Energy! ahead

Energy Report of the City of Vienna

Data for 2015/ Year of reporting 2017, Municipal Department 20

Stadt Wien

SMART CITY WIEN

ABBREVIATIONS

BLI	Bundesländer Luftschadstoff Inventur – survey of air pollutants in Austria
CHP	Combined heat and power, cogeneration
emikat.at	Emissions and energy data management system of the Austrian Institute of Technology (AIT)
ETS	Emissions trading system
GHG	Greenhouse gases
GIEC	Gross inland energy consumption
KliP	Climate protection programme of the City of Vienna
kWp	kilowatt peak
MA	Municipal Department
MIT	Motorised individual traffic
Non-ETS	Non-emissions trading system
PV	Photovoltaics
SCWR	Smart City Wien Framework Strategy
SEP	Urban Energy Efficiency Programme of the City of Vienna
STEP	Urban Development Plan oft he City of Vienna

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DATA 2015

for the City of Vienna

Wien! voraus

Energieplanung

Stadt Wien

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

1.1 PREFACE

In 2015, the highest concentration of greenhouse gases in the atmosphere to date was measured. These concerning figures are an important reason to implement measures that will help us meet the objectives of the Paris Agreement as quickly and consistently as possible. All efforts in this area will benefit future generations.

With its 1.8 million inhabitants, Vienna is a strong driver for innovation at the heart of Europe. Therefore, we must pay particular attention to energy efficiency and climate-friendly mobility, increase the use of waste heat, and promote the use of renewables for energy generation. Much has been achieved in all these areas. The impact of these efforts is reflected in this energy report: For the first time, more people in Vienna own an annual public transport pass than a car. Switching from cars to public transport has a dramatic impact on CO_2 emissions, as the transportation sector is the largest producer of carbon dioxide.

The first monitoring results show that the city is on the right track towards meeting the ambitious goals of the Smart City Wien Framework Strategy. We have also developed a new Energy Framework Strategy for Vienna, which lays out a clear path towards decarbonisation. This strategy gives equal attention to the energy policy areas of energy efficiency, supply security, economic viability, use of waste heat and renewables, and social impact.

Internationally, Vienna is regarded as a pioneer and driving force, and this year it was awarded for its heat pump initiatives: At the DecarbHeat conference in Brussels on 11 and 12 May 2017, the City of Vienna was awarded the "European Heat Pump City of the Year" award. Vienna's entry, which presented the city's main initiatives for promoting heat pumps, won over projects from Trondheim and Berlin.

Numerous innovative energy projects are an impressive demonstration of how sustainable energy supply can be implemented in a forward-looking way, and make Vienna a pioneer in the use of new energy technologies and efficient construction. A new app allows users to discover the many showcase projects in our city. It provides interesting information about buildings and projects all over Vienna. It will soon be updated with many additional projects.

These are just some of the highlights you can read about in this new energy report. It contains facts and figures about the city's energy supply, energy efficiency and use, renewables, the development of energy prices, and many other topics. There is no doubt: Vienna has to stay its course towards sustainability. The coming generations will thank us for it.

Maria Vassilakou

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

HERBERT PÖSCHL
became Head of the Energy Strategy Unit in the Executive Group for the Environment and Vienna Public Utilities in August 2016. Previously, he and his team were in charge of energy management for all major facilities of Wienenergie GmbH for medium-term energy asset planning and operational management for electricity, natural gas (fuel oil), district heating and CO_2.

1.2 INTERVIEW

Interview by Herbert Ritter (Municipal Department 20)
with Bernd Vogl (Municipal Department 20) and Herbert Pöschl
(Executive Group for the Environment and Vienna Public Utilities).

HERBERT RITTER: *Last year, you developed the Energy Framework Strategy 2030 for Vienna. What does the city need an energy framework strategy for, and why was it developed now?*

HERBERT PÖSCHL: One reason for developing the energy framework strategy was that Vienna, as the largest city in Austria, has a very high energy density. That means that energy demand and consumption are extremely high compared to the city's size. The international and European objectives of the Paris climate agreement have to be reflected in Austria's strategies as well as in the strategies of each province. That is why such a strategy is essential for Vienna.

BERND VOGL: In 2014, the City of Vienna adopted the Smart City Wien Framework Strategy. In its development, many fundamental long-term energy goals for 2030 and 2050 were discussed and decided. But we also need specific strategies that set out the details of how our ambitious long-term goals can be achieved. Therefore, it was the logical next step to follow up on the Smart City Framework Strategy by tasking the energy experts with designing a strategic framework for energy in Vienna, especially with a view to what measures can help us achieve the goals. Currently, we have some great people working in energy, so they were able to present a solid, well-rounded result in a very short time.

HERBERT PÖSCHL: I have been working for the Executive Group for the Environment and Vienna Public Utilities since 1 August 2016. As a "newcomer", this was a new challenge for me and it was great to see what we were able to achieve in the short time available. We can be proud of the results.

HERBERT RITTER: *Vienna already has several strategies and programmes with a strong focus on energy, like the Smart City Wien Framework Strategy you mentioned or the climate protection programme. How is the Energy Framework Strategy embedded in the city's array of programmes and how do they link up to each other?*

BERND VOGL: Vienna developed the Urban Energy Efficiency Programme SEP in 2006, an ambitious climate protection programme in 2009, and the Smart City Wien Framework Strategy in 2014. Therefore, there did not seem to be much urgency to develop an additional energy strategy. However, the first discussions and plans for an energy strategy began in 2011 because there was a need for a holistic view of Vienna's energy system. There were also first discussions about an action plan for renewable energy in 2012. Now all of these ideas are being bundled in a comprehensive Energy Framework Strategy for Vienna.

We are not the only city to do this; the Paris Agreement and decarbonisation efforts are omnipresent. However, we are a lighthouse city that is already implementing the energy system 2.0. We have achieved what other cities are still trying to do: We have nearly eliminated oil and coal from our heat market. The next step is switching from natural gas to renewables. To this end, we have to reinforce our efforts towards the use of waste heat and renewables.

HERBERT PÖSCHL: I consider the Smart City Wien Framework Strategy an umbrella strategy that is located above the Energy Framework Strategy, the Urban Development Plan and the climate protection programme. These sub-strategies are all on one level and interact with each other.

BERND VOGL: We illustrated the relationship of the different programmes and strategies to each other in the Energy Framework Strategy. The Smart City strategy is above all the other strategies, the Energy Framework Strategy encompasses the entire energy sector, and the other strategies (the climate change adaptation and urban development programmes) are connected and have some overlap. Together, they form a large strategic framework. It is not about the plans and ideas of individuals, but about cooperating more closely and understanding that we are one single organism that is trying to meet ambitious energy and climate policy goals.

HERBERT RITTER: *The Energy Framework Strategy lays out the energy policy goals of the city. What are they, what are their special characteristics, and how do they relate to each other?*

HERBERT PÖSCHL: The energy policy goals are supply security, waste heat and renewables, energy efficiency, economic viability, and social impact. None of these objectives has a higher priority than the others, they are all equally important. I think it is important that these energy policy objectives reflect a sustainable, socially equitable, fair and forward-looking energy supply system for the city.

BERND VOGL: The City of Vienna considered it very important to add the social dimension to the Smart City discussion, which was previously very much focused on technology. We on the energy side also wanted to work gradually towards decarbonisation in a balanced way, always keeping in mind these energy goals. Decarbonisation and using domestic resources is a sustainable and socially beneficial approach. Future generations will be grateful for the effort we put into pushing these issues, just as we are grateful to past generations for building hydropower stations and giving Austria a step ahead in the renewables sector.

HERBERT RITTER: *The Energy Framework Strategy works towards decarbonisation. What are the main areas in which action is taken, and what are the next key measures? What major challenges do we have to overcome?*

HERBERT PÖSCHL: Taking our strategic areas as a starting point, our main challenges are in the fields of strategic and sustainable energy supply, waste heat and renewables, the energy-efficient city, energy use, mobility, and, of course, innovation and digitisation. There are many excellent projects in the city that have already been completed. There are also projects that are halfway done and now being revived. We are also addressing new issues, such as digitisation. It's a step towards the future.

BERND VOGL: Broadly speaking, we have two main issues in the city: Mobility on the one hand, heating on the other. Both rely heavily on fossil energy sources; in the heating sector, it is natural gas, and even district heating still uses some fossil energy sources. The entire heating sector needs to shift more towards energy efficiency and renewables. We will have to look at how the gas system, which plays a big part in heating, and related technologies develop. Will there be renewable gas, and how much? How will cogeneration technologies, which are a very efficient way of energy generation, develop? We should keep using cogeneration, as combined heat and power plants are considered the backbone of our energy supply and can provide electricity when there is a shortage, e.g. when renewables are not producing enough.

For mobility, this means reducing private traffic in the public space and shifting towards public transport, cycling and walking, but also increasing electromobility. A city can provide suitable infrastructure, but it has very few ways of influencing technological developments as such.

HERBERT RITTER: *How can we reduce energy consumption? What are the legislative approaches at all levels, including the European level, where the motto is "energy efficiency first"? What strategies are available, particularly in the buildings and mobility sectors?*

BERND VOGL: Energy consumption is an important part of the strategy, particularly in the buildings sector. Electromobility is a leap forward in energy efficiency in the mobility sector, but in the buildings sector, where we have already done a lot, it is harder to reduce energy consumption further. That requires long-term investments. We know from the current funding instruments that it is hard to speed up refurbishment rates. The City of Vienna has been active in this area for 20 years, e.g. with the thermal energetic refurbishment initiative "Thewosan", which yielded very visible results. Nevertheless, we must remain active in this field.

HERBERT RITTER: *The strategy also includes the energy use by end users, particularly in the section on consumers. Could you tell us a bit more about that?*

HERBERT PÖSCHL: It is important to reach people with our awareness-building measures. We also have to launch projects in kindergartens and schools to teach young children how to use energy. This is important because it is the only way to ensure that tomorrow's adults know how to use energy efficiently.

BERND VOGL: The "Wien Energie Erlebniswelt" experience is a great educational project, which our department helped develop. It is a good investment and it shows how Vienna tries to address all parts of the population with tailored energy information.

HERBERT RITTER: *In order to achieve a more sustainable energy supply, the "Vienna model" must be developed further while maintaining a high supply security. What approaches does that entail?*

HERBERT PÖSCHL: The Vienna model has two main components: Energy generation in the city on the one hand, and customer portfolios on the other, e.g. electricity, heating, or gas customers. These are linked by the overarching topic of grid infrastructure (district heating, electricity, natural gas, and in the future perhaps grids for biogas or synthetic gas). Over the next years, we must continue to expand the Vienna model, adding renewables and waste heat to it. There are also important new topics, such as increased use of photovoltaics and prosumer approaches that allow private users to sell electricity to their neighbours. The great technical challenge we are facing in this regard is what these many small power plants would mean for the electricity grid and supply security. Vienna has a very high degree of supply security, and we cannot let new technologies jeopardise that. The City of Vienna and the national government must create a legal framework within which these innovations can be implemented.

BERND VOGL: Speaking of prosumers, we are currently implementing the "Smart Meter" project in Vienna. We are making large investments in this system, which will give us new methods for steering and using flexible tariffs. The city is a large consumer and should be able to use more energy when there is a lot of it. We want the city to act as energy storage. We are already in talks with the neighbouring provinces, as this is an energy region with a lot of wind and PV power. It is most beneficial to use this electricity directly in the energy region, for example with electric vehicles. We also want buildings to use and store energy. We are currently discussing methods like concrete core activation and heat storage, as well as battery storage. There are many funding initiatives in this area. Every prosumer needs energy storage. Smart meters will give us even more opportunities in this field.

HERBERT RITTER: *The Energy Framework Strategy 2030 lays out the strategic guidelines for the energy sector. What are the next steps, how will you implement these plans?*

HERBERT PÖSCHL: The Energy Framework Strategy provides the framework for Vienna's energy policy. The individual areas will give rise to various initiatives, and we will implement projects in the fields of energy efficiency and renewables. Another question we have to answer is how to ensure that housing remains affordable in Vienna.

BERND VOGL: As regards the overall structure of the Energy Framework Strategy, we decided to set up a steering group, which we will be heading jointly. We will commission and support sub-programmes that are focused on measures for specific issues. These sub-programmes will report about their progress to the steering group on a regular basis, and may be adapted if necessary. The steering group is the point of contact for all sub-programmes supported by the Energy Framework Strategy for Vienna.

HERBERT RITTER: *Thank you for the interview.*

1.3 MILESTONES ON THE ROAD TO A SUSTAINABLE ENERGY FUTURE

Global developments

Paris Agreement enters into force

On 4 November 2016, the Paris Agreement entered into force after over 55 countries, accounting in total for over 55 percent of the total global greenhouse gas emissions, had deposited their instruments of ratification with the United Nations. Austria was among the first countries to ratify the agreement.

At the Paris climate protection conference (COP 21) in December 2015, 195 countries had agreed on a universal, legally binding global climate protection agreement for the first time in history. It includes a global action plan that aims to limit global warming to well below 2°C. The signatories commit to becoming climate neutral by the second half of the 21st century.

To this end, the countries will meet every five years and update the goals with more strict objectives if scientific findings show it to be necessary. The consequences of the exit of the United States from the Paris Agreement as announced by US president Trump on 1 June 2017 will only become clear in the coming years.

A global mega trend: Wind power and photovoltaics becoming more competitive

In 2016, the global investments in renewable energy installations were over US$ 280bn (source: Bloomberg New Energy Finance). The lion's share of these investments was into wind power and PV installations. While annual investments in the sector have been hovering around the $300bn mark for seven years, the installed capacity resulting from those investments has nearly doubled in that period. This is reflected in the dramatic price drop in wind power and PV installations, which has made them the cheapest way of generating electricity in many parts of the world. A spectacular example of this was the tender for the third construction phase of the Mohammed bin Rashid Al Maktoum Solar Park in Dubai, which is to be expanded by 800 MW. In May 2016, the contract was awarded to a consortium with a bid of US$ 0.0299 (€ 0.026) per kilowatt-hour of solar power.

Price drops have been even more dramatic for battery storage, with prices falling by over ten percent a year. The continuation of this trend will not only make electric vehicles commercially viable by 2025 but also mean a breakthrough for stationary energy storage (especially in conjunction with private PV installations).

Diesel emissions scandal heralds change in the automotive industry

The diesel emissions scandal, also referred to as "dieselgate", began in September 2015, when an illegal system was detected that throttled the exhaust cleaning mechanism of diesel engines of a car manufacturer, designed to keep measured emissions levels below US thresholds. The ensuing media reports and public discussion led to a massive loss of trust in diesel vehicles in general. As a result, several automotive manufacturers have announced plans to focus on electric mobility rather than combustion engines even sooner than initially planned. Discussions are also being held at the regulatory level, e.g. regarding diesel bans in various European cities, and the ambitious annually increasing electric car quota that China is implementing in 2019. The impact of this and other political regulations on automotive mobility cannot yet be estimated.

Developments at EU level

The "Winter Package": "Clean energy for all Europeans"

At the start of December 2016, the European Commission presented an over 1000-page draft package of measures, the so-called "Winter Package". It contains several proposals for new Directives, amendments to existing legislation, and working plans, and is aimed at ensuring progress in all five dimensions of the energy union (decarbonisation, energy efficiency, energy market, energy security, and research, innovation and competitiveness). The plan is to reach an agreement on the Commission's proposals no later than the second half of 2018, which coincides with the Austrian Presidency.

The Commission's proposals include goals for 2030 and measures for more energy efficiency, renewable energy, buildings, effort sharing, etc. In particular, they include the following:

- Energy efficiency: Proposal for a revised Energy Efficiency Directive, proposal for a revised Energy Performance of Buildings Directive, new proposals for energy efficiency of products (Ecodesign Directive); Smart Finance for Smart Buildings initiative
- Renewable energy: Proposal for a recast of the EU Renewable Energy Directive including bioenergy
- Electricity market design Proposal for a recast of the Internal Electricity Market Directive and the Internal Electricity Market Regulation, proposal for a new Regulation on supply security, proposal for a recast of the ACER Regulation, final report on the Sector Inquiry on Capacity Mechanisms by DG Competition
- Governance: proposal for a Regulation on Governance of the Energy Union for climate protection and energy

The proposal on the governance mechanism is of particular interest. It obliges the member states to draw up a plan with a number of objectives (e.g. for carbon dioxide reduction, more renewables, energy efficiency) and report implementation progress to the Commission at regular intervals. These plans are intended to ensure that the Union-wide target of at least 40% reduction in economy-wide greenhouse gas emissions by 2030 is reached, which the EU committed to as a contribution to the Paris climate agreement.

Agreement on reduction of EU emissions trading 2021-2030

The EU Emissions Trading System (EU ETS) is an EU climate policy instrument with the aim to reduce greenhouse gas emissions at the lowest possible cost to the national economies. Currently, the EU ETS limits the CO_2 emissions of some 11,000 power stations, factories and other plants in several sectors of industry. The system currently covers approx. 45% of GHG emissions originating in the EU. The basis of the system is that the companies included have to buy a tradeable certificate for each tonne of CO_2 they emit, and only a limited number of new certificates are issued each year. This number is being reduced by 1.74% annually until 2020.

In February 2017, the EU Parliament agreed to reduce the number of certificates by 2.2% annually between 2021 and 2030. It remains to be seen whether this will raise the price of certificates, which have been at only €5 per tonne for years. The price of certificates will be a factor in whether e.g. highly efficient gas cogeneration plants can compete against coal-fired power plants on the European electricity market.

Developments at the national level

Key legislation and strategies at a standstill

Despite long discussions, the federal government was not able to adopt or even submit the planned "Integrated Energy and Climate Strategy" before the (early) end of the legislative term. It was supposed to define Austria's quantitative goals until 2030 (ideally until 2050) in the areas of energy efficiency, renewables, and carbon dioxide (cf. EU Winter Package above) and with what tools they would be reached.

There were also no notable improvements in the implementation of the Energy Efficiency Act in the year under review. Due to a large number of generous regulations for individual measures (e.g. recognition of fuel additives or the sending of free flow restrictors to consumers as efficiency measures), the market for energy efficiency certificates remains oversupplied. The amendments for stricter calculation methods have not yet had any effect. As a result, the price for energy efficiency certificates is at nearly 0 cent per kWh, providing no incentive for real energy efficiency measures.

Green Electricity Amendment

In the last session of the legislative period, the green electricity amendment was adopted unanimously by the National Council on 29 June (and the Federal Council on 5 July). The amendment includes changes to the Green Electricity Act, the Electricity Industry and Organisation Act (EIWOG), the Natural Gas Act, and the Energy Control Act, as well as some minor changes to the CHP Points Act. In the next years, funds will be freed up from the budget to, e.g., reduce waiting times for approved installation for wind power, PV and storage, biogas, and small hydropower. The "Green Electricity Amendment" is expected to trigger investments of over half a billion Euro, increase the share of renewables in electricity generation in Austria by approx. one percentage point, and make it possible for residents of multi-family homes to use electricity generation installations (e.g. PV) communally.

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

Projects implemented in the field of energy between 1 July 2016 and 30 June 2017.

Strategies

New strategies – new challenges – new objectives

Energy Framework Strategy for Vienna
The government manifesto for the second term of Vienna's coalition government of Social Democrats and Greens includes the development of an Energy Framework Strategy for Vienna. This Energy Framework Strategy has been developed and will, after final adaptations, likely be presented to the Vienna City Council in late 2017.

Development and finalisation of an SEP successor programme ("SEP 2030")
Consistently increasing energy efficiency is an important component of a sustainable energy policy. Therefore, a successor, nicknamed "SEP 2030", was developed for the Urban Energy Efficiency Programme SEP, and was mostly completed in 2017. The programme is being developed with the assistance of the Energy Center Wien (ECW). When it will be presented to the City Council depends on the adoption of the Vienna Energy Framework Strategy.

Strategic concept on spatial energy planning
The strategic concept on spatial energy planning, whose development began in December 2016, is now in the final development phase. The strategic concept is being developed to meet the goals of the Urban Development Plan 2025 (STEP 2025). The objectives set out in STEP 2025 and the Energy Framework Strategy provide the context for spatial energy planning in Vienna.

The strategic concept defines the position and goals of the City of Vienna with regard to spatial energy planning and determines the necessary steps for establishing spatial energy planning in Vienna. It describes four main areas of action, which are each divided into several bundles of measures. It will be presented to the City Council in early 2018.

Ideas for a smart city

"European Heat Pump City of the Year" Award
At the DecarbHeat conference in Brussels on 11 and 12 May 2017, the City of Vienna was presented the "European Heat Pump City of the Year" award by Celine Fremault, Minister of Housing, Quality of Life, Environment and Energy for the Brussels-Capital Region.

Vienna's entry, which presented the main initiatives for promoting heat pumps, won over projects from Trondheim (Norway) and Berlin (Germany). The projects included in Vienna's entry were the development and management of the city's subsidies for heat pumps as well as the integration of energy maps into the online city map to show potential for near-surface geothermal energy in the city.

Data and research

Energy options study in Donaufeld
A novel method for assessing energy supply options in new urban development areas was developed for the urban development area Donaufeld. A project advisory committee consisting of representatives of Municipal Departments 20 and 25, housing fund Wohnfonds Wien and energy supplier Wien Energie agreed on the basic approach and input parameters. This method will be used for other urban development areas in the future.
The final report is available on the homepage of Municipal Department 20.
https://www.wien.gv.at/stadtentwicklung/energie/pdf/energieversorgung-donaufeld.pdf

Report on "Legal aspects of spatial energy planning"
As preparation for the implementation of new energy supply options, the legal aspects of their integration into existing planning tools were studied. The study focused on identifying existing obstacles and determining the legal scope of action. It also contains recommendations for the adaptation of existing legal instruments. The report is available online at:
https://www.wien.gv.at/kontakte/ma20/publikationen/index.html#studien

Study of waste heat potential in Vienna
Municipal Department 20 supported a study of the AIT Energy Department, which gathered data on the main potential sources of waste heat from commercial enterprises in Vienna and assessed the volume of waste heat. The companies were selected depending on their sector, number of employees, and size. Based on this, their potentials for waste heat were calculated and localised on the map. The next step will be to make this information publicly available as part of the energy potential maps, aggregated to statistical grids (250x250m).

