperation for implementing the Smart City Wien Framework Strategy
Specific objectives	Analysing strategies. Making the complex and strategic approach more concrete, to get fields of action for Participation. Identifying the relevant Stakeholders and the needs of the Citizens, definition of target groups. Formulating a participation concept with recommendations for measures and options for improving participation.
Impacts	More Citizen oriented measures and actions by involvement. Higher implementation powers through coordination and shared vision with Stakeholders and Citizens. Awareness and acceptance for Smart City Wien targets, changed user behaviour. Higher social inclusion and legitimacy of Transformation process.
Qualitative analysis of what has been achieved so far on this theme	During the work in TRANSFORM and the local working group key actors for civil society participation were involved. It was important to directly translated the Smart City Wien and Smart Energy City objectives to them, to work-out how to reach citizens and additional Stakeholder Groups. Out of this next activities are already planned like a learning programme for community colleges and a Smart City Wien Forum in May 2015.
Municipality involvement	Different Municipal Departments and Companies. Working groups organized and led by MA18 – Department for Urban Development.
Key-actors	Citizens, Civil society, public/private Stakeholders, Municipal Departments, decision makers and politicians

My Smart City Wien

„My Smart City Wien“

Text contributed by kon-text

Initial position

According to previous conclusions there is an increased need for closer examination of ongoing participation processes in the city in order to prepare background information for the Transformation Agenda. In the same time, the significance of Smart City Wien is in maintaining the

high quality of life through social participation, not excluding possible change through innovation and proactive approach, the development of new forms of public and private partnership. Therefore, My Smart City Wien is one step forward in interpreting Smart City Wien Framework Strategy, adopted by the Vienna City Council on 25th June 2014. The concept of "***My Smart City Wien***" provides background knowledge on the issue of participation for the practical policy /action plan named "Transformation Agenda".

Project description

„**Participation** is used in urban planning to enable residents, stakeholders and different interest groups to take part in decision-making processes. In this context, communication must be seen as the foundation of any form of participation. Depending on the intensity and nature of the communication paths (and/or the resulting participation options), different stages of participation may be distinguished: information, consultation/dialogue and co-operation (cf. Klaus SELLE[24])." Cause, „Participation can harbour many benefits for urban planning, as it is enriching and can create a winwin situation for all parties involved: Taking local and emotional knowledge of the population onboard complements the planners' expert know-how very well and can help to improve the outcome. This may generate novel findings and ideas that can be taken into account when implementing a project. At the same time, citizens acquire competencies in dealing with the city administration, its procedures and planning processes. "[25]

In the centre of The Smart City Wien Framework Strategy is the effort to preserve the city as a liveable, socially inclusive and dynamic place for future generations, as well as to continue an urban development. **Participation through stakeholder management** and **public/citizen participation** is defined as one of the central tools and tasks necessary to implement a smart city strategy by Vienna standards.

Derived from previous stakeholder process, aimed to activate and include different stakeholders in development of The Smart City Wien Framework Strategy, early involvement of the citizens should be established as a guarantee for participation in smart city development. At this point the important task for the Smart City Wien Framework Strategy is to define implementation steps on the level of city and districts urban development. The aim of the project ***My Smart City Wien*** is to provide guidelines which would include Vienna's residents in the following dialogue and implementation phase of the Smart City Wien Framework Strategy.

My Smart City Wien **bottom-up approach** is used to supplement the mainly **top-down approach** of the Smart City Wien Framework Strategy. As a result, both approaches should correspond to each other and they should jointly present background knowledge (program) for future implementation of the strategy.

This project would open wide dialogue about implementation of the Smart City Wien Framework Strategy, in which different options and scenarios will be mutually considered and developed with stakeholders working with different groups of citizens.

The goal of the ***My Smart City Wien*** project is to develop participation guidelines that include ideas and measures on how to engage inhabitants of Vienna into Smart City urban development process. Furthermore, this concept should draft ideas how to empower citizens to:

[24] Cf. Klaus SELLE (ed.), 1996, p. 69; SELLE, 2000, p. 92; In: CLUE - WG2 - Good practice report, 2014, p. 5
[25] Cf. Klaus SELLE (ed.), 1996, p. 69; SELLE, 2000, p. 92; IN: CLUE - WG2 - Good practice report, 2014, p. 6

- understand the idea of Smart City Wien,
- identify the benefits of Smart City Wien in everyday life,
- contribute to the implementation process with their own ideas.

However, this could be accomplished only if the key issues of the Smart City (such as efficient use of resources, sustainability, innovation, quality of life, social inclusion and participation) are addressed and discussed on local level of action as well as on everyday level of interaction.

In the first step ***My Smart City Wien*** concept is addressing **important local key actors** as in the process of implementation of the **Smart City Wien Framework Strategy** on the neighbourhood level. In November 2014, they were invited to a workshop discussing how to involve their clients into Smart City Wien. These inputs would be part of the foundation to facilitate processes starting in 2015.

My Smart City Wien provides a concept that describes how the involvement of citizens, and the respective target groups, in the implementation of the Smart City Wien can be done in the future by institutions experienced in the field of participation and familiar actors at the local level.

Based on everyday vocation of local key actors, it is defined that they could contribute to enhanced involvement of inhabitants. Due to their know-how with local target groups, they should be involved as project partners during the upcoming implementation phase. Conceived as a starting point, the project should be interpreted as a support for interested local actors and social institutions to develop and undertake various projects and processes that would include various segments of the population in Smart City implementation phase.

On Participation in the Smart City Wien Framework Strategy

The Smart City Wien Framework Strategy is an umbrella strategy, which defines mission and joint vision for the development of the city until 2050. In order to translate the results the Smart Vienna Framework Strategy into operational reality, Viennese approach includes participation as a key issue**.** To develop a background document on citizens involvement the way was analysed in which the Smart City Wien Framework Strategy is positioned with its objectives to the notion of "participation".

As the instrument in our research project we used visual data analytics methodology to create graphics that illustrate our findings. Cloud graphics are showing the expression mentioned in relation to the chosen topic, edited by theme and clustered according to frequency of mention and the context. The frequency and the importance of the phrase is reflected in the size and thickness of the words.

Illustration 22. Cloud "Participation" in the Smart City Wien Framework Strategy

As the Illustration 22 is showing the word “Participation” is the mostly mentioned, and other terms are clouding around it. To take a part is the second most common phrase. Involvement, contribution and to give a voice are used very often in the context of participation.

It was important to establish intern association agreement on participation in Smart City Wien Framework Strategy. As the term "participation" can be used and understood differently, the Smart City Wien Framework Strategy was regarded as a comprehensive unit, with the aim to provide the local key actors with simplified background information. It has been important to get an insider view of how the goals are interrelated and whether the term "participation" in the Smart City Wien Framework Strategy has been considered as an instrument or a method for the implementation of the strategy. First findings are indicating that in the interdisciplinary complexity of the phenomenon Smart City Wien participation has a dual role.

One of the objectives of the ***My Smart City Wien*** project is to collect and differentiate intricacy of participation, to evaluate it critically and to consider different meanings in context with possible upcoming activities.

In general, we can observe several levels of participation (cooperation, consultation, information, etc.). The nature of participation in the document can also be determined by identifying the target groups of the strategy.

Illustration 23. Cloud "Target groups" in the Smart City Wien Framework Strategy

In the Smart City Wien Framework Strategy different target groups are addressed. Illustration 23 is showing that main position have citizens (in German there is a distinction in gender: Bürgerinnen und Bürger) of Vienna - and general target groups: population, inhabitants, residents. Other target groups are recognized but noted far less in comparing to the key target group of the Framework Strategy - Viennese people.

Depending on the target group specifics, different levels of participation are intended. This was particularly considered in the selection procedure for the workshop participants - local key actors. In addition, the goal was to collect feedback opinion of local key actors on the correlation between Smart City Wien participation and implementation.

Identifying the local key actors for the workshop

In order to adequately reach Vienna's citizens, a method should be developed to bring the topics and ideas of the Smart City Wien initiative to the target groups and benefit from the diverse feedback by properly addressing different interests of the target groups. It is particularly relevant that the diverse interests are appropriate correspond. For example: the energy issue should be differently addressed to children than to refugees or displaced persons - as they are having different needs and ways of communication. **The imparting of information, the exchange of experience, multiplication of the knowledge, would be through the local key actors.**

The workshop addressed different actors on the local level: experts in citizen participation, institutions that work directly with citizens, institutions that develop joint projects with citizens and for them, that communicate, consult and/or are involved in urban development processes. These institutions were invited as representatives that could reach various target groups. They will be introduced in the following:

Name of the institution *German / English*	Scope of work	Location and distribution/ structure	Target groups	Examples of projects with potential linkage to Smart City *Name of the project*
Magistratsabteilung Integration und Diversität (MA 17) **Municipal Department 17 - Integration and Diversity**	Basic work in the area of migration, integration and diversity analyses the influences and results of integration on society and the challenges of integration for politics, administration and society. • To provide the people in the districts with information and raise awareness on the topic of integration • To initiate festivals and events, and develop platforms to promote dialogue and communication in the neighbourhoods	4 regional offices in Vienna	Interested and affected parties and institutions	Project "Smart Wissen"
Magistratsabteilung Bildung und außerschulische Jugendbetreuung (MA 13) **Municipal Department 13 - Education, Out-of-School Activities for Children and Youth**	Planning, control, coordination and networking of extracurricular children and youth work in Vienna: • Mobile social work with adolescents in public places • Leisure time and recreation facilities for young persons	Projects are realised in corporation with youth organizations working in the Vienna city area at different locations	Focus on children and youth	"Smart Kids", "Wiener Parkbetreuung"
Wiener Volkshochschulen (VHS) **Vienna education centres**	• Education • Information & education mediation • Knowledge transfer • Space providing	44 locations	Entire population of Vienna	"Nachhaltig in Wien"
„die umweltberatung" **„Eco Counselling" environment Consulting**	"die umweltberatung" advocates for a sustainable, ecological development of economy and society. Experts provide customer oriented answers to an ecological lifestyle and implement forward-looking projects	1 location in Vienna's 10th district	Consumers, multipliers and companies	"Pilotprojekt SELF"/ "EnergiecheckerIn werden"; "Reparatur-netzwerk Wien"

Wiener Gebiets-betreuungen Stadterneuerung - GB* **Vienna urban renewal offices**	Advice on housing issues, neighbourhood improvement, stimuli for local businesses and plans for the use of public spaces and green areas	17 locations	Residents (tenants and flat owners) and business representatives of the respective service areas in Vienna districts	"Alltagswege-Projekt"; "Grätzelbeiräte"
Lokale Agenda 21 Wien (LA21) **Local Agenda 21 Vienna**	Sustainable urban development at the district and city level Intensive and broad participation of citizens and other relevant actors	7 locations	Residents of the respective Agenda districts	Different citizens groups in their districts: „Mobilität", „Bewegung zu Fuß", „RadfahrerInnen-gruppen", „Energie-gruppe",„Solargruppe"
Nachbarschafts-zentren des Wiener Hilfswerk (NBZ) **Vienna's Neighbourhood centres**	Organizations for development cooperation and humanitarian aid. As part of Hilfswerk Austria they conduct activities according to the principles of sustainable development and the universal Human Rights. Neighbourhood centres see themselves as meeting places for people of all generations.	10 neighbourhood centres in Vienna	People of all generations and social layers in the neighbour-hood focus on: elderly people, ill persons and children and youth	„Ehrenamtsbörse", „Wissensbörse", „Nachbarschafstag"
Caritas Wien **Caritas Vienna**	Caritas shares the mission of the Catholic Church to serve the poor and to promote charity and justice throughout the world.	11 retirement and nursing homes; 18 facilities for people with disabilities; 50 points for the mobile services; 3 counselling services for people in emergency situations; 6 homeless shelters for women and men	Focus is especially on the poor, the weak, the disadvantaged and the marginalized of all ages and sexes	„Grätzeleltern"
Wien Energie Ombudsstelle **"Wien Energie" - Ombudsman's Office**	Provides an enhanced customer service for "social hardship cases". Office prepares and enables individual solutions together with those affected and involved social institutions.	1 location	Customers of Wien Energie,; people in acute and difficult life situations	Project "NEVK"

Table 1. Local key actors for the workshop

The participants of the workshop are primarily selected from coordination bodies, i.e. the upper level of the institutions. Those citywide organisations are representing a vast spectrum of citizens on local level: children and youth, people with special needs, population with a migration background, residents of adjacent neighbourhoods.

