Energy! ahead

Data for 2013 / Year of reporting 2015, Municipal Department 20

StaDt+Wien

SMART CITY WIEN

ABBREVIATIONS

GIEC	gross inland energy consumption
MA 20	Municipal Department 20 – Energy Planning
OMV	national gas and oil company
PV	photovoltaic
PVT	photovoltaic thermal hybrid solar collector
PV area	1,000 kWh = 6.5 m² PV area
SEP	Vienna Urban Energy Efficiency Programme
STEP 2025	Urban Development Plan Vienna
UBIMET	weather service provider

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* **Maria Vassilakou**
Deputy Mayor of Vienna, Executive City Councillor for Urban Planning, Traffic & Transport, Climate Protection, Energy and Public Participation

1. PREFACE

This is the fourth edition of the Energy Report, which provides facts and figures on the energy system of the City of Vienna. But what do these facts, figures and analyses tell us? The transition to renewables has long begun in Vienna. The Energy Report shows us that 11 percent of Vienna's energy demand is already met with renewables. I am particularly pleased that there are more than 1000 PV systems in Vienna, among them many showcase projects on roofs of public buildings. But we have not finished yet – every single citizen can benefit from the energy transition. In May 2015, we opened the 13th citizens' solar power plant in Vienna – and the interest in them is undiminished.

Climate protection is another core element of Vienna's energy policy. Cities need to make most of their processes carbon neutral. Therefore, the City of Vienna supports the EU's energy and climate strategy and aims to reduce greenhouse gas emissions by 80 percent, increase the share of renewables to 50 percent and lower energy consumption by 40 percent by 2050. This will generate less emissions, reduce consumption and decrease dependence on energy imports considerably.

Much has happened in the area of mobility as well. While the traffic and transport sector remains one of Vienna's largest energy consumers at approximately 36 percent, many people are switching over to public transport. The number of holders of annual passes for Vienna Public Transport has grown enormously: one in three citizens have an annual pass.

Another challenge Vienna is facing is its rapid growth by some 20,000 people annually. New residential areas with suitable infrastructure and special energy system solutions for each location are needed. This makes it important to plan energy supply in a structured way early in the planning phase in close cooperation with urban developers.

Nevertheless, we also have to save energy and make our city even more energy efficient. Vienna began focusing on energy efficiency ten years ago with the Urban Energy Efficiency Programme, and we are currently developing a follow-up programme. The energy system of large city cannot be transformed overnight. What matters is that we are moving in the right direction. Vienna has laid out the path with its Smart City objectives. But we are already seeing positive impacts of the measures implemented so far, as the Energy Report 2015 clearly shows.

Maria Vassilakou

QUESTIONS

ANSWERS

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* **Matthias Watzak-Helmer,**
  has been working at Energy Center Wien since 2013. He studied Eco-Energy Engineering at the University of Applied Sciences Wels and Georgia Tech Savannah, specialising in energy efficiency and renewable energy sources.

* **Bernd Vogl**
  became Head of the Energy Planning Department (MA 20) in September 2011 after working at the Ministry of Environmental Affairs for more than 18 years in the field of energy planning and innovative energy systems.

* **Eva Dvorak**
  has been responsible for renewable energy issues at MA 20 since 2013. Previously, the meteorologist was responsible for the energy sector at Austria's largest private weather forecast service UBIMET and worked as technical consultant for environmental promotion in Austria at Kommunalkredit Public Consulting GmbH.

* **Herbert Ritter**
  has been Deputy Head of MA 20 – Energy Planning since its founding (1 January 2011). He has been working for the City of Vienna since 2009 and was previously with the Austrian Energy Agency for 12 years, where he focused on various energy matters.

* **Waltraud Schmid**
  has been the director of the Energy Center Wien since its founding in 2013. After working for the Austrian Energy Agency for eight years, she began working for the European Commission in November 2000, where she worked in various positions, most recently managing the Intelligent Energy Europe programme.

2. INTERVIEWS

EVA DVORAK *and* BERND VOGL

KRISTINA GRGIC: *Energy and climate protection are on the political agenda across the world. What challenges does the energy planning department of a large city like Vienna face?*

BERND VOGL: Municipal Department 20 – Energy Planning (MA 20) was founded four years ago and we have since found our place in the workings of the City Administration. By that I mean that energy matters now have a professional representation with the necessary resources in many administrative processes. We have excellent employees at MA 20 and Energy Center Wien who contribute ideas and know-how in many parts of the City Administration and thus have an impact on the city's energy supply situation.

Of course, for an energy department, all processes and activities related to the energy consumption of buildings are of particular importance. Energy demand for hot water and heating is very important, but the energy needed for mobility and household use can also be influenced by the way in which our buildings are constructed.

MATTHIAS WATZAK-HELMER: *So the energy demand for heating buildings remains high in cities. What are the goals of MA 20 with regard to heating supply in new urban development areas?*

BERND VOGL: Vienna is a rapidly growing city with many large development areas where housing and infrastructure are being created for thousands of people. The currently largest one is Aspern – Vienna's Urban Lakeside, which can accommodate approx. 20,000 inhabitants, but there are other major projects at the North and Northwest Railway Stations, Donaufeld, Hausfeld and Berresgasse, to name just a few. As early as 2006, in the first Urban Energy Efficiency Plan, our Administrative Group was urged to consider energy aspects in urban planning. Now we have introduced energy spatial planning in urban development areas and a separate chapter on this was included in the urban development plan STEP 2025, which has garnered considerable international attention for Vienna.

On the one hand, we are one of the trailblazers internationally, but on the other, we are just starting to develop administrative processes, which we are now also working on in a joint EU project with 7 other European cities (Berlin, Zagreb, Warsaw, Stockholm, Paris, Amsterdam & Zaanstad). The new strategic concept on high-rise buildings now makes an energy concept compulsory for high-rise projects as well.

It is very important to consider the issue of energy when planning new urban development areas or high-rise buildings. We have developed a guide for urban development, which aims to use energy infrastructure, such as district heating, efficiently and also focuses on locally

available energy sources. If we want less greenhouse gas emissions and want to be less dependent on countries with fossil energy resources, we must start thinking more about using energy sources available locally or in the metropolitan region. This kind of planning has to happen at the start and it requires more thinking and planning effort. That creates jobs in growth sectors but is, of course, less convenient for actors in the building sector than just talking to Gazprom to ensure natural gas supply for decades to come. We are replacing gas with a mix of waste heat, solar energy, ambient heat (ground, groundwater and air), geothermal energy and green electricity from the region. Vienna's district heating network is of course an important part of our heat supply.

We are currently examining smart energy supply options for several urban development areas. An important example is the study on energy options for the Donaufeld urban development area, where we have found that in the long run, energy systems based on locally available energy sources are already cost-effective, but the initial investment costs are high. Smart solutions are always also a matter of suitable financing models.

KRISTINA GRGIC: *How can Vienna cover part of its energy demand with renewables? And what else is possible? What untapped potentials are there in the city that you think should be promoted?*

EVA DVORAK: We have to consider locally available renewable energy sources when planning heating, in particular, but also for the general electricity supply for buildings. This is absolutely indispensable in the medium to long term and our daily work is to explain this to citizens and planners. Our survey of geothermal heat potential in the Vienna region was an important step in this direction, because we should use more geothermal energy.

We commissioned the Geological Survey of Austria to create a geothermal heat zone map, which will be available as an overlay on the online city map as a resource for housing developers and people who are building their own home. It allows people to check what potential energy sources are available at a given site, e.g. whether a groundwater heat pump or a borehole heat exchanger would work better. The 21st and 22nd districts are extremely well suited for thermal groundwater use. Borehole heat exchangers are recommended particularly in the western part of Vienna, where you sometimes don't even need a permit to install one, depending on the site.

Generally speaking, geothermal heat is a safe energy supply system – making a well or borehole is a one-time investment, but then it reduces heating costs considerably for decades to come. If you combine this with a PV system on the roof, you are even more independent of market prices, because you can generate some of the electricity needed for the operation of the heat pump. You can check whether PV is feasible on our solar potential map, which has been popular for many years.

MATTHIAS WATZAK-HELMER: *What other renewable potential is there in Vienna that has not yet been sufficiently exploited?*

EVA DVORAK: The solar energy potential I just mentioned remains largely untapped. In theory, 55 percent of Vienna's roof surface is suitable for solar thermal energy or PV. This is a total area of approx. 29 km², of which 21 km² are "very suitable" and 8 km² are "suitable". So there remains a lot to be done on Vienna's roofs. But wind energy is an important topic as well. The Central Institute for Meteorology and Geodynamics (ZAMG) made a study on the potential of small wind turbines. Wind power can be a bit difficult in the city because of noise and the risk of ice throw, but it can be used on the outskirts of the city, where the turbines can be built at an appropriate distance from other structures.

In the city proper, we will probably have to get along with very few small wind turbines. However, the wind potential study, which maps the wind conditions at 10 m above the average building height, has shown us a lot of new possibilities and applications we were not aware of previously. One example is ventilative cooling in buildings, which could be particularly interesting for historic buildings. In all cases, we make data collected available to other interested parties so that they can benefit the whole city.

