

Vienna Climate Guide

Towards a climate-friendly city



**City of
Vienna**



Vienna Climate Guide

Towards a climate-friendly city

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**“So that Vienna will still
be the most liveable city
worldwide in 20 years
from now”**



The City of Vienna has played a pioneering role in climate protection for many years. More than two decades ago, in 1999, it already adopted its first Climate Protection Programme. As a result, it has succeeded in reducing per-capita CO₂ emissions by almost 40 percent. In Austria, Vienna is the federal province with the lowest per-capita CO₂ emissions. We have one of the densest public transport networks, are among the top regions for district heating in Europe and more than 50 percent of green space make Vienna the “Greenest City of the World”.

Vienna is in a very good position, but we must also be clear about one thing: We must not and will not relax our efforts to protect our climate and environment. Quite the contrary: The climate crisis is a major challenge worldwide and is going to shape the next decades. Therefore, we assume our responsibility and will further intensify our hard work towards resolute climate protection policies in all the activity areas of the City of Vienna. After all, we want to continue the good Viennese tradition of serving as a role model in Austria but also at the European and international level.

In 2020, we were the first federal province of Austria that set itself the objective of becoming climate-neutral by 2040 in Vienna's government agreement. The Smart City Wien Strategy and the present Vienna Climate Guide together provide the framework and show the way towards reaching that objective. On the basis of extensive groundwork, we present the key levers and measures required for achieving climate neutrality.

Through forward-looking and responsible policies, we have already demonstrated in the past that Vienna is able to address major challenges optimally. We will remain true to this principle also in the field of climate protection so that Vienna will still be the most liveable city worldwide in 20 years from now.

Michael Ludwig
Mayor of the City of Vienna

**“Vienna stands for social
climate protection”**



The climate crisis is the biggest challenge of our times. Temperatures are rising on our planet and the consequences are becoming more and more tangible – heat, droughts, extreme weather events. We know: We humans have caused climate change ourselves. But we also know what we can do about it: Taking action — quickly and jointly — as we have long had the tools needed to tackle the climate crisis.

The government agreement of the Vienna coalition government for progress has moved climate protection and climate change adaptation into the focus of the city's policies. The goal is clear: Vienna is to become climate-neutral by 2040. The present Vienna Climate Guide outlines the course we have to take together. It takes up the headline goals of the Smart City Wien Strategy and lays down the measures we need to take and the levers we have to move in all areas — from mobility to energy, from the circular economy to services of general interest — in order to reach those goals.

These measures and levers can be summarised in one sentence: Vienna stands for social climate protection. We see the protection of the foundations of our existence as a social task. As a result, we focus on measures that are not only good for the environment and climate but also good for people. After all, you need a good and healthy climate for living a good and healthy life.

The train to the climate-neutral city is on track. The Vienna Climate Guide points the way forward. And we will take all people of Vienna along on this journey. The major challenges we face require a particularly high level of outreach, dialogue and participation. This crisis affects us all, and therefore we can only deal with it together. On this note, "All aboard!"

Jürgen Czernohorszky

Executive City Councillor for Climate, Environment, Democracy and Personnel

**“A promise to the young
people in Vienna”**



The Climate Guide sets the course for the future of our beautiful city — and, above all, for the young Viennese. Our coalition government for progress addresses challenges jointly in professional co-operation: Through clear strategies, in specific plans, on the basis of measurability and evidence.

Climate protection is a matter for us all as it lays the foundation for the future of the children of this city. It is our responsibility to safeguard a liveable city also for young people in the future. Our horizon goes beyond the next few years. We are developing policies for today, tomorrow and the day after tomorrow. Being the City Councillor for Youth, I have the task to see fairness between generations as my compass: We make reliable policies that children and young people can have confidence in. Vienna's schools, for example, contribute significantly towards the climate goals. All new school buildings are energy self-sufficient to the greatest extent possible. Our "cool schools" are seen as a good example throughout Europe.

In addition to the financial budget, we also introduce a separate climate budget: Thus, we will not only be able to see exactly the financial expenditure but also the CO₂ emissions resulting from projects in the future. Our climate protection measures focus on mobility, new technologies and related, newly created jobs. This is about education and science, and this is to do with the participation of citizens, especially when it comes to creating green spaces and adjusting to climate change in the districts and neighbourhoods.

Vienna will be climate-neutral in 2040. We have provided the guide. I invite all the Viennese: Do join in!

Christoph Wiederkehr

Executive City Councillor for Education, Youth, Integration and Transparency

Editorial

By planning proactively and dealing with challenges of all kinds together, Vienna has become what it is today: the most liveable city of the world. This distinction has not been achieved by pure chance because being a liveable city requires continuous development, assuming responsibility for future generations and courageously taking on new challenges. Vienna's history shows that we are really good at that!

We Viennese still profit today from the bold and foresighted decisions taken in the past. From Vienna's water supply, the construction of Danube Island as a part of the flood protection system, the protection of the large share of green areas, exemplary waste management, the establishment and development of the district heating system and an outstanding public transport network to subsidised housing construction to ensure affordable housing, our city is in an optimal position for addressing new challenges and adapting to new conditions. This is also evident in the case of climate change.

Climate change raises great challenges for us. We feel its effects more and more strongly. It requires viable, long-term solutions. With this in mind, the Vienna City Government committed itself to the objective of climate neutrality by 2040 in the government agreement adopted in 2020, called for climate resilience and defined Vienna's climate goals in greater detail in the Smart City Wien Strategy (SCWS). But how can we reach those ambitious climate goals?

A key element is the present Vienna Climate Guide. On the basis of extensive groundwork laid by the city, it brings together the key levers, measures and tools that will be needed to achieve climate neutrality and climate resilience in Vienna.

The Climate Guide constitutes the transition from theory to practice. It is to commit us to a common vision and clearly state what is needed for turning it into reality. Indeed, we must not only discuss climate protection and climate change adaptation but also join forces to tackle them.

1

A new age is dawning

Vienna is the most liveable city worldwide. Affordable housing, a well developed public transport network, easily accessible green spaces, excellent healthcare, inclusive education institutions, a wide range of cultural activities and good opportunities in the labour market contribute to the quality of life in our city. Important aspects of this quality of life also relate to climatic conditions in Vienna that will require our commitment and actions in the coming years.





1.1 Grandma, what is a snowman?

Climate data of the past years clearly show that we are in the middle of **man-made climate change**. Global warming is progressing faster and faster. The main causes of these world-wide changes are obvious. In particular, the **combustion of the fossil fuels of coal, oil and natural gas, but also the destruction of forests and soils** have released greenhouse gases on a gigantic scale since the Industrial Revolution began and have changed the composition of our atmosphere and, as a result, our environment. The origins of global greenhouse gases harmful to the climate are shown in Figure 1.

It is a fact that human actions are the main cause of climate change [2]. The good news: **We ourselves are in control and can do better in the future!** The objective is a climate-neutral future in order to limit the consequences of climate change that are already clearly felt today to a tolerable level. Therefore, it is important to reduce greenhouse

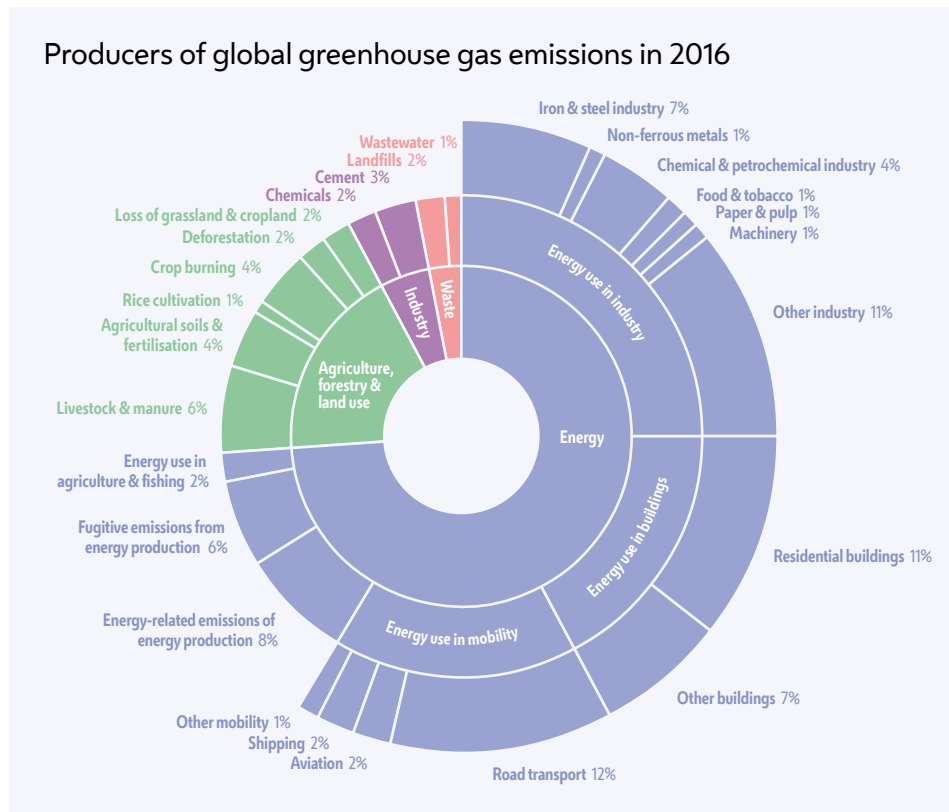


Figure 1
Producers of global greenhouse gas emissions in 2016 (emissions of electricity production are allocated to the sectors consuming electricity); own chart based on [1]

gas emissions as quickly and drastically as possible especially in the mobility, building and energy sectors so that, eventually, we hardly release any greenhouse gases to the environment. This requires decisive and resolute action.

Development of temperatures in Vienna

Deviation of annual mean air temperature from the long-term average for the period 1961-1990 in degrees Celsius

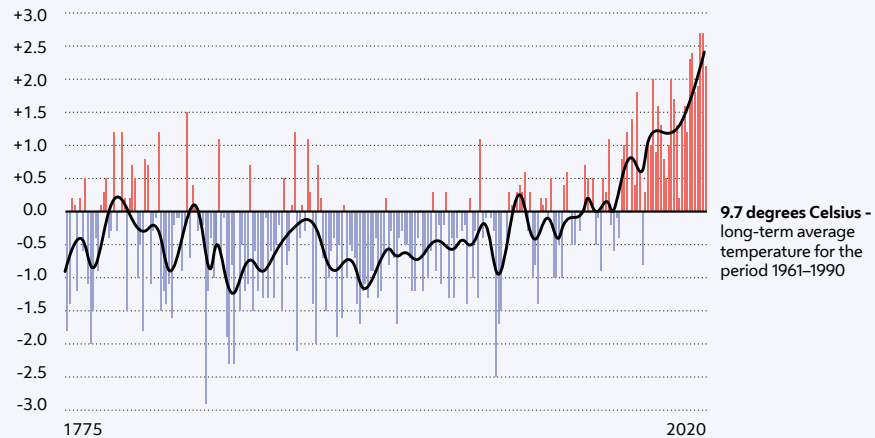


Figure 2
Climate review. Deviation of annual mean air temperature from the long-term average for the period 1961-1990 in degrees Celsius; own chart based on [5]

Given the fairly advanced climate changes, however, it is not enough to merely avoid greenhouse gas emissions as people and the environment already suffer from the direct and indirect effects of climate change today.

Rising temperatures, an increasing number of extreme weather events, such as torrential rainfalls or hailstorms, rising sea levels and retreating glaciers, have become the norm and affect our health, our quality of life and our economy. There is no region worldwide where climatic changes are not noticeable. This is also true for Vienna.

According to scientific studies, Vienna will be among the European cities most affected by the climate crisis [3]. Our main problem: It's getting hotter!

Since the 1970s the **annual mean temperature has increased** by roughly two degrees Celsius in Austria and **by even three degrees in Vienna** [4]. We already feel that now in the hot summer months, when temperatures climb to almost 40 degrees Celsius and do not fall below 20 degrees Celsius during the night. No relief is in sight! The extent and acceleration of this temperature increase have already been emerging for years. While,

on average, we only had ten hot days with maximum temperatures above 30 degrees per year in the period from 1961 to 1990, their number **already averaged 33 per year** from 2015 to 2020 [6]. And the trend is rising!

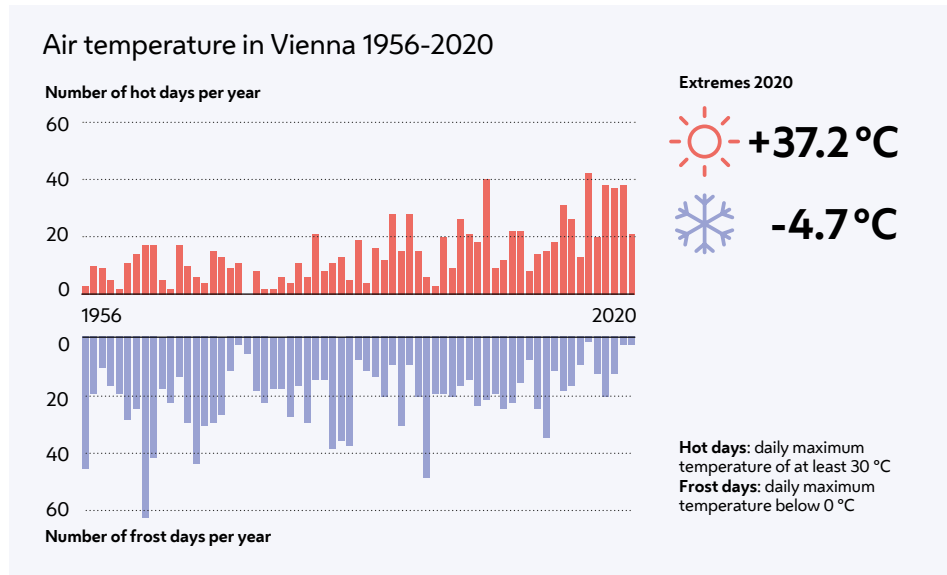


Figure 3
The climate has already changed substantially; own chart based on [7]

Scientists expect that Vienna will further warm by **up to four degrees Celsius by the end of the century**. Heat spells that only lasted for an average of five days in the past 30 years may extend for up to 28 days towards the end of the 21st century [3; 8]. Depending on the success or failure of global climate protection efforts, temperatures recorded in Vienna by the end of the century might be similar to the ones prevailing in the **port city of Marseille in Southern France** or the **West African metropolis of Dakar** [9]. That will not be Vienna as we know it!