Concrete core activation: local supply
In 2016, a cooperation project headed by TU Vienna was launched, which develops assessment methods for the use of thermal component activation. The findings of the project, which will be used to develop standards, will hopefully increase our understanding of efficiency and energy supply of buildings. Due to its thermal characteristics and inertia, concrete core activation is a good way to store and use fluctuating energy volumes generated by renewables. Concrete core activation can also be used as storage to reduce the load on the electric grid.

Energy potential study for rivers
Municipal Department 20 commissioned the Geological Survey of Austria (GBA) with studying the thermal potential of rivers and brooks in Vienna and to determine areas suited for thermal use with heat pumps.
The streams in the Vienna Woods were found to be unsuited for thermal use, with the possible exception of the Wien and Liesing rivers. The next step will be to verify these findings with discharge and temperature data. The thermal use of watercourses in Vienna is, therefore, mainly possible along the Danube Canal and the Danube. The results will be available in late 2017.

Storage systems in Germany
If fossil energy vectors are to be replaced by renewables, solar and wind energy are particularly suited where they are available in sufficient amounts. As these energy sources are very volatile, it is a major challenge to reconcile the fluctuating supply and the energy demand. Methods for providing more flexibility are needed – for example energy storage.
Municipal Department 20 commissioned a literature review on the status quo (as at end of 2016) of energy storage in Germany. The central question was how recently initiated energy storage activities in Germany have developed. The study focused on sources available online as well as expert newsletters and print products. The perspective of municipalities and municipal energy suppliers was of particular interest.
The results can be found on the homepage of Municipal Department 20 at:
https://www.wien.gv.at/stadtentwicklung/energie/pdf/energiespeicherung-deutschland.pdf

Awareness building measures

Interest in energy and climate protection is growing. More and more people, for example, want to know about heat pumps, passive houses, or installing their own photovoltaic system. The demand for more information and practical advice regarding energy is growing. Municipal Department 20 addresses this demand with a number of specific activities:

"Energy!ahead Vienna": energy showcase project app
A newly developed app presents energy showcase projects from Vienna. The projects are illustrated with attractive pictures and a description of the main energy indicators. The app provides users a fun way to gain interesting information about buildings and projects in Vienna. Some information is only unlocked when you are at the location of the building. The map view provides an overview of the location of the showcase projects.

Energy literacy app
As part of the implementation of the energy literacy certificate "energie-führerschein" in the Vienna City Administration, a training app was developed. It is intended as additional motivation for young people attending the "energie-führerschein" course to think about saving energy in their spare time and to prepare them better for their certification exam.
https://www.wien.gv.at/stadtentwicklung/energie/rette-deine-insel.html

Geothermal energy handbook
The handbook provides information on different ways of using near-surface geothermal energy for forward-looking projects. The systems presented in the publication can be used in single-family homes and in large residential and commercial buildings alike. It is intended to help users decide on suitable heating and cooling systems that use the soil as a source of heat or cold. The guide is available on the homepage of Municipal Department 20:
https://www.wien.gv.at/stadtentwicklung/energie/pdf/leitfaden-erdwaerme.pdf

Dialogue forum
The forum "Wiener Energie Impulse" is intended as a point of communication that bridges business, industry, politicians and multipliers in the neighbourhood. It is an interdisciplinary gathering for a fact-based exchange of experiences and ideas. The exciting format and communication possibilities promote dialogue between stakeholders in the fields of energy industry, forward-looking housing and working, mobility and logistics, public participation and new media. The four events in this series were dedicated to different topics, and provided an opportunity for discussion of their opportunities and challenges.

Plus magazine
Plus magazine presents innovative technologies and achievements in energy supply and use. It discusses current energy issues in Vienna and other urban areas, presents showcase projects, and prints interviews with pioneers who provide innovative energy solutions. The latest issues focused on innovative storage technologies and energy flows in buildings.
https://www.wien.gv.at/stadtentwicklung/energie/plus.html

EU projects

Smarter Together

In February 2016, Vienna, together with Munich and Lyon, launched a large-scale EU project, where the cities will develop new strategies for comprehensive urban renewal. In addition to the refurbishment of buildings, it also includes modern mobility and energy supply solutions, including changes to heating systems. Smarter Together, which is managed by Municipal Department 25, addresses all of these topics and aims to bring new ideas to Vienna and demonstrate them in Vienna's 11th district, Simmering. Three housing estates will we refurbished and a school gymnasium will be replaced with a zero-energy facility. This area will also have the first "mobility points", i.e. locations that connect different modes of mobility. Municipal Department 20 is in charge of the working package "Integrative infrastructure and services", which addresses energy supply questions, an IT platform, and the development of a piece of urban furniture that provides electricity. The project runs until the start of 2019, and will be followed by a two-year monitoring phase.

Urban Learning

In the EU Horizon 2020 project URBAN LEARNING (2015-2017), eight European capitals or major cities faced challenges together, such as reconciling their considerable population growth with ambitious goals for reducing fossil energy and CO_2 emissions. Vienna, Berlin, Paris, Stockholm, Amsterdam / Zaanstad, Warsaw and Zagreb aimed to improve the institutional capacity of local authorities for integrated urban energy planning.
The focus was on urban planning processes and related tools, such as zoning plans, concepts, and contracts. Each partner city developed a proposal for the integration of energy into the planning process for urban development areas and the appropriate framework conditions. They also studied existing tools and technological solutions for neighbourhoods. To this end, each city installed local working groups consisting of experts from different departments and external stakeholders, such as energy suppliers. The aggregated results are available at http://www.urbanlearning.eu/learn-and-exchange/deliverables/.

The cities shared and discussed their findings and questions with others. Vienna fosters an ongoing exchange with the cities of Salzburg and Graz. The working groups will continue to develop and implement the suggestions after the conclusion of the project.
In Vienna, the project directly supports the development of the strategic concept on spatial energy planning as part of STEP 2025, it allows a more in-depth discussion of certain issues, and shares international experiences from various cities. The project is coordinated by the Energy Center Wien, and Municipal Department 20 is Vienna's contact for the project.
The closing conference will be held in Vienna on 17 October 2017.
Further information available at: *www.urbanlearning.eu*

1.5 ENERGY – FROM GENERATION TO USE

a. An overview of the main concepts

AMBIENT HEAT ...refers to heat found in the environment that is used for energy generation, such as near-surface and deep geothermal energy and solar heat.

BIOGENIC FUELS ...includes the organic part of domestic waste, wood pellets, wood briquettes, wood chippings, charcoal, waste liquor, landfill gas, sewer gas, biogas, bioethanol, and biodiesel.

BLI BUNDESLÄNDER LUFTSCHADSTOFF INVENTUR ...is a survey conducted by the Environment Agency Austria to analyse the development of greenhouse gases and selected air pollutants in Austria's federal provinces.

CLIMATE-CORRECTED DATA ...corrects the differences between years caused by varying weather conditions. As a result, the energy consumption for different years is shown as it would have been had the weather been the same.

CO_2 EQUIVALENT ...makes it possible to compare different greenhouse gases. Carbon dioxide is a gas generated in all combustion processes. There are also other greenhouse gases, such as methane or nitrous oxide. These different types of gases do not all contribute equally to the greenhouse effect. For example, methane has 21 times the climate impact of carbon dioxide, so it is referred to as having a CO_2 equivalent of 21.

COMBINED HEAT AND POWER (CHP) ...is the cogeneration of electrical energy and heat, for example in a heating plant.

COMBUSTIBLE WASTE ...includes industrial waste and the non-renewable share of domestic waste.

CONVERSION LOSSES ...refers to the energy that is lost during the conversion of primary energy to secondary or useful energy.

ECOBUSINESSPLAN VIENNA ...is the environmental service package of the City of Vienna for enterprises. It includes professional advice and consulting, support with the practical implementation of measures, legal certainty, and effective PR.

EMIKAT.AT ...is a data management system of the Austrian Institute of Technology (AIT) that provides an emissions inventory based on emitters.

ENERGY FLOW CHART ...is a chart depicting the energy flows within a given system, such as the City of Vienna, in one year.

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.
FROST DAY	...is a day on which the minimum temperature goes below 0°C.
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).
GROSS INLAND ENERGY CON-SUMPTION (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.
HEATING DEGREE DAYS	...are based on an indoor temperature of 20°C and a base temperature (exterior temperature at which the building is heated) of 12°C. This is designated as HGT20/12. This is the sum of the differences between indoor temperature and mean outdoor temperature for all heating degree days over one year and is indicated in Kelvin x days (Kd).
HEATING PLANT	...is an installation for the centralised generation of heat for water and space heating or for use in industrial processes.
HOT DAY	...is a day on which the maximum temperature is at least 30°C.
HYBRID PRO-PULSION/HYBRID CAR	...is a propulsion system or vehicle that uses a combination of different technologies. In this report, the term is used for propulsion systems that combine petrol and electricity or diesel and electricity.
ICE DAY	...is a day on which the maximum temperature is below 0°C.
KILOWATT PEAK (KWP)	...is the peak power of a solar module under strictly defined standardised test conditions.
KLIP	...is Vienna's climate protection programme.
KLIP BALANCE METHOD	...is the basis for all calculations in Vienna's climate protection programme (KliP). It is the result of BLI minus emissions trade and minus traffic emissions that cannot be attributed to Vienna. The vehicle emissions that cannot be attributed to Vienna are the difference between the emissions caused by traffic in BLI and the Austrian emissions inventory emikat.at.
OTHER TYPE OF PROPULSION	... in this report, refers to propulsion systems that use liquid gas or hydrogen (fuel cells) as well as hybrid systems that combine petrol and liquid gas or petrol and natural gas.

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 converting it into another form of energy.

PV AREA ...this report uses photovoltaic surface area as a unit of energy measurement to illustrate comparisons. 6.5 m^2 of PV area correspond to 1,000 kWh.

SECONDARY ENERGY ...is the energy that is generated with the conversion of primary energy. This may be wood pellets, diesel fuel or electrical energy.

SUMMER DAY ...is a day on which the maximum temperature is at least 25°C.

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 consumption of the energy sector, transport losses and non-energy use.

USEFUL ENERGY ...is the energy that is actually used for heating, lighting, mechanical work, propulsion, etc.

How has energy consumption changed in Vienna over the last decades? Are we using more and more energy?

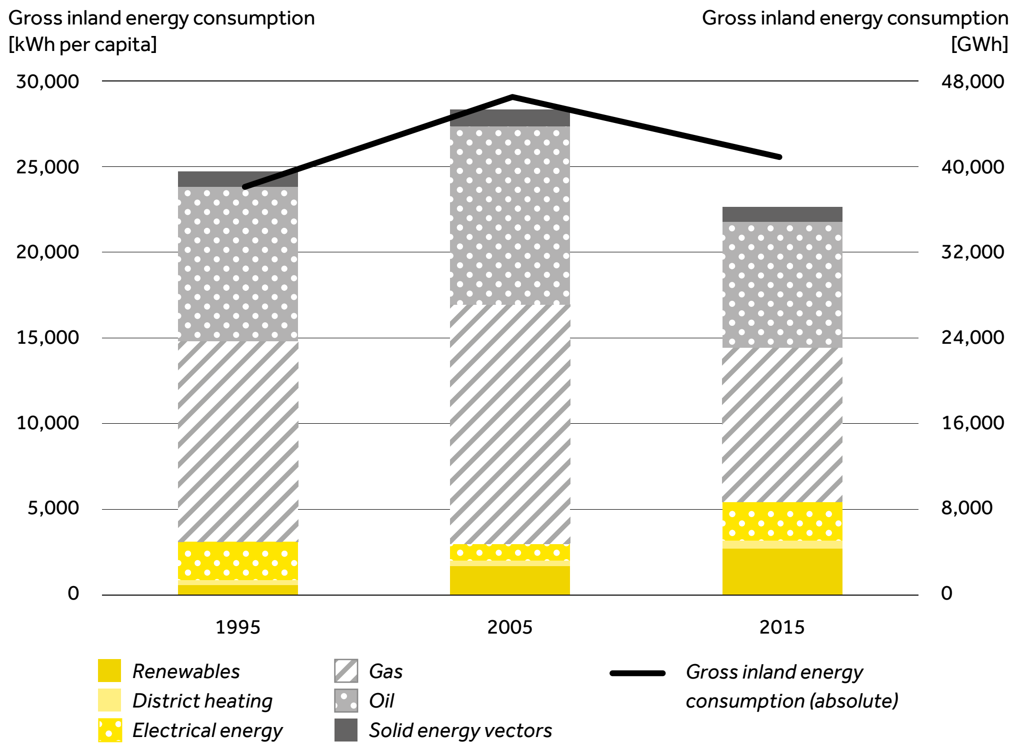


Fig. 1.1
Energy consumption (absolute and per capita) in Vienna by energy vectors.
Sources: Energy balance 2015 and population data

Since the post-war period, the energy consumption of Vienna's population has increased steadily. While in 1995, energy consumption per capita was at approx. 25,000 kWh, it had risen by 15% to 28,500 kWh by 2005. This marked the peak in Vienna's energy consumption. Since 2005, there has been more focus on energy efficiency, resulting in a decrease of energy consumption per capita by 20% to 23,000 kWh. This reduction is due both to the more efficient use of energy – absolute consumption went down from approx. 47,000 GWh in 2005 to approx. 41,000 GWh – and to population growth (+10% between 2005 and 2015). The uses and conversion of energy are described in detail in the section "Energy flow chart of the City of Vienna".

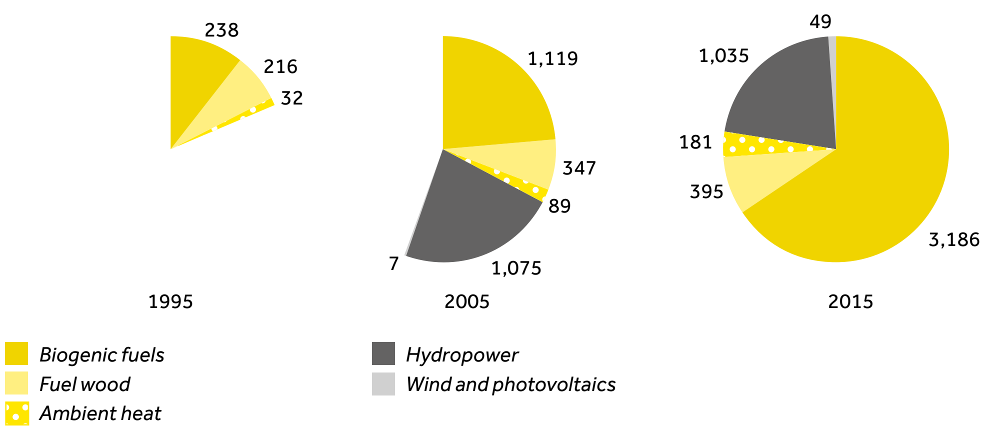
How clean or renewable is Vienna's energy supply today? What big changes have been made in the last years?
Since 1995, the share of renewables in gross inland energy consumption increased from 2% to 12% or, in absolute figures, from approx. 900 GWh to approx. 4,900 GWh.

There were large changes in the area of hydropower. In 1998, the Freudenau power plant on the Danube was opened, and between 2001 and 2014, four small hydroelectric plants went on line. The largest growth in the sector of renewables is in the area of biogenic fuels.

This increase is nearly exclusively due to the EU Biofuels Directive, which concerns the blending of biofuels with conventional fuels (diesel, petrol) for motorised traffic. New technologies such as wind power, photovoltaics and heat pumps have gained a more firm hold on the market in recent years and have been able to increase their share considerably.

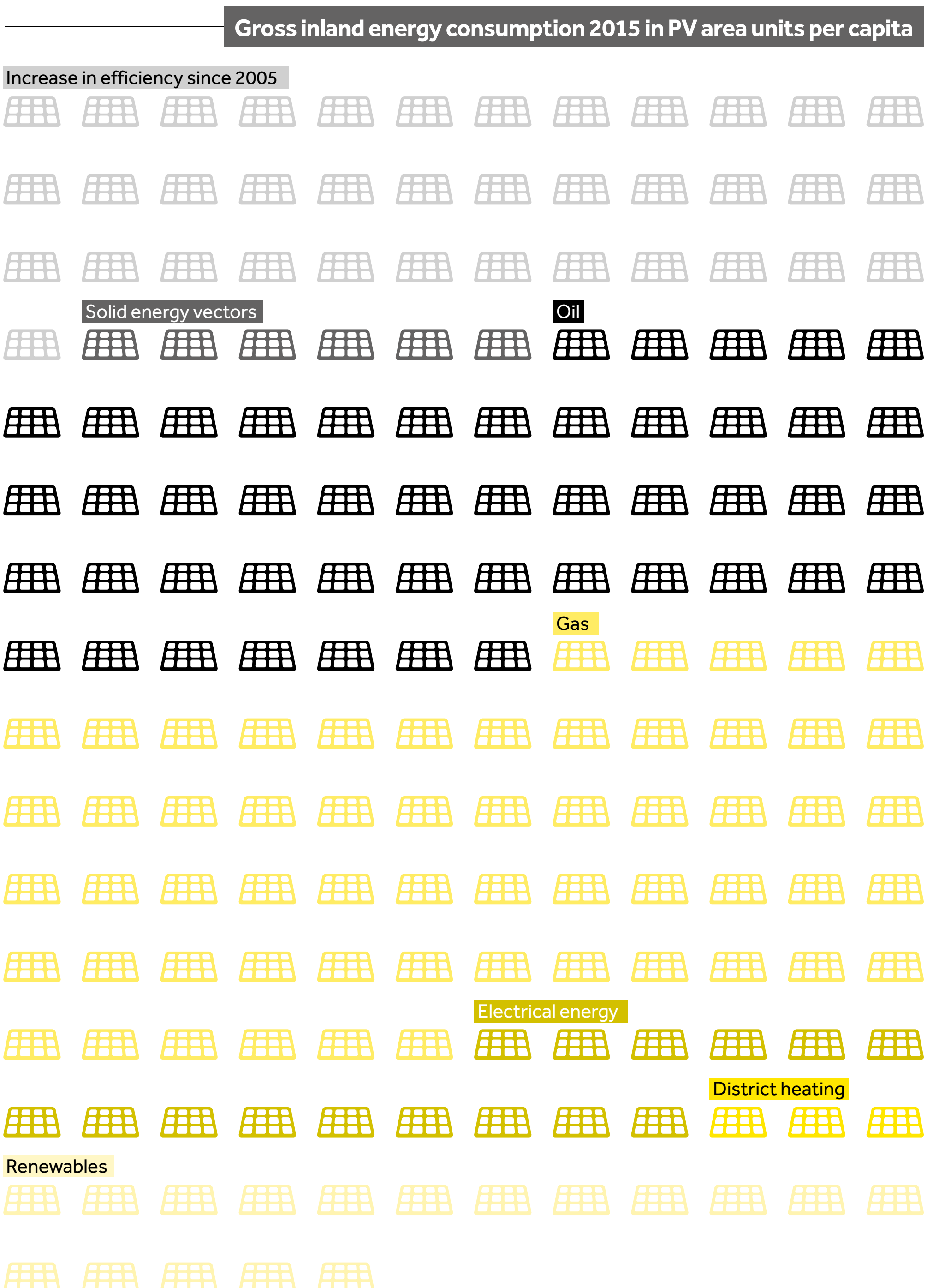
Fig. 1.2
Generation of renewable energy in Vienna (absolute), 1995-2015
Source: Energy balance 2015

Renewable energy sources [GWh]



How can we best illustrate energy consumption?
Gross inland energy consumption can be illustrated with PV area units. One PV area unit generates 1,000 kWh of energy and has a size of 6.5 m^2.
In order to provide all energy used in Vienna, an area of approx. 269 km^2, or 65% of the city's total surface, would have to be covered with PV panels. Compared to 2005 – the year with the highest energy consumption in Vienna – the area required has been reduced by 35 km^2, or 12%.
Per capita consumption has been reduced by 37 PV area units in total since 2005. For every person living in Vienna, 113 PV area units of energy from fossil sources are imported to the city, the majority of them natural gas (59 PV area units) and oil (48 PV area units). In 2015, the energy mix had 7 more PV area units per capita from renewables than in 2005. Over the next decades, we will need to further reduce the number of fossil PV area units by increasing efficiency or replacing them with renewables.

Fig. 1.3
Gross inland energy consumption 2015 in PV area units per capita

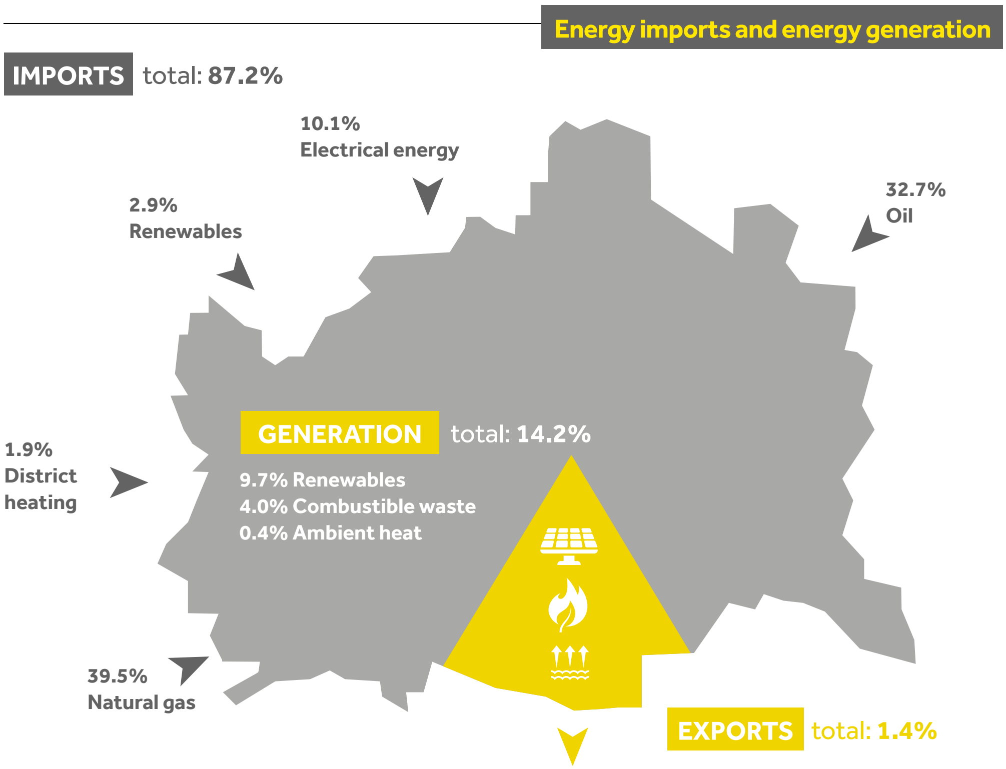


Note: The term "solid energy vector" refers, for the most part, to combustible waste that is converted into district heating in waste incinerators, as well as a small percentage of coal. District heating here refers to industrial waste heat from the Schwechat oil refinery outside Vienna, which is imported to the city. The part of district heating in Vienna that is generated from waste, biomass, ambient heat, or gas, is not visible in gross inland energy consumption, but is included in final energy consumption.

c. Energy flow chart of the city of Vienna

How much energy is needed to run a whole city? Where does that energy come from?
14 percent of the energy needed is generated in Vienna itself, mostly from renewable sources. 87 percent of energy comes from the surrounding area, with the fossil energy sources natural gas and oil making up the majority of imports. Approx. 1.4 percent of energy is exported again; the rest makes up the gross inland energy consumption.