The **workshop participants should act as change agents for the Smart City Wien Framework Strategy**, first through their colleagues and co-workers, then through cross-sectoral partnerships, local actions and other promotional activities. Workshop invitations are not exhaustive, but they are the first common step, set in order to establish the clarification of Smart City participation process. Accordingly, the participants are always determined by the subject group of the particular network they represent.

Within the scope of the Workshop ***My Smart City Wien*** on 20th November 2014 the first ideas have been collected **together with local key actors** and formed the initial concept draft "Guidelines for citizen's engagement on neighbouring level at the implementation phase of Framework Strategy".

Workshop My Smart City Wien - intermediate results

Illustration 24. Smart City for the participants

The first impression is that participants observe Smart City as a new way of cooperation, as well as that collaboration is needed to develop and work smart. A second focal point is around the terms sustainable and technology that are getting a new reinterpretation. A third emphasis is gathering around the idea of inclusion and equal participation.

Mapping the target groups

The following rough overview illustrates general target population of workshop participants - categorised into target groups. Every target group named in the plenary session was collected, identified and clustered. This overview serves to identify which target groups were covered during the workshop.

Illustration 25. My Smart City Wien workshop ©kon-text

The institutions identified in their work the following target groups:

1. Neighbourhood residents
2. Children and youth
3. Socially disadvantaged
4. Volunteers
5. Multipliers/Networking partners
6. Economy (business and entrepreneurship)
7. Young and creative milieus

In addition, there were target groups identified that are not representing inhabitants, per se, then rather partners on city level-such as municipal departments, universities and research institutions - and therefore they are not relevant for the ***My Smart City Wien*** project.

Following target groups were used for further work in smaller groups. They were selected because the information about how these groups could be achieved appears to be particularly important.

- Children and youth
- Socially disadvantaged
- Neighbourhood residents

Other target groups like entrepreneurs, young and creative milieus, as well as volunteers were not chosen because they were either significantly less often mentioned (volunteers); or not explicit target group of ***My Smart City Wien*** (business companies); or they are already involved in other parallel programs of Smart City Wien (young and creative milieus).

Working Groups

Three working groups were formed based on the above-mentioned criteria:

1. Children and youth
2. Socially disadvantaged
3. Neighbourhood residents

The aim of the group work was to discuss points of contact on "Smart City Wien" along the three selected target groups.

The following issues were discussed:

- What are the points of contact / themes for each target group, related to Smart City and the objectives of the Smart City Vienna framework strategy?
- How can the target groups be reached?
- What role each institution could take?
- Already existing projects and new project ideas on the topic of Smart City.

Working group: Children and youth

The target group of children and adolescents was underlined as particularly important because they are the "citizens of tomorrow". The topic of Smart City should be communicated to youth as early as possible. This process should be associated with fun and to the grade corresponding age and level of development.

Connecting factors to the Smart City

As starting point for the target group of children and youth were particular issues mentioned, which are related to the environment, living conditions and the practical realities of the target group.

Since working with this specific target group in the long run is not always predictable, space for flexibility should be enabled. There should be opportunity for the initiation of different projects with the awareness that not every project succeeds for the young. In general, it should be kept in mind that working with children and young people requires patience. It should be taken in greater account that 'elite' projects could exclude groups or milieus.

Recommendations

Children and young people can be achieved with activities when their demands are considered:

- lustful and stimulate all the senses
- arouse interest and triggers personal concern
- time-frame of the activities should be rather short because the living conditions of youth is changing rapidly
- projects should be simple (elementary), however not underestimating the skills of children and adolescents (knowledge of modern technologies, etc.)
- the project results should be visible (e.g. tree planting)

The definition of Smart City projects is still unclear for all participants. It needs more information about the development, the implementation and the financial support from government before starting new projects in their institutions. It was noted, however, that networks and partnerships are an important basis for social projects and therefore should be maintained. During the workshop session, no new projects were developed, per se, but rather were considered which of those many projects that are being implemented in Vienna, could be attributed to the umbrella of Smart City. These existing projects should be made much more visible and associated with the Smart City. This could contribute to accelerated implementation of Framework Strategy and facilitate integration of the institutions.

Working group: Socially disadvantaged

The group of social disadvantaged is not easy to describe, as there are many different forms of social problems. The participants described problems in the everyday work with this particular target group trough many facets of work with individual clients.

The initial common point for all participants is major obstacle in work with authorities. By this is meant that in a large, bureaucratic system as it is in Vienna, it is difficult to set them through for their clients. There is a perception that housing in Vienna is getting more expensive and therefore not affordable for all groups. The participants would like to develop new forms of affordable housing.

Connecting factors to the Smart City

The projects for socially disadvantaged target groups should meet the social needs of the group. At the start of the project should be clarified how the Smart City Vienna could contribute to the life of these target groups in detail. In a next step, action plans for each sub-target group should be created. A special focus should be set on energy saving and housing of the socially disadvantaged. What is needed is a closer cooperation between the various partners involved with the respective institutions.

Recommendations:

- raising awareness of disadvantaged groups on energy issues
- connection between housing and energy saving should be underlined
- to establish spatial priorities ("pilot areas")
- Social mixing is required
- affordable housing: Idea of a "new social housing Vienna"
- renewal of public housing and residential buildings
- renovation at the level of residential units (such as water heater exchange, replacement of windows, etc.)
- new models of "cooperation" (such as the settlement movement)
- to use a local knowledge for self-organization

Social Housing should be an important asset of a Smart City Strategy in order to create social inclusion of diverse target groups. Collaboration between various institutions and authorities should be made possible and thereby is very important that contact with certain representatives is made.

Working group: Neighbourhood residents

Neighbourhood residents, as a target group, are very inhomogeneous and therefore not easily accessible target as a whole. Depending on the operational structure of each institution, we could identify different subgroups between residents: the curious ones, interested or engaged ones, or those who have certain problems or concerns. Since the project funds are very limited in general, the available time is an important aspect that determines workflow. Hence institutions often focus on those projects or goals that can be achieved in a short time

Connecting factors to the Smart City

Starting points for the target group of neighbourhood residents are lying in aspects of daily life, housing and living environment. In order to address more than "the dedicated and easy to reach" subgroups, additional means of communication should be taken. Difficult to reach are often subgroups with limited resources such as time resources, financial resources or personal resp. social resources. Those subtype target groups should be personally addressed.

To achieve these objectives, within the framework of a project with limited resources, the route via cooperation partners and networks of various communities has been proposed (for example: through local community clubs and other local institutions, cooperation partners). To achieve neighbourhood inhabitants, a sample of positive goals should be set, that are adjust to a personal level of understanding. A pure deficit orientation is not motivating. If one of the goals of Smart City is a behavioural change in its essence, it should be considered that behavioural changes could take time. The aim of Smart City should be to create awareness about personal responsibility trough awaking concern, tangible efficiency. Implementation should be set to a possible level.

Distinction should be made between the following levels:

- Information: interconnected widespread of information on Smart City goals
- Guided interaction: making Smart City together experienced as a process, for example by guided tours
- Individual action: Individual involvement should be based on personal benefit

Discussion and Feedback

The following illustration shows cluster based on frequently mentioned terms and critical points in the discussion on possible developments and future implementation of Smart City.

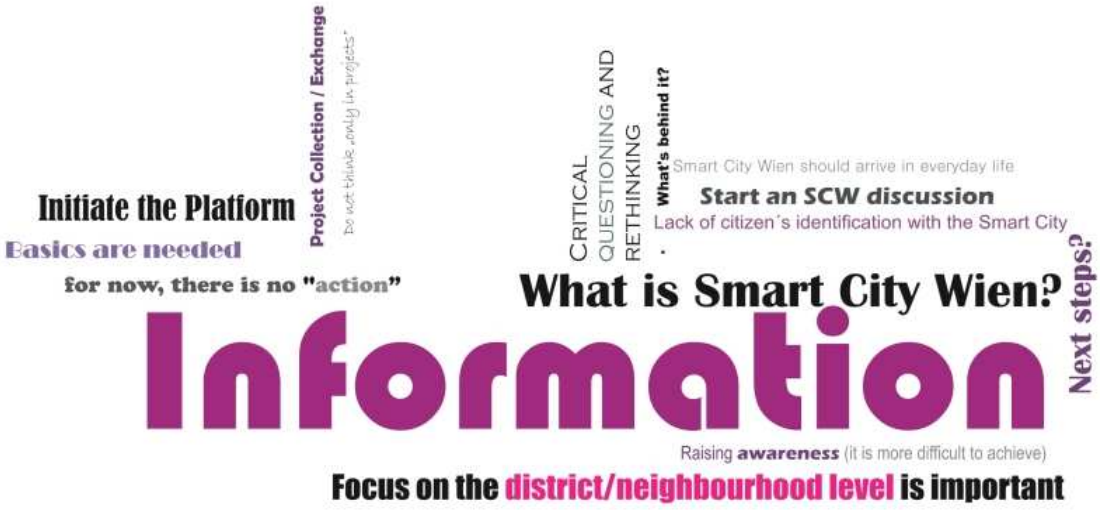


Illustration 26. Cloud "feedback associations"

Illustration 26 is showing that Information and clarification on the Smart City Wien phenomenon is needed, before starting with project roll-out. Rising awareness is seen as part of information and as a goal. Focus on neighbourhood level is very important for all participants of the workshop.

Formulating key messages (recommendations) on Smart City Wien Strategy (together with local key actors for local government and stakeholders)

Following points are the first findings from the local actor's workshop and especially the feedback discussion, compounded in tree main topics:

1. Maintain the exchange between the institutions and bringing in the dialogue about Smart City

- The workshop event is a starting point to initiate a continuous dialogue on the topic of Smart City between the present institutions and the Department for Urban Development
- Critical questioning and rethinking in this phase is required: What is Smart City? What's behind it?
- The next steps for the institutions should be transparently indicated: the first outline should be drafted by those responsible for Smart City in the jointly developed concept ("My Smart City Wien") to achieve clarity
- Support disclosure of Smart City topics and communication
- Describe requirements profile for Smart City projects: What are the criteria for Smart City projects?
- Platform and/or collection and/or exchange of projects should be initiated; the online platform on Smart City _web site should have information on all projects by organizations
- Topic and events distribution list

2. Bringing Smart City Wien closer to the inhabitants

- There is a lack of a comprehensive identification of the citizen with the Smart City
- Smart City should be more present in the daily life of citizens
- Message: It's about my / your money (energy, mobility)
- Gap between the framework strategy and actual project is too large - intermediate blocks are needed - the collaborative thinking
- A focus on the neighbourhood level is very important
- Instead of concentration on producing new projects , focus should be on raising awareness (it is more difficult to achieve)
- Knowledge transfer: policy makers + institutions / facilitators / actors / local residents

3. Information about Smart City Wien

- Smart Ambassadors or messengers that can communicate the theme are required
- Adjusting – need translators
- Tools, flagship projects, ambassadors
- Professional Public Relations and Marketing to demonstrate the benefits of Smart City
- Willingness to cooperate with other institutions is certainly present

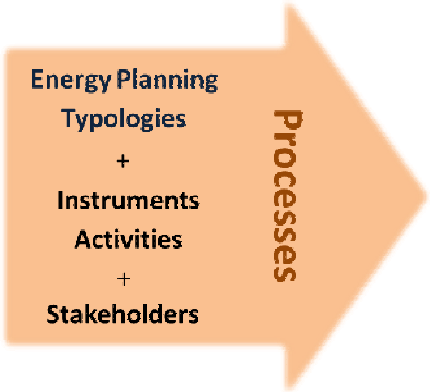
Follow-up

After analysing the Smart City Framework Strategy on the topic of participation, the focus was on the different approaches and opportunities for potential citizen participation. Within the scope of the workshop ***My Smart City Wien*** the first ideas have been collected together with local key actors. In the next phase of the project ***My Smart City Wien,*** guidelines will be further developed through information dissemination and feedbacks from individual and target groups strategies. This extensive phase will be given in the next few months a lot of attention.