MATTHIAS WATZAK-HELMER: *What will be the biggest changes in heating for cities and are there already visible changes?*

BERND VOGL: We are constantly looking at new developments in other countries and cities and trying to learn from their ideas. One important trip was to Switzerland and Vorarlberg, in western Austria, where we looked at innovations and technologies in the areas of buildings and heating. The standard of their buildings is very high – they have an extremely low energy demand thanks to good planning – and that brings the energy system to the next level. Locally available energy sources can provide a considerable part of heating. In future, it will be possible to use relatively low temperatures for heating supply, e.g. low-temperature waste heat, which was not possible before. That is very good and we are working on that in Vienna as well.

An important part of such modern heat supply systems are energy storage systems that can store warmth during summer for the winter months or balance peak loads. In urban areas we are seeing that ground heat storage systems, which can take up cooling loads and solar energy gains in summer, are feasible and efficient.

Another important topic is integrating renewable energy sources into district heating and thinking about new sources for district heating. We can also combine district heating with locally available energy. With district heating, we are currently highly dependent on a single technology and we need to diversify.

There are many changes on the energy markets at the moment and it is important for us to learn from others' examples. But we also have to keep in mind that Vienna is a city with a large existing building stock, with many old buildings from the late 19th century, which is part of the city's charm and character. It takes longer to implement innovative heating systems in existing buildings. It is a lot easier when you have a new construction project. But of course we have also made a lot of progress in existing buildings with numerous efficiency measures and in particular the Urban Energy Efficiency Programme (SEP), and will continue to do so.

MATTHIAS WATZAK-HELMER: *Power stations in urban areas are always faced with resistance, whether they use renewable or fossil resources. Ideally, they should have no emissions and not be seen. How can we manage to integrate renewables into the city anyway?*

EVA DVORAK: Energy planners and urban planners don't always think the same way. Our goal should be to promote the integration of energy systems and concepts into the townscape and increase their acceptance among citizens. This was also our idea behind the solar energy guide we wrote together with urban planners. It shows that solar energy systems do not have to be irritants but can and should instead be planned as design elements of buildings. Examples of this are energy-generating shading elements, façades or insulation elements. Greening buildings is also no problem with regard to solar energy generation – the combination can even be mutually beneficial.

The integration of renewables into the city is a process that started years ago but that is by no means finished, because the market is constantly generating new products. But unfortunately, renewables still have to overcome many obstacles. We have to learn to use these new technologies and remain open for innovation, but that does not mean that anything goes – health, people and the environment must always be considered. But on the other hand, that should not mean that we only use what has worked in the past. We have to push innovation. We have to approach and promote new technologies, also with regard to our Smart City goals. The administrative simplification for small PV systems is a step in this direction. We are trying to remove obstacles and make the remaining ones easier to overcome.

That is quite a challenge, and we are working hard to support other technologies as well so that they can gain a foothold in the city. MA 20 creates space for innovation. Without us, many things would not be implemented and new technologies might remain untapped.


Energies
Energies

HERBERT RITTER *and* WALTRAUD SCHMID

KRISTINA GRGIC: *What does the Austrian Energy Efficiency Act involve and what are its implications for Vienna?*

HERBERT RITTER: The Energy Efficiency Act includes some fundamental changes to how we address energy efficiency. Energy suppliers must become energy service providers. The obligation for suppliers to ensure that their customers save energy, in particular, forces them to change their methods. Suddenly energy savings have value. This means new challenges and opportunities for all actors. For our work, this means that we have to consider how we in the Province of Vienna can use the tools the Federal Act gives us. Therefore, we are working on a successor programme to SEP ("SEP2") and have set up a separate working group on the Energy Efficiency Act. Its goals are to find a position and harmonise goals within the City Administration and with the directly affected utilities companies.

The federal government has already made an important contribution by implementing a monitoring body. It is important to be clear on how efficiency measures are quantified and evaluated.

MATTHIAS WATZAK-HELMER: *The Urban Energy Efficiency Programme SEP ends at the end of 2015. What were its big successes?*

HERBERT RITTER: The City of Vienna began addressing efficiency early on and considered it important from the beginning. Vienna introduced SEP in the same year the EU passed the Services Directive, in 2006. This was the first conscious focus on efficiency. After ten years, SEP is now coming to an end.

Its biggest success is that everyone is aware of energy efficiency. SEP is a programme of measures, but even more than that, it is a programme that seeks to motivate and raise awareness.

KRISTINA GRGIC: *What results have you had in the different areas?*

HERBERT RITTER: We have been able to achieve enormous savings in subsidised housing construction with the various measures. A lot has changed where buildings are concerned, with refurbishment measures (such as thermal rehabilitation of existing buildings) and new heating systems, in particular the switch to district heating. We have also implemented many measures within the City Administration, for example in the refurbishment of administrative buildings and the use of more efficient street lighting systems.

The EcoBusinessPlan measures for raising awareness in companies and the energy consulting services for different target groups have also generated large savings.

MATTHIAS WATZAK-HELMER: *What are the challenges for the successor programme?*

HERBERT RITTER: SEP2 is no longer completely new territory, because SEP has laid a solid foundation. SEP was developed over several years with the involvement of all relevant organisational units and adopted unanimously by the Vienna City Council in June 2006. With SEP2, we want to keep the process as lean as possible, because a lot has already been done. There are many programmes, such as the Smart City Framework Strategy, the Vienna Climate Protection Programme (KLiP II) and the strategic concept on mobility of STEP 2025, which provide us with a framework. But that does not mean that we won't involve the most important actors. We are just focussing and streamlining the process.

SEP2 will be Vienna's contribution to the implementation of the EU Energy Efficiency Directive and will be coordinated with the Federal Energy Efficiency Act.

KRISTINA GRGIC: *2014 was the first full year of operation of the Energy Center Wien (ECW). How has it become established in the city?*

WALTRAUD SCHMID: Perhaps "established" is too big a word after only one year. But I would certainly say that we have laid a solid foundation for future work. We have assembled a competent team and started cooperating with a number of departments and offices of the Vienna City Administration. The feedback is positive. The Vienna City Administration is full of committed people, and supporting them is not only successful but also fun.

Just as a reminder: The Energy Center Wien was set up to support the City of Vienna in implementing its ambitious energy objectives. With this, Vienna has joined the ranks of the Austrian provinces and European regions that have an energy agency as an external centre of excellence that is closely affiliated with the administration. However, there is one big difference: The Energy Center Wien does not provide consulting for households or businesses, because we already have institutions for that, e.g. the environmental consultancy and EcoBusinessPlan. Our main client is the city itself – both the administrative and the political sides, as well as institutions with close ties to the city, such as energy suppliers.

We offer technical and economic expert support and have many years of experience in advising politicians on urban energy issues and in supporting implementation processes, which is just as important as technical know-how. Together, that is a very attractive mix. We also have a wide range of tasks, from programme support and the development, support and monitoring of implementation projects to cooperation and networking with stakeholders. Currently, we are, for example, supporting the city in developing SEP2 and energy concepts for urban development areas, and providing energy efficiency consulting for departments of the City Administration as part of the PUMA programme.

MATTHIAS WATZAK-HELMER: *What successes have you had?*

WALTRAUD SCHMID: A nice project we had right at the start was supporting Municipal Department 9, the Vienna City Library at City Hall, with modernising its lighting. We found a solution with many advantages, which is often the case when you improve energy efficiency: It not only saves energy, it also improved the quality of lighting, is better for the books, and gives the library a modern touch.

We were also able to win a call for the klima:aktiv programme "renewable heating" together with other regional and local energy agencies, setting the focus on urban environments for the first time, which have a different profile when it comes to using renewables. The Energy Center also looks at projects elsewhere in order to bring interesting developments to Vienna, and shares successful projects from Vienna with other cities. An example of this is the EU project URBAN LEARNING, which the Energy Center submitted successfully. This programme addresses the topical issue of integrating energy aspects into urban and district planning, which we are looking at in the strategic concept on energy spatial planning in STEP2025. Many cities were interested in the topic and so we formed an attractive cooperation with the cities of Amsterdam & Zaanstad, Berlin, Paris, Stockholm, Warsaw and Zagreb, managed by Vienna.

KRISTINA GRGIC: *How does the work of the Energy Center benefit the city?*

WALTRAUD SCHMID: The city gains additional capacity and expert knowledge as well as increased flexibility. We are able to address issues more in depth and cooperate closer in networks than departments of the City Administration can. A lot of our work is intersectional and consists of bringing together different actors to allow them to create networks – from the city, energy suppliers, research, business. This is something organisations often do not have the time for in their daily work, but which can create enormous benefits with very few resources. This is easier when you can understand both sides and aren't directly part of the City Administration.

We are also more flexible when it comes to project participation. Vienna has decided to bring more EU funds to Vienna, and the Energy Center supports the City Administration in this objective. The most recent example is our support for the Administrative Group for Housing in submitting a large Smart City project to Horizon 2020, which is also a nice example of active cooperation between several administrative groups.

HERBERT RITTER: From our perspective, we can say that the Energy Center is off to a good start. We wanted to start with a lot of experience and expert knowledge, and this strategy worked. We didn't want to create an extension of MA 20, but a centre of excellence for the entire City Administration. Therefore, we are very happy to see that other departments and administrative groups appreciate and use the knowledge of the Energy Center.