Fig. 1.4
Energy generation and energy imports in Vienna, 2015



What enormous energy flows move through the city and where are they used?
The energy flow chart of the City of Vienna[1] shows how much energy is required to supply the city (41,402 GWh), how that energy is transformed and distributed, and where it is finally used. The chart shows a clear dominance of fossil energy sources (39% natural gas and 32% fuels) in the city's energy mix. Over half the natural gas is converted into electricity and district heating. Fuels and mineral oils (petrol, diesel, and other petroleum products), on the other hand, are used nearly exclusively by the largest consumption sector, transportation. The energy flow chart also shows energy losses, which amount to over 20,000 GWh, or 48% of gross inland energy consumption. These losses occur during different phases of the energy flow, , with approximately 4,600 GWh lost before arriving at the end user (conversion losses, transport losses, etc.) and approximately 15,200 GWh losses in end-user consumption.

[1] This energy flow chart considers both combustible waste and coal solid energy vectors. A more detailed differentiation is provided in the following chapters.

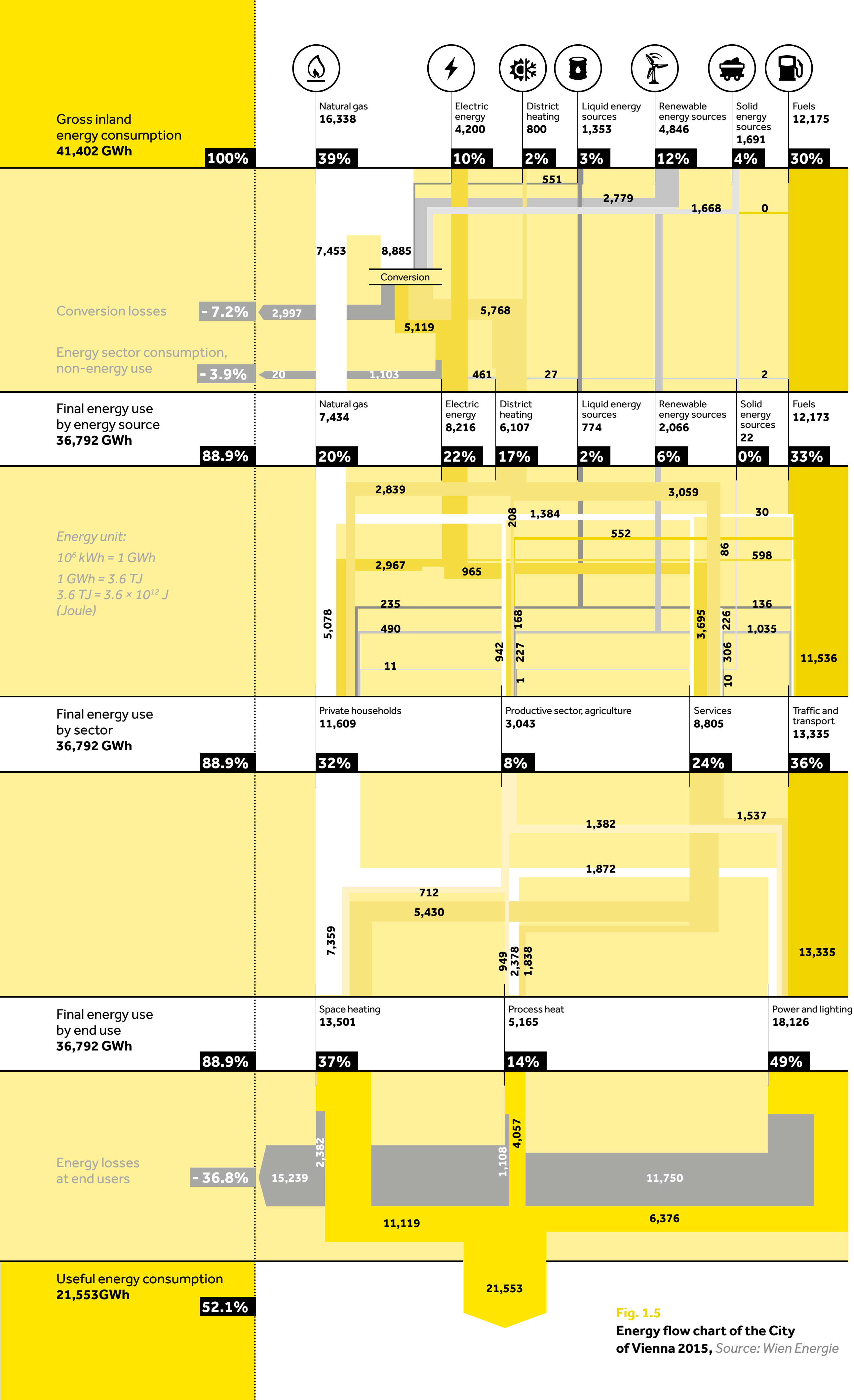
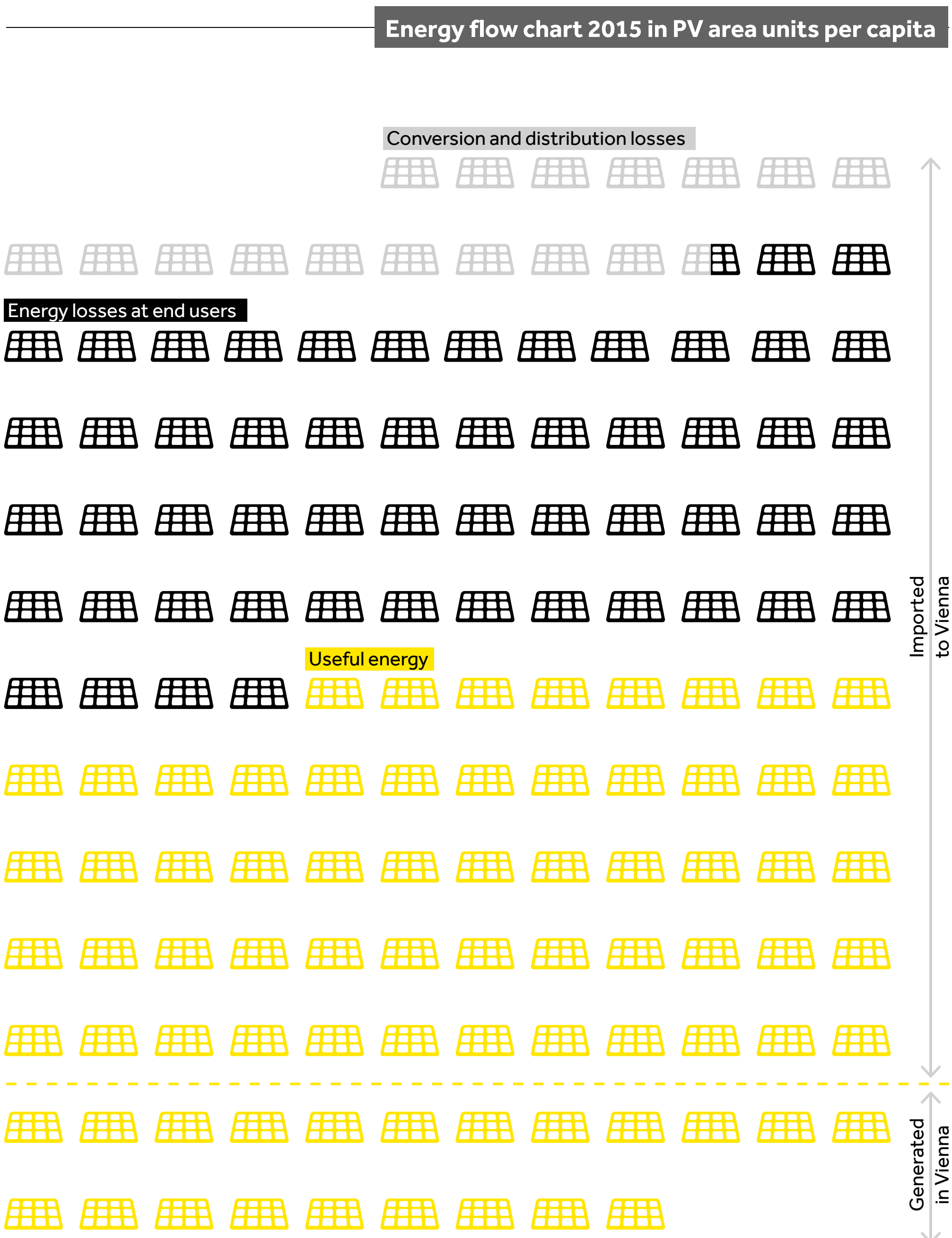


Fig. 1.5
Energy flow chart of the City of Vienna 2015, *Source: Wien Energie*

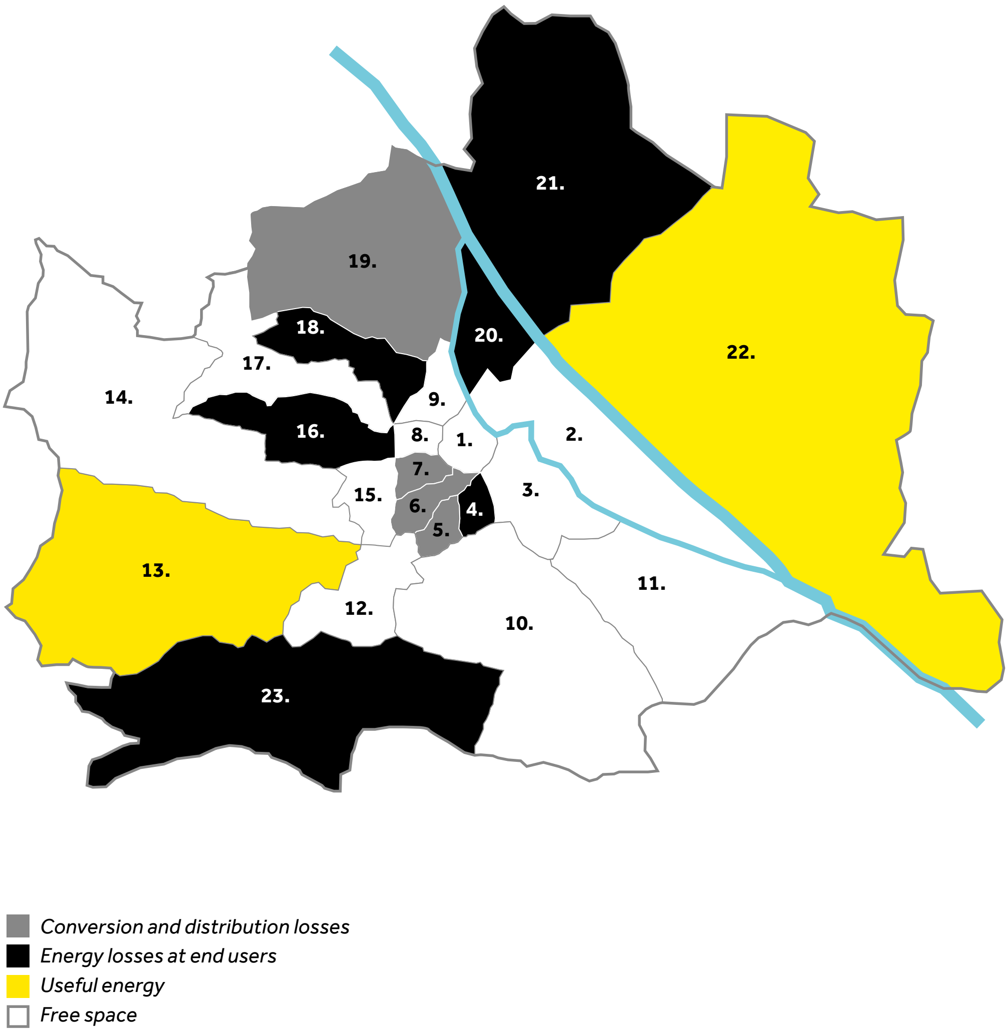
Fig. 1.6
Energy flow chart 2015 in PV area units per capita



This is a simplified illustration of the energy flow chart, with the energy flows converted into PV surface area. 1 unit of PV area has a size of 6.5 m^2 and generates 1,000 kWh energy. In 2015, each inhabitant of Vienna would have needed 148 PV area units to fuel their lifestyle. Out of these 148 units, 19 are provided from within Vienna (lower section of the illustration) and 127 have to be imported. Only just over half of these PV area units, 77 in total (shown in yellow) are consumed as useful energy, the rest are needed to compensate for losses. 16.5 PV area units are needed for conversion (e.g. biomass to district heating and electrical energy) and the distribution of energy in the grid (grey). Losses at end users (black) make up 54.5 PV area units.

Fig. 1.7
Energy flow in PV area units

Energy flow in PV area units



In order to provide all the energy used in Vienna, two thirds of the city's surface would have to be covered with PV panels. To compensate for transport losses and conversion losses (e.g. from converting biomass to district heating and electricity) incurred in 2015, 20 km² of the city, or the 5th, 6th 7th and 19th district (shown in grey), would have to be covered with PV panels. In order to cover the losses at final consumers, nearly 100 km², or the entirety of districts 4, 16, 18, 20, 21 and 23 (black) would have to be completely covered with PV installations. Even had there been no energy losses at all in 2015 and had all energy been used directly, we would still have needed 140 km² of PV panels, which corresponds to the combined size of the 13th and 22nd district (yellow).

This chapter presents indicators from the areas of energy, emissions, transportation, population and climate in relation to the population and value added. The indicators show the development from 1995 to 2015 for Vienna and provide comparisons with Austria overall and the other federal provinces. Data for regional value added are available from 2000.

The adoption of the Smart City Wien Framework Strategy in June 2014 was an enormous step towards sustainable energy supply through the conservation and intelligent use of resources. The strategy defined energy-relevant targets for different areas, such as efficient energy use, renewable energy sources, mobility, and buildings. The indicators for monitoring the energy-relevant targets and evaluating the development are shown in section 2.1.

The Viennese have reduced their per capita energy consumption considerably since 2005 and have begun using more renewable energy and waste heat. This is reflected in a reduction in greenhouse gas emissions. Mobility habits have also become more sustainable in the last year; the number of cars per inhabitant has been dropping since 2010 and the number of annual passes for Vienna Public Transport sold is increasing considerably.

A comparison of Austria's provinces shows that Vienna has the lowest energy consumption (final energy consumption total, private households, electrical energy) both per capita and in relation to value added. Most federal provinces have been able to reduce their per capita final energy consumption over the last years, in relation to value added for all provinces. The use of electrical energy has grown considerably in all of Austria. Vienna has the highest population growth of all provinces.

2

INDICATORS

2.1 MONITORING INDICATORS FOR THE SMART CITY WIEN FRAMEWORK STRATEGY

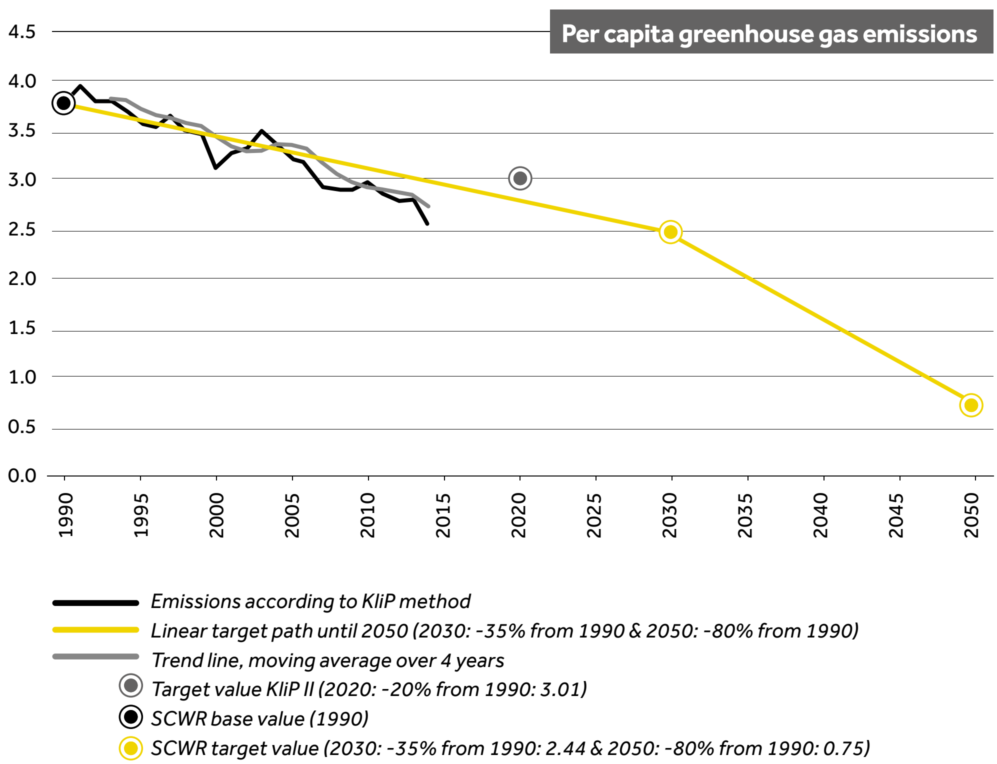
2.1.a Emissions per capita

Smart City Wien Framework Strategy (SCWR) objective:
Reducing per capita greenhouse gas emissions in Vienna by 80% by 2050 (from 1990 levels).[1]
Intermediate target: Reducing per capita carbon dioxide emissions in Vienna by at least 35% by 2030 (from 1990 levels).

Table 2.1
Per capita greenhouse gas emissions in Vienna
Sources: BLI 2014 and emikat.at 2014

t CO_2 equivalents per capita	1990	1995	2000	2005	2010	2013	2014	Change [%] base year 1990
Emissions according to KliP method	3.8	3.6	3.1	3.2	2.9	2.8	2.6	–31.6%
Trend line, moving average over 4 years		3.7	3.4	3.3	2.9	2.8	2.7	
Linear target path until 2050 (2030: -35% from 1990 & 2050: -80% from 1990)	3.8	3.6	3.4	3.3	3.1	3.0	3.0	–21.0%

Fig. 2.1
Per capita greenhouse gas emissions in Vienna, 1990-2014, SCWR target
Sources: BLI 2014, emikat.at 2014 and SCWR



Note: The emissions calculated using the KliP balance calculation method are the basis for all calculations for Vienna's climate protection programmes (KLiP I and KLiP II). The trend line is included to mitigate deviations caused by weather and leap years.

[1] This objective as well as all following energy and climate objectives can only be achieved if Vienna's efforts are supported by suitable framework conditions by the federal government and the European Union, including the recognition of early actions.

2.1.b Final energy consumption per capita

Smart City Wien Framework Strategy objective:
Increasing energy efficiency and decreasing final energy consumption per capita in Vienna by 40% by 2050 (from 2005 levels), reducing per capita primary energy input from 3,000 to 2,000 watt.

kWh per capita	1990	1995	2000	2005	2010	2014	2015	Change [%] base year 2005
Final energy consumption	18,744	21,002	21,663	24,117	23,388	20,186	19,993	–17.10%
Trend line, moving average over 4 years		20,578	22,123	24,127	22,671	21,428	20,952	
Linear target path until 2050 (-40% from 2005)				24,117	23,045	22,188	21,973	–8.89%

Table 2.2
Final energy consumption per capita in Vienna
Sources: Energy balance 2015 and population data

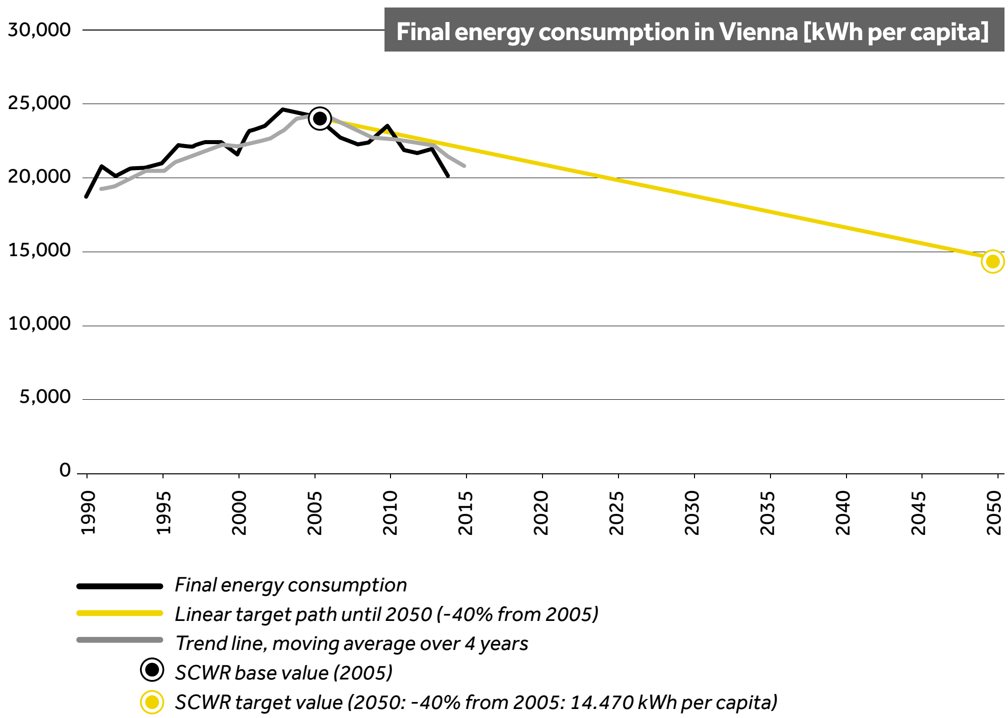


Fig. 2.2
Final energy consumption per capita in Vienna, 1990-2015, SCWR target
Sources: Energy balance 2015, population data and SCWR

Note: The trend line is included to mitigate deviations caused by weather and leap years.