7. Integrated Energy Planning

Theme – *Integrated Energy Planning*	
Description of the theme	New developments and changed requirements on energy supply and demand, like renewable sources and decentralization, necessitate integrated planning approaches on local level. Spatial differentiation and integration of energy aspects in urban planning and building is needed. Processes of urban and energy planning should be combined. Another aspect is the build-up of needed information and data sources. These are tasks defined by the 2014 adopted Urban Development Plan 2025.
General objectives	Integrating energy planning in processes of urban development. Preparing needed information and data on local energy situation and potentials.
Specific objectives	Identifying main ongoing activities to implement integrated energy planning in existing processes. Identifying and Consulting the main Stakeholders needed for integrated consideration of energy aspects (Interviews done 2014 by ÖIR). Spatial analysis which leads to energy typologies of Vienna as a spatial reference for establishing planning processes,
Impacts	Reducing CO_2 and energy consumption. Rising share of renewable energy sources. Affordable and sustainable energy supply.
Qualitative analysis of what has been achieved so far	TRANSFORM has given additional motivation and Know-how on themes of integrated energy planning. This is valuable pre-work for the upcoming concepts on city and different development sites level. In 2014 a high level group was constituted, which already has defined missions for institutions in Vienna to work out criteria and approaches in more detail. Also the work in data baselines has been intensified in TRANSFORM with the support of AIT and TU Vienna.
Municipality involvement	Department for Energy planning, Department for District Planning and Land Use, Department for Urban Development, Strategic Energy Policy Office,
Key-actors	Energy provider and distribution companies, Building sector with Developers, housing associations, public funds and social housing, local development agencies, land owners and tenants

Integrated Energy Planning is a key field of action for the Smart (Energy) City, combining most of the energy domains to implement smart energy solutions in processes of urban development and planning. The organisation and design of the urban pattern should be done with considerations about energy consumption factors and the integration of (renewable) energy sources and smart infrastructure – in an early stage of planning. TRANSFORM is directly supporting ongoing activities by the City of Vienna on integrated energy planning. Two actual priorities have been set by the local working group:



Energy Planning Typologies for Vienna – built upon different data layers on buildings, existing and potential infrastructures and socioeconomic conditions. The research approach

for the Transformation Agenda is to match up existing and new data together, to get deeper knowledge about needed action.

Process improvement for integrated Energy Planning. This involves actors and instruments resp. activities on a certain spatial levels, which are connected to the research on Energy Typologies.

Drawing up a Spatial Energy Typology for Vienna

Guiding Question: Which energy relevant data sets are available to draw up an typology for Vienna's building stock? How can these typologies be used for further energy planning approaches?

Introduction

Several city administrations are doing research on energy related spatial planning with a number of projects being initiated that focus on the analysis and lucid illustration of energy related indicators. Both the aims and intended users of these projects differ – from providing support for planning experts to the information of interested citizens, sometimes also providing online-tools enabling the users to do evaluations on their own. Meanwhile, data from many different sources have been collected and analyzed within these projects and visualized using geo-information systems. The Energy Atlas of Amsterdam and the spatial preparation of energy Data in Hamburg were inspiring examples shared in TRANSFORM.

In New York, for example, it is possible to check the estimated annual energy consumption for heating (including water), cooling and electricity on building and block level. Users can compare similar building types as well as compare their estimated consumption with the average of buildings of that size and type (knowledge about usage and types of energy intense businesses are necessary).

Illustration 27. New York: Estimated annual energy on building level

(Source: http://a.tiles.mapbox.com/v3/modilabs.map-6v5hnfw2.html)

In Zürich the whole administrative area has been classified according to defined quality-levels of the available public transport. Classes have been defined based on the quality of available stops (service intervals, type of transport vehicle, and other) as well as the reachability of these stops on foot. The

whole urban area has been rated according to the quality of public transport from A (excellent) to F (poor).

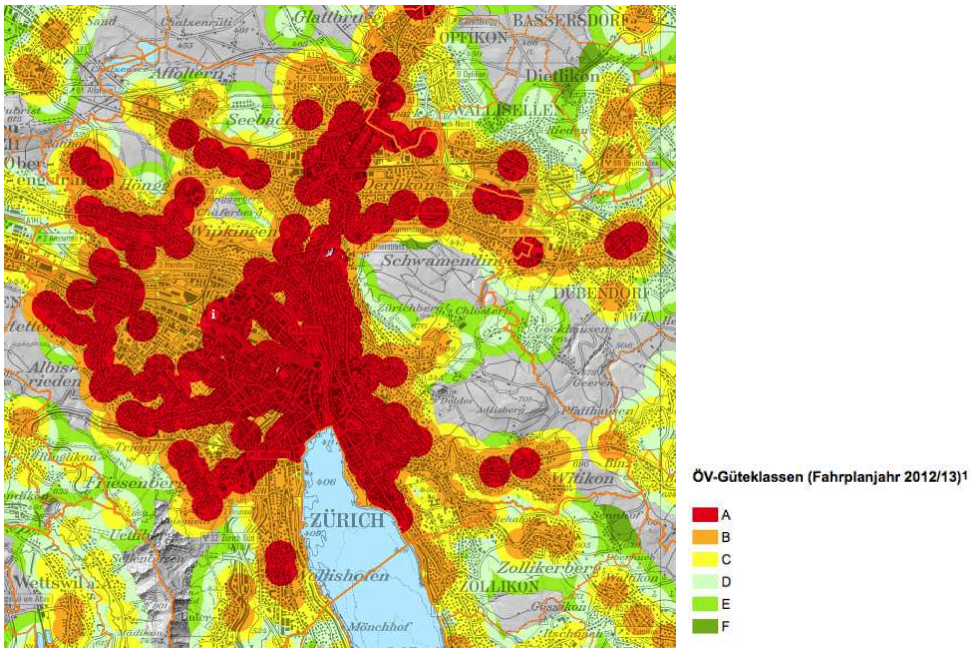


Illustration 28. Zürich: Areas according to quality of public transport

(Source: http://maps.zh.ch/?topic=OevGueteklassenZH&offlayers=bezirkslabels&scale=310000&x=692000&y=252000)

Boston provides an online tool that allows users to discover the solar potential of their rooftops based on the available solar cadaster. It automatically arranges solar panels on the roof and provides a cost and revenue calculation based on the configuration and estimated saved carbon oxide:

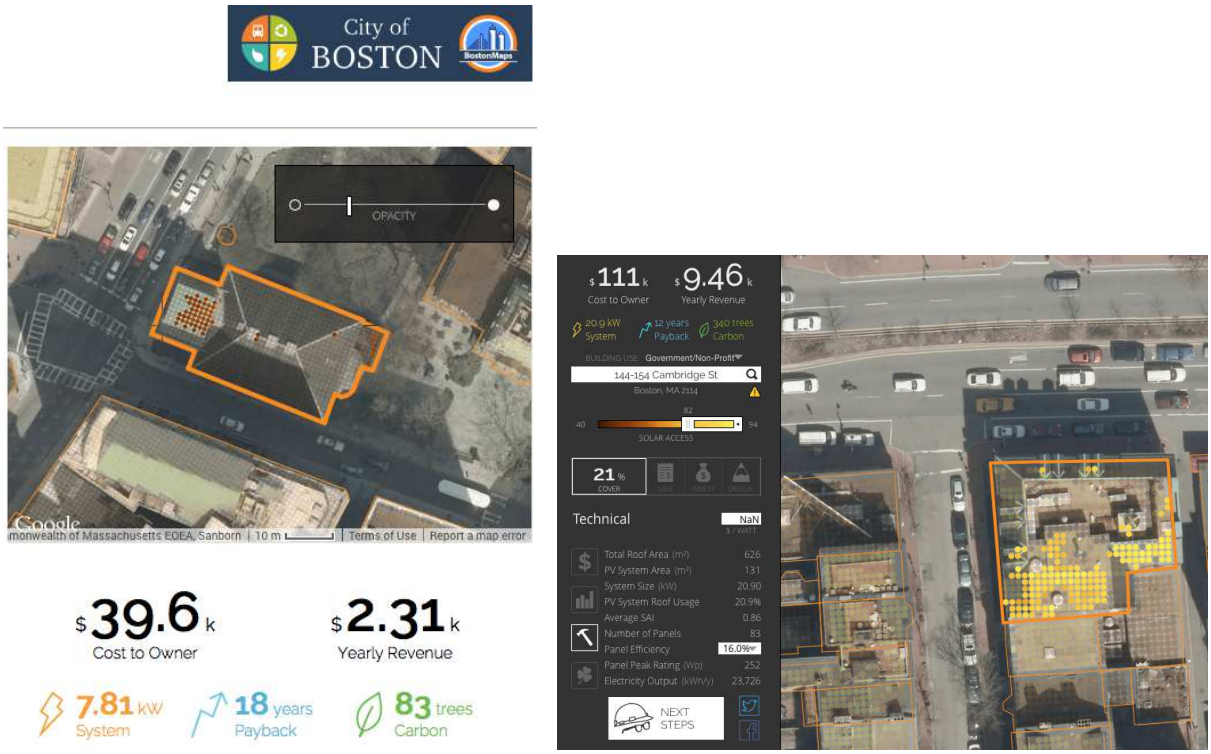


Illustration 29. Boston: Simulation of solar panels on rooftops including calculation of invest and return as well as savings of carbon oxide

(Source: http://www.mapdwell.com/en/boston)

An example of an Austrian project is ENUR (Energie im urbanen Raum - energy in urban space). It dealt with energy demand and requirements, consumer's behavior, energy concepts and projects, scenarios and planning instruments in the context of spatial planning. The focus of the research was to analyze the spatial development of Austrian cities and towns in relation to energy supply and planning.

The analysis was done for all of Austria based on a 250 x 250 meter grid provided by Statistik Austria. For three partner cities, findings and results have been further evaluated and analyzed including an enhanced visualization.