3. MILESTONES ON THE ROAD TO A SUSTAINABLE ENERGY FUTURE

Period 1 July 2014 – 30 June 2015

FEDERAL ENERGY EFFICIENCY ACT IS ADOPTED

With the adoption of the Federal Energy Efficiency Act in July 2014, Vienna gained support for the implementation of the city's ambitious energy goals. The objective is to stop the increase in final energy consumption in Austria despite economic and population growth and reduce it from 1,100 to1,050 petajoule by 2020. Approximately half of the reduction will come from federal strategic measures and the rest from measures of energy suppliers.

Energy suppliers must verify annual energy efficiency measures equal to 0.6% of the energy sales of the previous year to the monitoring body. The objectives of the Energy Efficiency Act are not only environmental and economic, but also social. 40% of energy efficiency measures will benefit private households to combat the phenomenon of "energy poverty"; measures that lead to improvements for low-income households are weighted more heavily.

Now that the Act has been passed and the monitoring body installed, it is important to create workable and transparent conditions for a rapid and true (rather than virtual) implementation of energy-saving measures at both the federal and the Viennese level. Vienna's particular interest is in the implementation of the necessary energy measures within its territory so that the region can also benefit economically from the environmental and social improvements. With regard to the implementation of the Energy Efficiency Act, the City of Vienna aims to support energy generation with highly efficient cogeneration plants. The "Viennese way" of cogeneration of electricity and district heating in CHP plants has given Vienna a comparatively "clean" and climate-friendly energy supply structure. This must be secured for the future, but it also has to be improved and developed to become even more efficient and increase the use of renewables. The Energy Efficiency Act will help in achieving this goal.

STRATEGIC CONCEPT ON HIGH-RISE BUILDINGS

Vienna has over 250 high-rise buildings, from Ringturm and the Herrengasse high-rise in the city centre to the Millennium Tower near the Danube. Over the last years, a new strategic concept on high-rise buildings was developed based on a 1991 high-rise study and 2001 urban development directives and adopted by the City Council.

Its aim is to allow a more detailed assessment of high-rise projects and improve civic participation and the quality assurance process. With regard to energy matters, it is particularly interesting to note that high-rise projects will also have to present an energy concept, which has to follow the energy standards set by the City Administration, just like energy concepts developed for urban development areas under STEP 2025. These standards include a high total energy performance, the use of renewables and energy-efficient heat generation. This makes it possible to place more emphasis on the energy and climate goals of Smart City Vienna, i.e. the aspects of energy efficiency and the integration of waste heat and local renewable energy sources.

URBAN MOBILITY PLAN VIENNA

The strategic concept for mobility lays the foundations for coping with the city's population growth and making Vienna's traffic and transportation system even greener.

It expands on the goals of the urban development plan STEP 2025 and provides a detailed roadmap for sustainable mobility in Vienna. Over the next decade, 50 bundles of measures will be implemented to reach ambitious goals such as green mobility (more walking, more cycling, more public transport), respect for other road users, and a 20 percent energy reduction in the traffic and transport sector.

CITIZENS' POWER PLANTS ON THE RISE

For the last three years, the city-owned energy supplier Wien Energie has been giving citizens the chance to participate in the expansion of photovoltaics. The demand is considerable and shows that civic participation in renewable energy projects is a successful concept. So far, 19 citizens' solar power plants with a total of 25,000 solar panels have been built. 5,500 individuals have participated in these projects, investing over EUR 20 million. Now, wind power has been added to the mix. On 1 June 2015, interested citizens could register for participation in the Pottendorf/Tattendorf wind park and reserve shares. It was sold out in just 7 minutes.

VIENNA – FERTILE GROUND FOR "LIGHTHOUSE PROJECTS"

There are a number of innovative and highly energy efficient buildings in Vienna that use renewables, and the city supports the implementation of such projects. With Austrian know-how, Vienna is building and refurbishing international best practice examples.

TU VIENNA OPENS AUSTRIA'S FIRST ENERGY-PLUS HIGH-RISE OFFICE BUILDING

The refurbished office building of the Vienna University of Technology (TU Wien), which was inaugurated in November 2014, is Austria's first high-rise office building that aims to feed more energy into the grid than it consumes for building services and operation. With this project, TU Wien shows that energy-plus standards can also be met in extremely complex projects. Over a period of two years, the former chemistry building of TU Wien was refurbished from the ground up. The result is a "house of the future" – Austria's first energy-plus high-rise office building.

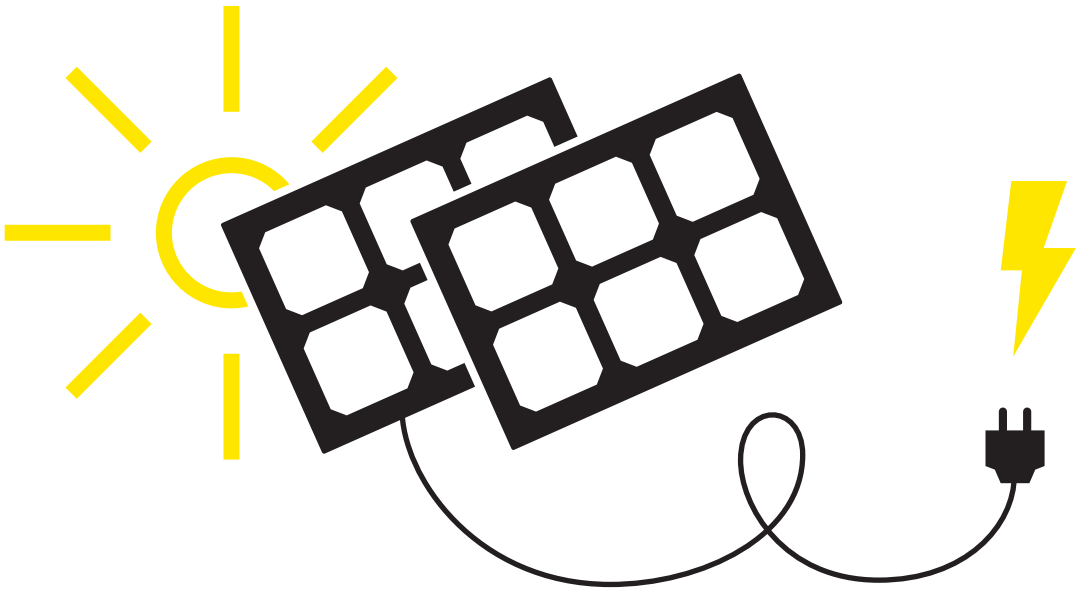
In the annual average, the house generates the entire energy used in the eleven-storey building. The façade, which has been optimised for insulation, shading and lighting, incorporates Austria's largest façade-integrated PV system. The house also uses innovative technologies to reduce its original energy consumption by up to 93%. The house adapts automatically to environmental conditions but does not remove freedom of choice from the people who work there: it is still possible to regulate the temperature, lighting and blinds, and to open the windows.

The findings from the research project now serve as a standard for future projects of TU Wien and are already being implemented in all of the university's buildings, e.g. by using more efficient computers and shutting down technical equipment overnight.

THE WORLD'S FIRST 24-STOREY WOODEN HIGH-RISE IN ASPERN, VIENNA'S URBAN LAKESIDE

In spring 2015, the decision was made to build the world's first 24-storey wooden high-rise building in Vienna. Construction on the innovative 84-metre building will start in autumn 2015 in Aspern – Vienna's Urban Lakeside. Existing timber-hybrid construction technologies were re-developed for the project. Thanks to innovative wood technology, approx. 75% of the building will be wood from the ground floor up.

It will be constructed according to the criteria of the new TBQ (total quality building) assessment system of the Austrian Sustainable Building Council. With this tool, the quality of the building will be documented and certified from planning to construction to use. The energy concept developed for the building includes energy supply measures and measures for the prevention of energy loss. They include elevators with energy recovery technology, PV systems, air/water collectors, foundation absorbers, and a decentralised ventilation system with air conditioning. The use of approx. 3,600 cubic metres of timber as construction material saves primary energy. Wood requires 60% less primary energy than reinforced concrete and binds emissions.



4. MUNICIPAL DEPARTMENT 20 – ENERGY PLANNING: SHAPING VIENNA'S ENERGY FUTURE

Between 1 July 2014 and 30 June 2015, the following projects and measures were implemented or continued:

4.1. Energy efficiency

PUMA CONSULTING FOR THE CITY'S DEPARTMENTS

A new service was established to improve energy efficiency in the City Administration and identify potential savings: The Energy Center Wien (ECW) offers consulting for departments and offices of the Vienna City Administration in energy matters. For example, it advised Municipal Department 9 (Vienna City Library) with regard to the lighting in the historical Adolf Loos apartment and the library at City Hall. The centre of excellence developed a modernisation concept for the Adolf Loos apartment. It calculated that the approx. 100 light points will save some EUR 33,000 over their life cycle (saving approx. 8 MWh electricity and 1.8 t CO_2 annually).

Initial consultations were also held for Municipal Department 49 – Forestry Office and Urban Agriculture, as well as the Hetzendorf Fashion School and the Vienna Main Library, which belong to Municipal Department 13. The centre also offered energy consulting for all Municipal District Offices in 2014 and 2015. The District Offices receive a final report with a list of potential savings, special recommendations, and the calculated break-even points for measures that require investments. So far, energy consulting has been provided for the Municipal District Offices of the 4th & 5th, 9th, 11th, 13th, 17th, 18th and 20th districts.