The resulting **implications are considerable**. High temperatures can severely impact our health and, thus, our quality of life, with individual groups being affected in different ways. In particular, elderly people, the chronically ill and children suffer during heatwaves. This also results in a higher burden on the people taking care of them. People with few social contacts and low incomes also suffer disproportionately (for example, due to their housing conditions). Accordingly, cooling and air conditioning increasingly become a social issue. The performance of Vienna's technical infrastructure may also be impaired by the increasing heat.

To prevent the climate crisis from becoming a climate catastrophe, massive investments need to be made for the future. If we fail to implement measures for climate protection and climate adaptation vigorously, we will pay dearly in the medium to long term. And the cost will be significantly higher than the additional cost resulting from the transformation to a climate-neutral and climate-resilient city.

WHICH CHANGES DO WE HAVE TO EXPECT IN VIENNA AT ANY RATE?

Our winters will be less cold, and the number of frost days is going down. Warm and hot periods will increase. The water cycle is intensifying so that heavy rainfall and floods will become more frequent. In parallel, periods of drought — i.e. periods without any rain — will increase.

If we do not take action, experts expect an economic downturn — triggered by climate change and the resulting social upheavals — by the turn of the century [10; 11]. In many places all over the world, people will partly have to leave areas that become uninhabitable. This gives rise to the risk of climate migration. The same applies to animals and plants, which either adapt to the new conditions or move to new habitats satisfying their needs. Nevertheless, a massive loss of biodiversity is to be expected.

Fortunately, however, we can do something about this — notably by joining forces! Climate change will not be resolved by scientists, enterprises or policymakers alone. We all need to become active. The role of the city is to show the way for this change, to set the course in due time and to involve all people of Vienna in finding solutions in the best possible way as well as to promote understanding for the necessary measures. This is what we do for us and the next generations so that Vienna will stay a liveable city also for our children and grandchildren!

1.2 All join forces!

International, European and Austrian climate policies are undergoing radical change. The international community, enterprises and many people really have begun to take the climate crisis seriously. Especially the past few years have been pointing the way for world-wide climate policy and, thus, also laid important foundations for the City of Vienna.

The **Paris Agreement** can be seen as a key turning point in international climate policy. Upon recommendation of the Intergovernmental Panel on Climate Change (IPCC), the

international community committed in the Paris Agreement of 2015 to limiting global warming on average to significantly below two degrees and **as far as possible below 1.5 degrees Celsius** above the pre-industrial level. The aim of this maximum temperature limit is to keep the negative impacts of climate change as low as possible. The approximately 190 signatories of the Paris Agreement¹ sent a strong signal to economic players and citizens by setting themselves the objective of achieving climate neutrality in the second half of this century. Affluent countries take a leading role in this context as they want to become climate-neutral already by the middle of the century, while poorer countries can take a bit more time.

¹ Currently, 192 out of the 197 parties to the United Nations Framework Convention on Climate Change (UNFCCC) have ratified the Paris Agreement (www.unfccc.int).



Vienna has set itself high goals and works ambitiously to make social climate policy for all. The combination of striving for social equity, promoting fairness for future generations, inclusion and clear, quantified emission reduction paths characterises Vienna's approach to climate policy. Those who want to achieve a lot must venture out of their comfort zone, challenge customary paradigms and allow for the participation of many people. The Vienna Climate Guide takes very big steps in this direction.

Sigrid Stagl

Chair of the Scientific Advisory Board of the Vienna Climate Council in 2022

The **UN Climate Change Conference held in Glasgow** in 2021 also focused on the 1.5-degree target of the Paris Agreement. Expectations for a clear commitment to climate protection and climate change adaptation were high and could also be met in part: For the first time, a UN climate summit stated that fossil fuels should be phased down — albeit in vague terms and only in parts. Thus, the signatories are moving in the right direction. Further and more ambitious steps will have to follow in the future.

This is already happening, for example, at the European level: The **European Union** is the **first major economic area** that has presented its climate objectives under the Paris Agreement. In December 2020, the EU heads of state and government decided to cut greenhouse gas emissions within the EU by at least 55 percent compared to 1990 and to make Europe the first climate-neutral continent by 2050.

To deliver the new ambitious climate target of the EU, the European Commission presented the Fit for 55 climate package in July 2021. It includes proposals for amending **more than a dozen existing European legal acts on climate and energy** so that the substantially more ambitious climate target can really be attained by 2030. Upon the adoption of the European directives and regulations that is expected for 2023, the legal framework for climate protection will fundamentally change in Europe.

Greenhouse gas neutrality by 2040 is an ambition as complex as can be. It extends to the entire city. Nothing and nobody is excluded from it. The Vienna Climate Guide identifies the most important priorities and tries to outline a path that remains manageable for everybody. This Guide will be hotly debated with “Viennese charm”, that is for sure – if not before, then when the broad implementation of the most important measures is launched: Fossil-free heat for each home; the next qualitative leap in public transport and only renewable e-mobility for considerably fewer but still many cars; more green spaces in the densely built-up city. Megaprojects like these show: Vienna wants more, Vienna wants a strong future for more than two million people.



Robert Lechner

Chair of the Scientific Advisory Board of the Vienna Climate Council in 2021

Austria endorses the plans outlined above and intends to launch its own bold initiatives in the current legislative period with the aim of being climate-neutral already in 2040.

Likewise, the **City of Vienna** committed to achieving climate neutrality by 2040 and set this out in the revised **Smart City Wien Strategy**. Here, Vienna can build on extensive groundwork as the city has pursued a comprehensive strategic climate policy since the late 1990s when the City Council adopted the **Climate Protection Programmes** (KliP in 1999 and KliP II in 2009).

In addition to climate protection, climate adaptation has increasingly moved into the focus. The past decades of the city's climate policy bear witness to countless efforts made to pool extensive knowledge within the administration and raise the common understanding of what we can do for our climate and where we can take joint action. This relates not only to planning but also to the implementation and monitoring of activities in order to ensure that top quality standards are reached. The action programmes and sectoral strategies of recent years reflect important findings of relevance for urban climate protection and climate adaptation.²

Now, the course is to be set for the next years in order to turn Vienna into a climate-neutral and climate-resilient metropolis by 2040. As a result, Vienna continues to be among the leading cities implementing climate protection and climate adaptation through concrete actions. On this journey, Vienna relies on time-tested measures and instruments but also breaks new ground in innovative ways.

² Some examples of these action programmes and sectoral strategies are: Vienna Health Targets 2025, VIENNA 2030 – Economy & Innovation, Digital Agenda Vienna, Urban Development Plan (STEP) 2025, Vienna Wood and Meadow Charter, Sustainable Forestry, OekoBusiness Wien (environmental service package of the City of Vienna), ÖkoEvent (guidelines for environment-friendly events), ÖkoKauf Wien (programme for sustainable public procurement), Vienna Food Action Plan, Organic Farming, Vienna Repair Network, Vienna Waste Prevention Programme, Vienna Waste Management Plan, DoTank Circular City, Urban Heat Island Strategy, action programmes on air quality, Vienna Water Charter, rainwater management, Adapting Infrastructure to Climate Change (INKA) programme, Surface Drainage – Guide for Construction Planning, Energy Framework Strategy, Urban Energy Efficiency Programme 2030 (SEP 2030), Environmental Management Programme in the Vienna City Administration (PUMA), Thematic Concept for Integrated Spatial and Energy Planning, PV Offensive, green electricity from drinking water power plants and PV modules on water reservoirs, Thematic Concept – Urban Mobility Plan Vienna.

2

**The Viennese way of
climate policy in social
and intergenerational
solidarity**



Major change processes, such as the achievement of climate neutrality, can only succeed if they build on a strong basis of widely shared values. The identity — the “DNA” of a society, so to speak — describes what makes us tick, what we are fired up for, what we are passionate about and what drives us. This differs from region to region and from city to city and provides the framework for changes and developments of any type. A common view of the city, shared values and visions also are a precondition for the acceptance of changes. This offers a great opportunity in the case of climate change: It is imperative to get as many people as possible enthusiastic about the change steps needed and to involve them actively in shaping the future! So, what is it that drives us Viennese?

A key element of Viennese identity is the desire to achieve **social equity, fairness between generations and inclusion**. For more than a century, Vienna has been a city in which opportunities for a “good life” open up for everybody — regardless of their origin and age, gender or social status. In particular, the idea of ensuring that Vienna will still be a liveable city in 20 years from now illustrates how important the decisions we take today are for future generations, too. In the Viennese understanding, a climate-neutral and climate-resilient world also has to be a social world characterised by more fairness between generations. Therefore, Vienna’s climate policy pursues the aim of climate justice.

Especially in Vienna, the **arts and culture** play an important role in bringing about this change. Changes require facts and imagination, science and the arts. Art is imaginative, creative and radical. Art opens up new perspectives, it reveals fractures, approaches and hidden things and thereby expands the scope for solutions.

It is not by chance that artists and culture professionals intensively address the subject of change in Vienna. With their work, the creative minds of the city touch sense and sensibility alike and hence can promote societal changes or create spaces for fantasising and arguing about values and visions. Thus, the heart beating for Vienna’s climate policy is also driven significantly by art and culture, creativity and imagination as well as by the desire for social equity. Against this backdrop, we pursue **seven typically Viennese principles** in order to address climate change successfully.

2.1 Vienna Principle 1: Vienna dream team – Social climate policy for all

The City of Vienna wants to provide the right framework for meeting the needs of us Viennese as best possible and in a future-oriented way. To do so, it is critical to know for whom we want to shape a climate-just future: Who are we Viennese? What are our needs?

When you take a closer look at us, you quickly realise: We are diverse. A motley crew. **A Viennese melange.** Accordingly, our needs are also highly diverse. In fields such as mobility, housing, consumer choices and energy use, our behaviour patterns and attitudes are clearly differentiated by gender, age and origin. **In line with our everyday behaviour, we contribute to climate change to a varying extent** — children differently from adults, men differently from women, each and every one in their very personal way. What stands out is that people with higher incomes tend to act in ways more harmful to the climate. Those who have more money usually consume more energy and resources. Heavier cars, larger homes and more frequent plane trips are among the most important factors that strongly influence our carbon footprint. This cannot be offset by purchasing organic food or separating waste effectively [12].

Regardless of our behaviour, however, we are **all affected by the impacts of climate change.** Heat, storms and floods do not differentiate between people. Nevertheless, we do not have the same possibilities for adapting to new climatic conditions or protecting ourselves from the consequences of climate change [13].

EXAMPLE OF DISPARATE IMPACTS OF THE CLIMATE CRISIS

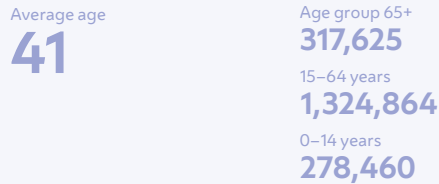
Elderly people and low-income earners suffer particularly during heatwaves. In both groups, women are heavily overrepresented. During the big heatwave of 2003 in Europe, the death toll among women was by 75 percent higher than among men of the same age [14]. This dramatic effect will also increase in Vienna given the rising number of hot days.

LIVING

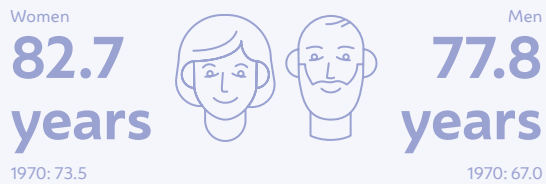
Who lives in Vienna? 1/1/2021



Age structure 1/1/2021



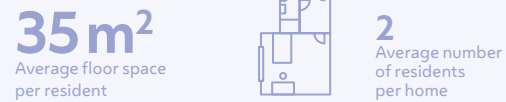
Life expectancy at birth 2020



According to forecasts, two million people will live in the Austrian capital by 2027. **Slightly more than half** of the city's population are women. In addition to the marked growth of the population, **our life expectancy is also increasing**. Today the average life expectancy is 83 years for women and 78 years for men. The number of people aged less than 15 years (278,000) living in our city is almost equal to the number of residents aged 65 years or more (318,000). In the **melting pot of Vienna**, 45 percent of the population was also born in Vienna.

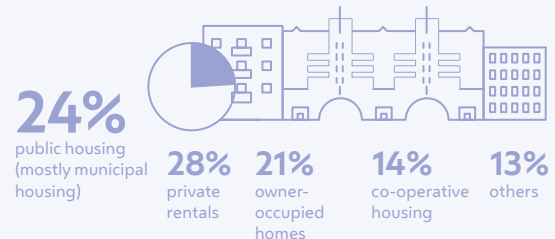
HOUSING

Average home size 2011, 2021



How does Vienna live? 2011

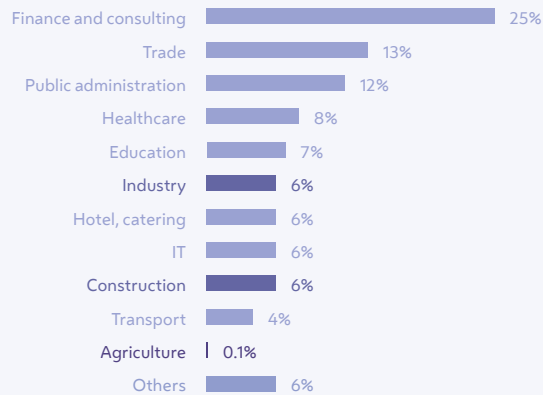
Homes by legal status



The homes of the Viennese offer them an average **floor space of 35 m² per capita**. On average, two persons live in a household. **Only approximately one quarter** of the population lives in **owner-occupied homes**. The majority rents a flat or lives in co-operative housing. Vienna's building stock mainly comprises **multi-storey residential buildings**. Most homes are heated with **natural gas and district heating**.