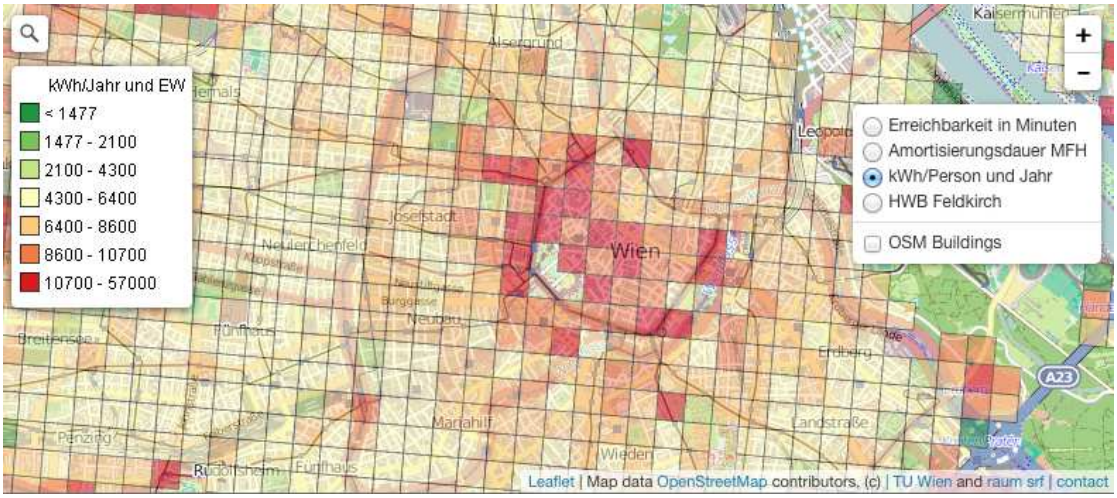


Illustration 30. ENUR: Estimated annual energy consumption for heating in kWh per year and inhabitant, picture shows a section of Vienna

(Source: TU Vienna)

Illustration 31. ENUR: 3-D visualization of estimated energy demand, section of the 14, district of Vienna

(Source: TU Vienna)

Energy typologies approach supported by TRANSFORM

The aim is the **development of an energy related building typology** on which the actual housing stock can be classified. The typology will be used as a basis for future integrated energy and spatial planning in Vienna and has therefore already been defined in the Urban Development Plan Vienna 2025.

Due to **data availability issues** and the prototype-character, the developed typology will be limited to energy **consumption for heating of private households**. In the first phase a suitable typology will be developed based on the available data. In the second phase the actual housing stock will be classified according to the typology. Together with the clients, the research team defined the target areas and fields of action for the development of the typology. Data privacy is an issue in this project. Therefore the typology will be developed on block-level. A workshop with Stakeholders from Vienna took place in November 2014, where the following aims have been identified on a global level:

- Identify areas with highest potential for renovation
- Classification of urban quarters according to their potentials / priorities
- Identification of requirements / boundaries for different energy related activities
- Linking potentials of renewable energy, extension of energy grids and urban development
- Visualizing the ratio of energy consumption and energy generation
- Estimating energy related characteristics of newly constructed buildings
- Defining dynamic, stable and deteriorating urban quarters
- Definition of types of building stock (resp. quality)
- Deducing realistic action, oriented goals
- Evaluation if the goals have been achieved
- Conflation of different data layers and spatial information for further analysis

These goals have been regrouped and structured in the following exemplary thematic fields and issues, whose clarification should be supported by the developed typology:

- Spatially differentiated visualization of energy demand: heating of private households
- Identification of areas demanding for action regarding energy efficiency
- Estimation of the amount of saved energy and CO_2
- Estimation of payback periods after energy efficiency or retrofitting measures
- Identification of areas of high potential as well as areas with limits to implementing renovation measures (due to social or legal conditions)
- Identification of correlation of high energy demand and high potential of RES or district heating

Catalogue of data

The following table holds a short listing of data to be considered. Some data are only mentioned as optional in case the dedicated data are not available. Data having been already basically analyzed in order to evaluate validity as well as usability within the project have been marked in green (Note: Not all data are suitable for developing the typology).

Topic	Source	Spatial reference	Data	importance
building	Flächenmehrzweckkarte (landscape usage)	parts of building	building geometry *(publicly accessible)*	high
building	BAGIS (database of urban zoning)	parts of building	period of construction, building utilization	high
building	Registerzählung (statistical survey on buildings and apartments)	building, flat,	period of construction, flats per building, building type, number of flats owned / rented, heating system	high
building	BGF-Estimation (floor space)	block	gross floor area	high
building	Energieausweise (energy passes of buildings)	building	building condition	high
building	Thermo-Scan	raster	heat dissipation as indicator for building condition	optional
(building)	Surface model - LIDAR	raster	To calculate building geometry *(publicly accessible)*	optional
topography	Terrain model - LIDAR	raster	To calculate building geometry *(publicly accessible)*	optional
building	Electricity	Unclear	Energy consumption	medium
building	Gas	Unclear	Energy consumption	medium
building	District heating	Unclear	Energy consumption	medium
building	Average flat floor space	Registration district	Number of flats, classified by size (below 44m², 45-59, 60-89, 90-129, more than 130 m²)	optional
block	RBW – Baublockabgrenzung (block geometry)	block	Reference block data (For definition of spatial reference system) *(publicly accessible)*	high
people	Register of residents	block	Socio-demographic data	optional
people	Kleinräumige Bevölkerungsevidenz für Wien (statistical	block	Socio-demographic data, inhabitants, households, origin (country)	high

	inhabitant data)			
people	Household income	block	Household income	high
people	Ownership structure (number and types of owners)	property	Ownership information	high
people	Sozialraumatlas (cluster of social composition of inhabitants)	Registration district	Social environment (7 clusters developed from 29 different indicators)	high
people	Employees	block / building	For distinction of utilization (living / work)	high
Infrastructure - Potential	Solar potential	building	Rooftop potential *(publicly accessible)*	high
Infrastructure - Potential	Geothermal potential	quarter	Available potential on a larger scale. Especially relevant for the eastern districts of Vienna)	high
Infrastructure	Energy grid	Vienna (vector, point layers for whole city)	Overall grid information of different energy sources (gas, electricity, district heating)	high
Building address	Address of entry / building	addresses	For definition of spatial reference system	high
building	Realnutzungskartierung	block /parts of block	Building utilization *(publicly accessible)*	high
Climate conditions	Climate data	Vienna	Climate data to be able to calculate reference climate as well as so called heating degree days	high

Table 2. Data overview, Sources and spatial reference

Data description

Some of the data listed above that have briefly been analyzed will be described in more detail and visualized in the following chapter for better understanding.

Data availability

In the past years efforts have been take to harmonize data of the City of Vienna, increase the sharing of information and organize access and responsibilities. Nevertheless it still needs internal contacts to the people in charge to make certain data available. This is especially the case for sensible or expensive data to provide. On the other hand a lot of urban data is publicly accessible, in different standards or interfaces, e.g. web map services.[26] Especially this automatized, computerized transmission of data for applications of citizens or businesses is one objective, which is realized for

[26] Here the INSPIRE Directive is important to notice: http://inspire.ec.europa.eu/

more and more data sets. This can be found at the Open Government Platform[27] or in the download section of the geo data viewer.[28] Some data is aggregated on a higher level because of privacy issues.

Data quality

Basically the available data are of high quality; nevertheless the analysis has been limited especially due to missing or incompletely provided meta-data description. The following criteria should be met in order to avoid these obstacles in further data deliveries. Additionally this would simplify the integration of these data into existing systems.

- Uniformly used projection (e.g. WGS84 EPSG:4326)
- Consistent naming of columns for block related date
- Consistent number of data sets within the block data set
- Delivery of energy related attributes for all blocks
- Full and consistent description of each dataset and attribute (column) containing at least: origin of attribute & date, explanation of abbreviation, description of attribute (unit,..)
- Consistent relation of buildings to blocks

Flächenmehrzweckkarte (FMZK)

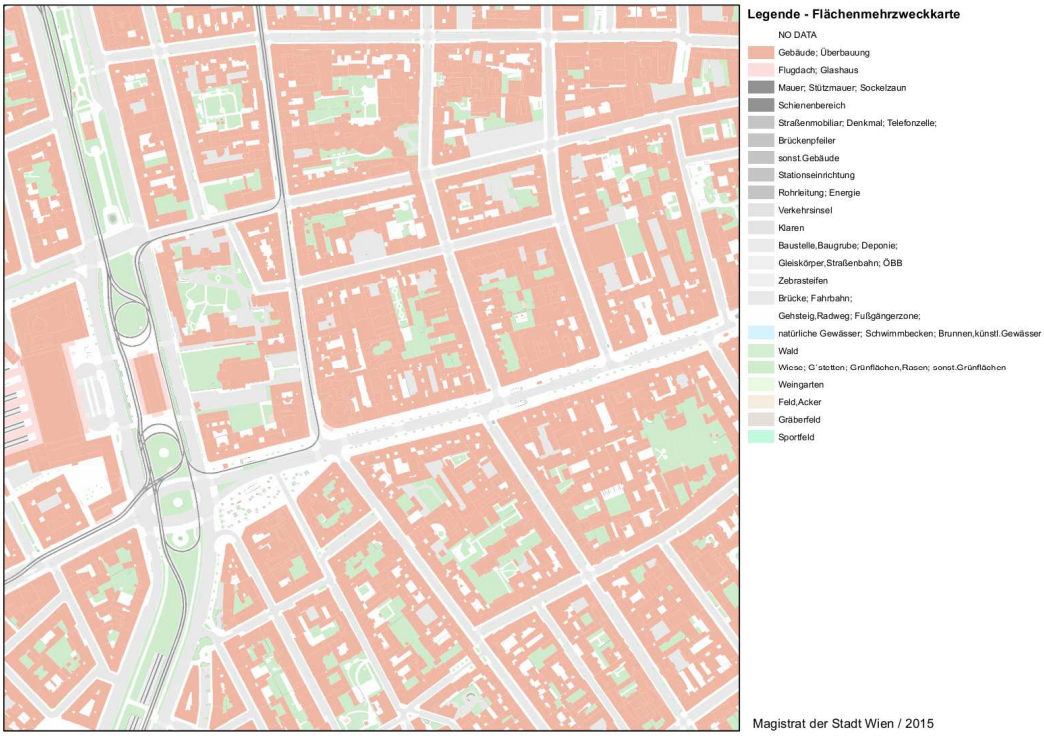


Illustration 32. Section of the Flächenmehrzweckkarte (detailed data on spatial utilization)

(Source: City of Vienna MA18)

The so-called "Flächenmehrzweckkarte" contains information about building geometry and basic building utilization. This data set is the main source to be used for calculating cubature and hull area (deducting surfaces of adjacent buildings). Based on these values the so-called "characteristic length" can be determined, which is defined as

[27] Data list see https://open.wien.gv.at/site/datenkatalog/ (German)
[28] https://www.wien.gv.at/ma41datenviewer/public/start.aspx (German)

lc (characteristic length) = cubature/hull area

Based on this parameter it is possible to estimate the amount of energy required for heating (objects with a lot of exterior surface need more energy, see red part in Illustration 33). Since this highly depends on construction periods, the following periods and their characteristic consumption values are used for the calculation:

- before 1900, after 1900, after 1945, building regulations 1976, building regulations 1993, building regulations 2001, OIB regulations 6:2007