ENERGY LITERACY CERTIFICATE FOR APPRENTICES AT THE CITY ADMINISTRATION

Saving energy not only saves money but is also an active contribution to climate protection. With the energy literacy certificate "Energieführerschein", young people learn to be energy-aware, save energy and address environmental and climate protection issues. The energy literacy course was launched by Municipal Departments 20 and 22 in cooperation with environmental consultancy "die umweltberatung". They defined learning targets such as basic energy knowledge and the ability to identify and implement energy saving measures through behavioural changes, and developed a standardised multiple-choice test that can be taken online. After successfully completing the test, the participants receive a certificate that is an additional professional qualification and can, e.g., supplement their CV. Several people within the City Administration have been trained as energy coaches, who are qualified to prepare apprentices for the energy literacy certificate.

The first apprentices of the City Administration participated in October 2014 and more are being trained continuously. With this initiative, the City Administration once again shows by example how concrete measures can be implemented to save resources.

ENERGY EFFICIENT BUILDINGS

Buildings are responsible for over a third of total energy consumption with heating, hot water, lighting and electrical appliances. In the interest of sustainable energy supply, MA 20 is particularly committed to making buildings and their use as efficient as possible and maximising the use of energy from renewable sources. MA 20 has commissioned a number of studies to determine the biggest savings potentials in the development and operation of buildings. For example, it examines which heating systems are the most cost-effective in the long term and what kinds of distribution systems should be prioritised in residential buildings. It also investigated what the biggest energy consumers are in office buildings and what generates the most costs in building development.

PILOT PROJECT TO COMBAT ENERGY POVERTY

In the past three years, Vienna has been very successfully implementing the pilot project NEVK ("Sustainable energy supply for low-income households through energy consulting and measures for increasing energy efficiency and energy savings based on networking and cooperation"). The NEVK project was managed by Wien Energie GmbH and carried out together with environmental consultancy "die umweltberatung". MA 20 was involved in initiating the pilot project and supported it on behalf of the City of Vienna.

The core of the NEVK project was to provide 500 free on-site consultations for low-income households and to implement over 900 tailored energy saving measures, ranging from exchanging lamps and appliances for more efficient ones to the installation of thermostat valves and the maintenance or exchange of gas boilers. These measures answered many energy-related questions and provided concrete improvements to the lives of economically disadvantaged people.

The project was supported financially by the Green Energy Fund Vienna and the Federal Ministry of Labour, Social Affairs and Consumer Protection (BMASK). Thanks to the positive experience of the NEVK project, the approach (on-site energy consultations combined with the implementation of tailored energy measures) has become a permanent part of Vienna's energy support scheme. The energy support team at Municipal Department 40 - Social Welfare, Social and Public Health Law coordinates the efforts and is in charge of managing requests, supporting the clients in implementing the recommended measures, and providing follow-up counselling. The consultations are provided by environmental consultancy "die umweltberatung" like in the NEVK project.

SEP – A PROGRAMME FOR MORE ENERGY EFFICIENCY IN THE CITY

For 10 years, the Urban Energy Efficiency Programme (SEP) was a crucial part of the city's efforts for more energy efficiency. With its numerous measures, the successful programme not only saved several gigawatt hours of energy, it brought energy efficiency into the public awareness. The programme runs out at the end of 2015, and will be succeeded by a new strategy. The follow-up programme is being developed in coordination with existing strategies and programmes (e.g. the Smart City Vienna Framework Strategy, the Climate

Protection Programme, etc.) and will be heavily implementation-oriented. It will focus on core energy-consuming areas and prioritise key activities. It will also implement measures of the Austrian Energy Efficiency Act. The new Urban Energy Efficiency Programme (SEP2) will be presented by the end of 2015 and provide a long-term framework for consumer-side energy policy in Vienna until 2030.

4.2. Renewable energy

NEW FUNDING PRIORITIES

To reach the energy objectives of the Smart City Wien Framework Strategy, Vienna is pushing the expansion of solar energy. The subsidy for PV systems from the Green Energy Fund is still being offered as previously, and between 1 June and 31 December 2015, it will be complemented by a pilot subsidy for electrical storage and PVT systems, i.e. hybrid systems that generate electricity and heat with the same panel.

Hybrid collectors utilise the area available for the generation of renewable energy in urban areas twice as effectively, combining the functionalities of solar thermal collectors and solar photovoltaics in a single panel, where previously this required two separate systems. A beneficial side effect is that the removal of the heat increases the efficiency of the PV system.

Electrical storage systems also have many benefits. They store the electricity produced by the PV system for use during times when the sun is not shining. This increases the amount of autonomously generated electricity, and users need to buy less energy from the grid. For grid operators, sunny days are a challenge, because a lot of energy is fed into the grid. Electrical storage systems can help reduce the load at peak times.

SOLAR ENERGY – CLEAN AND ATTRACTIVE

Solar power systems not only produce clean zero-emission energy, they can also be used as an architectural design element. In order to promote the use of solar energy in Vienna, a guide was developed in cooperation with Municipal Departments 19 (Architecture and Urban Design) and 22 (Environmental Protection). The Chamber of Architects and Chartered Engineering Consultants for Vienna, Lower Austria and Burgenland was also involved in its development.

The guide presents the different solar technologies and explains the individual components of solar thermal and PV systems in simple terms. Design guidelines show which systems are possible in which settings. Pictures of good examples of solar thermal and PV systems show how they can become an integral part of architecture in existing and new buildings.

It also highlights the many advantages of combining solar energy with façade and roof greening measures. The guide also includes information on possible subsidies and approval procedures for solar energy systems and building greening.

FIRST SOLAR POWER SYSTEM ON A BRIDGE IN VIENNA

Vienna has approximately 2,200 hours of sunshine a year, which can be used to generate electricity with the help of PV systems or heating with solar thermal plants. Every new solar power system is one step towards a sustainable energy future.

The footbridge Judith-Deutsch-Steg in the 20th district, which was built in summer 2015 to connect Handelskai with the recreation area on the Danube bank, is outfitted with a solar flower that generates green energy from sunlight. When the sun rises in the morning, the solar flower opens automatically, orients its 18 square metre solar module petals towards the sun and starts generating energy. The petals turn to follow the sun over the course of the day, allowing the optimum utilisation of the available sunlight. The project was initiated by MA 20 and is operated by Wien Energie GmbH, which is the owner. The generated electricity is fed into the grid. The 2.3 kW capacity system shows that renewables are on the rise in Vienna. Signs on the flower inform passers-by about the use of solar energy.

GREAT GEOTHERMAL POTENTIAL IN VIENNA

The Vienna region has particularly good conditions for the use of groundwater and near-surface ground heat for energy purposes. A pilot study surveyed the geothermal energy potential in Vienna for the first time.

Approximately a third of Vienna's area is well suited for the use of near-surface geothermal energy and groundwater for energy purposes. The thermal use of groundwater is particularly promising in the rapidly growing districts of Floridsdorf and Donaustadt on the northeastern bank of the Danube.

A pilot study commissioned by MA 20 and conducted by the Geological Survey of Austria is a comprehensive survey and assessment of the potential for energy use of near-surface ground heat in the city area.

This knowledge can be used to inform concrete measures for ensuring a sustainable energy supply. The data collected are particularly useful for the city's urban development areas. The results will facilitate the planning and construction of new plants for the optimum use of open and closed loop systems.

FIRST INTERNATIONAL CONFERENCE ON SMALL WIND TURBINES IN VIENNA

Compared to other technologies, small wind turbines are only beginning to emerge. Therefore, it is important to continue to develop this technology to ensure safe and cost-effective energy production. The first Conference on Small Wind Turbines in Austria in April 2015 attracted a large number of participants interested in this next phase of the energy transition. The potential of small wind turbines is still being underestimated. The goal of the conference with several international speakers was to create awareness for a renewable technology whose potential is not yet being sufficiently exploited. In the city, in particular, small wind turbines are one of the few ways of producing renewable electricity, in addition to photovoltaics.

Municipal Department 20 – Energy Planning, the Austrian Wind Energy Association IG Windkraft and the University of Applied Sciences Technikum Wien organised the Small Wind Turbine conference with the support of the Federal Ministry of Transport, Innovation and Technology (BMVIT) to satisfy the great interest in this technology. In addition to representatives of the small wind turbine sector from Denmark, China, Spain and Great Britain, Austrian institutes presented interesting facts on small wind turbines. The wide spectrum shows that small wind turbines have a lot of international support.

POWER-TO-GAS FEASIBILITY STUDY

In the long term, regenerative energy sources offer high supply security at low cost. Particularly when whole urban expansion areas are being developed, sustainable energy systems can be incorporated from the beginning. The starting point for this feasibility study, which was commissioned by OMV, MA 20, Wien Energie and Wien 3420 AG, is the proposition that under certain circumstances, the heating of a district or neighbourhood with locally produced gas from renewable electricity can already be economically and ecologically feasible today. The power grid cannot store electricity. This is where the classic power-to-gas model comes into play, which converts electricity from wind and solar energy to hydrogen via electrolysis. This hydrogen is then fed into the gas grid, where it is transported, stored and used to generate heat or electricity when needed. The study focused on a concrete urban development project for 20,000 residents and 20,000 jobs in Vienna: Aspern – Vienna's Urban Lakeside.

The study shows that under certain conditions and assumptions, a local gas grid with 60 vol.% hydrogen is technically and economically feasible – a new green urban gas network. The operation of 10 MW electrolysis ensures a constant 60 vol.% hydrogen for this local grid, with a peak load of 85% in winter and an average annual load of 50%.