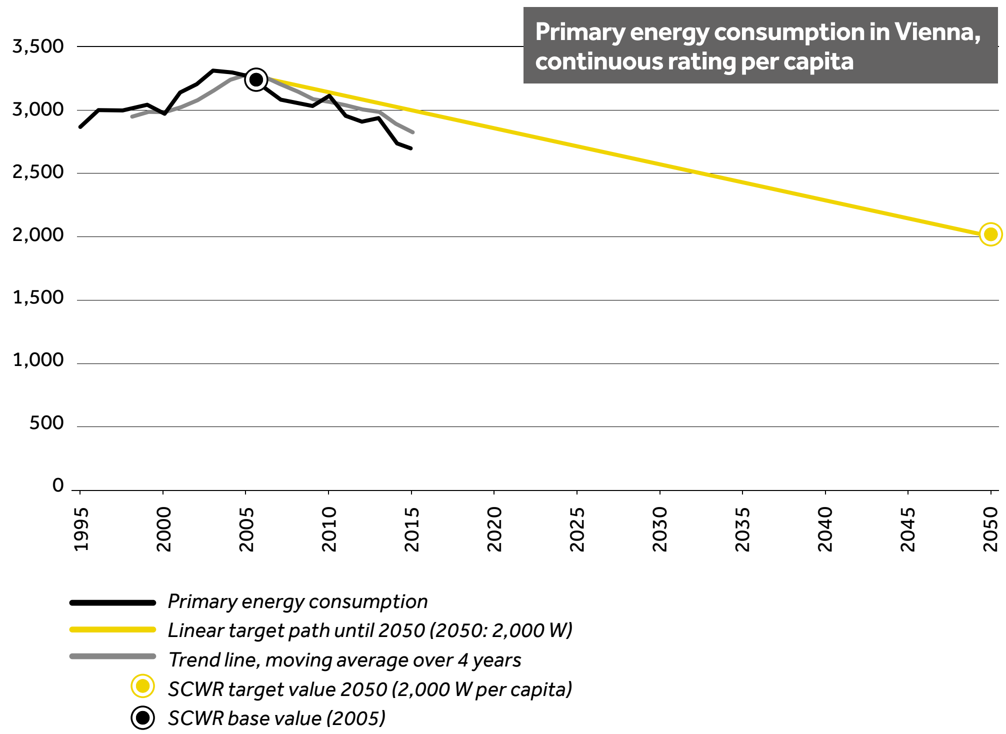
2.1.c Primary energy consumption per capita

Smart City Wien Framework Strategy objective:
Increasing energy efficiency and decreasing final energy consumption per capita in Vienna by 40% by 2050 (from 2005 levels) reducing per capita primary energy input from 3,000 to 2,000 watt.

Table 2.3
Primary energy consumption in Vienna
Sources: Energy balance 2015, population data, SCWR, AEA, MA 37 and OIB

Watt per capita	1995	2000	2005	2010	2014	2015	Change [%] base year 2000
Primary energy consumption	2,874	2,962	3,274	3,134	2,747	2,707	–17.3%
Trend line, moving average over 4 years		2,999	3,275	3,081	2,898	2,834	–13.5%
Linear target path until 2050 (2050: 2,000 W)			3,274	3,133	3,019	2,991	–8.6%

Fig. 2.3
Primary energy consumption in Vienna, 1995-2015, SCWR target
Sources: Energy balance 2015, population data, SCWR, AEA, MA 37 and OIB



Note: Primary energy consumption is calculated based on final energy consumption for Vienna and regional conversion factors (AEA, MA 37, OIB). The Swiss method of the 2,000 watt society cannot yet be applied exactly. The method is being developed further. The trend line is included to mitigate deviations caused by weather and leap years.

2.1.d Share of renewable energy in gross final energy consumption

Smart City Wien Framework Strategy objective:
In 2030, over 20%, and in 2050, 50% of Vienna's gross energy consumption will be covered from renewable sources[2].

Table 2.4
Share of renewable energy in gross final energy consumption in Vienna
Sources: Energy balance 2015, e-Control market report and SCWR

GWh	2005	2010	2014	2015	Change [%] base year2005
Renewable energy in Vienna	2,304	4,030	4,107	4,361	+89.3%
Net imports of renewable electrical energy to Vienna	1,327	968	3,917	3,127	+135.7%
Gross final energy consumption in Vienna	41,105	41,349	37,131	38,313	-6.8%
Share of renewable energy in Vienna	5.6%	9.7%	11.1%	11.4%	+103.0%
Net imports of renewable electrical energy to Vienna	3.2%	2.3%	10.5%	8.2%	+152.8%
Total share of renewables in Vienna	**8.8%**	**12.1%**	**21.6%**	**19.5%**	**+121.2%**

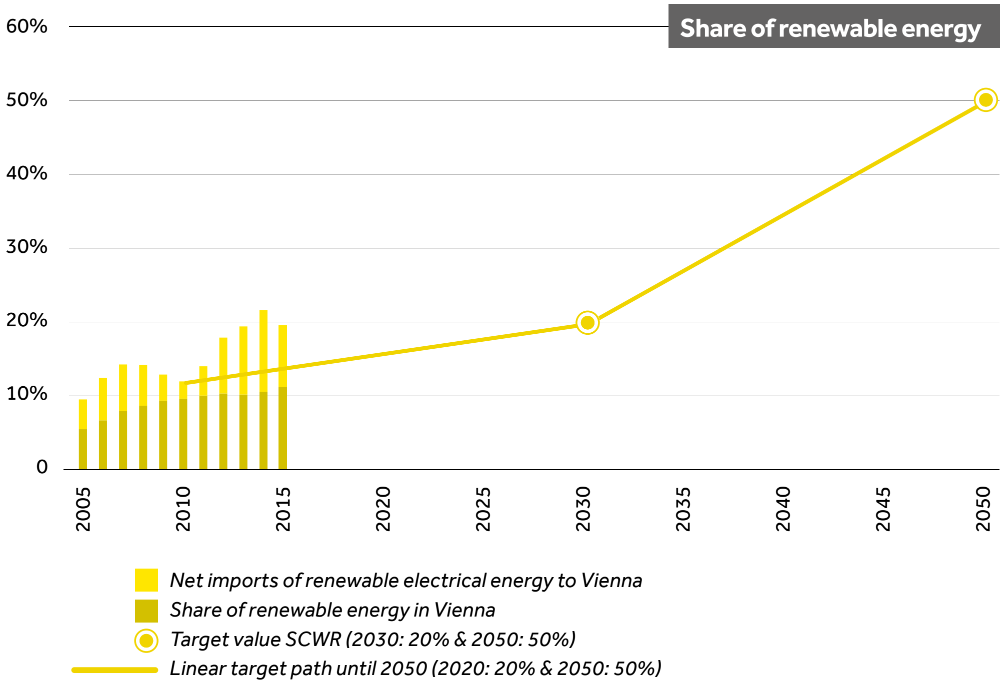


Fig. 2.4
Share of renewable energy in gross final energy consumption in Vienna, 2005-2015, SCWR target
Sources: Energy balance 2015, e-Control market report and SCWR

Note: The share of renewable energy in Vienna is calculated pursuant to EU Directive 2009/28/EC. The imports of renewable electrical energy are calculated based on the energy source mix for electricity generation in Austria excluding Vienna according to the energy balance of Statistics Austria. The share of renewables in electrical energy imported to Austria is calculated based on the ENTSO-E (until 2009: UCTE) electricity generation statistics for Europe published in the electricity market report of energy market regulator E-Control.

[2] These do not necessarily have to be located within the city limits.

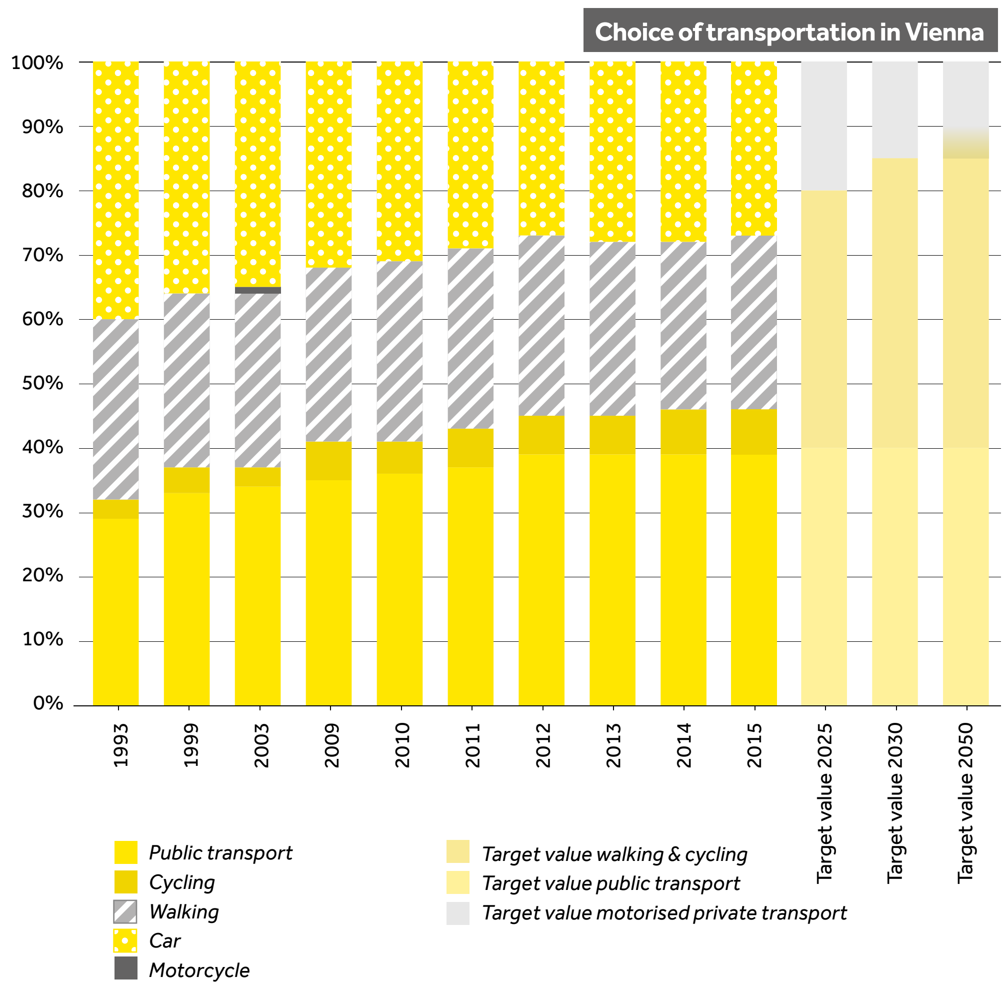
2.1.e Choice of transportation in Vienna

Smart City Wien Framework Strategy objective:
Strengthening CO_2-free modes of transportation (walking and cycling), maintaining the high share of public transport and decreasing motorised individual traffic (MIT) in the city to 20% by 2025, to 15% by 2030, and to markedly less than 15% by 2050.

Table 2.5
Choice of transportation, residents of Vienna
Source: Wiener Linien

Choice of transportation	1993	1999	2003	2009	2010	2012	2013	2014	2015	Change [%] base year 2010
Bicycle	3%	4%	3%	6%	5%	6%	6%	7%	7%	+40.0%
Motorcycle	0%	0%	1%	0%	0%	0%	0%	0%	0%	
Public transport	29%	33%	34%	35%	36%	39%	39%	39%	39%	+8.3%
Car	40%	36%	35%	32%	31%	27%	28%	28%	27%	–9.7%
Walking	28%	27%	27%	27%	28%	28%	27%	26%	27%	–7.1%

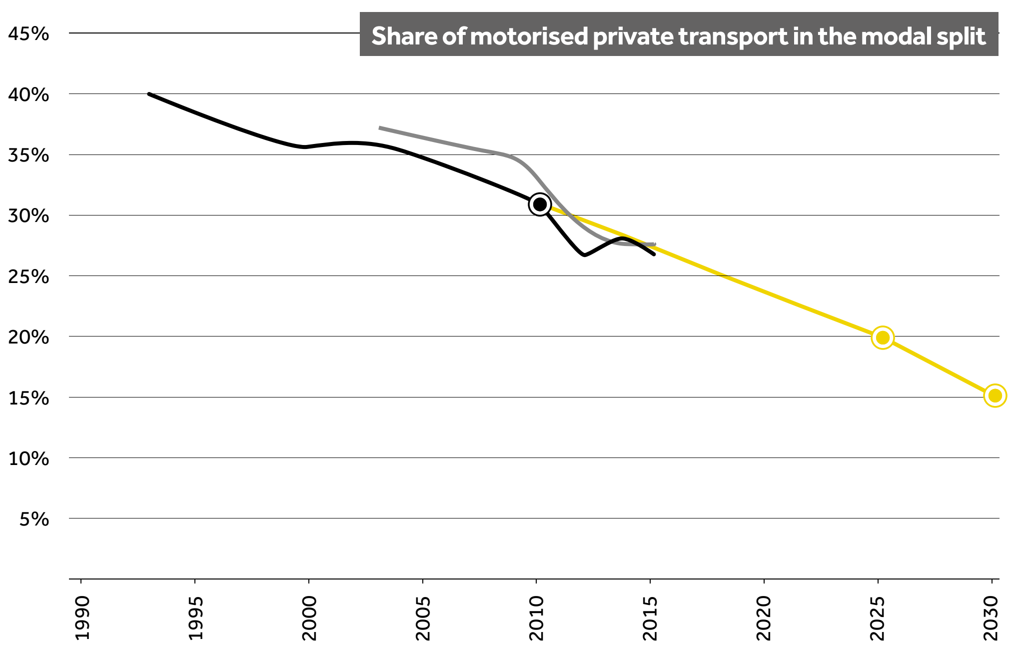
Fig. 2.5
Choice of transportation, in Vienna, 1993-2015
Sources: Wiener Linien and SCWR



2.1.f Share of motorised private transport in the modal split of the Viennese population

%	1993	1999	2003	2009	2010	2012	2013	2014	2015	Change [%] base year 2010
Motorised private transport	40%	36%	36%	32%	31%	29%	27%	28%	28%	−9.7%
Trend line motorised private transport, moving average over 3 years			37%	35%	33%	31%	29%	28%	28%	−16.2%
Linear target path until 2025, 2030					31%	30%	30%	29%	28%	−9.5%

Table 2.6
Share of motorised private transport in the modal split
Source: Wiener Linien



Motorised private transport
Linear target path until 2025, 2030
Trend line motorised private transport, moving average over 3 years
Target values motorised private transport, SCWR
Base value motorised private transport, SCWR

Fig. 2.6
Share of motorised private transport in the modal split, 1993-2015
Sources: Wiener Linien and SCWR

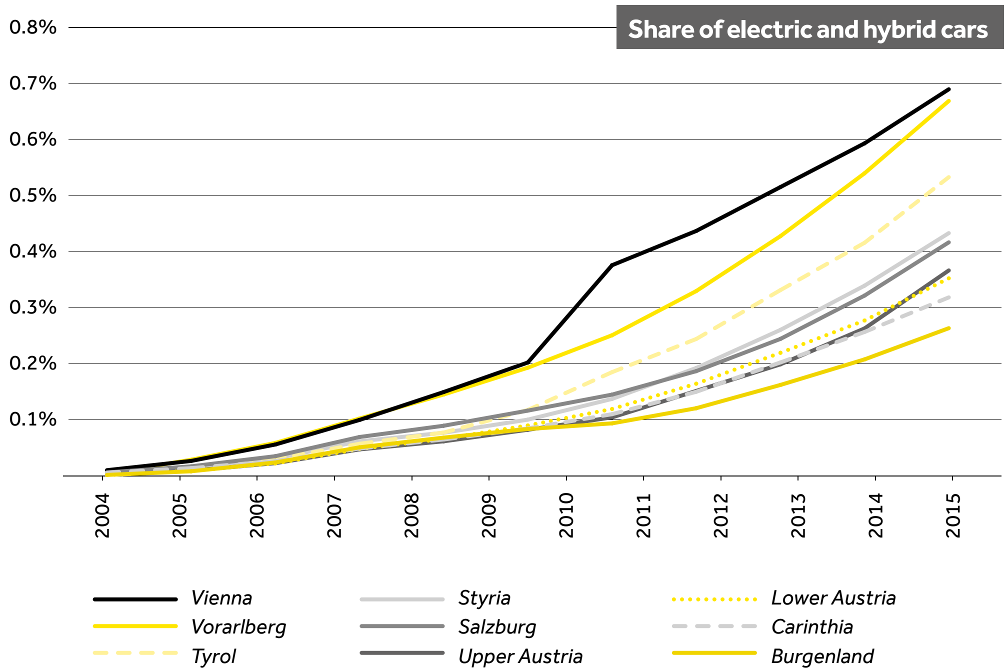
2.1.g Share of electric and hybrid cars

Smart City Wien Framework Strategy objective:
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 vehicles). By 2050, all motorised individual traffic within the municipal boundaries is to operate without conventional propulsion technologies.

Table 2.7
Share of electric and hybrid cars by federal province
Source: Vehicle registration figures

Share of electric and hybrid cars	2005	2010	2014	2015
Vienna	0.003%	0.19%	0.54%	0.67%
Vorarlberg	0.009%	0.20%	0.59%	0.69%
Tyrol	0.002%	0.10%	0.34%	0.43%
Styria	0.002%	0.08%	0.26%	0.37%
Salzburg	0.003%	0.12%	0.42%	0.53%
Upper Austria	0.001%	0.09%	0.28%	0.35%
Lower Austria	0.005%	0.12%	0.32%	0.42%
Carinthia	0.005%	0.08%	0.26%	0.32%
Burgenland	0.001%	0.08%	0.21%	0.26%

Fig. 2.7
Share of electric and hybrid cars by federal province, 2005-2015
Source: Vehicle registration figures



Note: Statistical data for hybrid motors available from 2006.

2.1.h Share of electric and hybrid lorries

Smart City Wien Framework Strategy objective:
By 2030, commercial traffic originating and terminating within the municipal boundaries is to be a largely CO_2-free.

Share of electric and hybrid lorries	2005	2010	2014	2015
Vienna	0.015%	0.03%	0.33%	0.53%
Vorarlberg	0.012%	0.03%	0.16%	0.18%
Tyrol	0.003%	0.01%	0.15%	0.16%
Styria	0.006%	0.02%	0.21%	0.24%
Salzburg	0.021%	0.01%	0.13%	0.12%
Upper Austria	0.005%	0.01%	0.13%	0.14%
Lower Austria	0.010%	0.03%	0.19%	0.24%
Carinthia	0.012%	0.04%	0.26%	0.26%
Burgenland	0.007%	0.02%	0.06%	0.10%

Table 2.8
Share of electric and hybrid lorries by federal province
Source: Vehicle registration figures

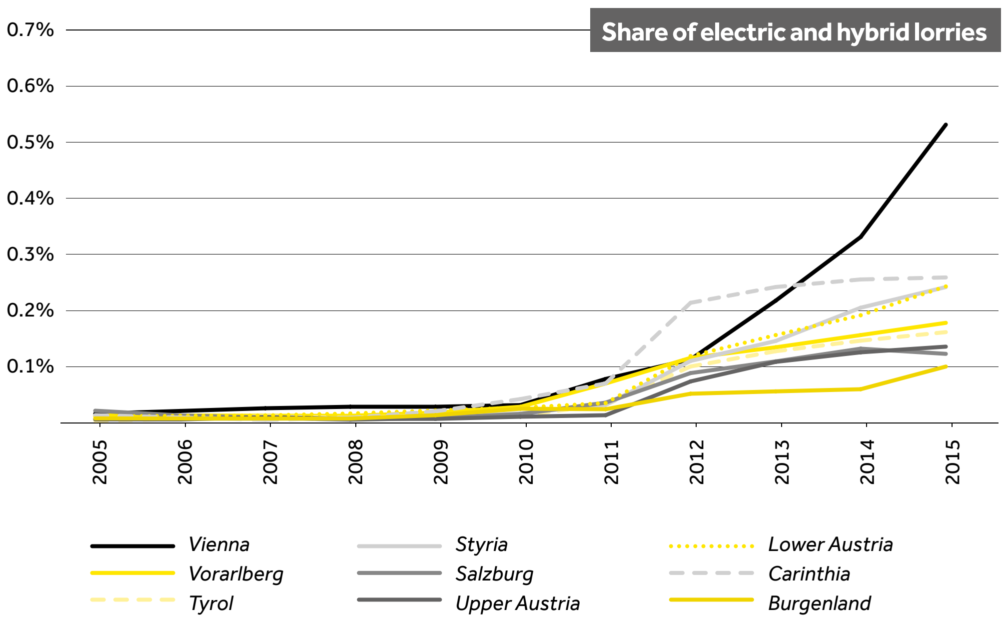


Fig. 2.8
Share of electric and hybrid lorries by federal province, 2005-2015
Source: Vehicle registration figures

Note: Commercial traffic both originating and terminating in Vienna is currently not being measured. Not all commercial vehicles registered in Vienna are used for trips within Vienna. The target value cannot be exactly monitored with the currently available data. Included vehicles: Lorries and semi-trailer towing vehicles (category N) as well as motorised transport trolleys. Statistical data for hybrid motors available from 2006.