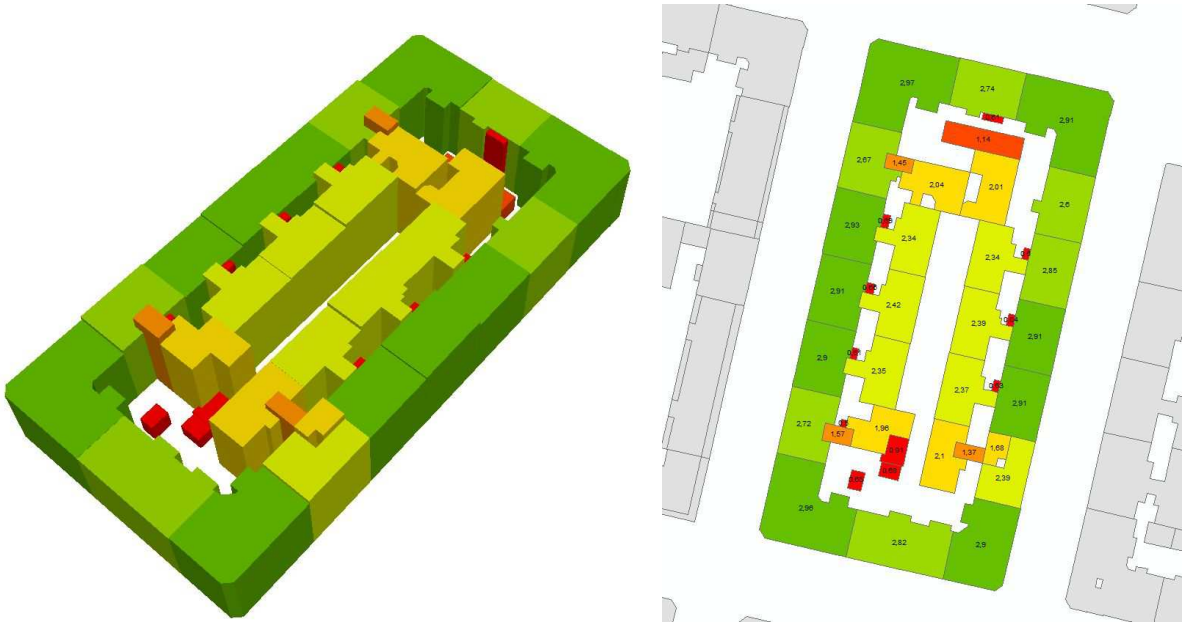


Illustration 33. Examples of the building compactness and characteristic length

(Source: City of Vienna MA20, TU Vienna)

The consistent aggregation of buildings into blocks requires that each building can be assigned to only one single block unambiguously. One can see in the following example that this is not always the case.

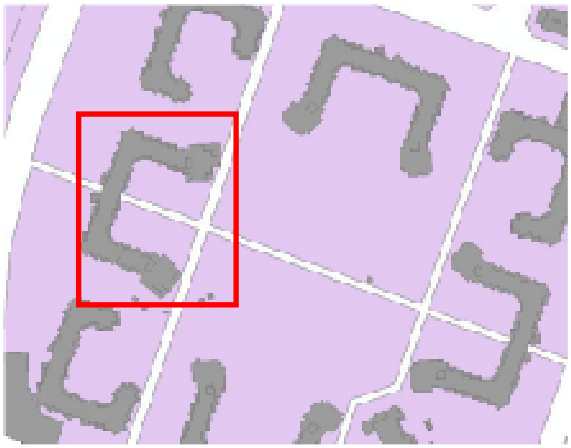


Illustration 34. An unambiguous assignment is not possible

(Source: City of Vienna MA20, TU Vienna)

Climate and period of construction

So far data containing information on construction periods have not been delivered. These data are essential to calculate the estimated energy consumption required for heating as explained above. Another essential data source are the climate data of Vienna, as the so-called "heating degree days", that can be derived from climate data for an area are also required to do the complete calculation. Climate data from 1950/51 to 1979/80 have already been georeferenced and digitized for this project. For the heating days also wind conditions were taken into account, as a factor raising heat demand.

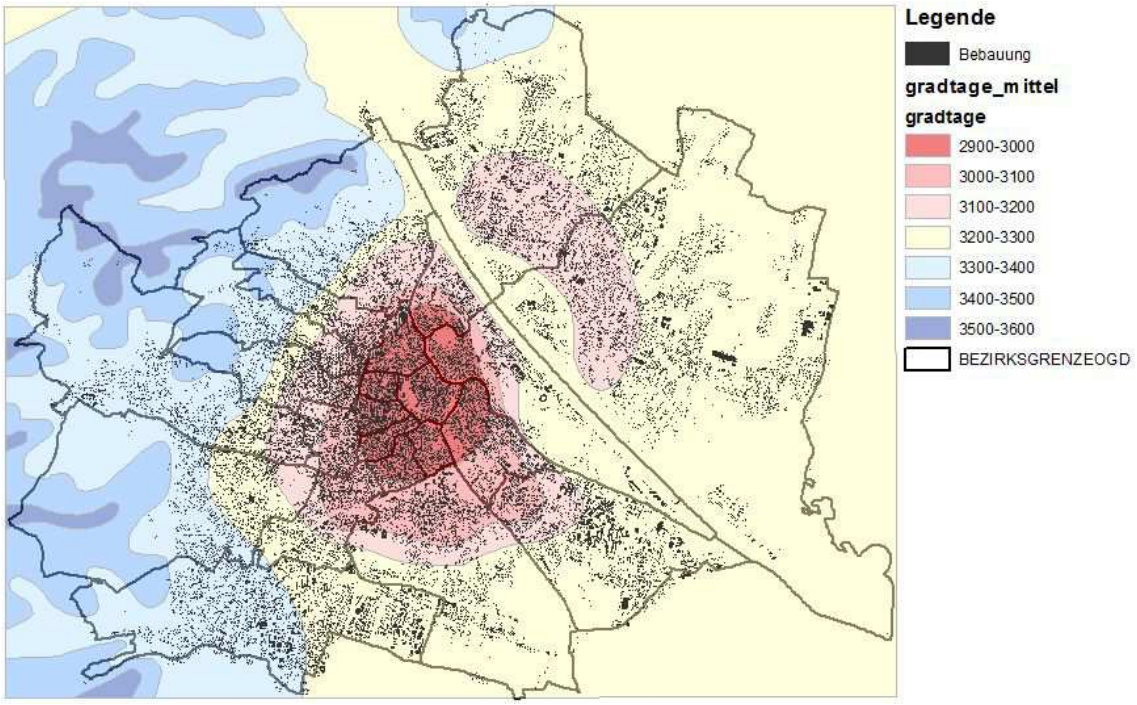


Illustration 35. Annual average heating degree days for the period from 1950/51 to 1979/80

(Source: ZAMG, City of Vienna MA20, TU Vienna)

As Illustration 35 shows, the values of the heating degree days vary – especially in the city center and to the western part of Vienna from about 2,900 to 3,600.

According to regulation 6 of the Austrian Institute of Construction Engineering (OIB) the amount of energy required for heating is being calculated based on heating degree days of 2.400 days/a (reference climate). Variations in the climate conditions will be taken into account when calculating these values for all buildings using the formula

$$HWBest,sk = HWBest \times HGT/3400$$

HWBest will be calculated from the buildings geometry and period of construction. **HWBest,sk** will also incorporate climate data. Based on the assumption that the characteristic length lc is 2.52, the following graph shows the influence of the climate data on the different construction periods. The resulting values vary by a maximum of about 20%. The construction period has a big influence on the calculation, and is an additional important factor.

Population

Population densities per block as well as number of inhabitants per block are an indicator for possibly affected persons. Higher densities in different areas with similar building structure might indicate higher efficiency.

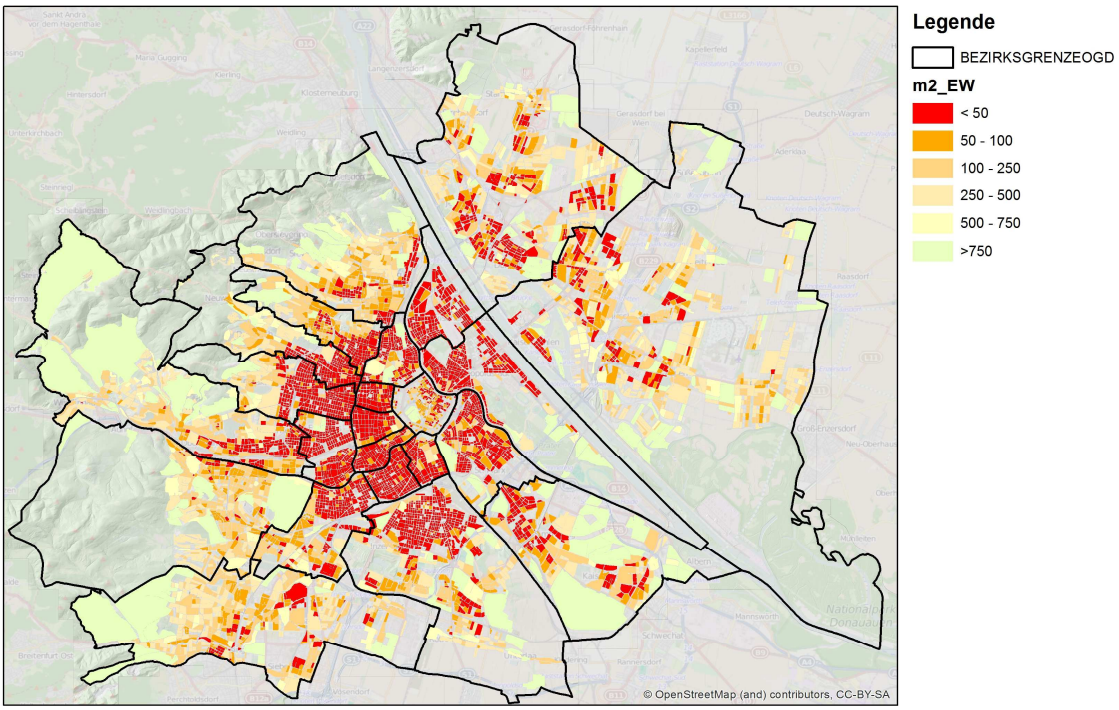


Illustration 36. Inhabitants (EW) per m2 on block level

(Source: City of Vienna MA18, Internal)

Social-economic database of Vienna

The socio-economic conditions of the population can have major influences on the implementation of measures, for example the willingness and ability to invest. The City of Vienna developed an methodology, which classifies Vienna into 7 types (from I. to VII) via cluster analysis. Key elements are fluctuation of inhabitants, migrants, children, unemployed residents or foreigners and poverty of employed people. The spatial scale is block level, so it can be taken into account in the development of the typology.