WORKING

Where do Viennese employees work? 31/10/2018



- Services
- Industry
- Agriculture

A large part of our **gross regional product** is generated in the **service sector**. Industry and agriculture play a minor role in Vienna. **More than half the city's employees** currently works in the fields of **finance and consulting, trade, public administration, healthcare and education**.

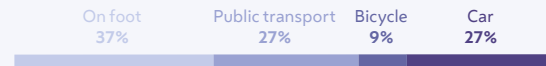
MOBILITY

Passenger car fleet 31/12/2020



Modal split 2019

How do the Viennese move around?



Three quarters of all trips are made **on foot, by bicycle or public transport** in Vienna. Only one in three Viennese owns a car. Out of the 700,000 passenger cars registered, **6,000 are e-cars**. In contrast, more than **820,000 annual public transport passes** were sold in 2020.

Table 1
We Viennese;
own charts based on [7]

Climate protection and the maintenance of good living conditions for us and future generations are not negotiable! Hence, activities that are harmful to the climate have to be reduced step by step. **In this process, well-designed climate policies need to go hand in hand with social equity** as, in fact, the climate crisis also is a social crisis. Effective climate policy improves the living conditions of people in the long term. Conversely, social measures always have to be considered also under the aspect of climate relevance and sustainability.

Whereas well-off people often even fuel climate change with their actions, the impacts mainly hit poorer people. Measures aimed at a reduction of greenhouse gases, adaptation to the effects of climate change and the preservation of the natural foundation of our lives also have to contribute to mitigating social disparities. **If climate change is not curbed and if we do not actively adapt to the new circumstances, social inequality will definitely aggravate.** Therefore, a crucial task of policymakers is to design measures of climate protection and climate adaptation and cushion their impact by means of accompanying actions in such a way that they promote social equity or reduce social inequality. At the same time, social climate policy has to take **on board everybody on the way towards climate neutrality**, it has to motivate people, create acceptance and thereby lay the foundation for change. Social climate policy has to highlight the medium- and long-term opportunities resulting from climate protection measures, provide solutions for accomplishing the transition and thereby strengthen cohesion within society. Therefore, social climate policy also gives everybody the possibility to contribute to the societal change process.

Finally, socially equitable climate policy also supports **those who do not manage by themselves** to live in a climate-friendly way and adapt to climate change. Indeed, the fair and just design of climate-policy measures eventually guarantees their effectiveness. Climate policy does not leave anybody behind; it is for all of us and is only strong if this is ensured!

2.2 Vienna Principle 2: **Benefitting from our head start – Viennese success stories today and tomorrow**

The history of our city spans many centuries and shapes the identity and character of our city. What defines us today has not come about overnight and is mainly attributable to the forward-looking plans, inventiveness and bold decisions of the city's residents. Today, Vienna has an excellent infrastructure, a well-functioning administration and a high level of social cohesion. Those are the things that other cities envy us.

We have to preserve that treasure and, in parallel, courageously go on a treasure hunt with regard to the new challenges! This includes, for example, **countless technical, legal, economic and social innovations** waiting for us in the energy sector.

TOP 10 VIENNESE SUCCESS STORIES BASED ON VIENNESE COURAGE

- Social housing construction ensuring affordable housing
- High share of green space with the protection of the Vienna Wood and Meadow Belt as a starting point
- Excellent healthcare
- Outstanding development of the public transport network
- High-quality water supply
- Effective flood protection resulting from the construction of Danube Island
- High share of district heating
- Sustainable forestry to preserve soils and woods
- Broadly based education system and qualification programmes
- Comprehensive social security systems, social peace and cohesion

CORE AREAS OF CLIMATE PROTECTION AND CLIMATE ADAPTATION WITH STRONG INNOVATION POTENTIALS UP TO 2040

- Expansion of renewable energies
- Meeting of heating and cooling demand without fossil fuels in new buildings
- Phase-out of natural gas heating systems in existing buildings in the long term
- Thermal and energy-related refurbishment of existing buildings and efficiency improvement of heating systems
- Expansion of the electricity, gas and district-heating distribution infrastructure as well as of storage facilities
- Integrated spatial and energy planning
- Reduction of cooling demand
- 15-minute city and city of short distances
- Strengthening and expansion of public transport and all other environmentally friendly means of transport
- Shift of freight transport from road to rail
- Switch to e-mobility in motorised private and commercial transport
- Active mobility and sharing
- Preservation of permanent grassland
- Prevention of methane and CO₂ emissions in waste management

Table 2
Core areas of climate protection;
own table based, among others,
on [15]

One thing is clear: To be successful, climate policy will require **massive public and private investments**. To support and back up climate policy, many levers have to be moved — in order to preserve existing achievements and create something new. If we do not take action, the consequential costs to be expected will be much higher than the investments to be made now [11]. Let us get started, there are countless opportunities ahead!

2.3 Vienna Principle 3: What to do with all the ideas? – Strengthening the regional economy with sustainable innovations

Quick action and targeted investments in the post-fossil society offer great potential for Vienna as a business location. If we develop viable solutions for the future early on, this will result in excellent opportunities for our city. After all, decision-makers worldwide are looking for ways to address climate change and are ready to invest in sustainable solutions. As the urgency of climate policy action increases, a window of opportunity will open up in the coming years that has to be used proactively for the fast implementation of structural measures of climate and economic policy.

Therefore, the City of Vienna will create conditions that enable and support investments in our common future. In addition to public-sector investments, attention is also given to investments of private households and enterprises (e.g. using such new financial instruments as green and social impact bonds³ and support programmes including OekoBusiness Wien⁴). The entire investment package aims at promoting a more just, more liveable, more resilient and better future for the Viennese. The focus is especially on strengthening regional economic cycles and a sustainable economy. For this purpose, the city's green public procurement programme, ÖkoKauf, will be developed into ÖkoKauf PLUS.

Hence, the present Climate Guide also is to be understood as an **“economic stimulus and innovation paper”** because the levers proposed in the following chapters will unleash public and, above all, private investments running into billions of euro that will have relevant effects for the gross regional product and the regional labour market.

³ “The Vienna City Government has the common goal of strengthening social cohesion in Austria and Vienna. Therefore, we will implement a pilot project related to social impact bonds as an innovative approach and potential alternative financing model in order to respond to current challenges.” (government agreement of 2020)

⁴ The environmental service package OekoBusiness Wien supports enterprises in doing business in a sustainable, ecological, climate-friendly and resource-saving way. Enterprises are important partners for achieving the climate goals.

2.4 Vienna Principle 4: And what's your line? – Creating new professions/vocations

The demands on our working world are changing just like our climate. **Climate-relevant sectors** and so-called “**green jobs**” are booming and are among the **most innovative markets of the world**. They cover a broad spectrum of specialisations, including the fields of renewable energies, waste and material flow management, air pollution control, water and wastewater as well as big data. There is already growing evidence today that **more climate-relevant jobs will be created than jobs detrimental to the climate will be lost** in the coming years [16]. Thus, climate protection and climate adaptation truly are an engine of job creation.

PRIORITY AREAS WITH POTENTIALLY HIGH DEMAND FOR QUALIFIED STAFF:

Construction industry, building crafts, heating, air conditioning, ventilation and sanitation systems, electrical engineering, building technology, resource governance and management, repair crafts, cooking trade, maintenance and servicing, environmental technologies, planning and administration in nature conservation and environmental protection, environmental consulting and education, environmental law, environmental policy.

Vienna recognises and responds to that trend. This is why the city is committed to promoting innovative **forms of learning and the design of training programmes** in the fields mentioned above. In the future, climate-relevant education priorities are to be developed and implemented in a targeted way, in particular, in elementary and primary education, i.e. in childcare facilities, primary schools, and lower secondary schools. Likewise, a training programme for climate-relevant occupations, courses in the field of apprenticeships and adult education as well as cross-sectoral learning and training companies are to be developed, and mandatory climate modules are to be integrated into existing training programmes. At the same time, close co-operation is needed with companies offering jobs, the Public Employment Service as well as existing education institutions (Public Learning Centres — VHS, Vocational Training Institute — BFI, Austrian Federal Economic Chamber — WKO, etc.).

In the sector of universities of applied sciences and universities, focal areas of education have to be refined (in co-ordination with the Federal Government). Finally, the City of Vienna

will invest in in-service training for the city's administration and municipal enterprises. Eventually, Vienna thereby also promotes a working world that allows us to make a contribution to society, to shape our future ourselves and to engage in meaningful activities. This goal also seems worthwhile with a view to a good work-life balance and job satisfaction.

As a result, embracing climate protection and climate adaptation as our standard practice will not only make Vienna more beautiful but possibly even raise the level of happiness and satisfaction of the working population.

2.5 Vienna Principle 5: **One for all, all for one – Shaping the future together**

Climate protection raises not only technical and economic issues but, in particular, **social issues** as well. For a sustainable and viable city that responds to the needs of the Viennese, it is important to listen to stakeholders and involve them actively. Especially with a view to climate justice, it is necessary to ensure the participation of frequently underrepresented groups who cannot cushion themselves against changes in their own living conditions (e.g. higher rents or gas bills).

Participation has great potential for creating a vital foundation and shared vision of our common future by integrating the wishes, ideas, know-how and competences, but also the fears of the population. Based on local knowledge, it is possible not only to find better and more efficient measures, but also to take account of diverse life situations. At the same time, the city itself can learn from this exercise and make even better solutions possible for us Viennese in the future. This applies not only to climate protection and climate adaptation but also beyond, for example, to efforts made to attain sustainability goals such as the Sustainable Development Goals (SDGs) drawn up by the United Nations.

2.6 Vienna Principle 6: **Be ahead of the times – Thinking the future with science, art and culture**

Vienna is a city with a highly diverse cultural scene and a long, outstanding art history. In Vienna, the **further development of society has always been primarily initiated or very**

strongly supported by the art and cultural scene. A look back shows how powerful the creative force of the designers, architects and visual artists of Viennese modernism was a mere century ago. Many societal and social innovations were conceived and implemented in co-operation with policymakers.

Vienna also has a strong, creative and dedicated art scene today that should be involved in the efforts because the challenges we are facing will demand all our creativity. At the same time, climate is a subject that offers rich potential for artistic development. Just think of the novel materials, designs and craft techniques that we need for the transition. We want to make Vienna the centre of the creative climate movement and will provide spaces in which we can develop and implement ideas.

Art, culture and climate-friendly cultural policy can make a significant contribution to climate protection and sustainability. To drive visible changes, support structures provided for culture have to be adapted to climate-relevant requirements. Respect of the environment and nature, concrete suggestions for acting ecologically, targeted initiatives and measures, such as the climate-friendly design of cultural infrastructure and resource-saving events, contribute to more sustainability in the cultural field.



Veronica Kaup-Hasler

Executive City Councillor for Cultural Affairs and Science

Just like then, we now have to think and work **in close co-operation with science and research**. We need dedicated, creative and knowledge-based actions. With its numerous universities and research institutions in combination with the city's creative people, Vienna is an optimal biotope for **Viennese climate modernism!**

2.7 Vienna Principle 7: Vienna shows how it is done – Leading by example

It is critical that a firm commitment as well as strong leadership and management are put into practice for a climate-neutral and climate resilient future at all levels within the city administration as well as in municipal enterprises. A fundamental requirement for this is that policymakers, administration and organisations closely related to the city share a common basic understanding of climate protection and climate adaptation. The City of Vienna can rely on extensive experiences and groundwork in this context. After all, it adopted two climate protection programmes and launched numerous climate-friendly programmes over the past 20 years.

However, the City of Vienna acknowledges that the full decarbonisation of a city has never been implemented so far. We will have **to learn at all levels**. The City of Vienna will also set a good example with regard to attitudes. An **open-minded, cross-cutting and implementation-oriented self-perception is needed among all players** in order to accomplish the transition to a better future that offers a high quality of life in harmony with nature.

The Vienna Climate Guide pools the existing climate-relevant expertise and complements it with a common road towards 2040. The individual chapters of the Climate Guide discuss the **key levers for attaining Vienna's climate goals by 2040**. These levers are presented in seven sections addressing the field of climate protection and five sections dealing with climate adaptation.

THE STRUCTURE OF THE CLIMATE GUIDE

Climate protection —

Vienna becomes climate-neutral!

- Mobility
- Buildings
- Waste management
- Production sector
- F-gases
- Electricity and district heat generation
- Transregional aspects

Climate adaptation —

Vienna becomes climate-resilient!

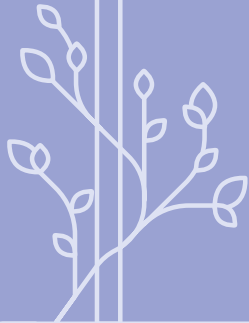
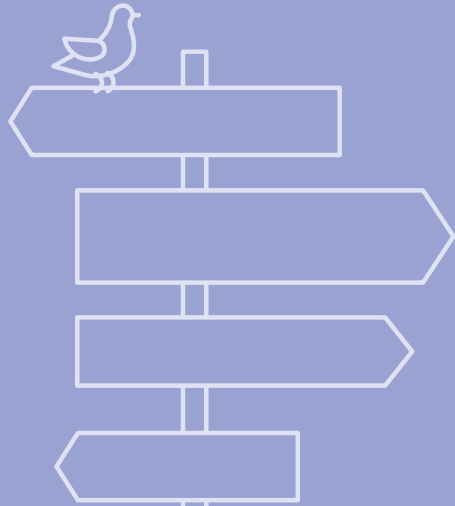
- Health and wellbeing
- Ecosystems, natural and recreation areas
- Urban development and planning
- Public space and buildings
- Infrastructure and services of general interest

In many cases, these key climate-relevant levers are derived from the city's existing sectoral strategies and action programmes on a wide range of subjects. In some cases, they provide for new lines of action. At any rate, the **focus is on the city's own sphere of activities**. For example, the effects of the positive change processes are to be made visible quickly in the buildings and infrastructures owned by the city. In addition, **requests and positions indirectly related to the federal level are outlined** in order to reflect co-operation and consultations needed between federal and provincial authorities. Moreover, **challenges faced at the European level are addressed** as well.