4.3. Spatial energy planning

DEVELOPMENT OF LOCAL ENERGY SPATIAL PLANNING SUPPORT

Energy spatial planning is particularly needed in districts where new projects are being developed and implemented or existing buildings refurbished. Municipal Department 20 – Energy Planning cooperated closely with Municipal Department 21 – District Planning and Land Use to support construction companies and developers in energy supply matters. An energy-efficient building envelope is one thing, but what energy sources are available on site? If no district heating is available, ground heat, groundwater, solar energy etc. can be used. Neighbouring systems can be combined, e.g. by supplying each other with energy from waste heat. To ensure that such efforts are coordinated and not wasteful, innovative energy concepts must be developed and studies conducted for the development areas.

An energy spatial planning team was set up within MA 20 to support such processes. It provides contact persons for the three planning groups of MA 21 for northern, western and southern Vienna.

URBAN LEARNING PROJECT

Vienna, Berlin, Stockholm, Amsterdam/Zaanstad, Paris, Warsaw and Zagreb are all rapidly growing cities with ambitious energy and climate protection goals. In the EU research project Urban Learning (Horizon 2020), these European cities are cooperating in the issue of governance of spatial energy planning. The Energy Center Wien coordinates the project. The participating cities have bilateral contacts but want to deepen them in the context of this project. This cooperation helps reinforce the position of some of the partner cities in the area of Smart Cities.

One of the goals of the urban development plan (STEP 2025) is the development of spatial energy planning for the City of Vienna. This process will be supported by the strategic concept on spatial energy planning. The Urban Learning research project adds a comprehensive international dimension to the strategic concept that increases its quality and innovation enormously.

Structured cooperation and a dialogue process for developing a common base for these efforts will be an important result of this project that will benefit the City of Vienna immensely. This is happening within the City Administration but also between the city and important players (e.g. energy suppliers, property developers, etc.).

STUDY ON ENERGY SUPPLY OPTIONS FOR DONAUFELD

The objective of the study "Energy supply options for the Donaufeld urban development area" is the development of potential technical solutions for energy supply that take into account local renewable energy sources. The study analyses concrete energy supply systems, evaluates them according to energy management, economic and ecological criteria, and formulates contributions for housing development competitions.

Additionally, this project will also serve as the basis for the development of a more general method that can also be applied to other urban development areas as a spatial energy planning tool.

PROGRESS REPORTS ON SPATIAL ASPECTS

According to STEP 2025, planning processes for spatial structures will be complemented with spatial energy planning. Due to the number and complexity of the issues involved in this matter, it was decided to develop several reports as preparation for the strategic concept to allow everyone involved or interested in the matter to reach the same level of knowledge.

Structuring data spatially makes it easy to see connections and developments that are not made as visible by other methods. Maps are also useful for communication with stakeholders and the public as well as for the joint development of tools for the planning of urban development areas. A selection of international examples from cities comparable to Vienna will demonstrate the approach to the topic of energy (particularly spatialisation).

All available data are being collected and analysed to show energy data for Vienna spatially in more detail. These maps as well as explanations and interpretations will be combined into a report with the working title "Energy spatial structures".

ENERGY DATA – A HIDDEN TREASURE

The Vienna City Administration is rich in energy-relevant data. However, so far there was no complete overview of which data are available, which department manages them, and their quality. As a result, data are often collected multiple times or not used as well as they could. To remedy this, Municipal Department 20 – Energy Planning created the "Working Group on Energy Data". Its objective is to structure all the energy data available in the City Administration and make it available to all departments. This will avoid duplications in future.

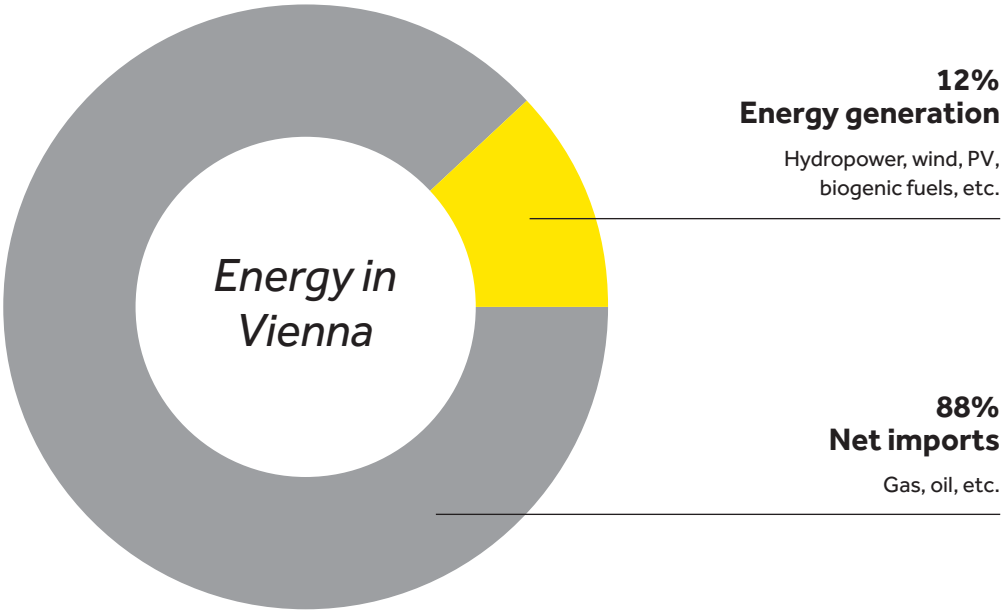
The aim is to develop a strategy for the entire City Administration that regulates the treatment of energy data and ensures that the level is the same in all departments. Several offices and departments from different Administrative Groups are involved in the process. Together, they are developing a uniform approach for the gathering, analysis and publication of energy-relevant data, taking legal aspects into account as well.

In autumn 2014, a workshop on energy data was held where an overview of the energy-relevant data available in the City Administration was made. Based on the workshop, the Working Group on Energy Data was founded, which had its first meeting in May. In autumn 2015, energy data sets will be made public via the Open Government Data portal of the City of Vienna.

5. Energy – From generation to use

5.1. An overview of the main concepts

Energy comes in many different forms. Not all energy sources can be used directly. Often, several steps are necessary to make energy useable. This section provides an overview of the steps from energy source to energy use and explains the concepts used in the energy flow chart.



Primary energy → *... is the **energy form or energy source in its initial state.** This may be a fuel (e.g. coal, wood, natural gas, crude oil) or energy from the sun, wind or ambient heat. Primary energy can usually only be used after conversion into another form of energy.*

Secondary energy → *... is the energy that is the **result of the conversion of primary energy**: This may be wood pellets, diesel fuel or electric energy.*

Gross inland energy consumption (GIEC) → *... is the **energy available in the city.** It is the difference between imported and exported energy (net imports) and the energy generated in the city itself.*

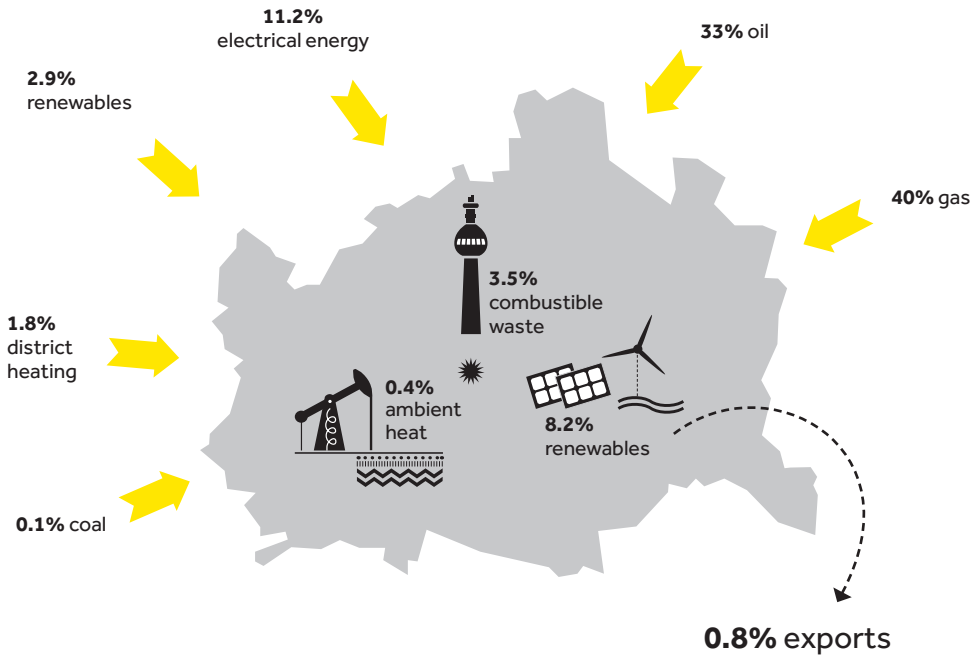
Gross final energy consumption → *... is the **energy available after conversion but before distribution to end users**. It is used to calculate the share of renewables at EU level. (cf. Directive 2009/28/EC)*

Final energy → *... is the **energy available to end users**, e.g. in the form of electricity, district heating, petrol, diesel, wood pellets or natural gas. They can use this energy directly or transform it further.*

Useful energy → *... is the **energy that is actually used** for heating, lighting, mechanical work, etc.*

Conversion losses → *... refers to the energy that is lost during the **conversion of primary energy to secondary energy**.*

Transmission losses → *... refers to the energy that is **lost in transmission from the source**, e.g. the power plant, **to the final consumer**. This includes the energy use of the energy sector, transport losses and non-energy use.*



5.2. Energy flow chart of the City of Vienna, 2013

How much energy is needed to run a whole city? What enormous energy flows move through the city and where are they used? The energy flow chart of the City of Vienna* answers these questions. It shows how much and in what form energy comes into the city or is generated there, and how it is transformed until it is finally used to provide warmth, light, mobility etc. In order to utilise primary energy sources such as natural gas, hydropower, wood or crude oil, power plants and refineries convert them into commercial final energy sources such as district heating, electricity, petrol, wood pellets etc.