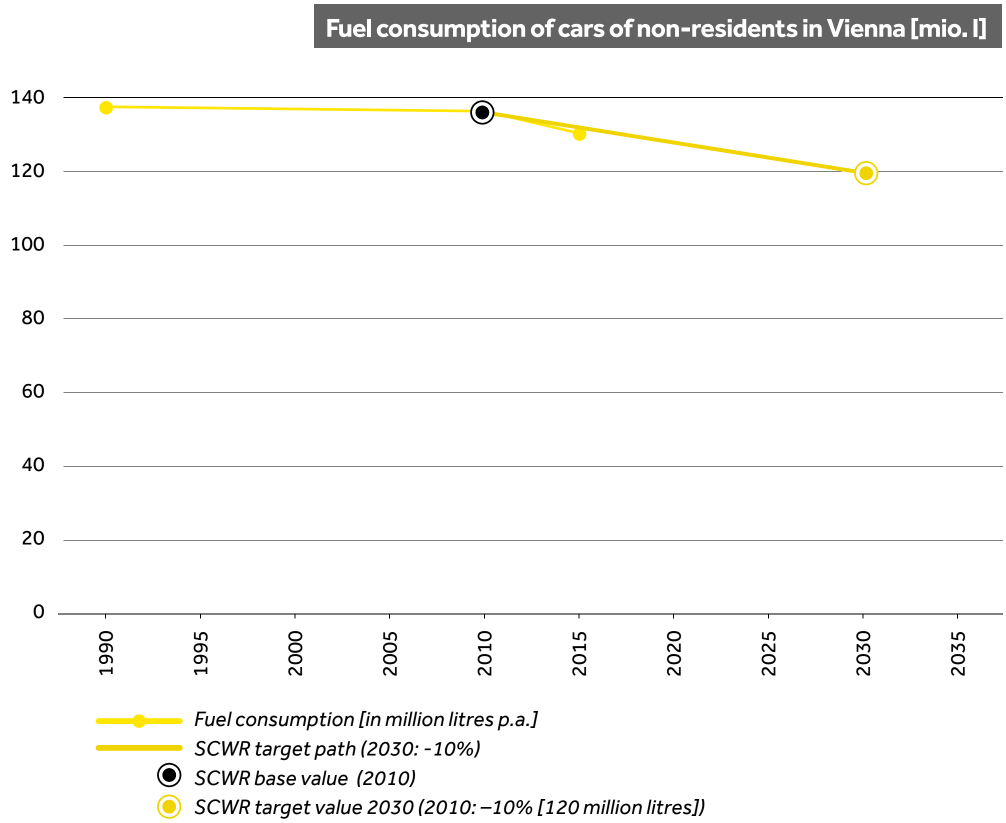
2.1.i Energy consumption of passenger traffic across city boundaries

Smart City Wien Framework Strategy objective:
Reduction of energy consumption by passenger traffic across municipal boundaries by 10% by 2030.

Table 2.9
Fuel consumption of cars of non-residents in Vienna
Sources: Data on private cars, City of Vienna and SCWR

Energy consumption of passenger traffic across city boundaries	1991	2010	2015	Change [%] base year 1990
Distance driven by cars of non-residents in Vienna [in million km]	1,596	1,820	1,809	–0.6%
Average fuel consumption in Vienna [in litres per 100 km]	8.5	7.3	7.1	–2.7%
Fuel consumption of cars of non-residents in Vienna [in million litres]	136	133	128	–3.3%
SCWR target path (2030: -10%)		133	130	–2.3%

Fig. 2.9
Fuel consumption of cars of non-residents in Vienna, 1990, 2010 and 2015, SCWR target
Sources: Data on private cars, City of Vienna and SCWR



Note: The energy consumption of passenger traffic across city boundaries is not currently being measured. Fuel consumption is calculated based on the average consumption of cars in Vienna (Statistics Austria) and the simulated driving performance of cars of non-residents in Vienna according to the traffic model (MA 18). These figures do not match the definition of the SCWR target exactly (traffic of non-residents versus traffic across city limits), but they are a good approximation.

2.1.j Share of energy sources for space heating, hot water and air conditioning

Smart City Wien Framework Strategy objective:
Cost-optimised zero-energy building standards for all new structures, additions and refurbishment from 2018/2020 and further development of future supply systems towards even better climate protection levels.

Table 2.10
Share of energy sources in final energy consumption for space heating, hot water and air conditioning in Vienna
Source: Nutzenergieanalyse 2015

Share of final energy consumption [%]	2005	2010	2013	2015	Change [%] base year 2005
Renewable energy vectors	3.5%	4.5%	5.9%	6.5%	+77.3%
District heating	32.8%	37.8%	39.4%	41.4%	+20.2%
Electrical energy	9.6%	9.3%	10.1%	10.4%	+6.6%
Natural gas	44.4%	43.2%	40.8%	43.5%	–8.4%
Oil	9.2%	5.0%	3.6%	3.8%	–62.0%
Combustible waste	0.1%	0.0%	0.0%	0.0%	–91.6%
Coal	0.5%	0.1%	0.1%	0.1%	–77.1%

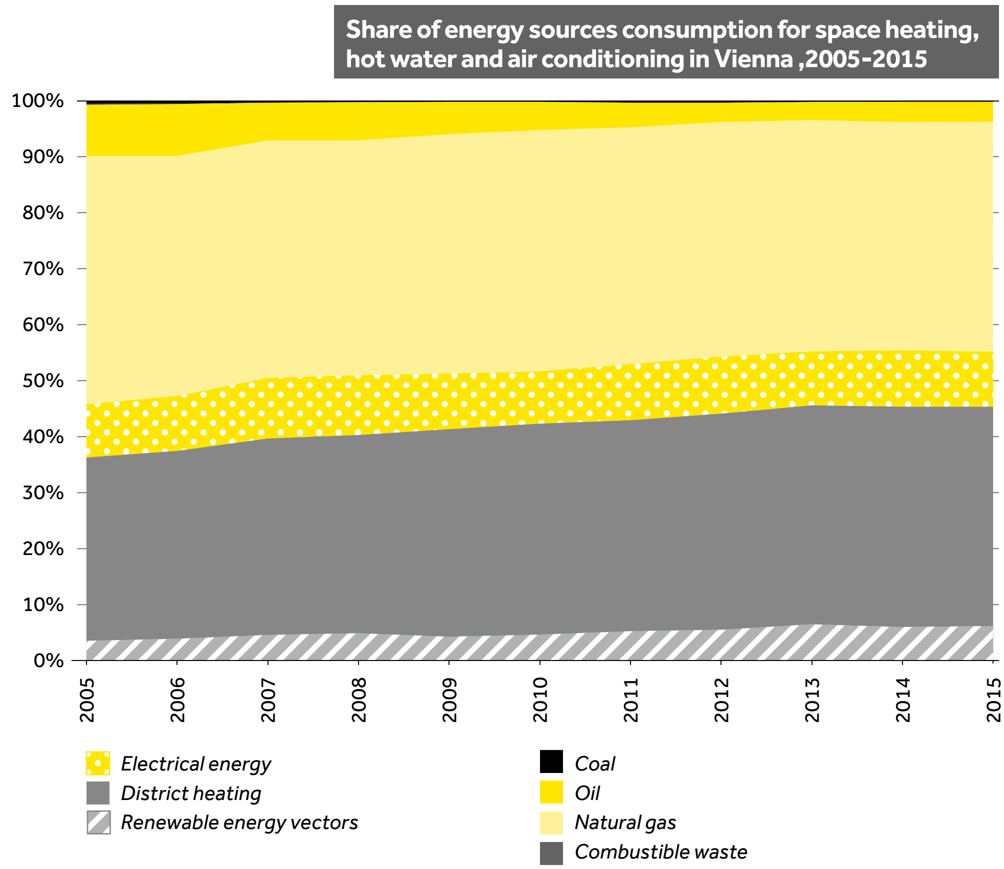


Fig. 2.10
Share of energy sources in final energy consumption for space heating, hot water and air conditioning in Vienna, 2005-2015
Source: Nutzenergieanalyse 2015

Note: The Vienna district heating system uses renewables, waste heat (e.g. cogeneration) and peak load power plants (e.g. gas).

2.1.k Energy supply for subsidised large-scale housing in Vienna

Table 2.11
Energy supply for subsidised large-scale housing in Vienna by year of subsidy granting and share of useful area
Source: City of Vienna

Share of useful area [%]	2005	2010	2014	2015	Change [%] base year 2005
Biomass	0%	1%	0%	0%	
District heating	95%	90%	61%	53%	−44.1%
Gas-powered central heating (including solar installations)	5%	9%	35%	39%	+653.8%
Heat pump	0%	0%	4%	8%	

Fig. 2.11
Energy supply for subsidised large-scale housing in Vienna by year of subsidy granting and share of useful area, 2002-2015,
Source: City of Vienna

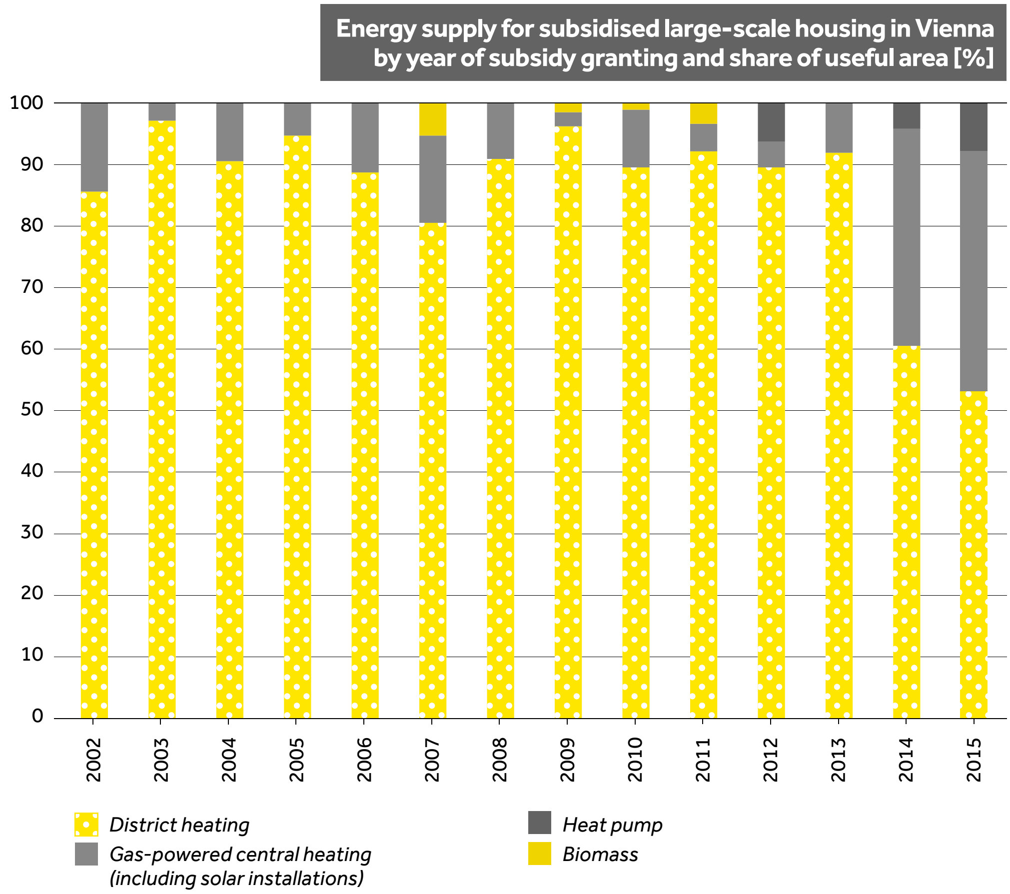
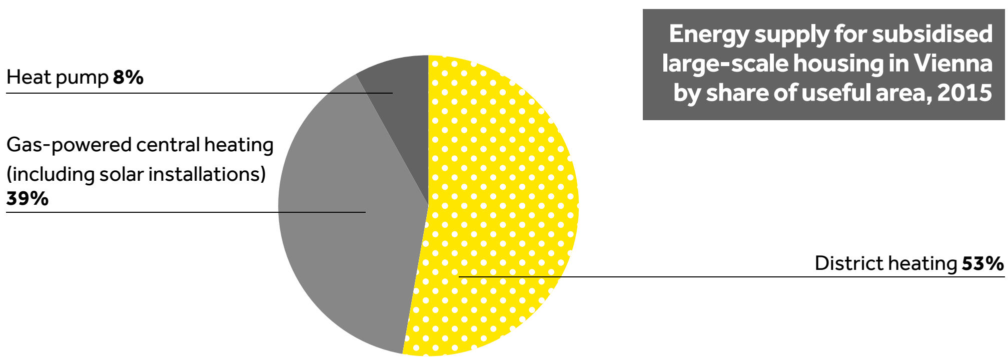


Fig. 2.12
Energy supply for subsidised large-scale housing in Vienna by share of useful area, 2015
Source: City of Vienna



2.1.I Final energy consumption for space heating, air conditioning and hot water per capita

Smart City Wien Framework Strategy objective:
Comprehensive rehabilitation activities entail the reduction of energy consumption of existing buildings for space heating/cooling/water heating by 1% per capita and year.

kWh per capita	2005	2010	2014	2015	Change [%] base year 2005
Final energy consumption for space heating, hot water and air conditioning	9,992	10,413	8,265	8,393	–19.4%
Trend line, moving average over 4 years		9,457	9,115	8,861	–6.3%
SCWR target path (-1% per year [from 2008-2012 average])		9,562	9,185	9,094	–4.9%

Table 2.12
Share of energy sources in final energy consumption for space heating, hot water and air conditioning in Vienna per capita
Source: Nutzenergieanalyse 2015

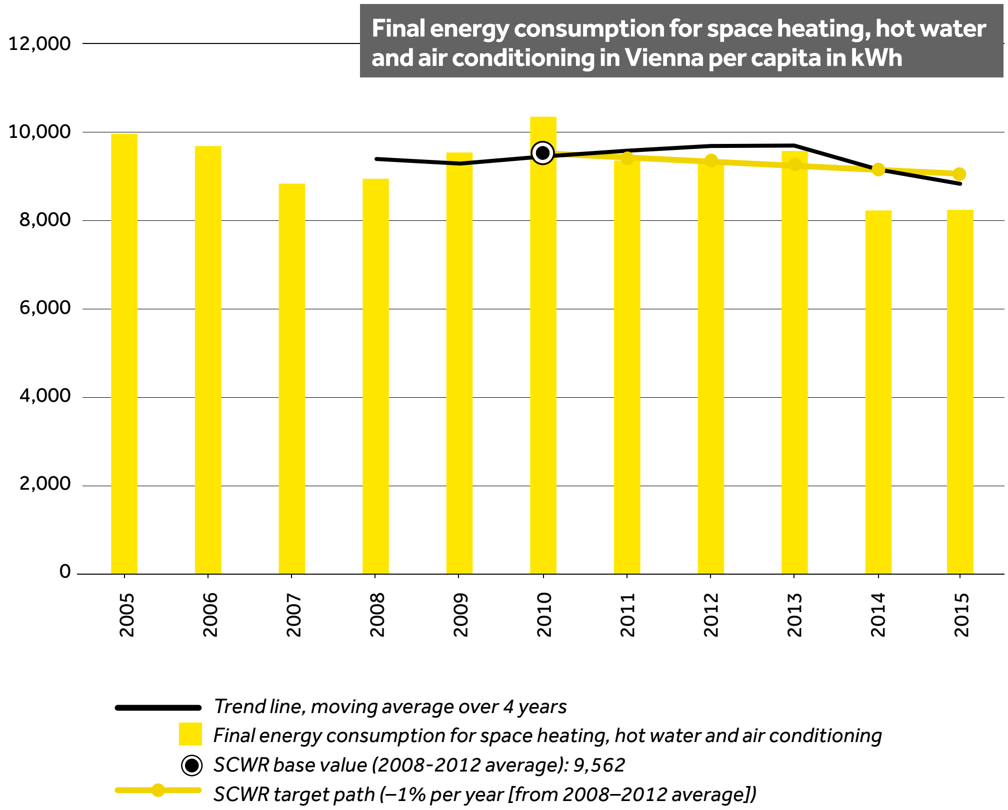


Fig. 2.13
Final energy consumption for space heating, hot water and air conditioning in Vienna per capita, 2005-2015, SCWR target path
Sources: Nutzenergieanalyse 2015 and SCWR

Note: The target path „-1% per year from 2010" is calculated using the equation
$\text{Target value}_{(\text{Target year})} = \text{Final energy consumption average}_{(2008\text{-}2012)} * 0.99^{(\text{Target year}-2010)}$.
The starting year is 2010 and the starting value is the average of 2008 to 2012.

2.2 DEVELOPMENTS IN VIENNA

2.2.a Final energy consumption per capita in Vienna

Table 2.13
Final energy consumption per capita in Vienna
Sources: Energy balance 2015 and population data

kWh per capita	1995	2000	2005	2010	2014	2015	Change [%] base year 2005
Services	5,057	5,302	5,706	6,222	4,947	4,785	–5.38%
Private households	7,032	6,992	6,923	7,030	6,116	6,309	–10.29%
Industry and agriculture	2,587	2,070	2,420	1,998	1,698	1,653	–36.09%
Traffic and transport	6,326	7,299	9,068	8,138	7,426	7,246	14.56%
Total	**21,002**	**21,663**	**24,117**	**23,388**	**20,186**	**19,993**	**–4.80%**

Fig. 2.14
Final energy consumption per capita in Vienna, 1995-2015
Sources: Energy balance 2015 and population data

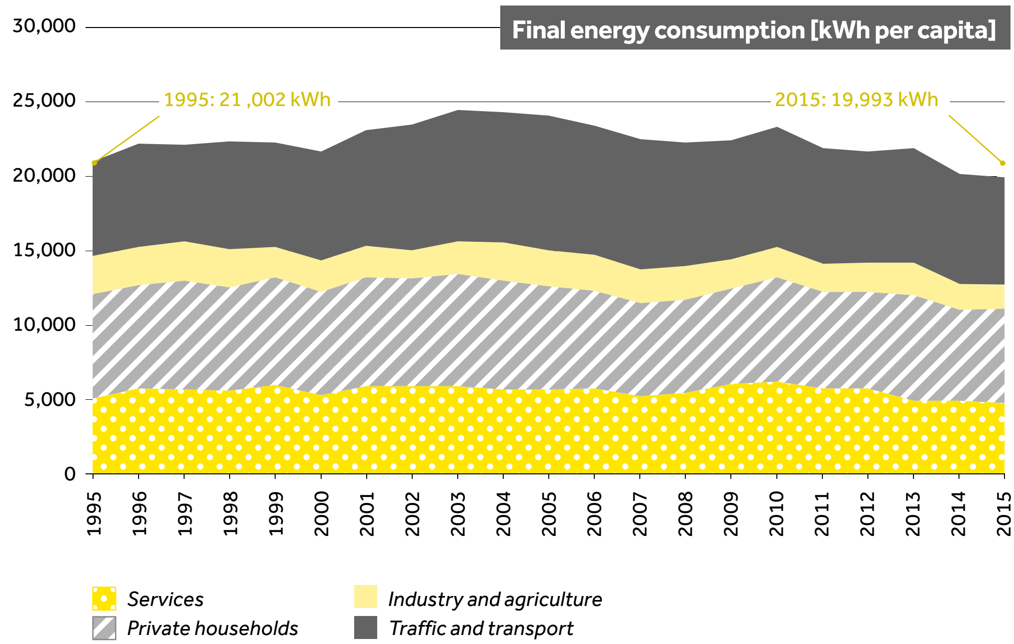
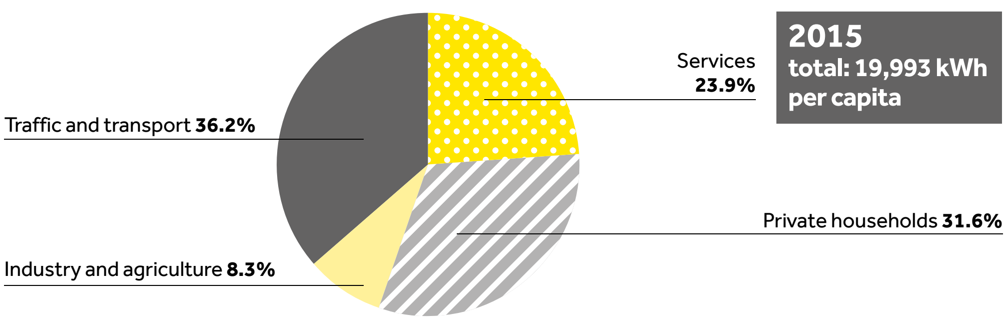


Fig. 2.15
Final energy consumption per capita in Vienna, 2015
Sources: Energy balance 2015 and population data



2.2.b Share of renewable energy and waste heat according to EU Directive 2009/28/EC

The EU Directive normalises hydropower and wind power and recognises only certified biogenic fuels as renewable. The percentages are calculated as share of gross final energy consumption.