3

**Towards a climate-
friendly city with
the Vienna Climate
Guide**





The **Vienna Climate Guide describes our common path** towards **Vienna's climate goals until 2040 with a view to a climate-friendly city**. Vienna's climate goals were laid down in the government agreement of 2020 and adopted in the updated Smart City Wien Strategy (2022) by the City Council. They comprise objectives both for **climate protection** and **climate adaptation**. In combination, they are to safeguard the quality of life for all Viennese and are to accomplish climate neutrality and climate resilience.

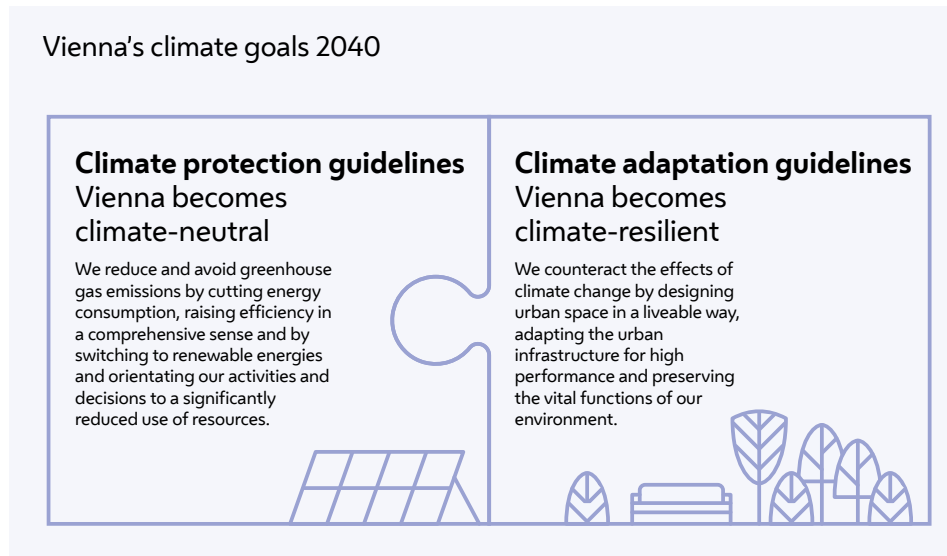


Figure 4
Vienna's climate goals until 2040;
own illustration

The Vienna Climate Guide corresponds to a **compact implementation strategy** that identifies the **common levers** for climate protection and climate adaptation. It describes how greenhouse gas emissions can be curbed or stopped and how the people of Vienna can be protected from the unavoidable consequences of climate change. The measures to be given priority and the tools behind them are not specified in detail nor are they finalised. Rather, the Climate Guide outlines basic directions.

Within the Climate Guide, the two pillars of **climate protection** (Chapter 4) and **climate adaptation** (Chapter 5) are of **equal significance**. The key subject of a **circular economy** is dealt with in Chapter 4 because essential parts of it can be associated with climate protection. In this context, it is important that measures and instruments of the two pillars can interlock, be interdependent, reinforce or sometimes even contradict each other. Any conflicts between objectives that seem to be irreconcilable today will have to be discussed and evaluated again and again within the framework of the actual implementation of specific measures for climate protection and climate adaptation in the coming years.

⁵ It is not always easy to link climate protection and climate adaptation. The advantages of emission reductions in and outside Vienna benefit us as well as others. The advantages of local adaptation measures tend to be felt at the local level. In addition, climate protection is clearly defined: Greenhouse gas emissions can be measured and are suitable for monitoring. Climate adaptation is difficult to measure as it deals with risk forecasts and the avoidance of manifold negative effects [56].

Cross-references between the two fields of climate protection and climate adaptation are illustrated by examples.⁵

The core task of the Climate Guide is to **provide orientation, improve understanding of the key levers** and **recognise interdisciplinary work as undisputed common ground**. To this end, we have to keep an eye on the constantly changing framework conditions at the international, European and national levels and, building thereon, engage in technical and political discussions in Vienna. The present Vienna Climate Guide reflects the current status of these discussions.

Furthermore, the Vienna Climate Guide kicks off a **long-term process** that will support us in fleshing out and implementing the best possible climate solutions for the people of Vienna. This process is described in greater detail in the chapter **“Management structures and regulations”**.

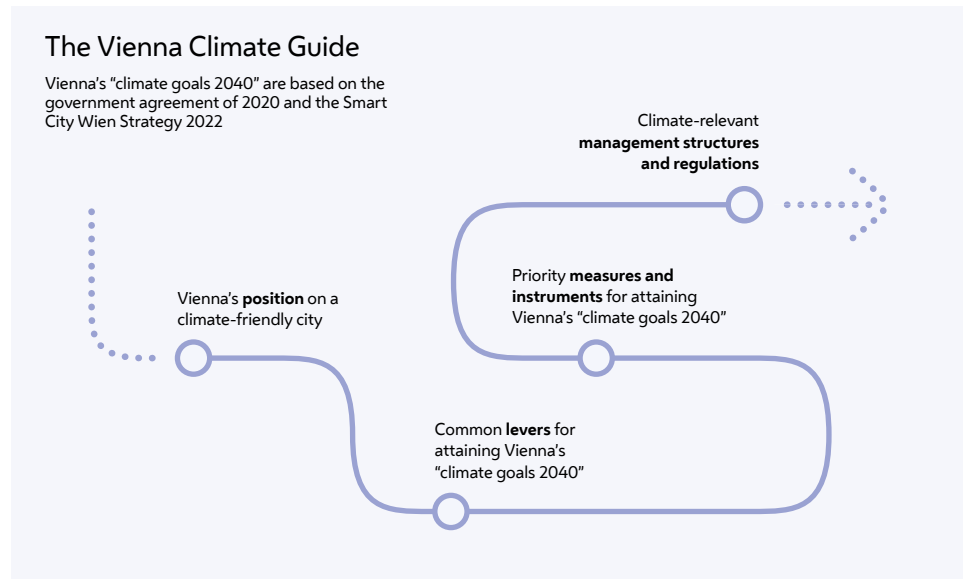
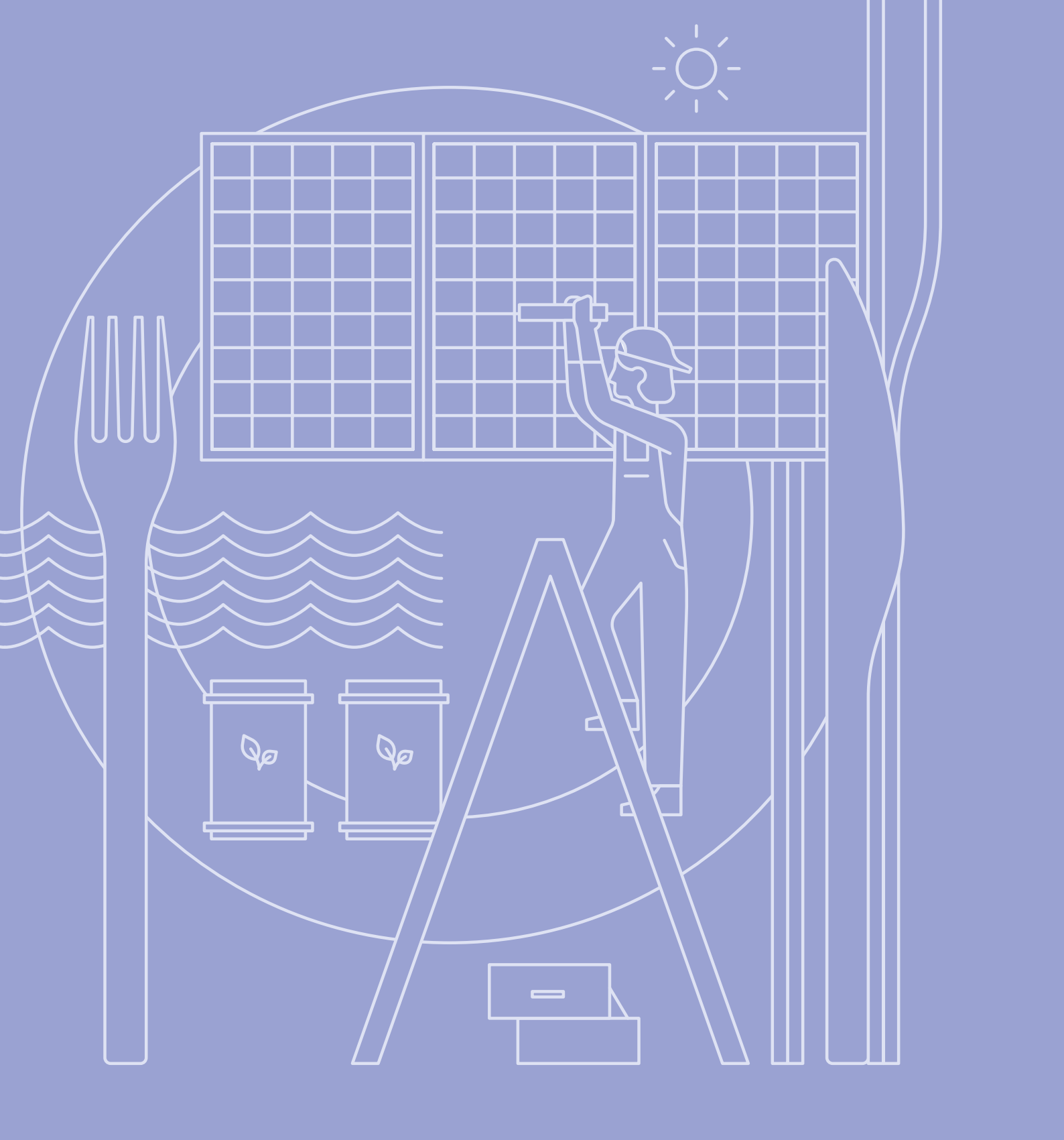


Figure 5
What is the Vienna Climate Guide?
Own illustration

4

**Climate protection:
Vienna becomes
climate-neutral**





Cities play a key role in climate protection! Indeed, life is concentrated in cities even though they only cover around two percent of the land surface. More than half of the world's population lives in urban centres. The majority of economic activities are performed in cities. Urban structures generate considerable emissions on a relatively small area due to the multitude of uses provided, such as housing, work, education, recreation as well as supply and disposal. However, cities are extremely efficient in doing so. This is evident, in particular, with regard to infrastructure as it is used optimally: One metre of road, water pipe, sewer, electricity line or district heating pipe serves more people in a city than, for example, in a suburban or rural area. As a result, building materials are used efficiently, distribution losses are kept low, soil sealing effects are concentrated and costs are saved.

This efficiency advantage of cities becomes especially clear when you look at greenhouse gas emissions per capita or per unit of economic output — here, Vienna outperforms all other federal provinces by far [17].

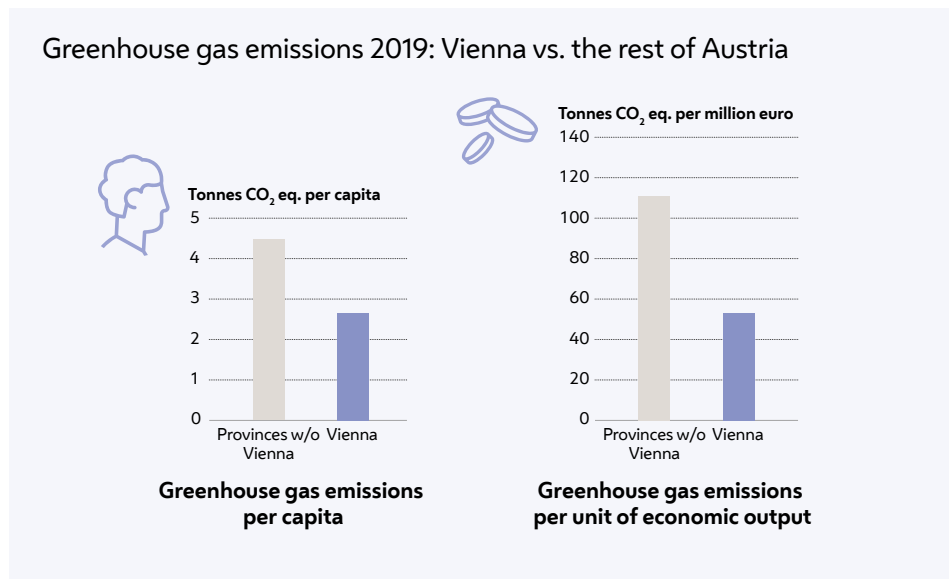


Figure 6
Comparison of greenhouse gas emissions of Austrian provinces (without taking account of emissions of enterprises subject to emission trading; in road transport without fuel tourism and in line with the mileage-based regionalisation of Environment Agency Austria); own chart based on [18], [19] and [20]

THE ROLE OF CITY AND COUNTRYSIDE IN CLIMATE PROTECTION

While the strength of cities lies in efficiently providing diverse uses in a small space, rural areas have valuable land reserves and, hence, lay the foundation for the satisfaction of basic needs, the provision of resources and the compensation of environmental impacts. Both roles — that of cities and that of rural areas — are therefore important and inseparably linked with one another when it comes to climate protection. Suburban areas located in the prosperous commuter belt around cities pose challenges. What many people still see as the big dream of a better life has to be called into question from the perspective of climate and soil protection: a detached house with garden and a garage accommodating two cars for commuting to work in the city every day.