The energy flow chart shows a simplified version of the most important flows as well as the energy losses between the individual conversion steps.

Natural gas is clearly the dominant energy source at 40 percent of the gross inland energy consumption of Vienna. More than half of it is converted into electricity and district heating using various processes.

In second place are fuels at 31 percent. The category of fuels includes diesel, petrol, and small amounts of other petroleum products.

The energy flow chart also shows the conversion losses, which amount to over 20,000 GWh or approx. 47% of gross inland energy consumption. These losses and the energy sector's consumption occur during different phases of the energy flows: conversion losses (2,329 GWh), consumption of the energy sector (365 GWh), transport losses (1,258 GWh), non-energy use (29 GWh) and losses in end-user consumption (16,126 GWh).

* *This energy flow chart lists waste suited for incineration and coal as solid energy sources. This is only done in the energy flow chart. In the chapter on energy generation, waste suited for incineration is shown separately. In other calculations, waste suited for incineration is partially considered to belong to the renewable energy sources.*

Energy flow chart of the City of Vienna 2013, based on the useful energy analysis 2013, as at December 2013 *Source: EFB*

Energy flow chart for Vienna 2013

100% = **43,073 GWh** = Gross inland energy consumption of the City of Vienna

Natural gas	Electric energy	District heating	Liquid energy sources	Renewable energy sources	Solid energy sources	Fuels
17,250 GWh	4,812 GWh	632 GWh	1,040 GWh	4,612 GWh	1,559 GWh	13,167 GWh
40%	**11%**	**1%**	**2%**	**11%**	**4%**	**31%**

-5.4%
Conversion losses

CONVERSION

-3.8%
Energy sector consumption, non-energy use 1,652 GWh

90.8% =
Final energy use by energy source 39,092 GWh

39,092 GWh = Final energy use by energy source

Natural gas	Electric energy	District heating	Liquid energy sources	Renewable energy sources	Solid energy sources	Fuels
8,211 GWh	8,300 GWh	6,558 GWh	881 GWh	1,927 GWh	49 GWh	13,166 GWh
21%	**21%**	**17%**	**2%**	**5%**	**0%**	**34%**

Energy unit:
10^6 kWh = 1 GWh
1 GWh = 3.6 TJ
3.6 TJ = 3.6 × 10^{12} J (Joule)

90.8%
Final energy use by sector 39,092 GWh

Private households	Productive sector, agriculture	Services	Traffic and transport
32%	**8%**	**24%**	**36%**
12,417 GWh	3,236 GWh	9,196 GWh	14,243 GWh

90.8%
Final energy use by end use 39,092 GWh

Space heating	Process heat	Power and lighting
38%	13%	49%
14,736 GWh	5,213 GWh	19,143 GWh

-37.4%
Energy losses at end users 16,126 GWh

12,127 GWh	4,096 GWh	6,743 GWh

53.3% = **22,966 GWh** = Useful energy consumption Vienna 2013

For the illustrations below, the figures from the energy flow chart were used and gigawatt hours were converted into PV surface area.