GWh	2005	2010	2014	2015	Change [%] base year 2005
Gross final energy consumption	41,105	41,349	37,131	38,313	−6.8%
Renewable energy	2,304	4,030	4,107	4,361	+89.3%
Share of renewable energy	5.6%	9.7%	11.1%	11.4%	+103.0%
Waste heat, not renewable	4,600	5,120	3,604	4,013	−12.8%
Share of waste heat, not renewable	11.2%	12.4%	9.7%	10.5%	−6.4%
Total of shares	**16.8%**	**22.1%**	**20.8%**	**21.9%**	**+30.1%**

Table 2,14
Share of renewable energy and waste heat according to EU Directive 2009/28/EC
Source: Energy balance 2015

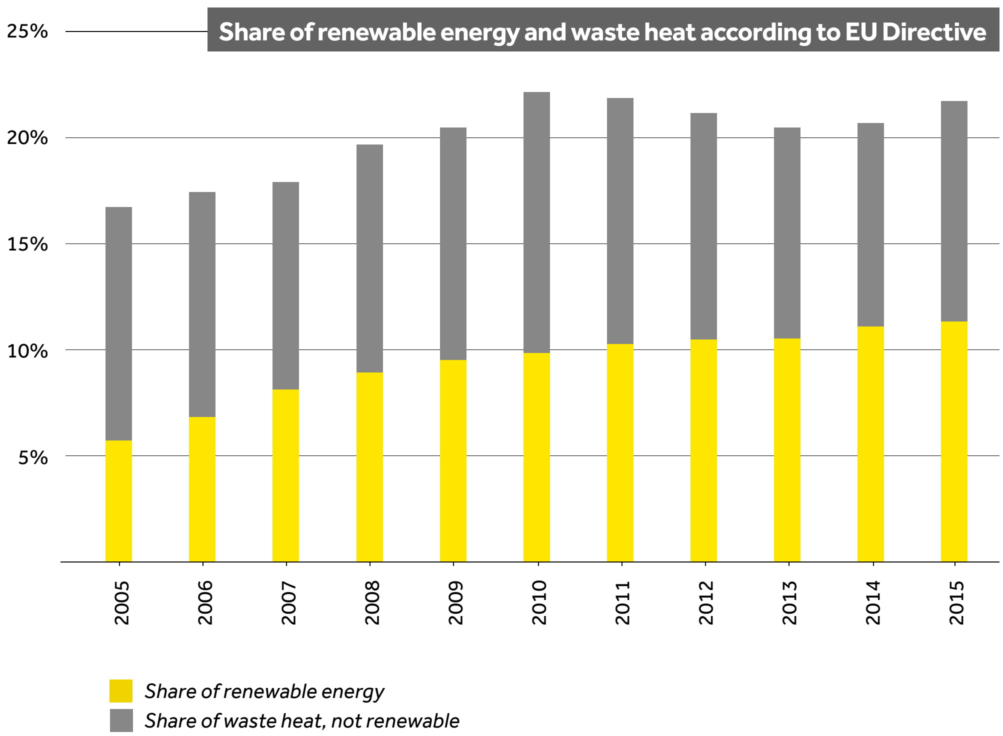


Fig. 2,16
Share of renewable energy and waste heat according to EU Directive 2009/28/EC, 2005-2015
Source: Energy balance

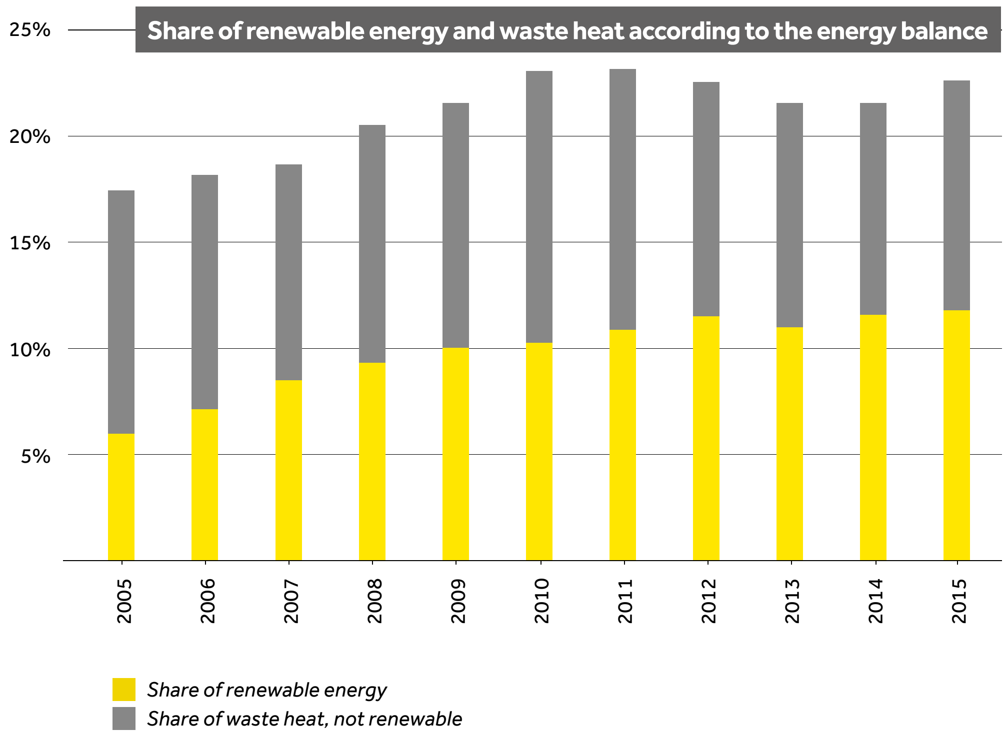
2.2.c Share of renewable energy and waste heat according to the energy balance

The energy balance includes the actual annual production of hydropower and wind power as well as all (even non-certified) biogenic fuels. The percentages are calculated as share of gross final energy consumption.

Table 2.15
Share of renewable energy and waste heat according to the energy balance
Source: Energy balance 2015

GWh	2005	2010	2014	2015	Change [%] base year 2005
Final energy consumption	39,373	39,525	35,664	36,792	–6.6%
Renewable energy	2,296	4,057	4,107	4,299	+87.2%
Share of renewable energy	5.8%	10.3%	11.5%	11.7%	+100.4%
Waste heat, not renewable	4,600	5,120	3,604	4,013	–12.8%
Share of waste heat, not renewable	11.7%	13.0%	10.1%	10.9%	–6.6%
Total of shares	**17.5%**	**23.2%**	**21.6%**	**22.6%**	**+29.0%**

Fig. 2.17
Share of renewable energy and waste heat according to the energy balance, 2005-2015
Source: Energy balance 2015



2.2.d Use of solar energy in Vienna's districts

	District	Output [kWp/1,000 inhabitants]	Area [m²/1,000 inhabitants]
	Vienna average	13.97	18.77
1	Innere Stadt	15.82	0.69
2	Leopoldstadt	8.36	6.91
3	Landstraße	11.81	3.97
4	Wieden	3.11	3.54
5	Margareten	1.13	4.62
6	Mariahilf	6.83	2.87
7	Neubau	6.74	9.77
8	Josefstadt	3.88	1.56
9	Alsergrund	4.35	7.44
10	Favoriten	8.75	8.39
11	Simmering	25.58	9.98
12	Meidling	10.29	8.83
13	Hietzing	14.61	42.23
14	Penzing	11.05	44.54
15	Rudolfsheim-Fünfhaus	5.11	6.24
16	Ottakring	2.42	13.26
17	Hernals	5.67	21.58
18	Währing	4.32	19.85
19	Döbling	7.20	33.76
20	Brigittenau	1.19	5.01
21	Floridsdorf	25.66	31.80
22	Donaustadt	29.66	42.45
23	Liesing	61.23	51.77

Table 2.16
Output of PV panels and surface area of subsidised solar thermal installations per capita by district, 2015
Sources: Energy database of MA 20 and population data for Vienna

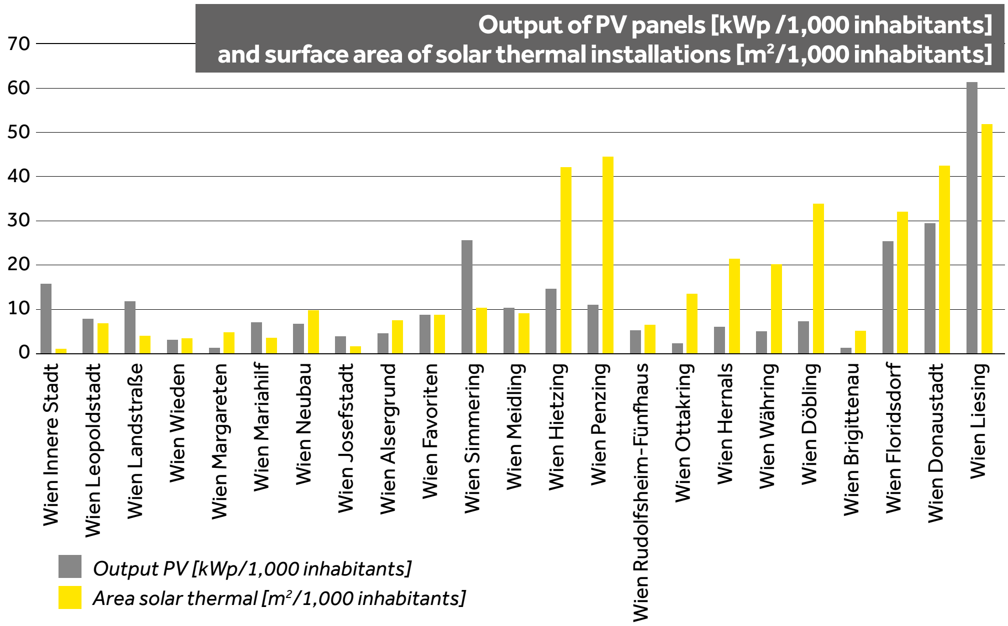


Fig. 2.18
Output of PV panels and surface area of subsidised solar thermal installations per capita by district, 2015
Sources: Energy database of MA 20 and population data for Vienna

2.2.e Electricity generation from renewable energy

Table 2.17
Share of electricity from renewable energy in Vienna's total electricity generation
Source: Energy balance 2015

GWh/a	2005	2010	2014	2015	Change [%] base year 2005
Electricity generation from renewable energy	1,135	1,331	1,354	1,399	+23.3%
Total electricity generation in Vienna	7,312	8,293	4,165	5,119	–30.0%
Share [%]	**15.5%**	**16.0%**	**32.5%**	**27.3%**	**+76.1%**

Fig. 2.19
Share of electricity from renewable energy in Vienna's total electricity generation, 2005-2015
Source: Energy balance 2015

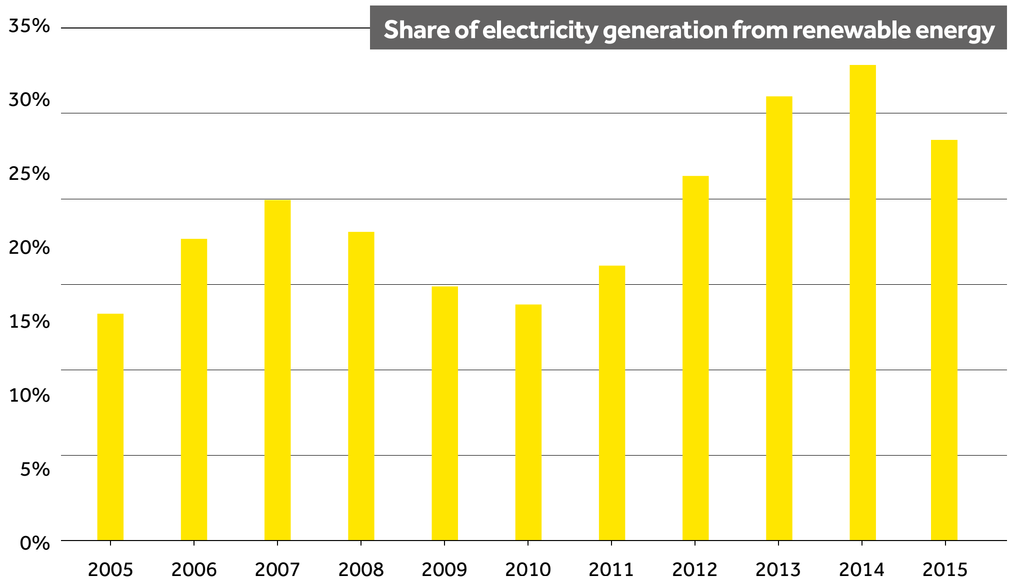
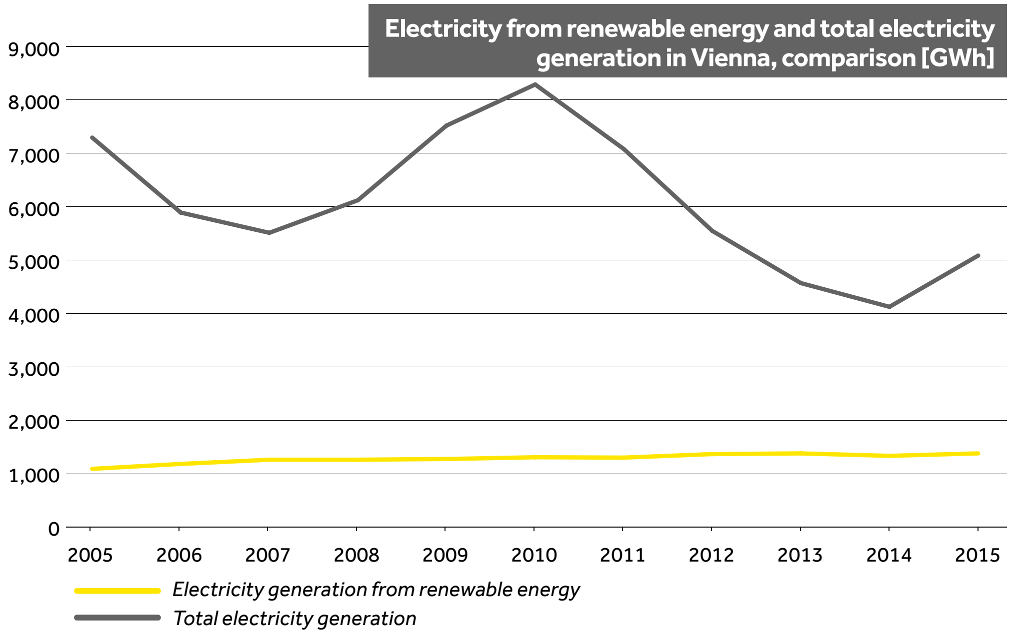


Fig. 2.20
Electricity from renewable energy and total electricity generation in Vienna, comparison, 2005-2015
Source: Energy balance 2015



Note: Electricity generation from renewables is growing steadily, total electricity generation fluctuates heavily.

2.2.f Greenhouse gas (GHG) emissions per capita

t CO_2 equivalents per capita	1990	1995	2000	2005	2010	2013	2014	Change [%] base year 1995
Total emissions according to BLI	5.5	5.4	5.2	6.2	5.7	4.8	4.4	−19.7%
BLI without emissions trading	4.4	4.3	4.0	4.5	4.0	3.8	3.6	−18.5%
KliP balance method	3.8	3.6	3.1	3.2	2.9	2.8	2.6	−31.6%

Table 2.18
Greenhouse gas emissions per capita in Vienna
Sources: BLI, EmiKat and population data for Vienna

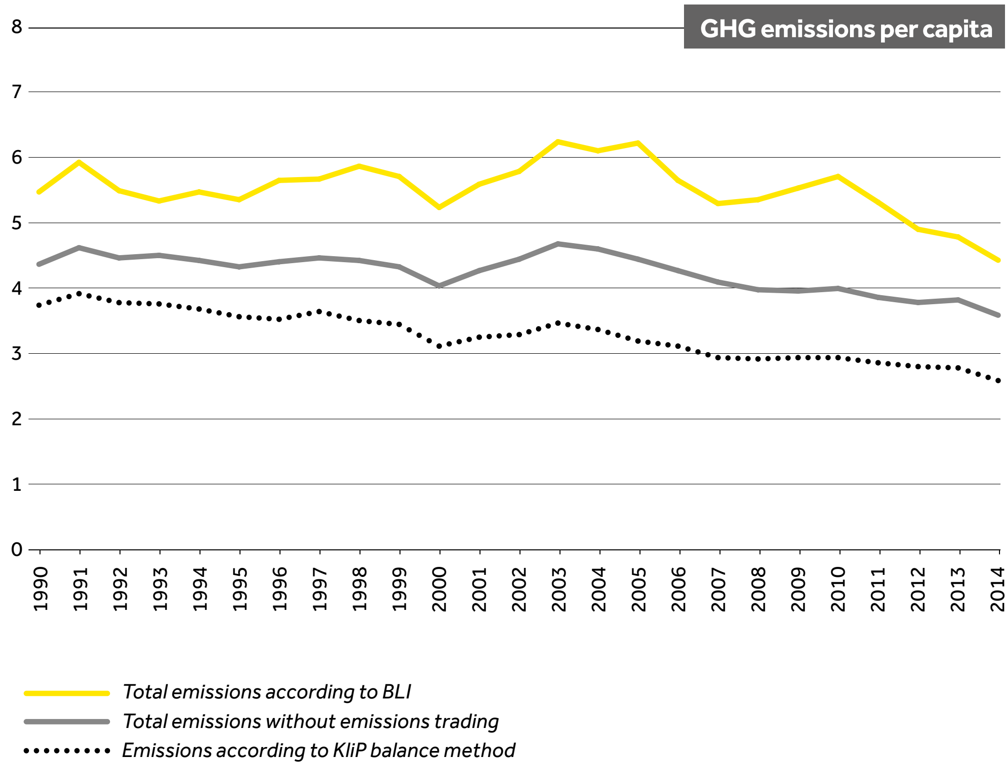


Fig. 2.21
Greenhouse gas emissions per capita in Vienna, 1990-2014
Sources: BLI, EmiKat and population data for Vienna

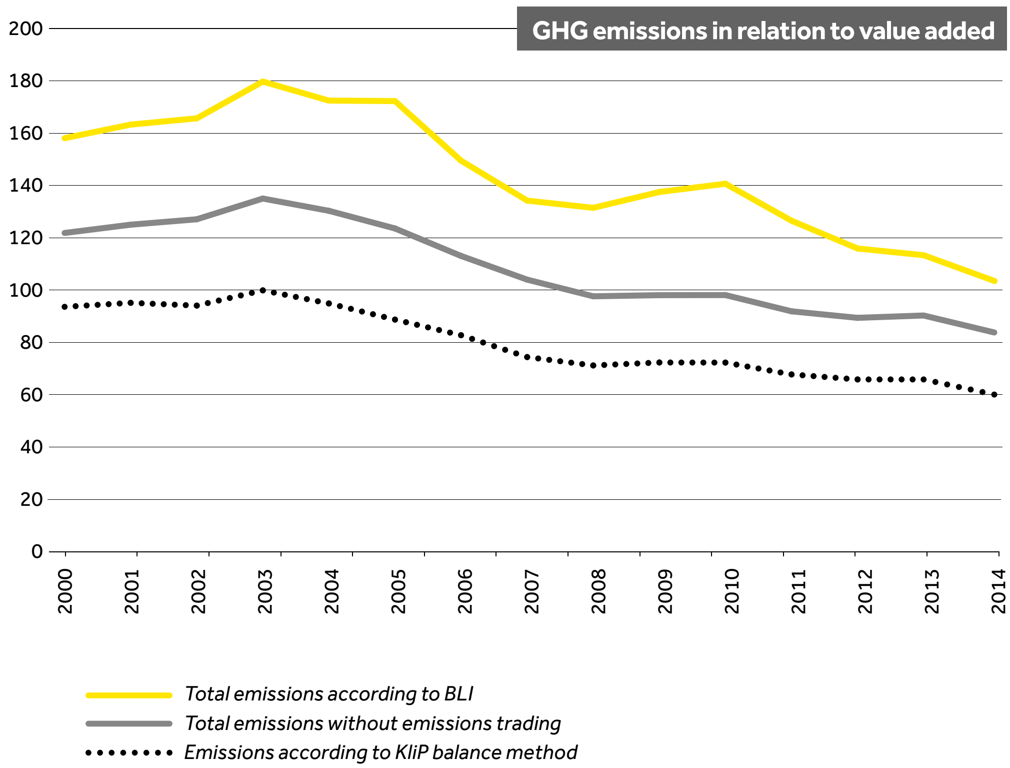
Note: At the time of writing, the emissions data for 2015 had not yet been published.