Building on this “good starting position”, we need to become climate-neutral! But what exactly do we have to focus on in order to reduce greenhouse gas emissions and make Vienna a climate-neutral city? Here, it is worthwhile to have a look at the greenhouse gas balance [18] drawn up for Vienna by the Environment Agency Austria (see Figure 7). It presents **all the emissions released to the atmosphere in Vienna**, e.g. by heating systems, vehicles, power and heating plants, other combustion systems or diffuse sources. This **“production-based”** or **“territorial” inventory**⁶ is commonly used in international and national climate policy and follows standardised calculation methods.

⁶ This “production-based” accounting method is to be distinguished from the “consumption-based” method. The latter aims at allocating all emissions released during the entire product (life) cycle to the “final consumers” regardless of where these emissions are generated. This method involves high data uncertainties or data gaps, but it is relevant for certain questions, e.g. when individuals or societies (“the Viennese”) want to assess the global carbon footprint of their consumption (see also Chapter 4.7).

Figure 7
Sectoral breakdown of overall greenhouse gas emissions in Vienna in million tonnes of CO₂ equivalents. Development (in absolute terms) in the period 2005-2019. The emissions covered by the respective headline goal of the Smart City Wien Strategy (SCWS) are identified; own chart based on the pollutant inventory for Austria's federal provinces published by Environment Agency Austria, 2021 [21]

Sectoral breakdown of greenhouse gas emissions in Vienna 2005–2019

Greenhouse gas emissions in million tonnes of CO₂ equivalents

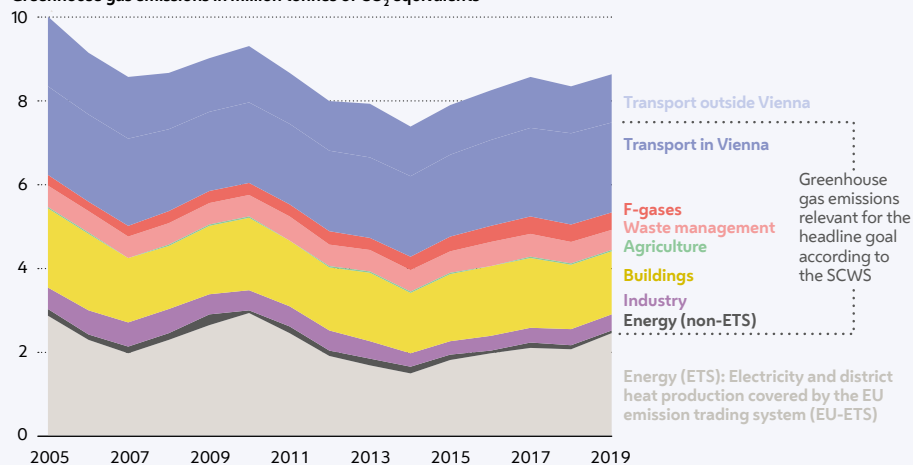


Figure 7 shows how overall greenhouse gas emissions have developed in Vienna since 2005 and which sectors generated them. As we can see, the emissions follow a downward trend and, in particular, the emissions of the energy sector are subject to substantial fluctuations. In part, these can be explained by dynamic changes in the European electricity, gas and emission trading markets.

Furthermore, Figure 7 identifies the types of emissions that the federal province⁷ of Vienna directly addresses under the headline goal of **climate neutrality by 2040** defined in the Smart City Wien Strategy and which types it does not consider. The majority of emissions are covered by the city's objectives within the framework of the SCWS and, as a result, form the core of our future efforts. Those emissions deserve our full attention. Approximately one third of the emissions released in Vienna are not taken into account in the emission-related objectives. The reasons why are explained in the following box that also delves deeper into the international and EU-wide greenhouse gas accounting rules.

⁷ With regard to greenhouse gas inventories, Vienna is considered as a province and not as a city because it has to apply the accounting rules and methods (harmonised internationally and Europe-wide) for regions as implemented in the pollutant inventory for Austria's federal provinces published by Environment Agency Austria.

VIENNA BECOMES CLIMATE-NEUTRAL DEFINITION OF THE EMISSIONS CONSIDERED IN THE RELEVANT HEADLINE GOAL

Figure 7 shows that the Viennese headline goal of climate neutrality by 2040 does not cover all emissions attributed to Vienna in the pollutant inventory of the Environment Agency Austria. In fact, the majority of emissions caused by the "Energy" sector and a considerable part of the emissions generated by the "Transport" sector are not taken into account in the headline indicator of the Smart City Wien Strategy. This can be explained as follows:

- "Transport" is broken down into two categories identified as "Transport in Vienna" and "Transport outside Vienna" in Figure 7. The pollutant inventory for Austria's federal provinces uses the energy balance for transport emissions, which in its turn is based on fuel sales in Austria. Those emissions are allocated to the provinces. In this process, Vienna is assigned (significantly) more emissions than the amount corresponding to the vehicle kilometres actually driven in Vienna. This is, for example, due to the fuel quantities and greenhouse gas (GHG) emissions attributed to Austria because of "fuel tourism" that are subsequently distributed to the provinces and, thus, also to Vienna. For this reason, the Environment Agency Austria has developed a more precise "second estimate" that takes account of additional information in the approximate territorial allocation of emissions.

Vienna uses these data, which are published annually in the pollutant inventory for Austria's federal provinces of the Environment Agency Austria, to be able to quantify the emissions of "Transport in Vienna" at least as well as currently possible. Within the framework of the "CO₂ headline goal" and the "Viennese carbon budget" (Figure 9), Vienna only takes account of the emissions of "Transport in Vienna". This is in line with the principle of only considering emissions released on the city's territory that is also applied in all the other sectors (territorial accounting).

- In the "Energy" sector, more than 95 percent of emissions are produced by plants with a capacity of more than 20 megawatts (e.g. power and district heating plants or co-generation plants) that fall under the scope of the European emission trading system (shown as "Energy (ETS)" in Figure 7). Smaller plants with a capacity of less than 20 megawatts account for a minor share (shown as "Energy (non-ETS)" in Figure 7). The emissions of plants subject to European emission trading are not included in the narrower accounting boundaries for Vienna's climate protection headline goals for the following reasons:
 - In accordance with the distinction that has been made in the EU since 2005 between the sectors covered by the EU ETS for large plants in industry and the energy sector as well as domestic air transport on the one hand and the sectors remaining a national responsibility (European Effort Sharing Regulation) on the other hand, pathways to GHG targets are not stipulated for the emissions of large plants in industry and the energy sector. This principle is applied by the Federal Government (see also the Federal Climate Change Act) and the other provinces.
 - In order to address, nevertheless, the major emitters subject to the ETS, the Smart City Wien Strategy and the Vienna Climate Guide still set ambitious objectives. However, they only indirectly relate to greenhouse gas (GHG) emissions by laying down pathways for the expansion of renewable energies in order to decarbonise the production of electricity and district heat (see Chapter 4.6).
 - The definition of a "ceiling" for the GHG emissions of the ETS sector by means of a maximum GHG budget would also be detrimental to the establishment and expansion of industrial plants in Vienna and would constitute a barrier to the use of gas-fired co-generation plants that might even be drawn upon to a greater extent temporarily in order to stabilise the Central European grid in view of the nuclear and coal phase-out in Germany. The latter would even be advantageous with a view to a Europe-wide CO₂ reduction.

Thus, the annual greenhouse gas emissions falling under the scope of the CO₂ headline goal indicator defined in the Smart City Wien Strategy was roughly five million tonnes of CO₂ equivalents in the past few years. Figure 8 shows the distribution of these greenhouse gas emissions across the producing sectors in 2019 and tries to highlight key “sub-producers” within these sectors.

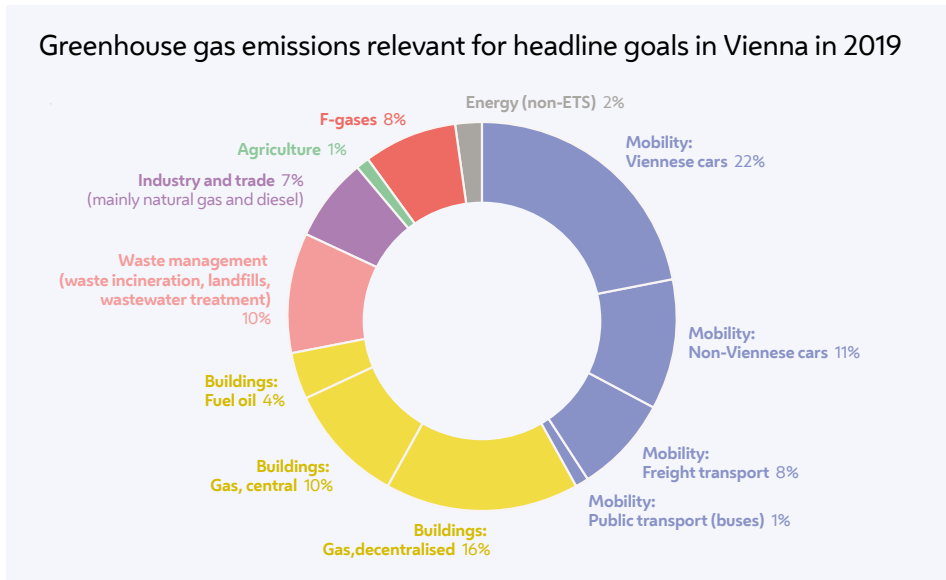


Figure 8
Sources of greenhouse gas emissions relevant for headline goals in Vienna in 2019; own chart based on the pollutant inventory for Austria's federal provinces published by Environment Agency Austria, 2021 [21]

Over the last five years, on average around 43 percent of the greenhouse gases relevant for Vienna's CO₂ headline goal were produced by the internal combustion engines powering motor vehicles, almost 30 percent by heating systems installed in buildings and ten percent by waste management. Roughly seven percent each were generated by fossil fuels used for production purposes in enterprises and by fluorinated greenhouse gases (F-gases) that are used, for example, in refrigeration systems. The rest (three percent) originated from small power and district heating plants that are not subject to the EU emission trading system. At 0.5 percent, the share attributable to agriculture was minimal. Approximately 90 percent of the greenhouse gas emissions considered were released in the form of CO₂ and resulted from the combustion of petroleum products or natural gas.

These greenhouse gas emissions relevant for the headline goal, as broken down by producers in Figure 8, are to be reduced to net zero by 2040 in line with the government programme of the Vienna City Government and the respective headline goal of the Smart City Wien Strategy.

Based thereon, the Smart City Wien Strategy defines targets for the development of greenhouse gas emissions in Vienna, energy consumption and Vienna's remaining "carbon budget" (see Figure 9):

- Compared to the baseline year 2005, Vienna reduces local per-capita greenhouse gas emissions by 55 percent by 2030 and is climate-neutral from 2040 on.
- Vienna decreases its local per-capita final energy consumption by 30 percent by 2030 and by 45 percent by 2040 against the baseline year 2005.
- "Vienna's carbon budget": Vienna fixes its carbon budget remaining for the time from 2021 at 60 million tonnes of CO₂ equivalents.⁸

⁸ Vienna's carbon budget of 60 million tonnes remaining from the start of 2021 results from the CO₂ reduction targets set in Vienna's government programme (e.g. halving per-capita transport emissions by 2030) and reasonable reduction pathways between 2020, 2030 and 2040. Hence, Vienna's "carbon budget" was calculated bottom-up on the basis of Vienna's climate goals and not top-down on the basis of reflections on the "fair" allocation of globally available remaining emissions in compliance with the 1.5-degree target.

It is obvious that **these goals cannot be attained by measures taken within Vienna's sphere of activities alone**. Indeed, to achieve climate neutrality in Vienna, measures are also required that, based on the distribution of competences, have to be taken by the **Federal Government or the European Union**. As the following sections show, this holds true for each emission-producing sector.