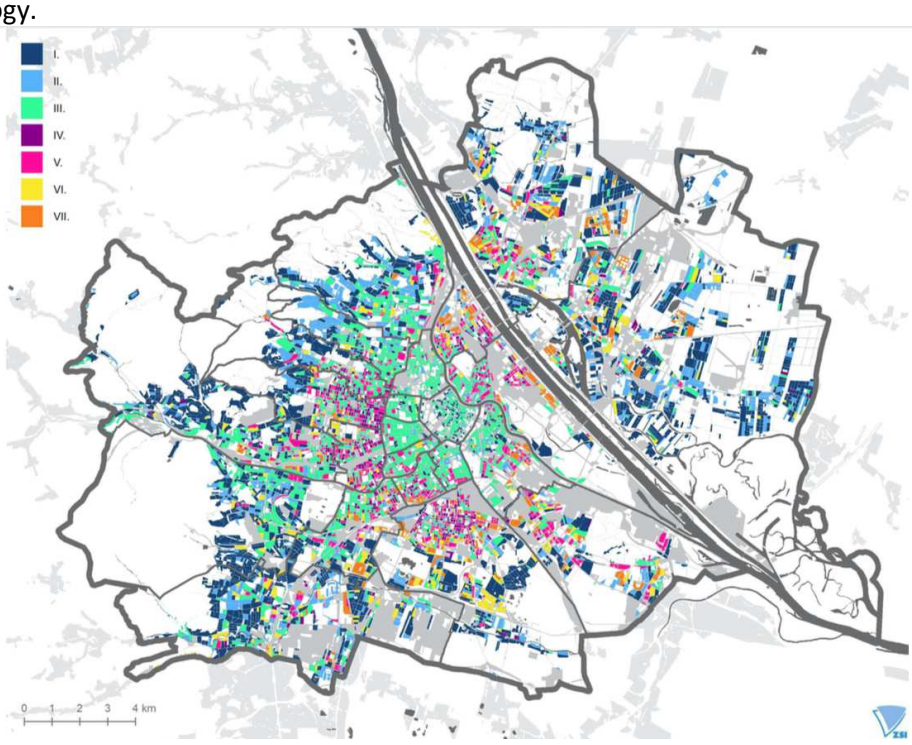


Illustration 37. Blocks classified by social-economic clusters

(Source: City of Vienna MA18)

Ownership structure

Due to legal limitations some options regarding renovation options depend on the majority vote of the property owners. Ownership structures and specific types of owner are indicators for impediments as well as chances for certain measures on energy efficiency and system adoption, and will be considered in the typology as well. T

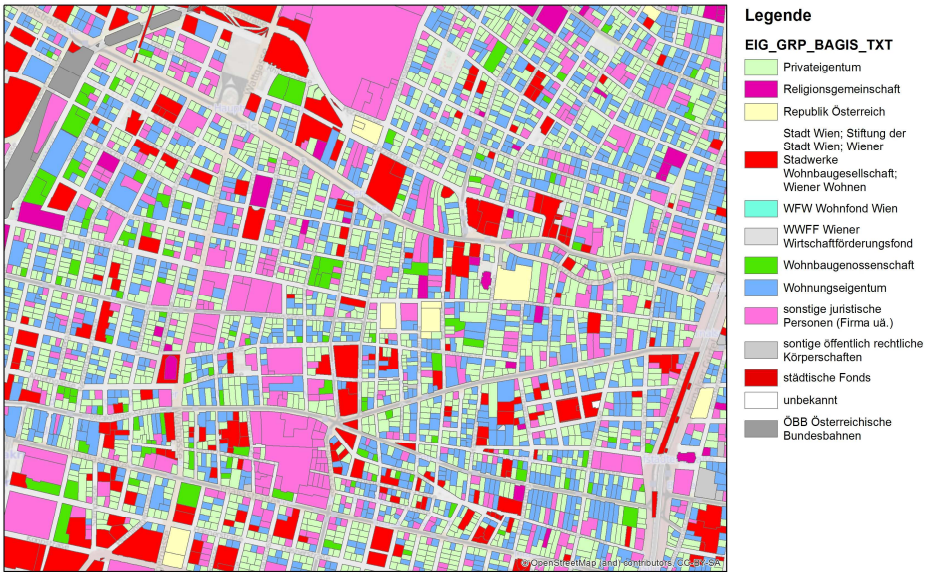


Illustration 38. Ownership structure, section of the 16. and 17. district

(Source: City of Vienna, TU Vienna)

Actual consumption data

It is also of interest to compare the estimated values with actual data of energy consumption. Data are available, but it is not clear whether these data contain the measured consumption or another estimate (to date, the metadata description is not available). Another fact is irritating when analyzing the data: The Vienna GIS holds about 11,000 blocks, whereas the delivered data set only contains values for around 8,000 blocks (containing values for heating, electricity or both). There is a number of blocks where data is available, but no inhabitants are registered to live in these blocks (about 1,500). Additionally there are about 230 blocks with registered inhabitants, but no data available. Central areas are affected by these problems as well as peripheral ones. This raises the question whether the data are actually valid and suitable for this project. Differentiation between private and business energy consumption remains a challenge.

Illustration 39. Blocks without energy consumption data, but registered inhabitants (brown areas)

(Source: City of Vienna MA20, TU Vienna)

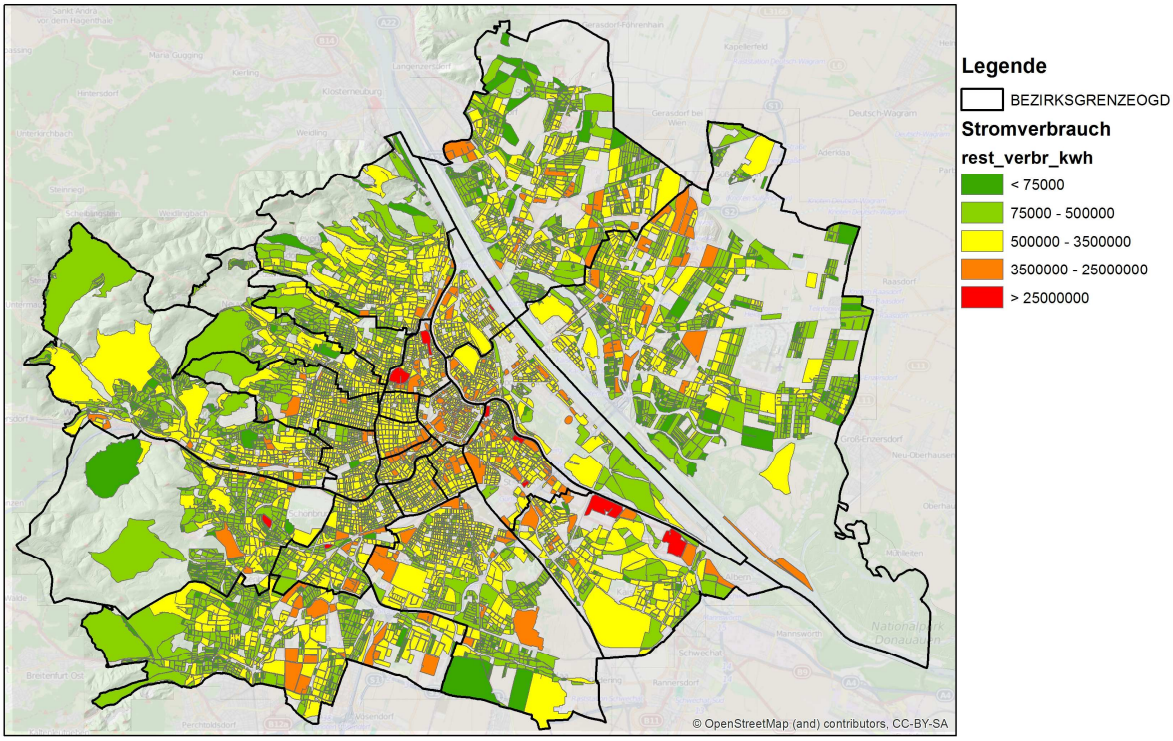


Illustration 40. Energy consumption for electricity on block-level

(Source: MA20, Internal)

Energy grids

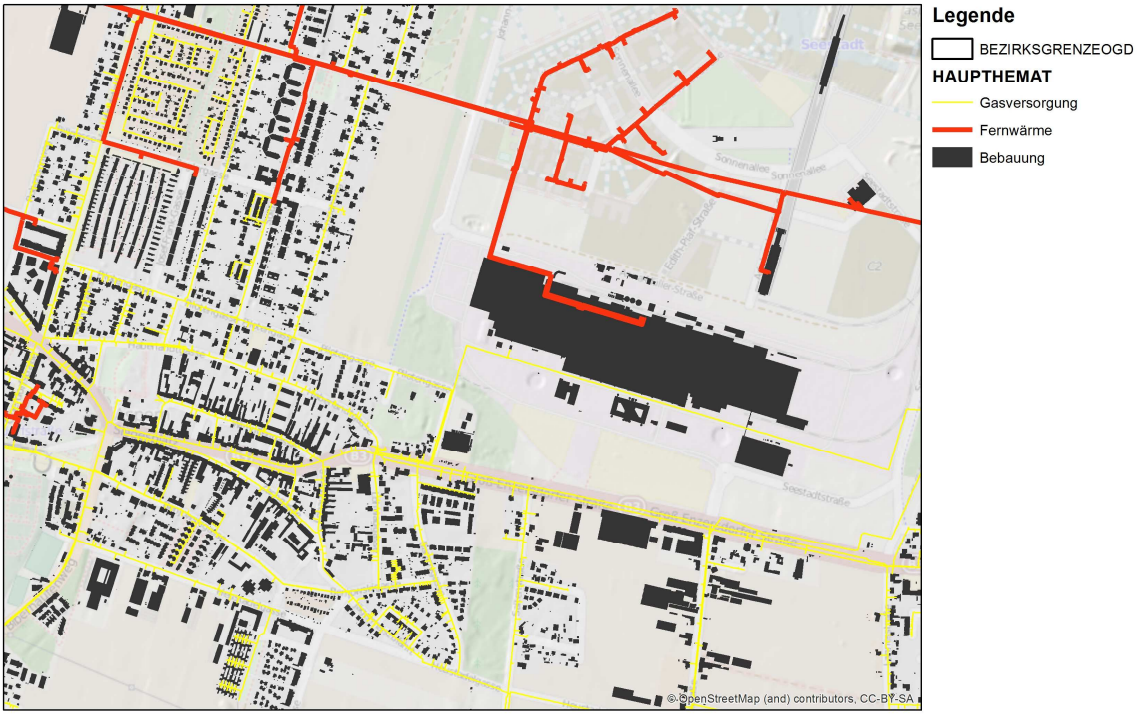


Illustration 41. Energy grid, section of the 22. District of Vienna

(Source: City of Vienna MA18, Internal)

The available infrastructure – especially district heating – provides additional options for energy supply. On the other hand it limits the options if not available. It needs to be taken into account for an estimation of the available potential though.

Solar potential

Of course the potential of renewable energy is relevant for developing the typology, especially solar energy, as it is an option for large areas of Vienna. The estimated solar potential per rooftop (per building or block) will be factored within the typology. The following pictures show the solar potential per rooftop for a part of Vienna and the overall situation for the whole city. Data refer to the year 2009, so alterations of the housing stock between 2009 and 2015 are not included.

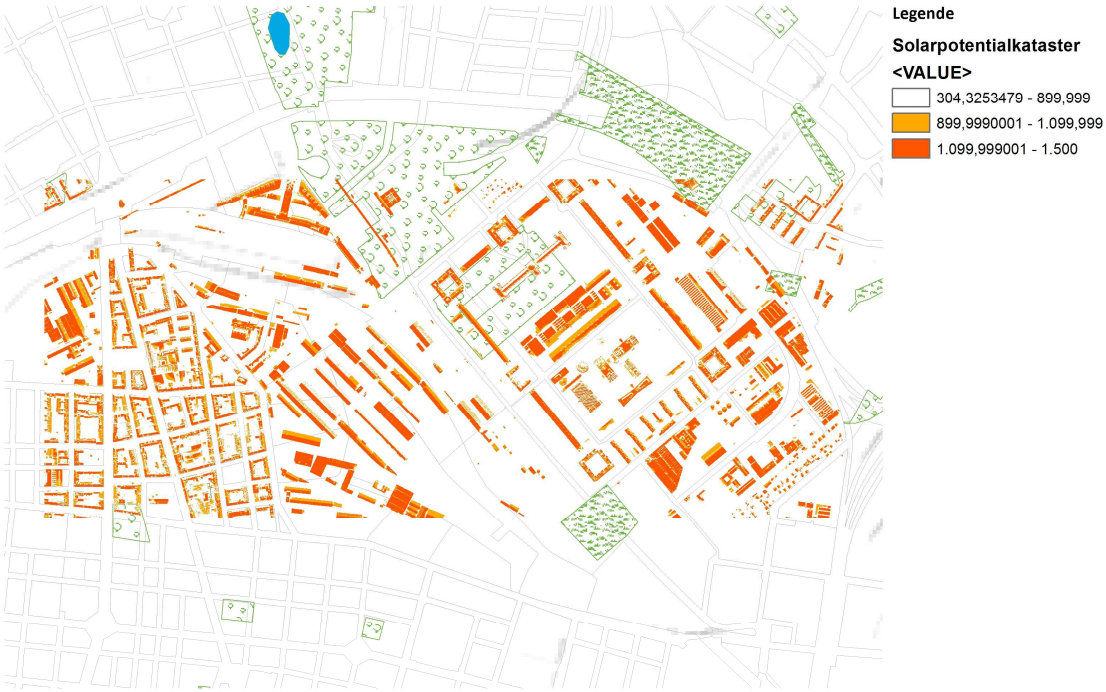


Illustration 42. Solar potential as raster data (extract of city wide data set)