Energy consumption in 2013 and development until 2050

Shown in total PV area

2013

Population = 1,741,246

Final energy use
total = 39,092 GWh

254 km² PV area

2050

Population projected by Statistics Austria = 2,149,178

Final energy use at **same per capita use as 2013*** = 48,250 GWh

314 km² PV area

Planned final energy use = 31,000 GWh

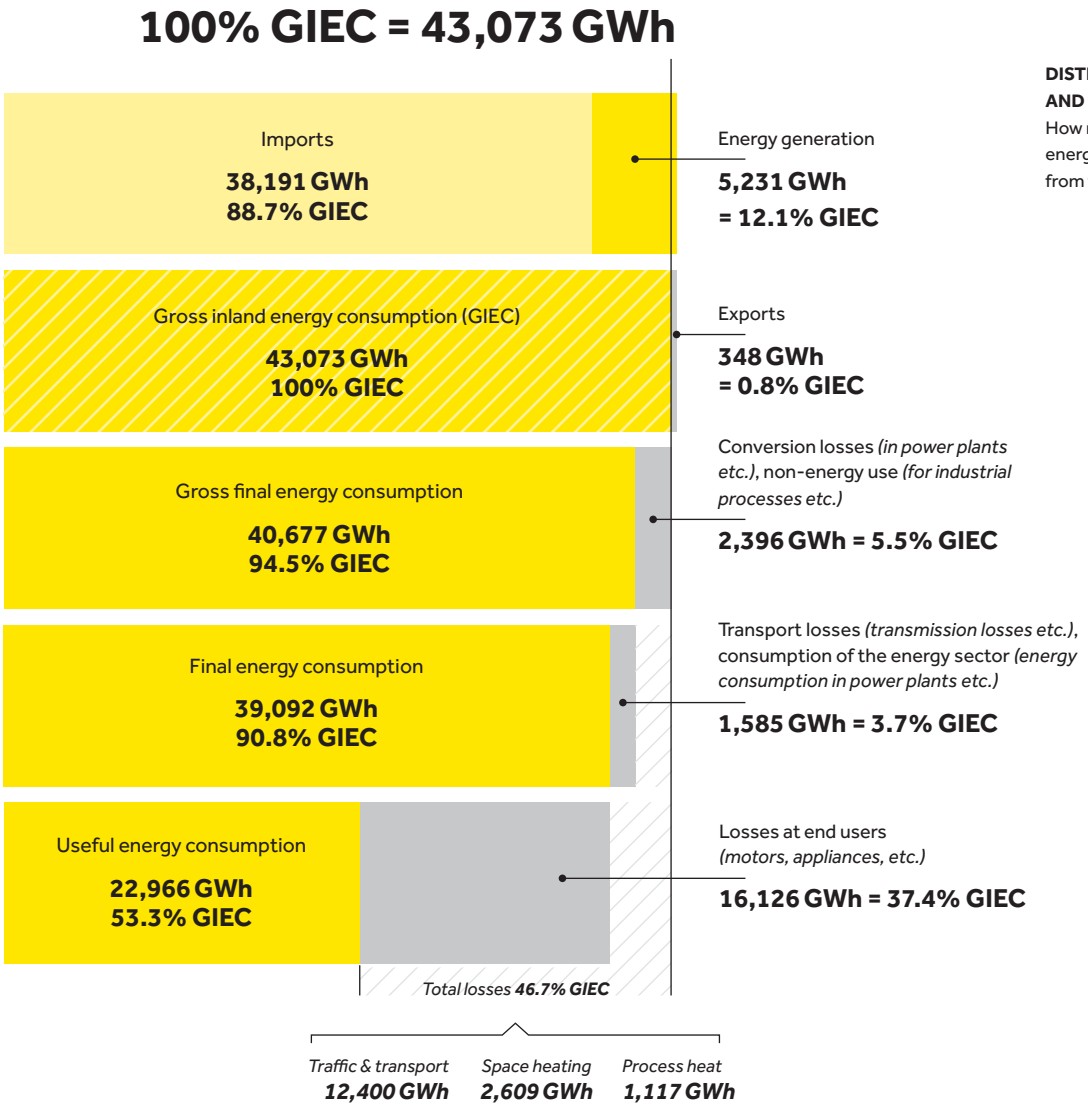
202 km² PV area

Resulting final energy savings if **goals are met** = 17,250 GWh

112 km² PV area

** Development until 2050 based on the objectives of the Smart City Wien Framework Strategy*

5.3. Energy use – an outlook



DISTRIBUTION AND LOSSES TODAY
How much useful energy remains from the GIEC

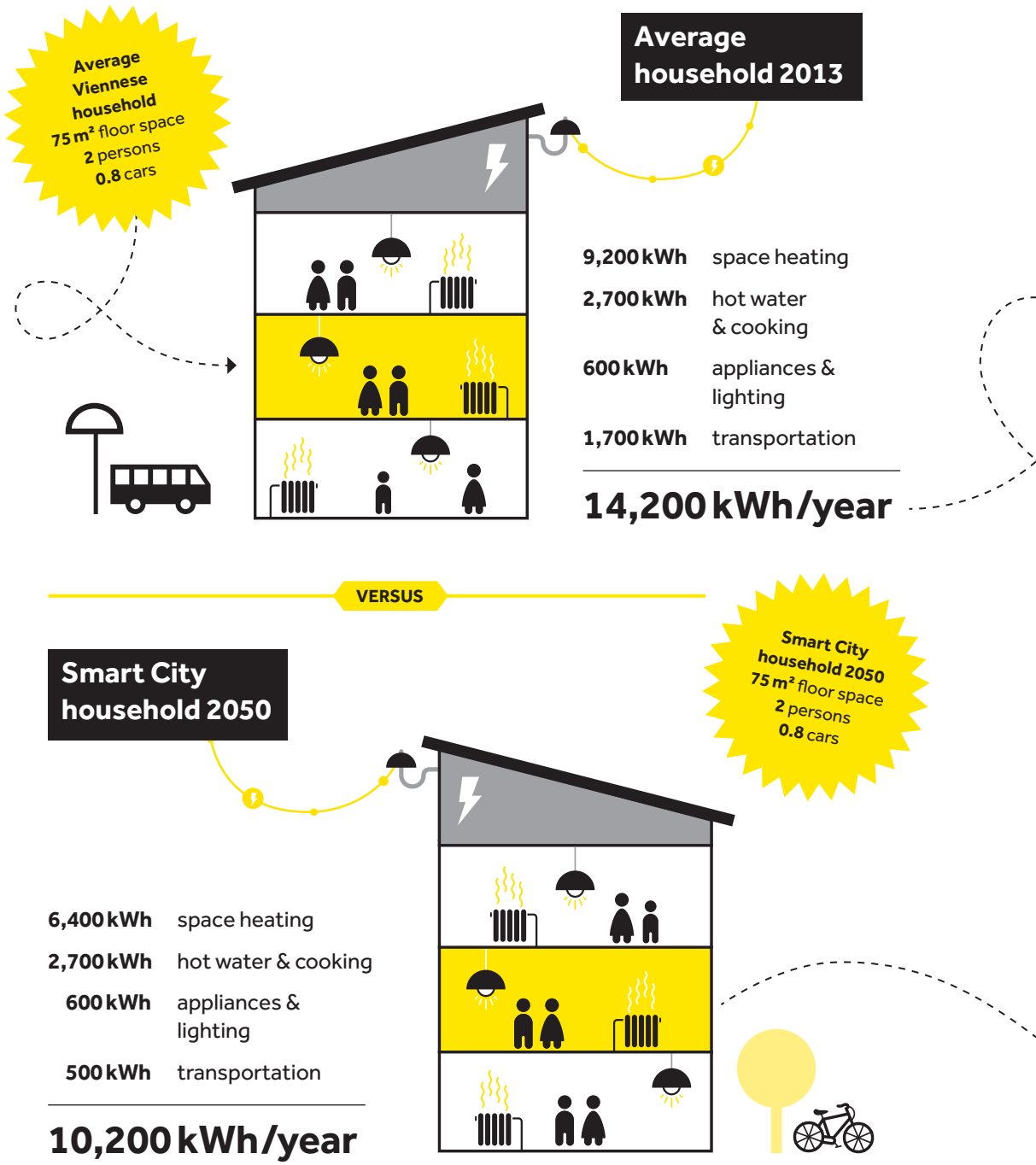
In keeping with the idea that wasting fossil energy is the past and efficient use of renewables is the future, we present the objectives of the Smart City Framework Strategy in terms of an average Viennese household. The "Smart City household" for 2050 shows one of several possible ways in which the available energy can be used. The use of photovoltaic surface area[1] as a unit of measurement illustrates the space needed to provide 100 percent sustainable energy for one household.

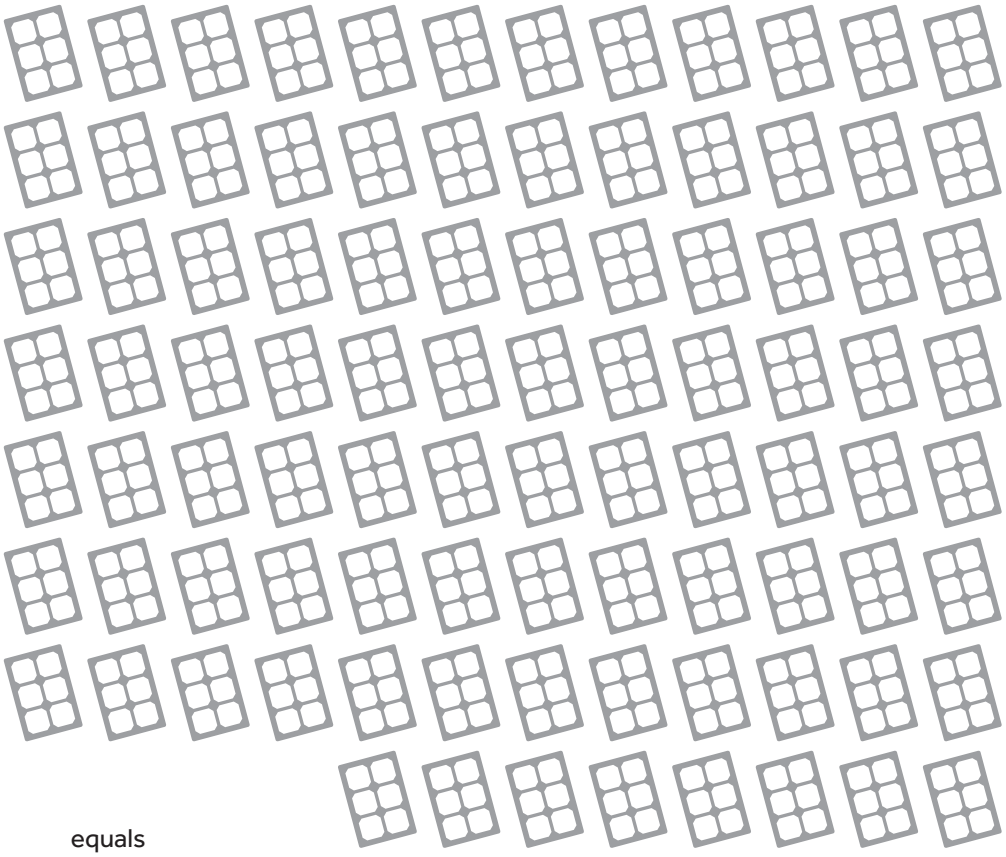
The objective of the Smart City Framework Strategy to reduce primary energy use per capita from approx. 3,000 to 2,000 Watt can be achieved without having to compromise on comfort. This can be done by reducing losses, e.g. through insulation of buildings, the use of electromobility or highly efficient appliances. The illustrated example assumes increased efficiency in buildings and transportation.

1 1,000 kWh = 6.5 m² PV area

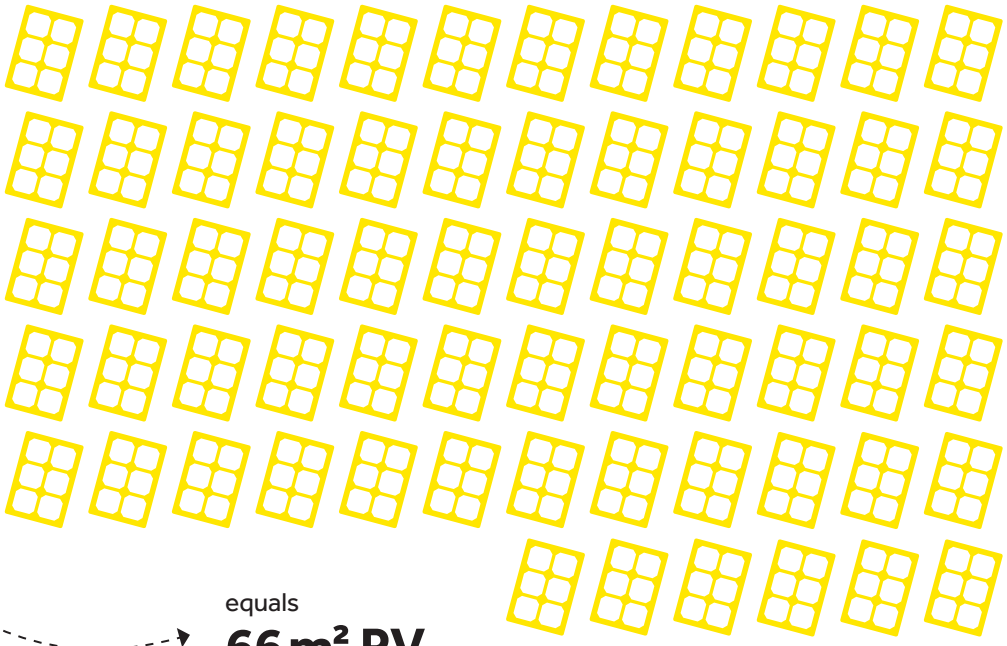
The energy consumption required for the heating and cooling of housing in Vienna will be reduced by 2050 by refurbishing existing buildings and constructing highly efficient new buildings. Savings in traffic and transport will be achieved through an increase in green mobility (public transport, cycling, walking) on the one hand and the use of more efficient vehicle technologies (e.g. electric cars) on the other.