Pathway of Vienna's greenhouse gas emissions to the 2040 target

Greenhouse gas emissions in million tonnes of CO₂ equivalents

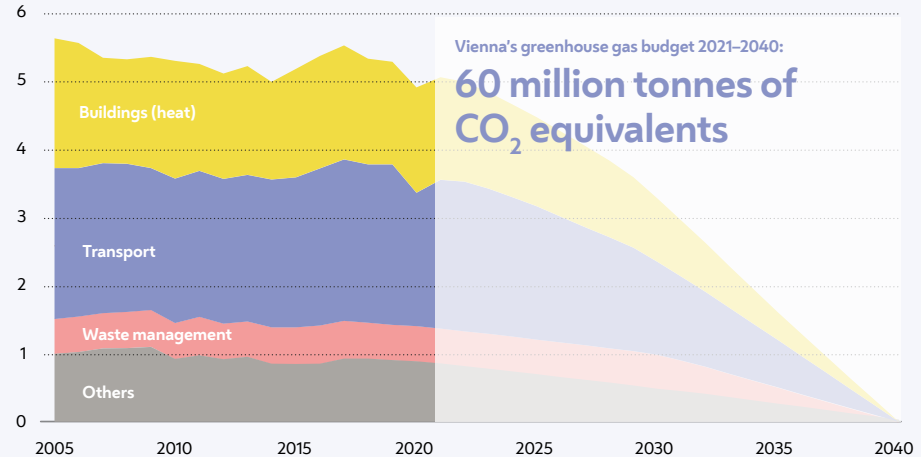


Figure 9
Development of (sectoral and aggregate) greenhouse gas emissions from 2005 to 2020 and pathways to greenhouse gas neutrality in 2040; own chart based on the pollutant inventory for Austria's federal provinces published by Environment Agency Austria, 2021 [21], and calculations by UIV

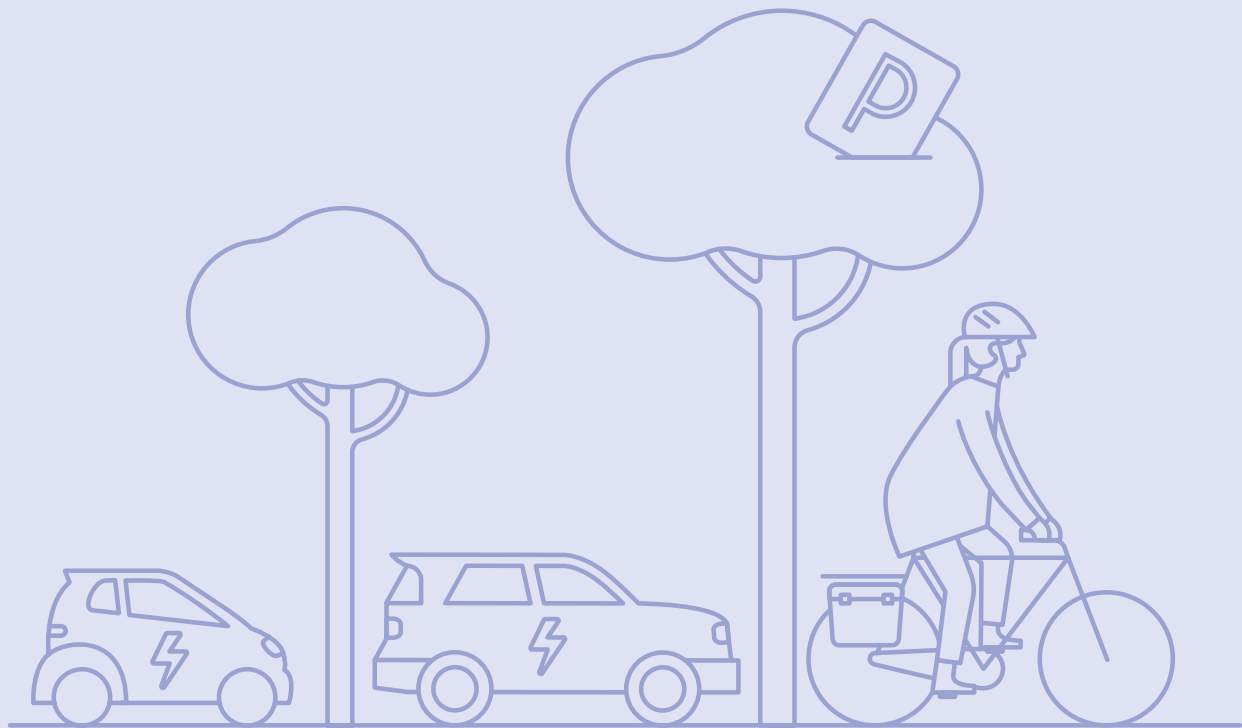
The following core priorities can be derived from the goals mentioned above:

- The focus is especially on measures reducing greenhouse gas emissions not covered by the current European emission trading system (ETS). As the vast majority of these emissions stems from **fossil-fuelled internal combustion engines** and **gas heating systems**, Vienna's climate policy has to address them as a priority:
 - **Goodbye to fossil-fuelled engines in transport** by switching to electric drives and by changing mobility behaviours as well as expanding public transport and the infrastructure for cyclists and pedestrians.
 - **Goodbye to gas in heat generation** by reducing the heat consumption of buildings and by switching to district heating and the use of ambient heat by means of electricity-powered heat pumps.
- In addition, Vienna also pushes ahead with the **decarbonisation of infrastructures owned by or closely affiliated with the city** that are covered by the emission trading system (ETS).
 - The decarbonisation of **electricity and district heat production** is to be made possible by the expansion of renewable energies in Vienna and Austria. Green gas⁹ is to be available for co-generation plants and other energy-efficient applications but not for heating buildings or supplying hot water in Vienna. Nuclear energy remains excluded as part of the solution.
- The list of priorities given above does not mean that the decarbonisation of other sources of greenhouse gases is not important. On the contrary: In view of the goal of climate neutrality by 2040, it is clear that any and all uses of fossil energy (coal, oil, gas) as well as other greenhouse gas emissions released (e.g. in waste management, F-gases) have to be reduced to zero or almost zero. Consequently, measures are defined for all sectors below.

⁹Green gas or renewable gas is a collective term referring to all kinds of decarbonised gaseous energy sources. Three types are distinguished: Biomethane is a combustible gas made from biomass and some waste fractions. Renewable hydrogen is hydrogen produced either from biomass and some types of waste or from green electricity and water. Attention has to be paid to the efficiency levels of hydrogen production. Synthetic natural gas refers to methane synthesised from renewable resources.

4.1 Mobility

Discussions on transport or mobility policies are among the most emotional debates of our times. Regardless of whether they centre on the construction of new roads, traffic-calming measures or the redesign of streets, they frequently involve two camps characterised by opposing views, in particular with regard to cars (and their parking spaces).



Even though many Viennese residents and enterprises need (their own) cars or find it difficult to imagine life without a car, **almost nine out of ten Viennese citizens agree with the statement that “In Vienna, you can manage quite well without having your own car”** [22]. This is the result of transport policy measures taken in Vienna on the one hand and also due to a generational and paradigm shift on the other hand: More and more people **wish for many sharing services as well as wide and safe sidewalks and cycleways**. And they want to have **more room** for lingering and meeting other people **in public spaces, for environmentally friendly mobility and for greenery** that we need for preventing the climate crisis. For the purpose of both climate adaptation and climate protection, we need to speed up the transition from a car-centred transport policy to a people-friendly mobility policy. In the future, we will drive our cars less and, if we still go by car, then only in zero-emission cars. By using our dense public transport network in combination with walking and cycling, the people of Vienna will increasingly turn multimodal and, hence, will move around the city at a cost that in many cases is lower than today.

The challenges faced in the transport sector have to be considered in close connection with the actions required in other fields: There is no social participation without socially just mobility, no liveable metropolitan region without environmentally friendly mobility, no identity-building urban development without mobility based on short journeys, no climate-fit urban spaces without mobility requiring as little sealed surfaces as possible.

Many things have already moved in the right direction in Vienna: **Compared with the other federal provinces, Vienna has the lowest per-capita CO₂ emissions by far in road transport** [17]. Moreover, Vienna is the only province that has recorded a significant decrease of per-capita emissions since 2005. The fact that transport emissions have nevertheless increased is attributable to population and economic growth in Vienna. More people and more economic activities also mean more traffic.

In Vienna, the number of cars per capita is roughly one third below the Austrian average. While all other provinces have registered double-digit growth rates for car ownership (cars per 1,000 inhabitants) since 2005, this indicator has seen a decline by seven percent in Vienna. This decrease in cars owned per capita is also owed to mobility policy measures taken during the past decades and years: As a result of the development of the public transport and cycleway network, the expansion of parking space management and the launch of the 365-euro annual pass, the number of Wiener Linien annual pass holders is significantly higher than the number of people owning a car. Against this background, it is hardly surprising that the number of kilometres that Vienna's citizens travelled by car per capita (in and outside Vienna) went down by 27 percent from 2005 to 2018, so that it is already down to almost half the percentage registered in the other provinces [23; 24].

Nevertheless, the combustion of petrol and diesel for **transport accounts for roughly 43 percent** (average for the years from 2014 to 2018) **of the greenhouse gas emissions of relevance for the respective headline goal in Vienna**. More than half of them are generated by car trips made by Viennese residents and around one quarter by journeys in cars not registered in Vienna. The third place is occupied by freight transport including delivery traffic. A minimal role is played by Vienna's public transport, which uses diesel buses only to a minor extent and instead has been offering an e-mobility option for a long time [25].

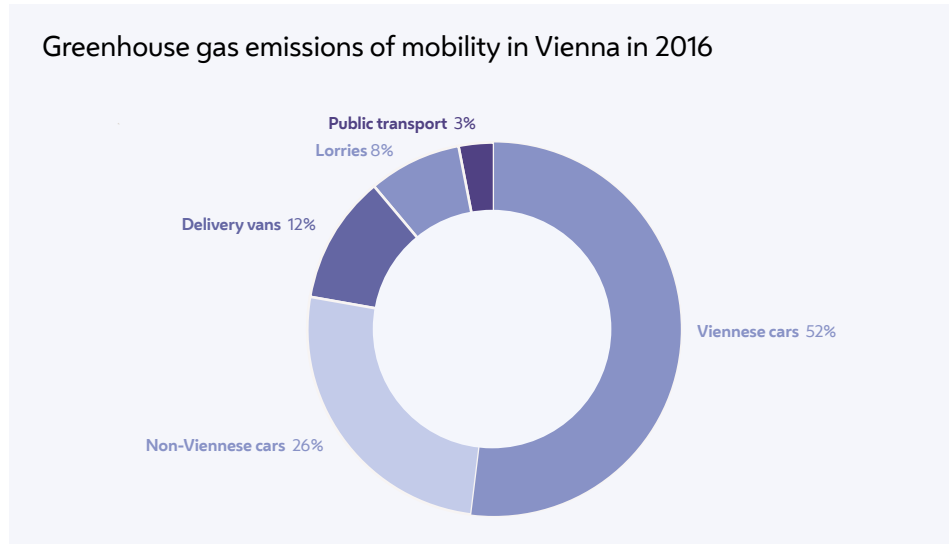


Figure 10
Breakdown of emissions generated by transport in Vienna, broken down by means of transport; own chart for 2016 based on model calculations by IVT of Graz University of Technology for UIV; rounded figures based on [25]

4.1.1 Our objectives

The Smart City Wien Strategy sets the following CO₂ headline goal for mobility:

- Per-capita CO₂ emissions in the mobility sector fall by 50 percent by 2030 and by 100 percent by 2040 (compared to 2005).

Additionally, the Smart City Wien Strategy also defines the following further objectives that are to ensure the achievement of the above CO₂ headline goal in 2030 while also pursuing other objectives of a liveable and innovation-friendly city:

- Commercial traffic within the municipal boundaries is largely CO₂-free by 2030.
- The share of journeys made by eco-friendly modes of transport in Vienna, including shared mobility options, rises to 85 percent by 2030 and to well over 85 percent by 2050, whereas the share of journeys made by private motor vehicles drops to 15 percent.¹⁰

¹⁰ Assuming that the average length of trips made by private motor vehicles does not change, a decline of the share of trips made by private motor vehicles from 27 to 15 percent results in a reduction of vehicle kilometres and hence of per-capita CO₂ emissions by around 45 percent. This decrease will be smaller if mainly shorter car trips are substituted by eco-friendly modes of transport.

¹¹ Almost 80 percent of all inward commuters currently cross the municipal boundaries by car whereas only slightly more than 20 percent use public transport. Provided that only half as many commuters travel by car to Vienna and the length of their trips within Vienna does not change, the vehicle kilometres travelled by this group in Vienna would be halved.

- By 2030, private motor vehicle ownership falls to 250 vehicles per 1,000 inhabitants; parking places are gradually reduced in public space.
- The volume of passenger car traffic crossing the city's boundaries falls by 50 percent by 2030.¹¹
- The share of non-fossil fuel vehicles in new registrations rises to 100 percent by 2030.
- Vienna implements and promotes the 15-minute city – with short journeys, vibrant, mixed-use quarters and a re-allocation of public street space in favour of active mobility, public transport and attractive places to linger.
- Mobility guarantee: You can be mobile in Vienna also without owning a car.
- In the mobility sector, per-capita final energy consumption falls by 40 percent by 2030 and by 70 percent by 2040 (compared to 2005).

4.1.2 Pathway to the objectives

Figure 11 presents the “pathway” for per-capita emissions of mobility in Vienna. It does not assume a linear trend from the COVID-19 year 2020 until 2030 and 2040 but rather expects that CO₂ emissions will initially rise after 2020/21 as a result of economic recovery and the revival of public life after the pandemic-related lockdowns. Even then, it will take some time for annual CO₂ reductions to gain momentum, above all as a result of the accelerating market penetration of e-vehicles but also in response to mobility policy measures.

LEVER 1

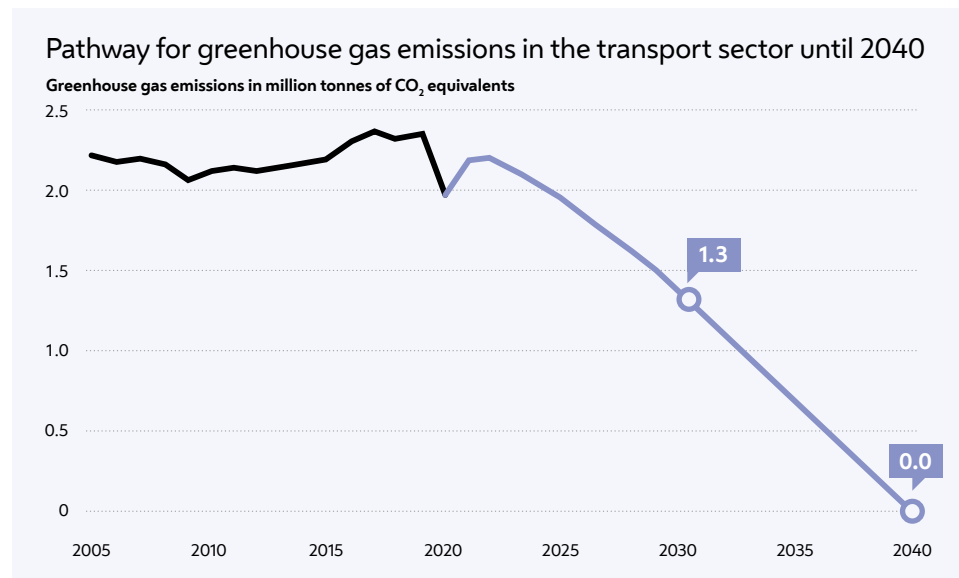
Avoiding private motor vehicle traffic and switching to eco-friendly modes of transport

LEVER 2

Phasing out fossil drive systems

Integrated into the national and European framework

Figure 11
Development of CO₂ emissions of transport in Vienna from 2005 to 2020 according to the pollutant inventory for Austria's federal provinces published by Environment Agency Austria, 2021 [21], and reduction targets for 2030 (halving per-capita emissions against 2005) and 2040 (zero emissions) with a reasonable pathway for the years in between; own chart



In the mobility sector, CO₂ emissions result from the development of two factors: the total **vehicle kilometres driven in Vienna** (for passenger cars, lorries, etc.), multiplied by the **average specific CO₂ emissions per kilometre of the vehicle fleet**:

$$\Sigma \text{CO}_2 = \text{total number of km driven} \times \text{CO}_2/\text{km}$$

Both factors will have to be addressed in order to halve per-capita CO₂ emissions by 2030 and reduce them to zero by 2040. From today's perspective, new technologies, in particular the gradual switch to e-mobility, are expected to account for most of the decrease without, however, fully achieving the objective. Rather, changes in mobility behaviour will also be indispensable. The scale of contributions towards the objective is also shown in Austria's Mobility Master Plan 2030, albeit for Austria as a whole (see Figure 12). It may be assumed that the contribution made by mobility behaviour will tend to be bigger in a city like Vienna.