(Source: City of Vienna MA20)

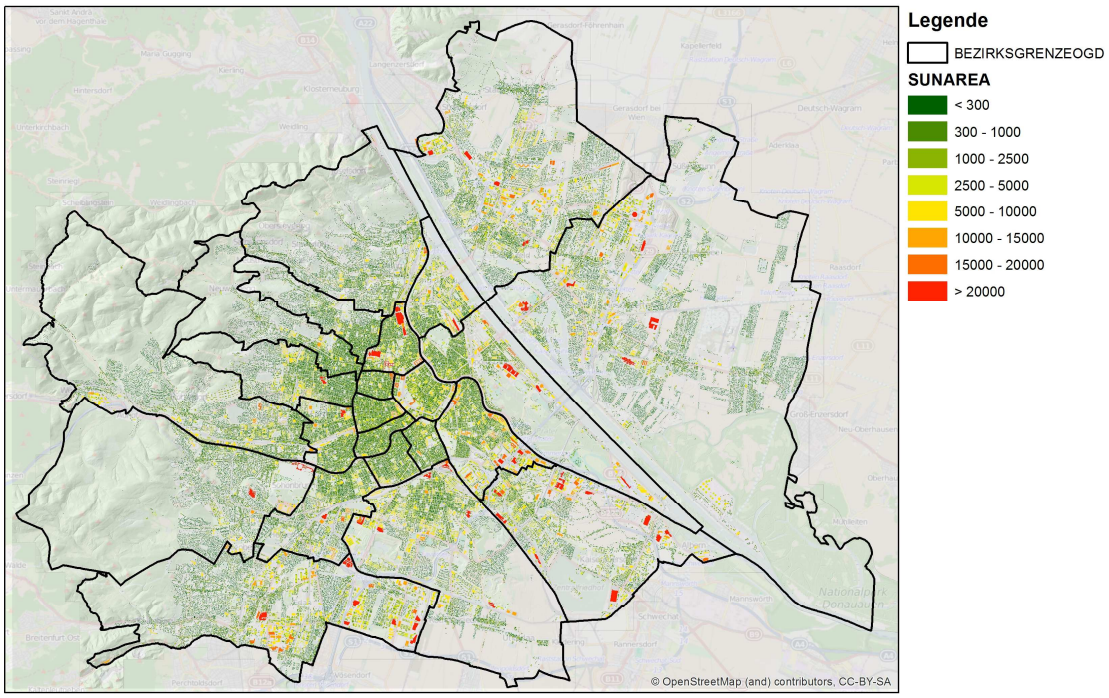


Illustration 43. Solar potential on building level

(Source: City of Vienna MA20, Internal)

Geothermal potential

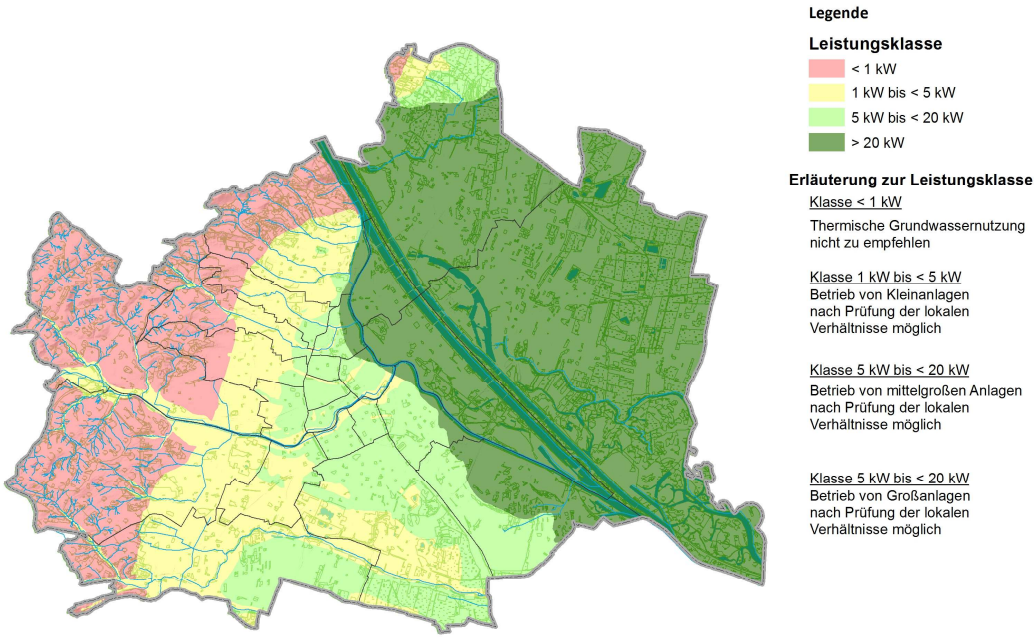


Illustration 44. Geothermal use of groundwater

(Source: Geologische Bundesanstalt, City of Vienna MA20, 2014)

As can be seen in the picture above, there is an enhanced geothermal potential available especially in the eastern part of Vienna. Data is only available on large scale therefore the data's usability for developing the typology is restricted, as the concrete local situation cannot be evaluated.

Planning Processes for Integrated Energy and Urban Planning

Guiding Question: How to include integrated Energy Planning into existing planning processes (Stakeholders + Activities)?

Working on integrated energy planning means cooperation between different Stakeholders and activities effecting the use of renewable energy sources or energy consumption for certain urban zones. The activities could be in quite diverse spheres, e.g. legislative, economic incentives or advising and participation models. They are used on different spatial levels, reaching from city-wide to urban quarter level and to individual apartments. Different policy sets are needed for smart energy systems in new urban quarters and for existing quarters, where refurbishment, upgrading or re-densification are to be implemented.

The potentials within existing activities for energy planning have to be activated by relevant Stakeholders, to conduct them for better results on energy standards. Many of the activities are not directly focussed on energy topics, but indirectly have important impacts on energy aspects (e.g. zoning, transportation). Therefore it is necessary to understand the circumstances of planning processes and to identify windows of opportunity to get energy aspects on track. Aiming at such a reorganization of planning processes, it is not foreseen to develop complete new planning processes. This will take too long for the actions needed in the next years. So the focus is on co-working and Governance between Stakeholders.

To gain knowledge for decision support, a screening and analysis of existing planning processes with their different activities (tools, instruments) and actors involved is crucial. The first steps of this analytic work concerned the administrative capabilities for an integrative energy planning approach. This analysis already had started in previous projects[29], and has been continued in the framework of the TRANSFORM project.

In 2015 some **preparation for a concept on integrated energy and urban planning** are already going on. This will be a very important step to strengthen abilities to implement, because new instruments, clarification of procedures, fundamental principles and cooperation of Stakeholders will be included. Major goals on district level are the maximum use of local available renewable sources, and in regard to the overall goals 2000 Watt primary energy input (means 17.5 MWh per person and year with all functions included) and 1 tonne of CO_2 per capita for all energy demands. In future local energy concepts should define energy systems in an early stage of development. Benchmarks like gCO_2/kWh are binding only for bigger developments within an environmental assessment.

OIR led a number of in-depth interviews with key departments and stakeholders relevant for the integrative energy planning approach. The analysis of this comprehensive, process-relevant study gained valuable information about the main challenges and helped to get insights about experiences and expectations from relevant stakeholders. In also provided a deeper understanding about the restrictions stakeholders are currently facing, how they would be willing to integrate energy aspects in their daily business and what framework conditions would be needed to provide for it.

The results from these interviews indicate a number of barriers and uncertainties to be considered and overcome. Beyond legal and financial restraints these mainly refer to knowledge gaps, lacking co-operation between municipal departments (and other municipal institutions) and partly also to different priorities or target conflicts between actors (e.g. building homes versus protecting green space, renovation versus heritage issues).

Against the background of economic constraints but also referring to energy and climate related objectives and a significant increase of civil consciousness for energy issues, main supporting factors for future integrative energy planning have been identified:

- intensify the cooperation between municipal departments
- knowledge and data provision as a basis for decision making, higher transparency of available information
- city guidelines and targets as a basis for strategic decisions from single actors in order to provide higher liability of planning
- switch from short term financial calculations to the consideration of lifecycle-costs

As a basis for analysis and the design of a future roll-out of integrated energy planning, the current involvements in energy planning activities are shown in the table below. The results from the inter-view-based analysis will serve as an important input for the local Smart City Working Group, where concrete process designs and recommendations on integrated energy planning will be developed.

[29] F.e. ENUR: http://enur.project.tuwien.ac.at/index.php/modgov.html

PESTLEGS categories (main aspects)	at the city level	at the level of districts or quarters	at the level of buildings or apartments
Political aspects	energy strategy, security of energy supply strategy (Considerations for the smart city system have to go behind isolated smart projects) Smart City Initiative	urban development projects	
Economic (and financing) aspects	funds for refurbishment and supporting higher standards (than defined by law) for new buildings	planning and financing of public infrastructure	*handling of funding requests*
Social aspects	awareness raising and information funds to abate energy poverty	neighbourhood management, local initiatives	guidance and advice for refurbishment *handling of energy poverty requests*
Technical (planning) aspects	urban development plan (STEP), mobility concept/ transport planning, renewable action plan (RAP), energy efficiency programme (SEP)	urban master plans ***missing: holistic energy concepts for quarters*** *(pilot project on the way)*	smart metering, apps, refurbishment of public (city owned) buildings infrastructure planning (i.e. district heating network) by municipal energy provider
Legislative aspects	regulations on buildings for efficiency and energy standards ***clear and equal guidelines for warm water supply***	urban zoning (land use) and local construction plans building developer competitions, environmental impact assessments (in large urban projects)	Detailing and binding regulations (building code) or contracts for individual sites. ***Implementation of public-private contracts for new developments beyond existing laws to be clarified***
Environmental aspects	climate relevant goals, environmental monitoring	only partly: environmental and climate targets for new districts	
Governance aspects	Smart City Framework Strategy, Climate Protection Programme (KliP) stakeholder management, monitoring	***missing: process of optimization/ binding agreements for future energy systems of quarters as a basis for strategic decisions of various actors***	***missing: agreements for energy systems on quarter-level to be linked to individual investors/ land owners (by regulations or contracts)***
Spatial approaches	Land mobilization and acquisition strategy (esp. for public housing)	target zones for refurbishment of building blocks ("Blocksanierung"),	Implementation of land acquisition strategy

	missing: (public) atlas of energy demand and total RES potential	partial knowledge on local RES potential	

Table 3. Main activities related to integrative energy planning by spatial levels (current status)

Integration of urban development and energy planning – a new Smart Energy City Vienna approach

The existing approaches of urban development and energy supply rest mainly on the separate activities of city planning, applying technical standards, aid for innovative new or refurbishment of buildings and the supply-side energy planning from the city-owned energy utilities. There is no area-focused integrated development approach in place, encompassing energy supply, (local) energy production and the production of new or the refurbishment of existing buildings from a holistic point of view. With the adoption of the Smart City Framework Strategy and the new Urban Development Plan 2025 (see above), the task has been formulated to elaborate new procedures and methods to integrate the urban development and energy fields with respect to energy and climate protection targets.