COMPARISON
Final energy use in a Viennese household in 2013 and a Smart City household in 2050





equals
92 m² PV



equals
66 m² PV

Energy consumption in Vienna in 2013 and development until 2050

Shown as PV area per capita

Renewable energy sources **per capita 2013**

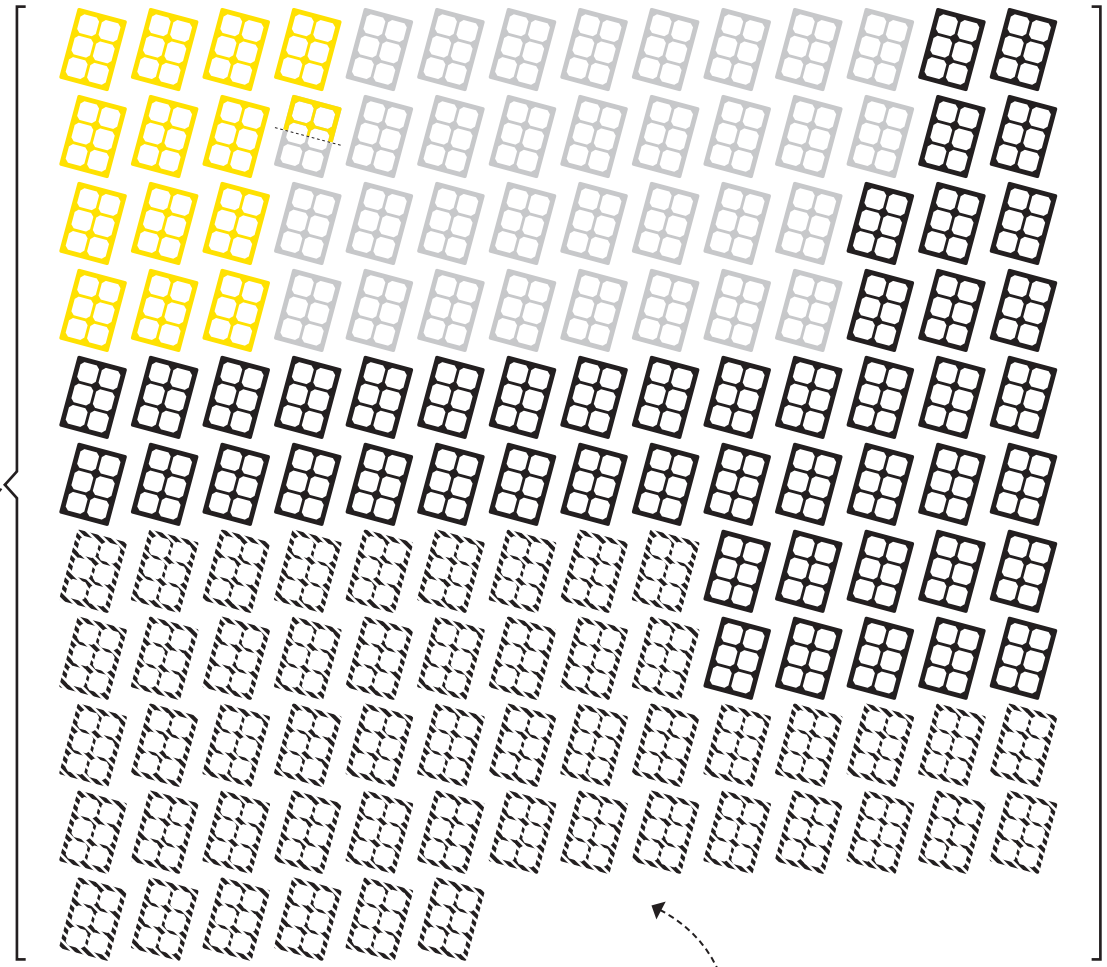
14.5 m² PV area

Increase **per capita by 2050**

32.5 m² PV area

Renewable energy sources **per capita 2050** (total)

47 m² PV area



**Development until 2050 based on the objectives of the Smart City Wien Framework Strategy*

Final energy consumption **per capita 2013** (total)

146 m² PV area

Efficiency increase **per capita by 2050**

- 52 m² PV area

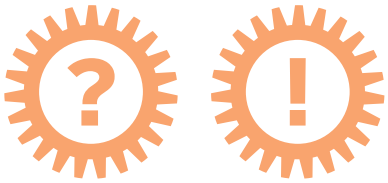
Final energy consumption (50% from renewable sources) **per capita 2050***

94 m² PV area

5.4. The main findings at a glance

The development of energy consumption and the associated greenhouse gas emissions are important issues for the City of Vienna. With the Climate Protection Programme (KliP1 and KliP2), the Urban Energy Efficiency Programme (SEP) and the Smart City Framework Strategy, the city has been demonstrating its increasing commitment to sustainable energy use and supply and climate protection for over 15 years.

The objective of this report is to document and evaluate the historical developments and status quo of energy use in Vienna for heating, electricity and mobility from 1995 to 2013. The main findings of the analysis of that period are the following:



ENERGY GENERATION

- Gross inland energy consumption increased from 38 TWh in 1995 to 47 TWh in 2005, but has since been reduced to 43 TWh in 2013. 280 km² of PV surface area would be needed to cover the energy consumption for 2013.
- In 2013, 5.2 TWh of energy were produced in Vienna, which corresponds to 34 km² PV area, 21 km² more than in 1995. 248 km² PV area, or 38 TWh, were imported in 2013, 14 km² less than in 1995.
- The main energy sources for Vienna's gross energy consumption are still fossil sources: Natural gas accounts for 40 percent, followed by petroleum products at 31 percent. The share of both energy sources has been sinking since 1995, the imported amount has remained approximately the same.
- Total final energy consumption increased from 208 km² PV area (32 TWh) in 1995 to 254 km² (39 TWh) in 2013 (maximum: 260 km² PV area in 2010); however, it has been largely stagnating since 2002.
- Final energy consumption per capita increased from 136 m² PV area (21 MWh) in 1995 to 160 m² PV area (24.5 MWh) in 2003, the highest rate so far. Since 2003, consumption has been falling, and was approx. 7% over the 1995 levels in 2013 at 146 m² PV area (22.5 MWh).
- The traffic and transport sector has the highest final energy consumption at 93 km² PV area, followed by private households at 80 km² PV area and the services sector at approx. 60 km² PV area.
- Between 1995 and 2013, energy consumption increased most in the transport sector (+48 percent), followed by services (+18 percent) and private households (+15 percent), while energy consumption in industry fell

- 130 km² PV area would be needed to meet Vienna's heating demand in 2013, 7 percent more than in 1995. Of the total heating energy consumption, space heating requires 96 km² PV area, cooking and hot water 26 km² PV area, and the rest is accounted for by steam and industrial ovens.

- 54 km² PV area would be needed to cover Vienna's electricity consumption in 2013. That is 11 km² more than in 1995, but consumption has been largely stagnating since 2006.

- Useful energy consumption in Vienna has increased by 21 km² PV area, or 3 TWh, to 150 km² PV area since 1995. The losses between gross inland energy consumption and useful energy are approximately 130 km² PV area, or 47 percent. The largest share of losses at 65 percent occurs in the transport sector.

MOBILITY

- Energy consumption in the transport sector increased to over 94 km² PV area (14.5 TWh) until 2005. Since 2005, it has been stagnating or sinking slowly.

- The choice of mode of transport has changed drastically since 1995. The share of trips made by car has gone down from 40 percent in 1995 to 28 percent in 2013. Instead, most trips are made by public transport.

- The share of cycle traffic has increased, doubling from 3 percent in 1995 to 6 percent in 2013.

- At 0.39 cars per person, the Viennese own less cars on average than the residents of Austria's other federal provinces and even the other provincial capitals. The number of cars per capita is sinking in most Viennese districts.

- The length of the public transport network has grown by over 10 percent since 1995. The expanded services are reflected in the strong increase in passenger numbers.

ENERGY EFFICIENCY

- Total energy consumption has remained relatively stable since 2003.

- The implementation of the measures of the Urban Energy Efficiency Programme (SEP) between 2006 and 2013 reduced energy consumption by 8.4 km² PV surface area, or 1,300 GWh.

- Losses from transformation and distribution to final consumers have been reduced from 39 km² PV area (6 TWh) in 1995 to 25 km² (4 TWh). The highest loss was registered in 1999, with approx. 46 km² PV area (7 TWh).

RENEWABLE ENERGY

- The share of renewables in gross final energy consumption nearly doubled from 2005 to a total of 10 percent in 2013. The main reasons for this are the compulsory mixing of biofuels with conventional fuels and the expansion of renewable heating supply, mainly from biomass, at final consumers and in district heating.

- In 2013, renewable energy covered 14.8 of total gross final energy consumption of electricity, 12.0 percent of district heating and 5.6 percent of gross final energy consumption in the transport sector.

- Renewable heat production has increased by 75 percent since 2005 to 1,900 GWh, mainly through increases in the use of biomass and waste wood. Its share in total heat production was increased by over 60 percent to nearly 10 percent between 2005 and 2013.

- The share of electricity from renewables has increased by 23 percent since 2005 to 15 percent in 2013. 83 percent of this is generated with hydropower, but the increase is mainly from other sources, such as biogenic fuels. The greatest percentage increase is in photovoltaics.

ENERGY PRICES

- The cost of energy has increased considerably since 2005, less for the industry than for households. The price gap between industry and households existing since 2005 has increased even more through the price developments on the liberalised energy markets.

GREENHOUSE GAS EMISSIONS

- According to a survey of air pollutants in the Austrian federal provinces, emissions in 2012, at 8.4 million tonnes of CO_2 equivalent, were only slightly above the level of 1995 (8.2 million tonnes) and far lower than in 2005 (over 10 million tonnes).

- The greenhouse gas emissions that Vienna can influence (excluding emissions trade and traffic emissions that are not emitted in Vienna) have gone down by 13 percent in total or 24 percent per capita since 1995.

NOTES

More information:

www.wien.gv.at/english/urbandevelopment/energy-planning