2.2.g Greenhouse gas emissions in relation to value added

Table 2.19
GHG emissions in Vienna in relation to value added
Sources: BLI, EmiKat and data for value added

t CO_2 equivalents per capita	2000	2005	2010	2013	2014	Change [%] base year 2000
Total emissions according to BLI	93.6	87.6	72.0	65.5	60.5	–35.4%
BLI without emissions trading	121.8	122.5	97.9	90.0	84.0	–31.1%
KliP balance method	158.1	171.2	140.5	113.1	103.8	–34.4%

Fig. 2.22
GHG emissions in Vienna in relation to value added, 2000-2014
Sources: BLI, EmiKat and data for value added



2.2.h Car density in Vienna's districts

Table 2.20
Car density in Vienna's districts per 1,000 inhabitants
Sources: Vehicle registration figures and population data for Vienna

Cars per 1,000 inhabitants		2008	2010	2011	2012	2013	2014	2015	Change [%] base year 2008
	Vienna average	393	396	396	396	391	387	373	–5.3%
1	Wien Innere Stadt	986	1,027	1,039	1,054	1,041	1,048	1,027	+4.2%
2	Wien Leopoldstadt	335	334	335	332	333	327	318	–5.0%
3	Wien Landstraße	441	464	453	445	441	449	437	–0.9%
4	Wien Wieden	424	424	422	422	417	408	402	–5.2%
5	Wien Margareten	330	327	322	322	315	309	298	–9.6%
6	Wien Mariahilf	388	384	384	383	371	360	352	–9.3%
7	Wien Neubau	373	368	370	368	363	354	342	–8.2%
8	Wien Josefstadt	361	358	357	353	346	340	328	–9.0%
9	Wien Alsergrund	401	388	385	384	376	368	358	–10.7%
10	Wien Favoriten	353	353	355	354	351	344	337	–4.5%
11	Wien Simmering	371	371	373	376	374	372	367	–1.1%
12	Wien Meidling	353	355	357	362	360	357	353	+0.0%
13	Wien Hietzing	448	449	452	456	455	451	442	–1.5%
14	Wien Penzing	383	389	390	396	393	388	382	–0.3%
15	Wien Rudolfsheim–Fünfhaus	311	307	305	310	303	296	287	–7.5%
16	Wien Ottakring	326	327	328	333	331	326	321	–1.5%
17	Wien Hernals	339	344	346	348	344	339	330	–2.8%
18	Wien Währing	373	371	373	371	362	358	349	–6.3%
19	Wien Döbling	418	423	423	420	419	417	411	–1.6%
20	Wien Brigittenau	311	314	311	309	304	301	295	–5.2%
21	Wien Floridsdorf	398	402	404	399	396	392	391	–1.6%
22	Wien Donaustadt	439	447	448	447	443	437	443	+0.7%
23	Wien Liesing	508	512	512	506	499	496	499	–1.7%

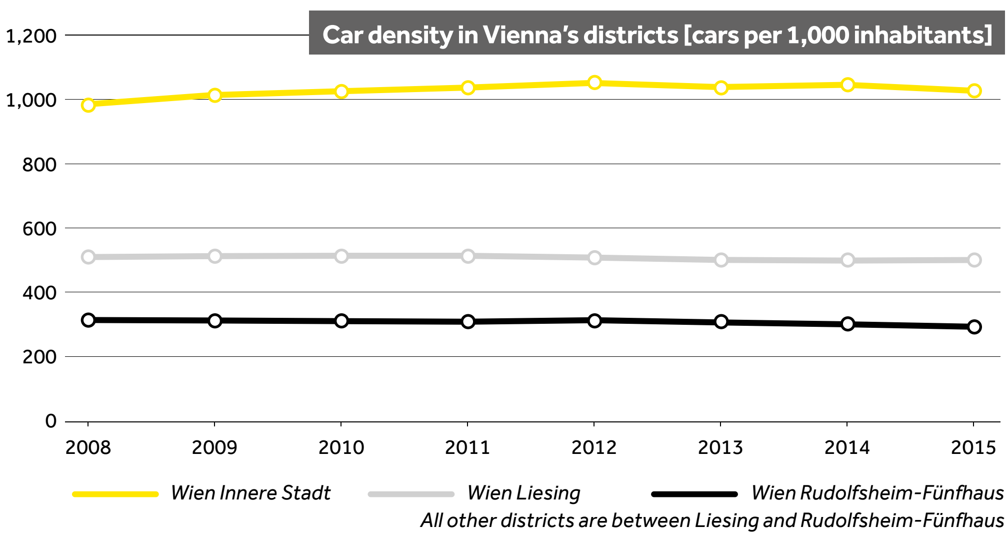
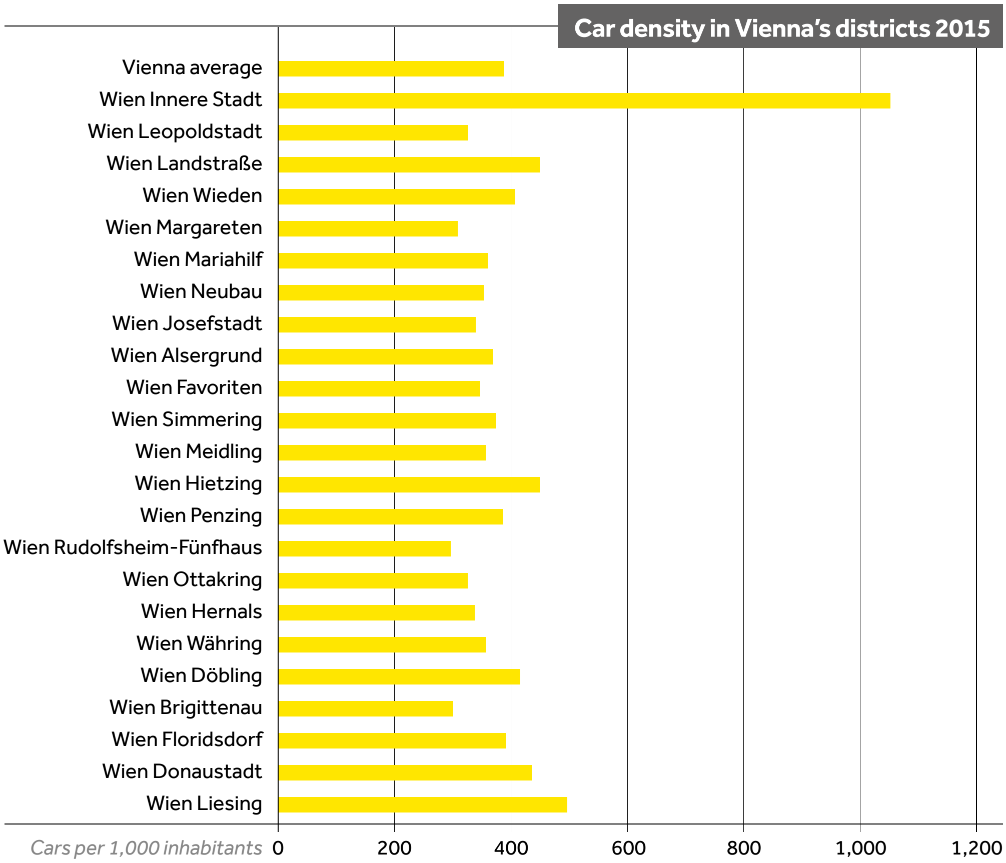


Fig. 2.23
Car density in Vienna's districts per 1,000 inhabitants, 2008-2015
Sources: Vehicle registration figures and population data for Vienna

Fig. 2.24
Car density in Vienna's districts per 1,000 inhabitants, 2015
Sources: Vehicle registration figures and population data for Vienna

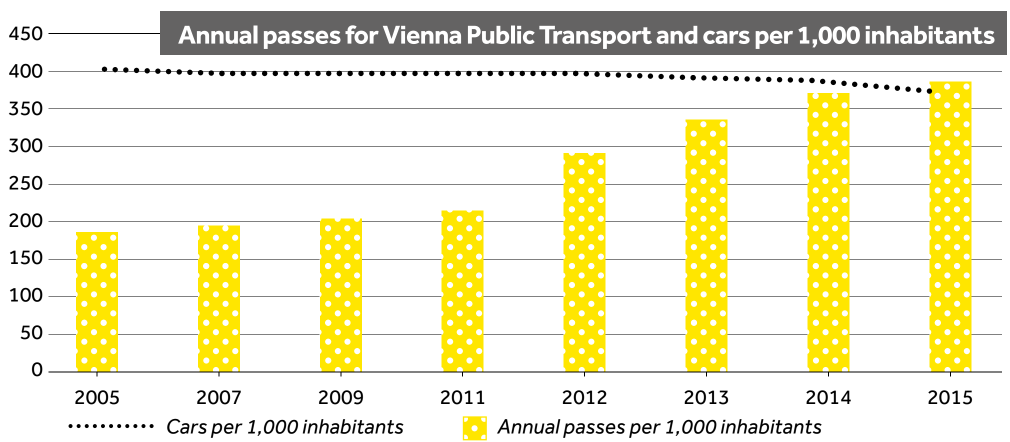


2.2.i Annual passes for public transport and cars per 1,000 inhabitants

Table 2.21
Annual passes for Vienna Public Transport and cars per 1,000 inhabitants
Sources: Wiener Linien and population data for Vienna

	2005	2009	2014	2015	Change [%] base year 2005
Annual passes per 1,000 inhabitants	186	200	368	387	+108.2%
Cars per 1,000 inhabitants	402	395	387	373	–7.3%

Fig. 2.25
Annual passes for Vienna Public Transport and cars per 1,000 inhabitants, 2005-2015
Sources: Wiener Linien and population data for Vienna



Note: On 1 May 2012, the price for the annual pass was lowered to €365.

2.2.j Changes in number of cars and inhabitants by district

Table 2.22
Changes in number of cars and inhabitants by district between 2005 and 2015
Sources: Vehicle registration figures, Statistical Yearbook 2006 and population data for Vienna

District		Change from 2005 to 2015	
	Name	Cars	Inhabitants
1	Innere Stadt	+5.2%	–5.5%
2	Leopoldstadt	+1.5%	+11.3%
3	Landstraße	+6.7%	+5.1%
4	Wieden	–2.8%	+7.2%
5	Margareten	–9.1%	+4.6%
6	Mariahilf	–6.5%	+6.9%
7	Neubau	–6.1%	+7.3%
8	Josefstadt	–8.9%	+3.9%
9	Alsergrund	–10.3%	+3.6%
10	Favoriten	+6.4%	+15.9%
11	Simmering	+10.6%	+15.5%
12	Meidling	+9.3%	+10.6%
13	Hietzing	–1.3%	+1.6%
14	Penzing	+5.2%	+9.2%
15	Rudolfsheim–Fünfhaus	–1.6%	+9.9%
16	Ottakring	+4.0%	+9.5%
17	Hernals	+0.5%	+8.4%
18	Währing	–5.0%	+4.8%
19	Döbling	–0.4%	+4.6%
20	Brigittenau	–3.1%	+5.9%
21	Floridsdorf	+8.9%	+12.6%
22	Donaustadt	+21.2%	+19.4%
23	Liesing	+5.8%	+10.3%

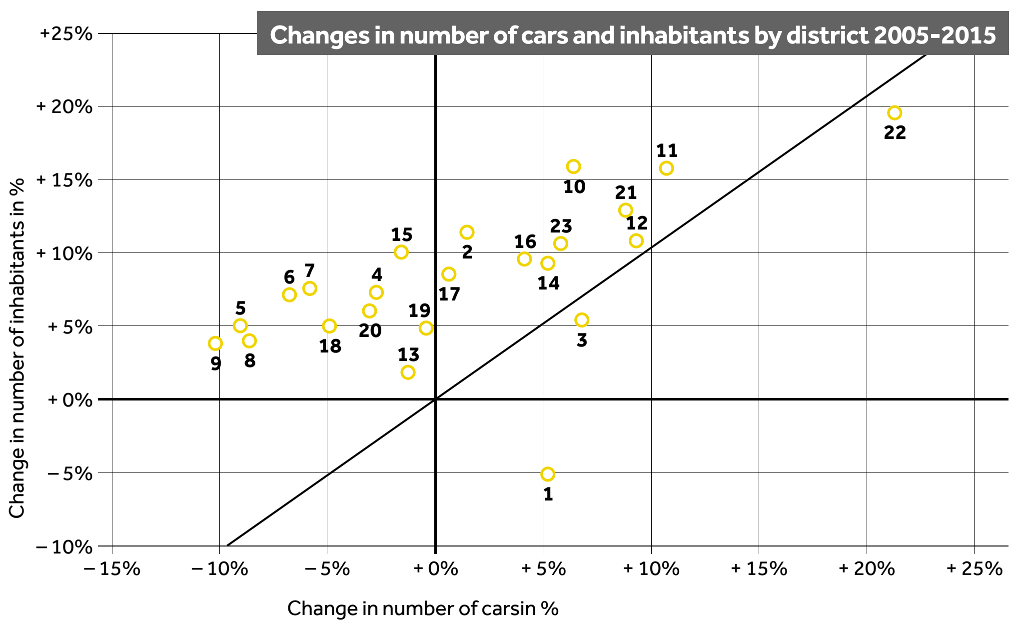


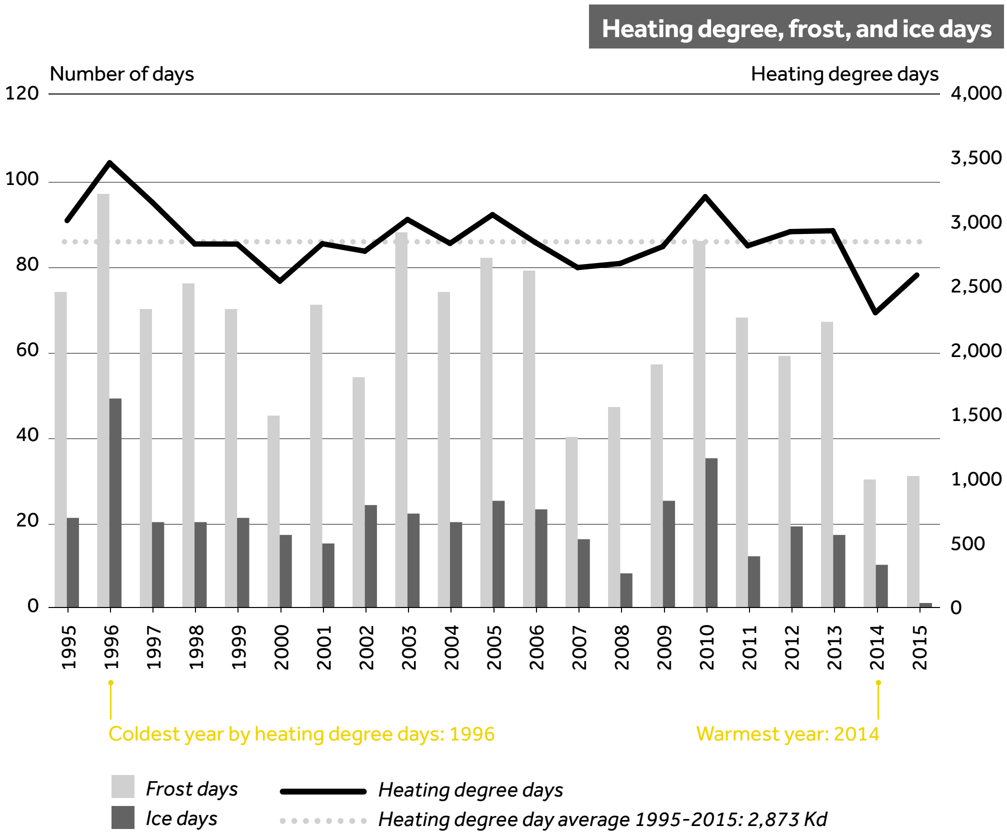
Fig. 2.26
Changes in number of cars and inhabitants by district between 2005 and 2015
Sources: Vehicle registration figures, Statistical Yearbook 2006 and population data for Vienna

2.2.k Heating degree, frost, and ice days

Table 2.23
Heating degree, frost, and ice days in Vienna
Sources: Statistical Yearbooks for Vienna

Vienna	1995	2000	2005	2010	2014	2015	Change [%] base year 1995
Frost days	74	45	82	86	30	41	−45%
Ice days	21	17	25	35	10	2	−90%
Heating degree days	3,025	2,551	3,071	3,212	2,303	2,594	−14%

Fig. 2.27
Heating degree, frost, and ice days in Vienna, 1995-2005
Sources: Statistical Yearbooks



Note: An ice day is a day on which the maximum temperature is below 0°C, and a frost day is a day on which the minimum temperature is below 0° C. The metric for heating degree days is the sum of the differences between indoor temperature and mean outdoor temperature for all heating degree days over one year.

2.2.I Average annual temperature, summer days and hot days

Number of days or temperature sums [Kd]	1995	2000	2005	2010	2014	2015	Change [%] base year 1995
Summer days	64	71	65	56	60	78	+21.9%
Hot days	15	26	12	15	13	42	+180.0%
Average annual temperature	10.4	11.7	10.2	9.9	12.0	12.1	+16.3%

Table 2.24
Average annual temperature, summer days and hot days in Vienna
Sources: Statistical Yearbooks

Average annual temperature, summer days and hot days

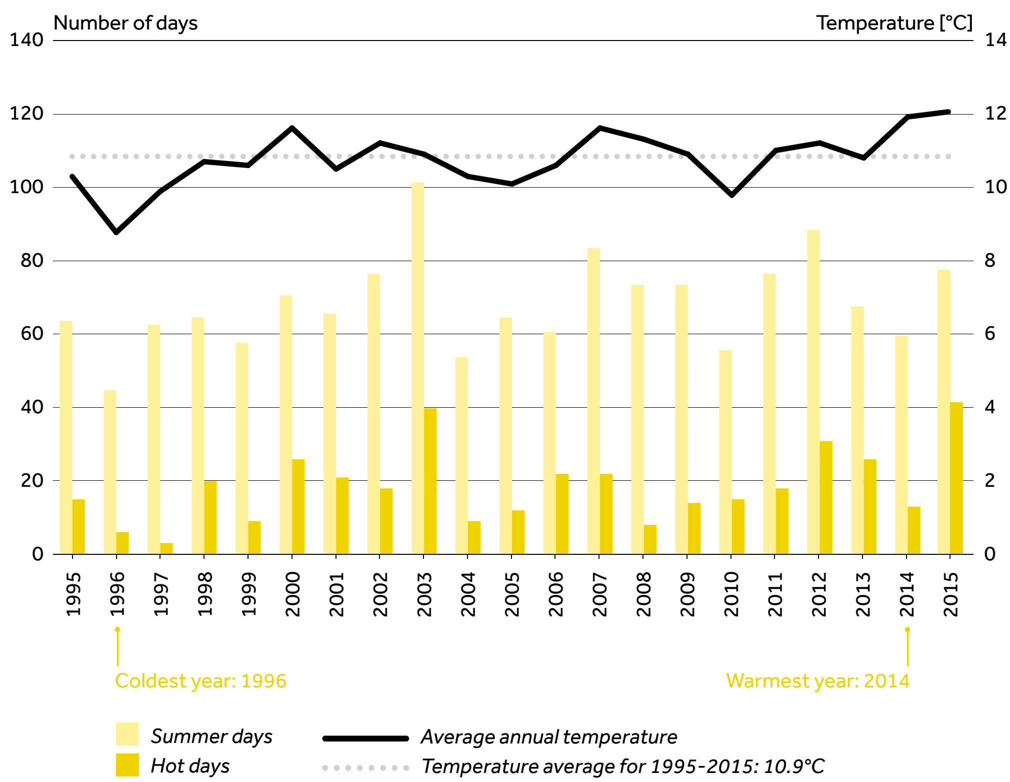


Fig. 2.28
Average annual temperature, summer days and hot days in Vienna, 1995-2005
Sources: Statistical Yearbooks

Note: A hot day is a day on which the maximum temperature is at least 30°C, and a summer day is a day with a maximum temperature of at least 25° C.

2.3 COMPARISON OF FEDERAL PROVINCES

2.3.a Final energy consumption per capita by federal province

Table 2.25
Final energy consumption per capita by federal province
Sources: Energy balance 2015 and population data

kWh per capita	1995	2000	2005	2010	2014	2015	Change [%] base year 1995
Vienna	21,002	21,663	24,117	23,388	20,186	20,470	−2.53%
Vorarlberg	26,863	27,217	31,320	30,739	27,936	28,426	5.82%
Tyrol	26,992	28,777	35,125	33,372	32,164	32,620	20.85%
Styria	33,482	37,403	42,381	41,736	39,725	40,268	20.27%
Salzburg	29,013	30,262	37,555	37,690	33,604	33,015	13.79%
Upper Austria	34,794	40,031	44,963	45,222	43,511	43,449	24.87%
Lower Austria	32,647	36,861	42,137	42,987	39,643	40,594	24.34%
Carinthia	31,169	33,988	40,788	41,806	40,230	41,365	32.71%
Burgenland	25,515	28,338	33,559	34,413	30,617	30,999	21.49%

Fig. 2.29
Final energy consumption per capita by federal province, 1995-2015
Sources: Energy balance 2015 and population data

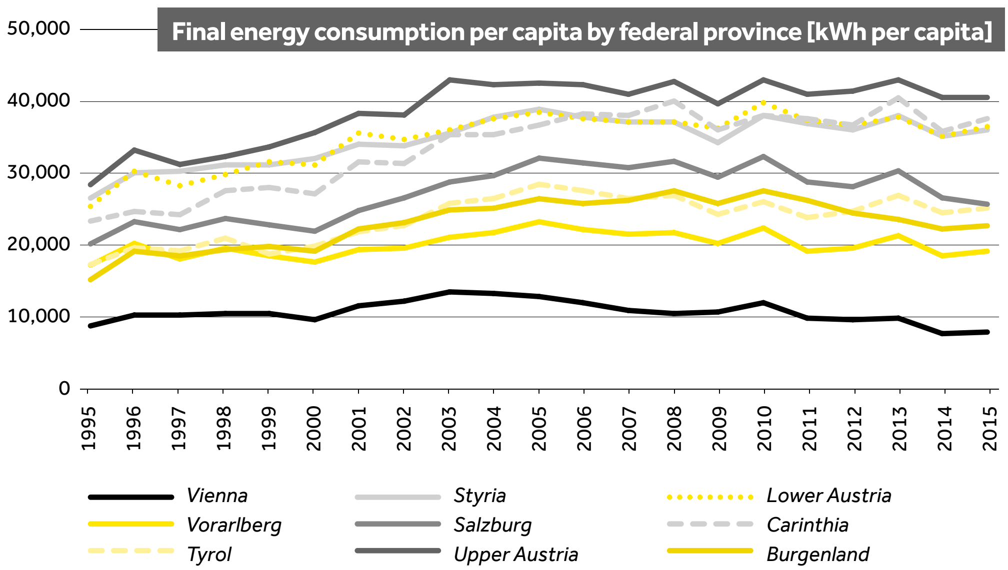
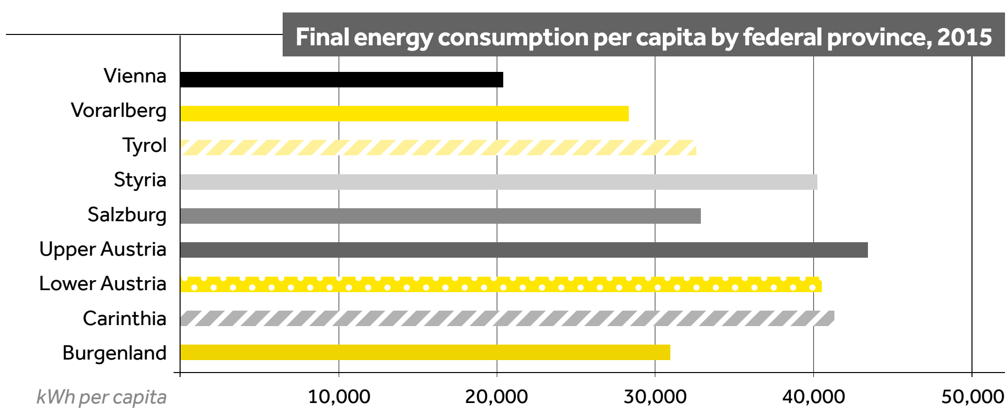


Fig. 2.30
Final energy consumption per capita by federal province, 2015
Energy balance 2015 and population data