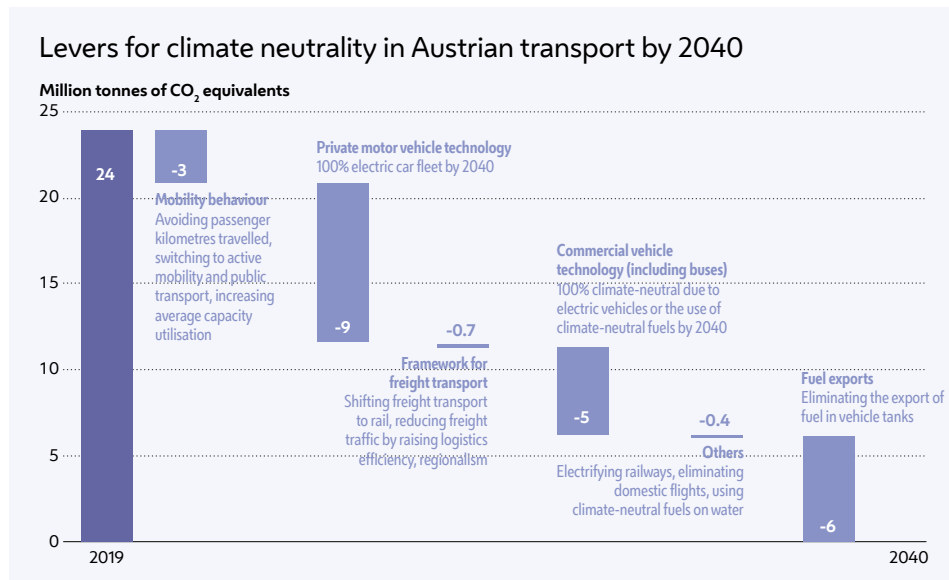


Figure 12
Levers for the reduction of greenhouse gas emissions of mobility in Austria; own chart based on BMK (2021) – Austria's Mobility Master Plan 2030 [26]

4.1.3 Key levers for attaining our objectives

With respect to the mobility sector, the following lines of action are crucial for halving CO₂ emissions by 2030 and achieving climate neutrality by 2040:



Avoiding private motor vehicle traffic and switching to eco-friendly modes of transport

The shift of mobility to eco-friendly modes of transport (public transport, cycling, walking, sharing) has stagnated in recent years. The following measures – mainly implemented by the City of Vienna, partly in co-operation with the surrounding region or the federal level – are to realign the trend with the city's mobility objectives:

- **Parking space management:** From 2022, the citywide rollout of the permanent parking permit ("Parkpickerl") for residents is to bring about a tangible reduction of inward commuting passenger car traffic. Parking space management is to be further developed in the coming years so that it makes an even better contribution to attaining the city's mobility objectives. The main focus will be on "zone models" to reduce traffic within districts and on differentiated prices and permissions in order to speed up the market penetration of fully electric vehicles. Revenues will continue to be earmarked for investments in eco-friendly modes of transport. This measure is to be preceded by a survey of existing indoor car parks in Vienna and the utilisation of their capacity in order to close a gap in our knowledge and subsequently allow for the better targeting of the leverage effect of parking space management.
- **Further development of the Vienna Garage Act:** The aim is to reduce the mandatory number of newly built parking slots as a function of a building site's accessibility by public transport (public transport service quality¹²) and its location. The cost savings achieved are to be demonstrably used for funding additional mobility services, such as car sharing in the private sphere. Attention is to be given not only to residential buildings but also to office buildings and retail premises.
- **Expansion, densification and acceleration of public transport,** in particular, on the outskirts of the city and into the surrounding region. Implementation of key Underground, S-Bahn commuter railway, tram and (express) bus projects. The successful conclusion of negotiations on the KlimaTicket annual pass between the regional public transport alliance Verkehrsverbund Ostregion (VOR) and the Federal Government and the Austria-wide coverage of this annual pass will give a boost to the urgently needed shift of traffic across Vienna's boundaries from private passenger cars to public transport.
- **City of short distances:** Vienna implements and promotes the 15-minute city by facilitating short trips, supporting mixed uses, establishing local pedestrian priority zones and raising the attractiveness of neighbourhoods. This is also supported by a re-allocation of public street space in favour of active mobility and attractive places to linger.

¹² The public transport service quality describes how well a location is accessible by scheduled public transport services. The approach is made up of two elements: First, the categorisation of public transport services by type and service intervals at all stops and, second, a spatial analysis of walking distances to the stop.

- **High degree of traffic calming and raising safety** (Vision Zero – no traffic fatalities) as well as improving comfort for pedestrians and cyclists by introducing a 30 km/h speed limit especially in more residential areas and by implementing Viennese “Supergrätzl” neighbourhood regeneration zones to be supported by structural measures and intensified controls.
- **25,000 new city trees in street spaces:** Trees will be planted, for example, in place of traffic and parking lanes.
- **More space and convenience** for eco-friendly modes of transport through the implementation of a “new Viennese street cross-section” in all new urban development areas and street modifications in existing built-up areas (e.g. greenery as a standard feature, fewer angle or straight parking spaces, sponge city function). Depending on the situation in each quarter and on the decrease in the number of vehicles, parking slots available in public space are to be reduced step by step.
- Promotion of city-wide **operator-independent locker stations** to reduce empty trips in parcel delivery and enhance customer satisfaction.
- Systematic **expansion of sharing services** (mobility stations and free-floating services) **and trial of new on-demand services** in selected test areas on the outskirts of the city as well as in the region; utilisation of digitalisation for billing and implementation; promoting the brand and expansion of the WienMobil mobility stations for integrated sharing services in public space (WienMobil bicycles, WienMobil cars); further integration of private-sector partners. Objective: Ensuring full mobility without car ownership throughout the city.
- **Cycleway offensive** for a comfortable, safe and dense network: Expansion of cycling infrastructure in line with the strategic cycleway development programme until 2025 and extension of long-distance cycleways until 2030 as well as closing the gaps and improving quality in the existing network; considerable increase in the number of secure bicycle parking places in public space. Transporting bicycles on public transport will become easier.
- **Raising the attractiveness of sidewalks** by ensuring minimum widths. Wherever required, parking spaces will be eliminated and obstacles, such as traffic signs, will be removed from the sidewalk surfaces.
- **Improving the data basis relevant for attaining the objectives and for decision making.** Better and more timely collection of data, above all for the following indicators: Traffic volumes at numerous representative places in the Viennese street network; utilisation of parking capacity in public space and car parks; modal split.

- Finally, eco-friendly modes of transport can be strengthened by providing structured **support to climate-friendly mobility services of enterprises** (corporate mobility management). This requires the provision of resources and structures by the City of Vienna for advising and assisting enterprises in designing and implementing their mobility management concepts.
- Measures involving the redesign of public space (planting of trees, quality initiatives for cycleways and sidewalks) and, hence, contributing to both climate protection and climate adaptation are to be increasingly supported by **competitions and participatory formats**.

LEVER 2



Phasing out fossil drive systems

The phase-out of conventional internal combustion engines is mainly driven by EU regulations requiring vehicle manufacturers to reduce the CO₂ emission of the new car fleet in the EU by specific deadlines. The EU, however, aims at achieving climate neutrality only in 2050 and therefore will adjust its timelines to that target year. The City of Vienna supports the efforts made at the European level to decrease the CO₂ emissions of the vehicle fleets more sharply than previously stipulated. The CO₂ pathway for new passenger cars proposed by the European Commission within the framework of the Fit for 55 package (43 grams instead of 55 grams of CO₂ per kilometre in 2030 and zero grams in 2035) is welcome, although it would be desirable to put an end to the registration of new cars with internal combustion engines throughout Europe even earlier in order to reach zero emissions in transport by 2040. Moreover, the City of Vienna also supports all regulations ensuring environmentally friendly production and — in the spirit of the circular economy — especially the recycling of batteries installed in e-cars (see also Chapters 4.3 and 4.7).

To attain climate neutrality already by 2040, however, Vienna and the Federal Government have to take measures to steepen the CO₂ decline for domestic vehicle fleets and, in particular, to phase out fossil fuel combustion engines. Further benefits: Air quality improves in Vienna, street noise is reduced, the batteries of e-cars can absorb solar electricity and help stabilise the power grid (see also Chapters 4.6 and 5.4). The following measures have to be taken by Vienna and/or the Federal Government:

- **Price differentiation** based on the amount of specific CO₂ emissions and/or vehicle size (reversal of the trend towards SUVs on grounds of efficient energy and space use). Within its field of competence and sphere of influence, Vienna can shape road pricing and parking charges on Vienna's streets and in car parks.
- **Access restrictions or parking ban** for vehicles with (high specific) CO₂ emissions. In concert with more and more European cities aiming at banning cars with internal

combustion engines from parts of their territory (“low-emission zones” or “zero-emission zones”) or from the entire city, Vienna will also soon clarify steps to be taken in this direction. From the time when such regulations are adopted, they are suitable for massively influencing purchasing decisions in favour of zero-emission vehicles in and around Vienna.

- **Installation of more charging points in car parks and semi-public space:** Adjustment of regulations in order to raise the number of e-charging stations, bring transformers in line with the power output required and specify the concrete structural measures necessary for the installation of charging stations in car parks and semi-public parking lots. Additionally, promotion of smart charging systems in housing construction so that the electricity generated by photovoltaic systems (see Chapter 4.6.3) can be integrated and stored in the best possible way and the strain on power supply systems and, thus, the cost of their expansion can be minimised. Reduction of administrative burdens.
- **Expansion of charging infrastructure in public space:** A sufficiently dense network of charging points will be provided also in public space, above all in quarters undersupplied with charging stations in car parks and semi-public space, where the installation of charging stations should be given priority. Promotion of the development of and scientific support for innovative projects (e.g. inductive charging).
- Owing to a **mix of regulatory requirements and supporting incentives**, delivery vans will be largely emission-free already in 2030. As a result, the goal of CO₂-free logistics in commercial urban transport is attained. Vienna's taxi fleet will gradually switch to electric vehicles and other zero-emission technologies by 2025.
- **Municipal vehicle fleets are becoming CO₂-free:** The European Clean Vehicles Directive, which entered into force in 2021, defines mandatory and gradually rising minimum percentages for the public procurement of low-emission passenger cars and heavy-duty vehicles, in particular buses used in public transport. The City of Vienna will take the lead in its procurement activities and orientate itself to the percentages becoming effective two years into the future.
- At the latest from 2025, no new petrol or diesel vehicles will be purchased anymore. Exceptions may be needed for special-purpose vehicles if CO₂-free alternatives are not available yet. This ensures that the municipal vehicle fleet will become CO₂-neutral already before 2040.