In order to do so, it is necessary to define what shall be elaborated in these new processes to be introduced to the city´s ways of doing urban development and energy planning and how the current standard procedures will have to be adapted. Therefore legislative instruments for planning are needed to enable the integration of renewable energy infrastructures and energy efficient solutions for private property development (see also Table 3).

Based on the experience from making the Implementation Plans in TRANSFORM and from other pilot activities, it can be concluded that these new processes include the following elements:

- Energy supply and production concepts for sub areas in the city,
- which are linked to the overall energy and climate protection strategies and
- made binding and relevant to all the city´s own activities and to all investors in the area.

Thematically, this relates to all existing and to new urban development areas, but so far it has been mainly in the focus to provide innovative energy supply in new development areas of the (fast) growing city.

While the urban development plans so far have defined the background for building development, public spaces and the transport system, the options to define and implement a future smart energy system remain quite limited - vis á vis energy system providers, building developers and new corporations to be settled in. So far, only indirect approaches have been used in order to provide a smart and sustainable energy system, e.g. making use of the legal framework of the Environmental Impact Assessment as an instrument to set certain standards for the energy system (required, however, only in large development areas).

Future “smart” urban development requires instruments directly dealing with the energy systems to be installed, defining the contributions from the individual parties in a binding way: City, energy system providers, building developers, tenants and homeowners in their roles as energy consumers and producers. To realize the smart city energy system conceived in the Implementation Plan aspern Seestadt, a binding arrangement between these parties is needed: A commitment to invest and operate a system designed with respect to reducing fossil fuel inputs and CO_2 emissions, allowing for the feed-in from individual producers and flexible enough to make future adaptations possible.

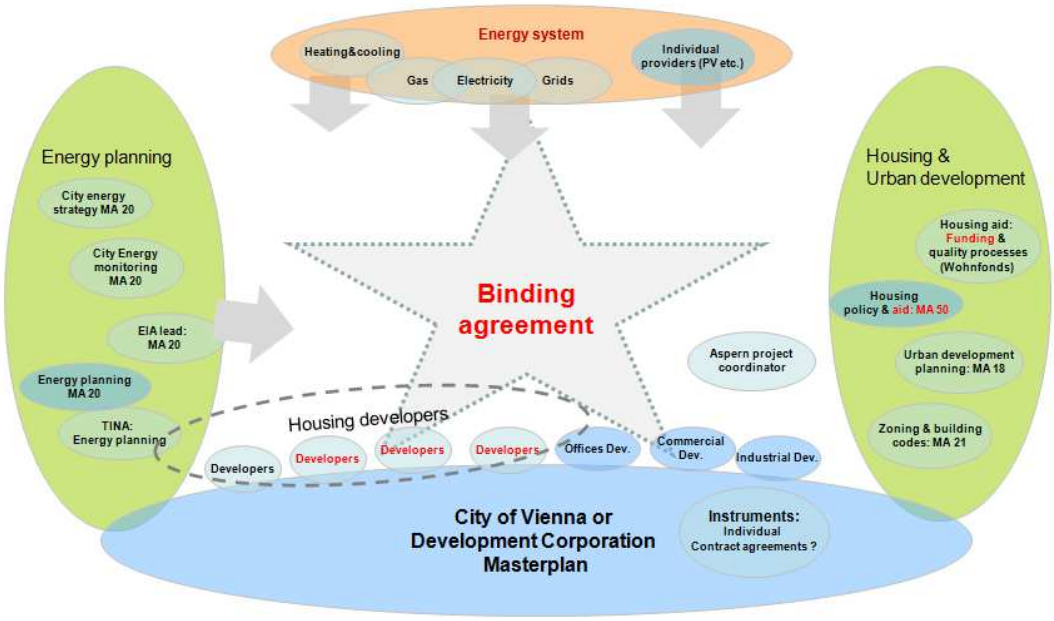


Illustration 45. Reaching binding agreement in integrated urban and energy planning

An integrated approach for joint urban development and energy planning will use some of the experience also from other cities – like Copenhagen and Hamburg – in order to provide effective processes and reach binding agreements.

Discussion of a new procedural approach – based on the Hamburg example, transferred to Vienna

During the ILS in Vienna, the different approaches of integrated energy planning processes in TRANSFORM cities have been discussed and compared in terms of transferable procedural steps and aspects for Vienna.

As pointed out at the beginning of the document, this is document a scientific study by the city for the city. So the following list is presenting the outcome of this discussion and is seen as a starting point for further discussion on the development of a tailor made process for integrated energy planning in Vienna. The process in Vienna might follow the subsequently presented steps:

1. Vienna MA 21 (or a Development Corporation) provides an urban development masterplan
2. Vienna MA 21 (or a Development Corporation) in corporation with MA 20 (Energy Planning) tenders an extended energy analysis - options for the area relating to:
   - Energy demand/ building standards/ densities
   - CO_2 targets realistic for alternative technical systems
   - Cost estimates
   - System concept: District Heating, temperature levels, waste heat, solar/PV use etc.
3. System selection:
   Vienna MA 20, MA 21, MA 50 (City Housing), in coordination with Wien Energie and Wiener Netze (public energy utilities) decides about the requirements for an energy system, CO_2 targets and other criteria (e.g. price ceilings etc.) Here legislative instruments are needed.

4. MA 20 leads a tender procedure for concession and selects a consortium of energy suppliers to give a full service concession. Further elaboration how to organize this legally with private property owners is necessary.
5. MAs 20 and 21 (District Planning) define a connection area in accordance with the suppliers energy system and obliges land owners/ investors to link up to the grid via urban development contracts (if there is no such regulation in Zoning Plan as in the Hamburg case)
6. Implementation phase
7. Monitoring and control: CO_2 limits, price levels, technical quality and security of the system

So far, such a systematic approach, including tender procedures, concessions and contracting, does not exist in Vienna. Resulting from the current situation in the energy markets, with high uncertainties about cost factors and with fast changing technological options, however, it seems necessary to create a process which is geared to provide innovative and sustainable systems for new urban developments.

The leading institution relating to this task, the Energy Planning Department (MA 20) recently has started to provide with necessary information for such a process by tendering a so called “Options Study” for another urban development area about half the size of aspern Seestadt. This study represents step #2 in the above procedure and is supposed to create the basic design alternatives for energy supply and distribution systems in the area. The further steps are still open for development and debate, particularly relating to legal and economic requirements. Important are the same precondition and requirements for all players on the market (f.e. whe it comes to district heating price regulations). The energy planning of Vienna (like MA 20) will need more concrete and legislative binding instruments to ensure the energy transformation locally. For the application of these instruments expertise and procedures have to be available.

Part D: What has been achieved so far

First of all, the preparation and work on the Transformation Agenda in TRANSFORM directly supported the generation of the Smart City Wien Framework Strategy. This support was content wise, when it comes to definition of new targets for a city environment, and on organization, when it comes to Governance, linkage between (existing) strategies and the level of actions and needed Stakeholders. The project TRANSFORM aimed to be closely connected to ongoing task of the cities between the steps of a so called Transformation cycle such as setting targets, action and monitoring. The project was very much driven by the different city representatives. As a result of this know-how and confidence on strategic procedures and interdisciplinary course setting has been raised. The strategy assessment as part of the Transformation Agenda is exemplary for this.

In Part C first steps to raise the ability to implement are brought up. The 42 actions from the 2012 created Action Plan are still very relevant. The TRANSFORM project gave the resources to review these actions, to bring them into the strategic agenda of decision making for the upcoming years. One big point of the Action Plan in this document is participation, social awareness and cooperation between the city and private actors. Because of this participation was chosen as one of two focus themes for this Transformation Agenda. The working group and workshop in the project "My Smart City Wien" has brought first findings which will be considered for future participation formats (already scheduled in 2015). It's important to know how to involve different target groups and be in touch with key actors and institutions which are working with citizens. Essential is the personal contact on the ground.

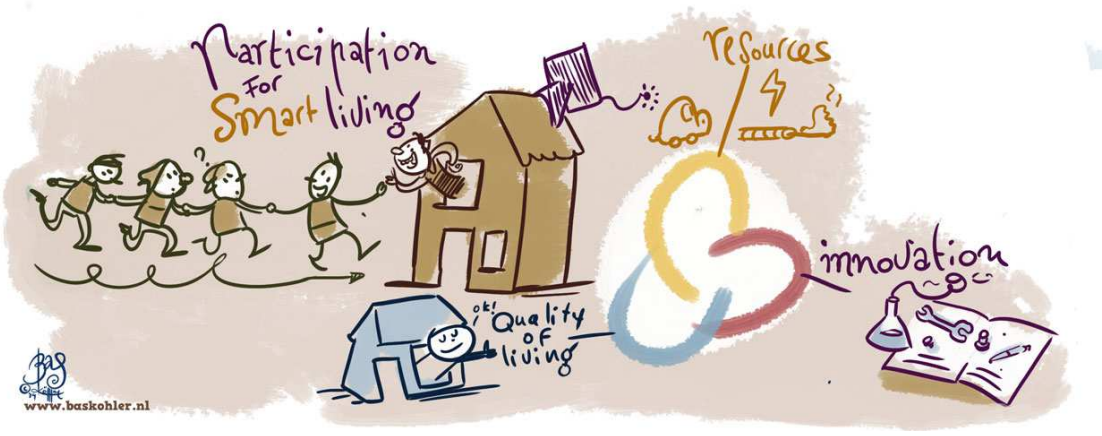


Illustration 46. Smart City Wien focus © baskohler.nl

On integrated energy and urban planning TRANSFORM managed to raise know-how about different approaches and also awareness throughout local Stakeholders about these possibilities. The Intensive Lab Session in aspern Seestadt in September 2014 (4 day Implementation lab in TRANSFORM) proved the need on new approaches on integrated energy and urban planning. Results of the exchange in TRANSFORM have been included in the Transformation Agenda. The discussion of

a procedural approach on district level energy planning is showing how this new and complex situation could be handled at Vienna. The discussion has already spread out of TRANSFORM within Viennese Stakeholders. In August 2014, 14 Interviews were done with different relevant Stakeholders in Vienna on energy planning.

Data appeared as a bigger issue in the TRANSFORM project than thought at the beginning. As soon as more detailed questions for tailor made energy solutions in a complex and changing energy market came up, information is becoming valuable. The work on energy typologies is a direct support for energy planning in Vienna in terms of data collection and spatial analysis of geo-data. The different existing datasets were put together for one assignment. Thereof typologies can be built to have an additional database for different activities of energy planning. Implementation within the decision support environment tool of TRANSFORM is necessary and useful.

The Stakeholder Mapping provided a basis for internal discussion and a good documented overview of actual and needed Stakeholders for the Smart Energy City transition. Especially Stakeholders engaged in housing and real estate development need to be more involved when it comes to implementation. Financial issues and investment actions couldn't be included in this Transformation Agenda in a way that the City of Vienna can get additional surplus. There are different ongoing business and financial models, but for review and recommendations of future approaches intensified approaches are necessary. Energy flows of waste or water are not considered like other themes because of limited priority and relatively good Status Quo in comparison to other (for the TA selected) themes. At the end TRANSFORM was an important vehicle for cross-institutional work on local level, beside the project level. Dissemination with other buddy cities has been started within TRANSFORM in December 2014 (Workshop with Munich, Berlin, Salzburg, Graz, Association of Austrian Cities and Towns).