2.3.b Electrical energy per capita by federal province

kWh per capita	1995	2000	2005	2010	2014	2015	Change [%] base year 1995
Vienna	4,307	4,635	4,873	4,931	4,606	4,571	+6.1%
Vorarlberg	5,927	5,569	6,636	6,934	6,723	6,655	+12.3%
Tyrol	6,863	7,122	8,058	7,345	7,236	7,097	+3.4%
Styria	6,058	7,116	7,764	7,930	7,789	7,758	+28.1%
Salzburg	6,185	6,199	7,193	7,499	7,195	7,094	+14.7%
Upper Austria	7,020	8,216	8,888	9,325	9,509	9,415	+34.1%
Lower Austria	5,610	5,876	6,371	6,688	6,610	6,694	+19.3%
Carinthia	6,473	7,106	8,172	8,706	8,762	8,749	+35.1%
Burgenland	3,608	4,332	4,821	5,415	5,563	5,855	+62.3%

Table 2.26
Electrical energy per capita by federal province
Sources: Energy balance 2015 and population data

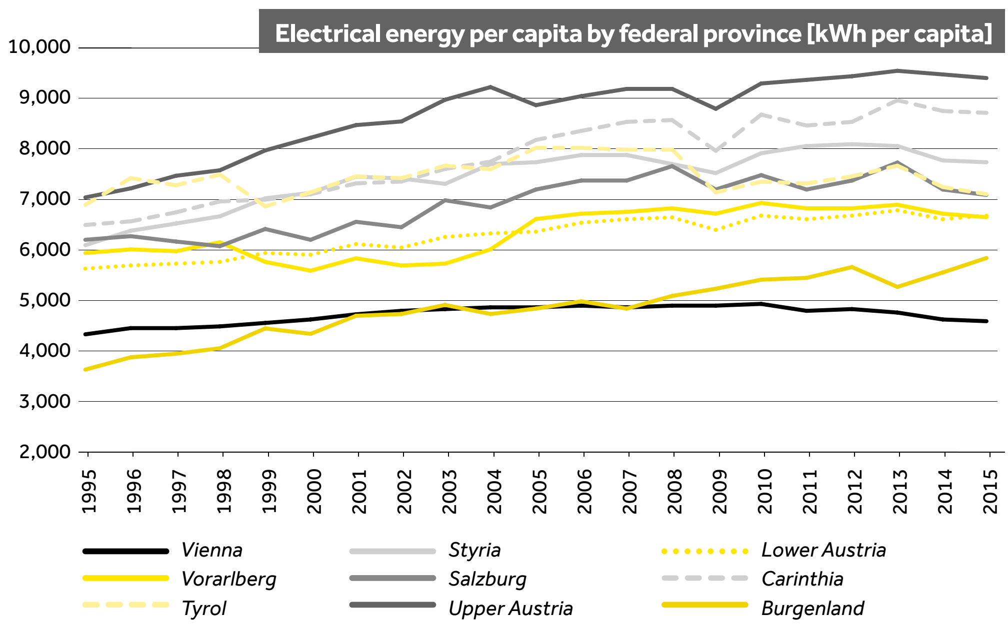


Fig. 2.31
Electrical energy per capita by federal province, 1995-2015
Sources: Energy balance 2015 and population data

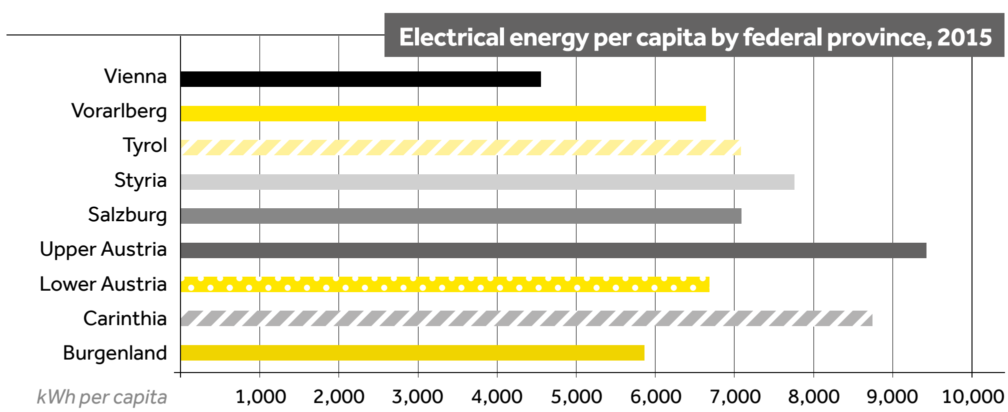


Fig. 2,32
Electrical energy per capita by federal province, 2015
Sources: Energy balance 2015 and population data

2.3.c Final energy consumption of private households per capita by federal province

Table 2.27
Final energy consumption of private households per capita by federal province
Sources: Energy balance 2015 and population data

kWh per capita	1995	2000	2005	2010	2014	2015	Change [%] base year 1995
Vienna	7,032	6,992	6,923	7,030	6,116	6,459	–8.15%
Vorarlberg	8,743	9,016	8,177	8,381	7,160	7,495	–14.27%
Tyrol	8,210	8,334	8,746	8,485	7,621	8,022	–2.29%
Styria	9,483	9,254	9,255	9,225	8,465	8,925	–5.89%
Salzburg	8,415	8,697	8,649	8,346	7,684	8,115	–3.56%
Upper Austria	9,192	9,155	8,828	8,916	8,123	8,584	–6.62%
Lower Austria	10,944	10,445	9,868	10,225	8,560	9,103	–16.82%
Carinthia	10,693	9,720	9,546	9,595	8,687	9,147	–14.46%
Burgenland	11,609	11,359	9,863	9,897	7,903	8,243	–28.99%

Fig. 2.33
Final energy consumption of private households per capita by federal province, 1995-2015
Sources: Energy balance 2015 and population data

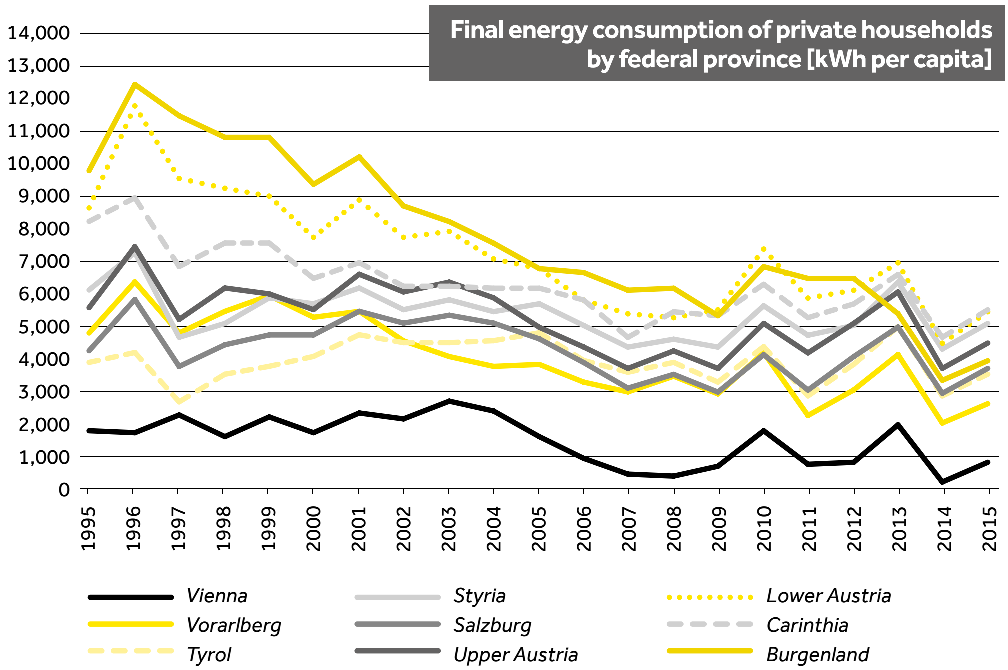
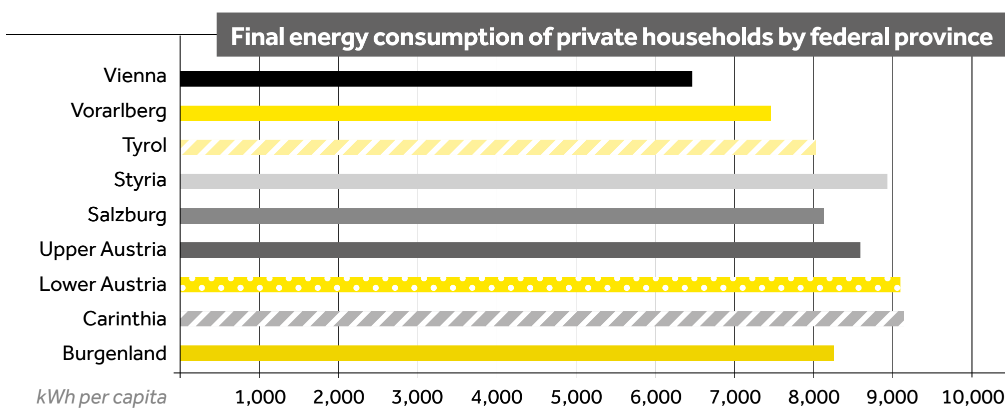


Fig. 2,34
Final energy consumption of private households per capita by federal province, 2015
Sources: Energy balance 2015 and population data



2.3.d Final energy consumption in relation to value added by federal province

MWh/million €	2000	2005	2010	2014	2015	Change [%] base year 1995
Vienna	653	661	573	475	477	−26.9%
Vorarlberg	1,117	1,108	943	756	761	−31.9%
Tyrol	1,200	1,230	1,034	878	880	−26.6%
Styria	1,833	1,753	1,509	1,278	1,286	−29.8%
Salzburg	1,156	1,228	1,029	837	811	−29.8%
Upper Austria	1,743	1,662	1,444	1,229	1,220	−30.0%
Lower Austria	1,890	1,902	1,679	1,395	1,412	−25.3%
Carinthia	1,732	1,774	1,591	1,379	1,399	−19.2%
Burgenland	1,840	1,853	1,650	1,284	1,272	−30.9%

Table 2.28
Final energy consumption in relation to value added by federal province
Sources: Energy balance 2015 and data on value added

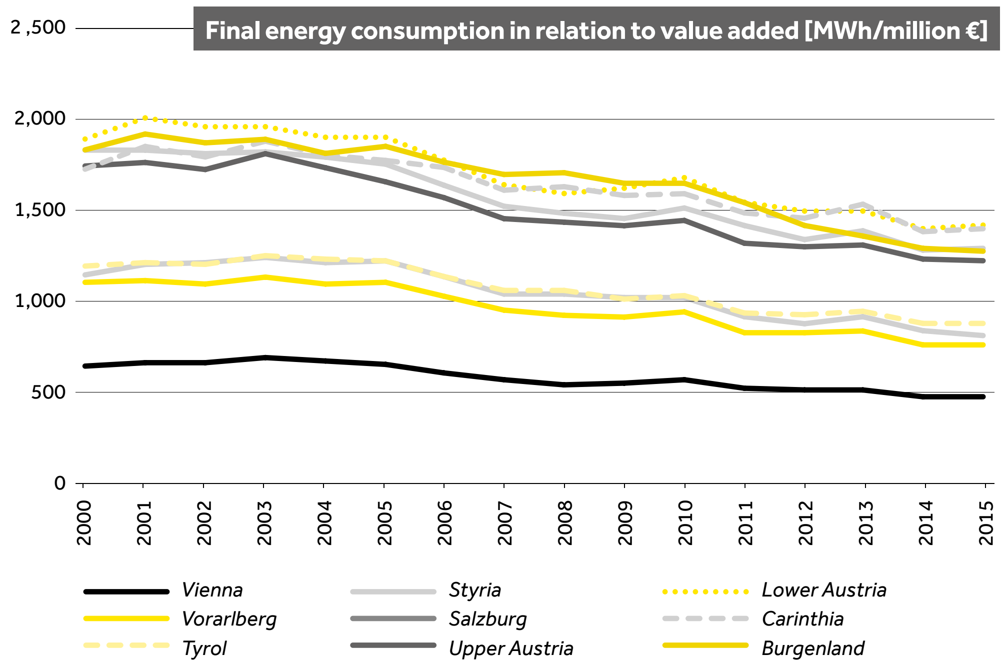


Fig. 2.35
Final energy consumption in relation to value added by federal province, 2000-2015
Sources: Energy balance 2015 and population data

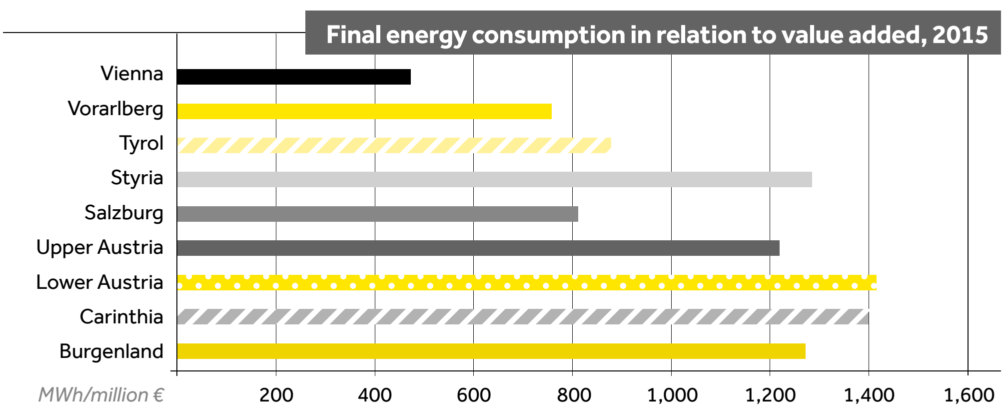


Fig. 2.36
Final energy consumption in relation to value added by federal province, 2015
Sources: Energy balance 2015 and data on value added

2.3.e Car density in provincial capitals

Table 2.29
Car density in provincial capitals per 1,000 inhabitants
Sources: Vehicle registration figures and population data

Cars per 1,000 inhabitants	2008	2009	2010	2011	2012	2014	2015	Change [%] base year 2008
Vienna	393.2	396.0	396.1	395.7	391.3	386.7	372.5	–5.3%
Sankt Pölten	543.0	555.2	561.9	567.9	571.0	573.8	571.2	+5.2%
Salzburg	483.4	502.1	505.5	511.7	514.2	516.5	517.5	+7.1%
Linz	495.8	506.5	513.9	517.7	519.0	516.4	510.0	+2.8%
Klagenfurt	573.0	587.7	595.9	606.9	609.9	607.4	605.9	+5.7%
Innsbruck	440.8	445.5	449.1	452.2	445.7	443.7	437.4	–0.8%
Graz	470.4	475.5	476.5	477.3	476.5	473.4	471.4	+0.2%
Eisenstadt	634.0	644.0	653.3	660.5	667.9	669.7	676.2	+6.7%
Bregenz (district)	484.7	499.9	506.6	513.9	519.5	524.5	528.7	+9.1%

Fig. 2.37
Car density in provincial capitals per 1,000 inhabitants, 2008-2015
Sources: Vehicle registration figures and population data

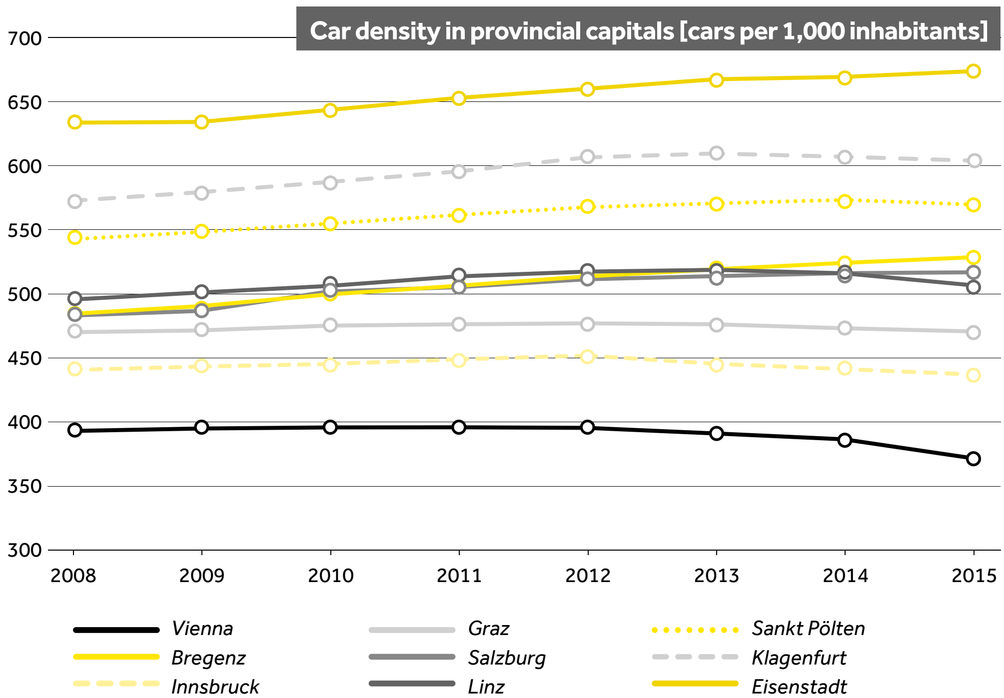
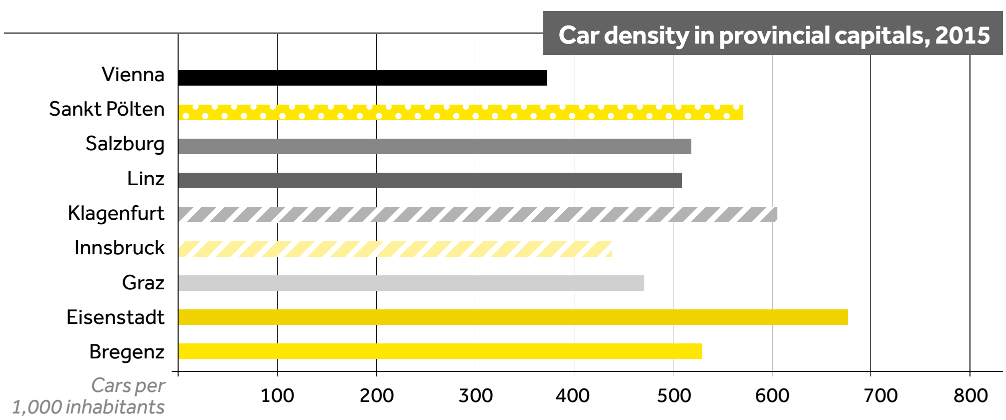


Fig. 2.38
Car density in provincial capitals per 1,000 inhabitants, 2015
Sources: Vehicle registration figures and population data



2.3.f Population growth by federal province

Province	1995	2000	2005	2010	2014	2015	Change [%] base year 1995
Vienna	1,542,667	1,548,537	1,632,569	1,689,995	1,766,746	1,840,226	+19.3%
Vorarlberg	341,408	348,366	360,054	368,366	375,282	384,147	+12.5%
Tyrol	649,875	667,459	688,954	704,662	722,038	739,139	+13.7%
Styria	1,186,136	1,182,930	1,196,780	1,205,045	1,215,246	1,232,012	+3.9%
Salzburg	506,626	512,854	522,369	526,730	534,270	545,815	+7.7%
Upper Austria	1,360,051	1,370,035	1,394,726	1,409,253	1,425,422	1,453,948	+6.9%
Lower Austria	1,518,489	1,535,083	1,568,949	1,605,897	1,625,485	1,653,691	+8.9%
Carinthia	560,708	560,696	558,926	557,998	555,881	560,482	0.0%
Burgenland	277,529	276,226	278,032	283,697	287,416	291,011	+4.9%

Table 2.30
Population growth by federal province
Source: Population data for Vienna

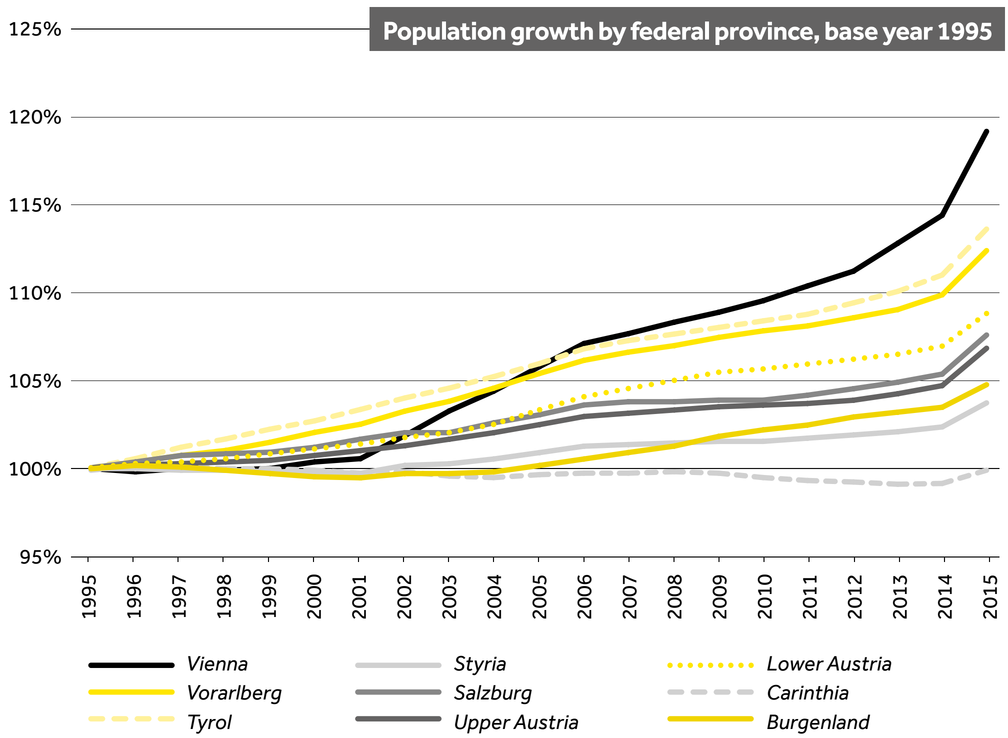


Fig. 2.39
Population growth by federal province, 1995-2015
Source: Population data for Vienna

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