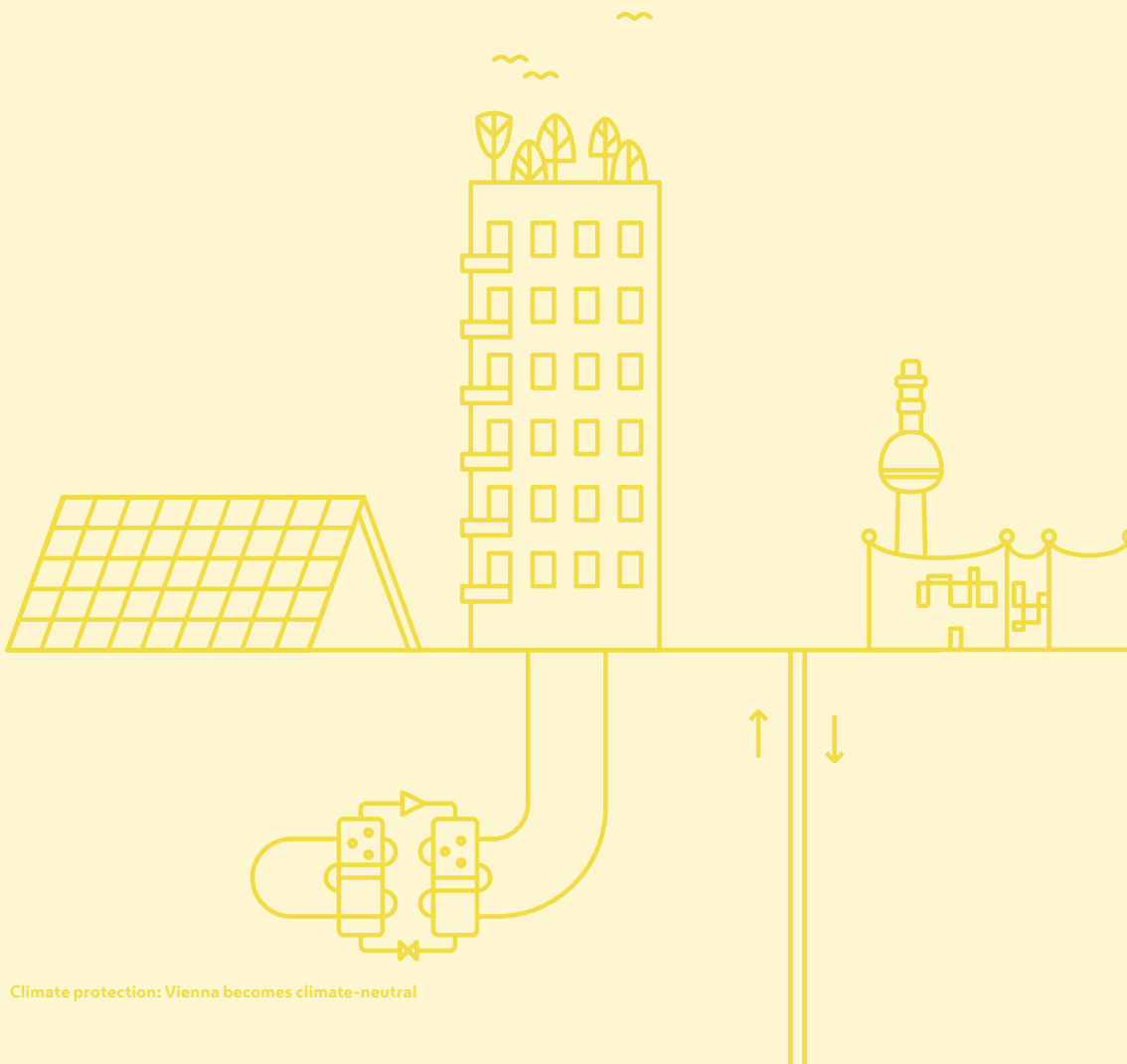
Interplay of Federal Republic and federal provinces

Necessary framework conditions defined at the federal or regional level are also crucial for the mobility transition. Issues that may need to be discussed are outlined below:

- Internalising the costs of passenger car traffic, elimination of the tax privilege for diesel cars, greening of the commuting allowance, elimination of tax advantages for company cars.
- Ensuring settlement development along large-capacity public transport axes within the region.
- Raising support for Vienna's commuter rail/regional express rail initiative, i.e. pushing ahead with the planning and funding of the second railway infrastructure package together with the Austrian Federal Railways (ÖBB). Expanding the scope of services in transport service contracts with ÖBB and Wiener Lokalbahnen. Express bus lines are to be implemented as a quickly feasible complement to the railway system in the region. Regiotram lines supplement services between the axes of commuter railway lines.
- Reform of road traffic regulations: The objective of keeping car traffic flowing is to be complemented or replaced by other objectives or guiding principles, such as providing more space and ensuring distributive equity for sustainable mobility modes.

4.2 Buildings

In the past decades, considerable emission reductions have been achieved owing to attractive promotion models for building refurbishment programmes, the expansion of district heating as well as the quick implementation of requirements defined by the Austrian Institute of Construction Engineering (OIB) and the nearly zero-energy standard in the construction of new buildings. Thus, the CO₂ emissions of the building sector have decreased by 37 percent since 1990 and by 20 percent since 2005. On a per-capita basis, savings even amounted to 51 percent and 32 percent, respectively. As a result, the CO₂ reductions of the building sector significantly exceeded the average of all other sectors.



In **comparison with the other federal provinces**, Vienna has **by far the lowest per-capita final energy consumption for heating and hot water supply**. This is due not only to the smaller per-capita size of homes but also to much lower heating energy consumption per square metre as a result of substantially more compact buildings in Vienna. Accordingly, Vienna is also among the best in the ranking of federal provinces by per-capita CO₂ emissions.

In Vienna, affordable and liveable housing is seen as a fundamental right that constitutes a crucial factor for social peace, cohesion and quality of life. Already today, living in Vienna offers all options of a CO₂-reduced lifestyle while per-capita soil sealing is at markedly lower levels by comparison. On the one hand, climate resilience has to be given top priority in housing construction. On the other hand, we are launching initiatives that specifically promote energy efficiency and sustainability in refurbishment projects. This path has to be pursued vigorously so that we can hand over a climate-friendly city to future generations.



Kathrin Gaál

Deputy Mayor and Executive City Councillor for Housing,
Housing Construction, Urban Renewal and Women's Issues

¹³ This headline goal of the Smart City Wien Strategy traditionally takes account of all greenhouse gas emissions in Vienna except for those of plants currently falling under the EU emission trading scheme. This means that emissions related to the use of electricity and district heating in buildings are not considered in the building sector but rather in the energy sector, whose plants, however, are almost exclusively covered by the EU emission trading scheme.

From 2014 to 2018, Vienna's **building sector**, specifically heating, cooling and hot water supply, accounted on average for almost **30 percent of the greenhouse gas emissions of relevance for the headline goal**¹³. Oil- and coal-fired heating systems hardly play a role here. **Almost 90 percent of CO₂ emissions recorded in the building sector are generated by gas heating systems** — mostly by around half a million gas boilers in homes or workplaces and, to a minor extent, by gas-fired central heating systems serving one or more buildings.

The Viennese breakdown of heating systems differs fundamentally from that of other federal provinces. As a result of these structural differences, other provinces where oil-fired heating systems prevail in single-family houses can reduce their CO₂ emissions more easily and faster than Vienna. Here, CO₂ neutrality of the building sector can only be achieved by an even stronger expansion of district heating and heat pumps (and only in isolated cases by means of biomass). Furthermore, the provisions of housing law and the Natural Gas Sector Act applying to multi-family and multi-storey residential buildings as well as mixed-use buildings prevailing in Vienna constitute major obstacles to decarbonisation.

Apart from waste management, **the decarbonisation of the building sector may be the biggest challenge on the way towards climate neutrality in Vienna**. This is due to the following reasons:

- **The legal framework for ensuring security of planning and investments is still¹⁴**

¹⁴ As per January 2022.

lacking: The basic conditions required for the transition in heating are just being prepared or under political discussion at both the federal and Viennese levels. Hence, a binding legal framework giving orientation, for example, to building and home owners, tenants and craft businesses is not (yet) in place. The same holds true for energy suppliers and system operators, which have to invest in the expansion of district heating and electricity systems in order to provide the suitable and decarbonised infrastructure for replacing fossil heating systems.

- **There is not much time left until 2040:** The refurbishment or replacement cycles of relevant building parts and heating systems are measured in decades. In the building and heating sector, in particular, changes are therefore much lengthier than in other sectors. If the phase-out is to be completed for oil by 2035 and for gas by 2040, numerous heating systems will have to be replaced before the end of their technical service life.
- **Hundreds of thousands are affected:** The necessary conversion measures require interventions in hundreds of thousands of apartments and tens of thousands of buildings that will be felt by many people and, for some of them, will result in changes to their habits. The expansion of the district heating system will temporarily be visible and audible in many streets.
- **More well-qualified key workers are needed:** Key sectors are partly affected by a lack of appropriately qualified workers. Both the massive increase in the thermal rehabilitation of buildings and the installation of many more climate-friendly heating systems require more specialised workers and, therefore, timely qualification programmes and re-trainings but, at the same time, give an enormous boost to employment and value creation in the labour market and for the economy of Vienna.
- **Costs are incurred:** It will not be possible in each case to finance the conversion measures from the reserves established for buildings. And it will not be possible in each case to compensate these one-off costs by lower expenditure on energy within a reasonable period of time. Thus, tailored solutions have to be found for this problem, too, in order to protect Vienna's residents against excessive financial burdens.

4.2.1 Our objectives

Vienna's City Government is aware of these special challenges raised by the heating transition. Therefore, the Smart City Wien Strategy has defined the following climate protection goals for the building sector:

¹⁵ Compared to the average for the years 2005 to 2010.

¹⁶ Compared to the average for the years 2005 to 2010.

- We completely phase out fossil heat supply by 2040.
- The final energy consumed per capita by heating, cooling and hot water systems in buildings decreases by 20 percent by 2030 and by 30 percent by 2040.¹⁵
- Related per-capita CO₂ emissions fall by 55 percent by 2030 and to zero by 2040.¹⁶
- Developers' competitions in subsidised housing accelerate social innovations and new solutions for climate protection and climate adaptation.

In the government agreement, the City Government also laid down that:

- "Fossil fuels are phased out for heating, cooling and hot water supply by 2040." [27]
- "...green gas, including hydrogen from renewable energy sources ... is to be used for co-generation plants or other high-grade energy purposes rather than for heating and hot water supply in Vienna." [27]
- "Within the next two years, a concept will be developed for the gradual switch from fossil-fired heating systems to district heating and renewable heating systems in existing buildings by 2040..." [27]

Since spring 2021, work has been underway on such a concept with the title "Heating and Cooling Vienna 2040". Several working groups are developing the concrete measures needed for the heating transition. Consideration is also given to the joint heating strategy of the Federal Government and the federal provinces that currently is in preparation and under negotiation.

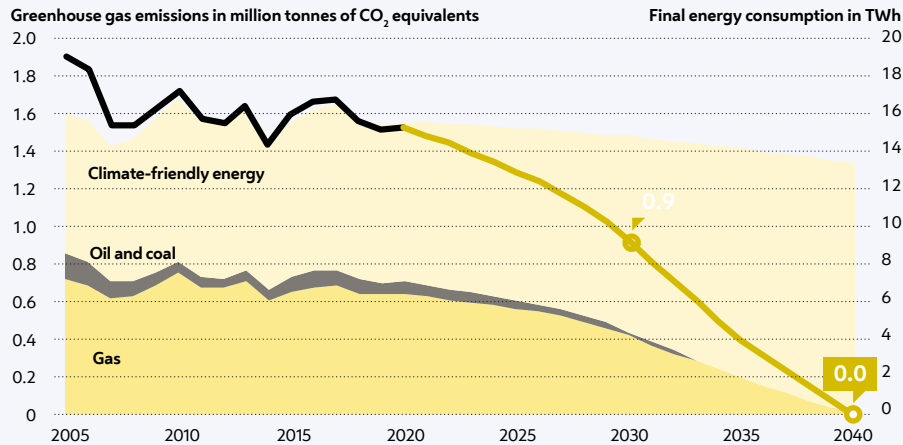
4.2.2 Pathway to the objectives

The reduction of per-capita CO₂ emissions by 55 percent by 2030 and to zero by 2040 requires that final energy consumption and the energy mix develop as shown in Figure 13.

Due to the increasing number of refurbished buildings, final energy consumption falls in the building sector in absolute terms, in spite of expected further population growth that results in a rise of the heated area by more than 50 m² per additional resident (in housing plus non-residential buildings). The share of gas in final energy consumption declines from more than 40 percent today to less than 30 percent by 2030 and to zero by 2040. The remaining use of fuel oil is to be finally consigned to the files of history by 2035. Gas heating systems are primarily replaced by district heating, which will be substantially expanded, or heat pumps.

The pathways shown below do not envisage a linear development from now to 2040 but rather a "ramp-up" of heat/energy measures from approximately the mid-2020s on.

Pathway of greenhouse gas emissions in the building sector by 2040



LEVER 1

Creating the framework for phasing out fossil heating systems

LEVER 2

Reducing energy consumption and using renewable heating systems

Integrated into the national and European framework

Figure 13
Pathway for oil and gas consumption and thus towards climate neutrality in Vienna's building sector; own chart based on Statistics Austria (2021), Environment Agency Austria (2021), estimates by UIV [21; 28]

The initially low replacement rate — see Figure 14 — is based on the assumption that a substantial upward trend and the required multiplication of both annual new connections to the district heating network and annual installations of new heat pumps can only be expected after the framework conditions relevant for Vienna will have been adapted at the federal and Viennese levels.

Pathway for annual switches from residential gas heating systems to climate-friendly systems

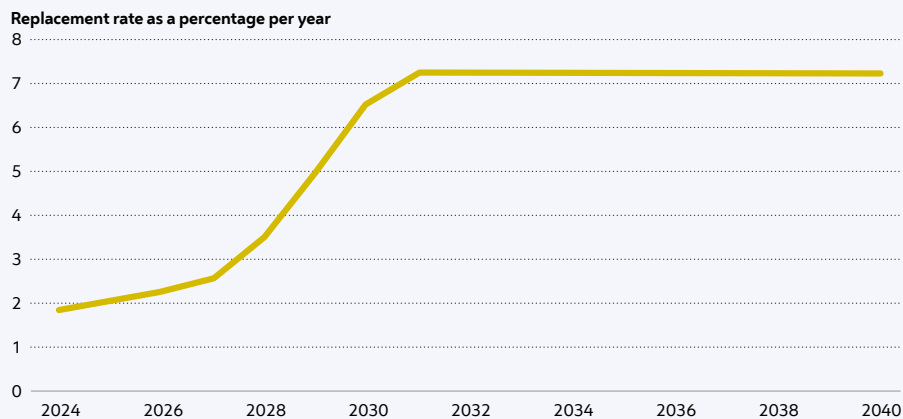


Figure 14
Pathway for annual switches from residential gas heating systems (as a percentage of target-relevant units) to climate-friendly systems; own chart based on calculations by UIV

It is all the more important to put in place and communicate swiftly the changes outlined below in order to ensure a high level of security of planning and investments for all. This is what building owners need for the replacement of their heating systems on the one hand and what system operators and energy suppliers require for the timely provision of network infrastructures and production capacities for additional district heating connections and heat pumps on the other hand. And, finally, clarification is needed on how all this can be accomplished while ensuring social sustainability.

4.2.3 Key levers for attaining our objectives

By the end of 2022, the key levers described below are to be consolidated through the preparation of a detailed strategy and the parallel development of an implementation programme for “Heating and Cooling Vienna 2040”. Certain tasks will also be performed by the Federal Government under the joint heating strategy of the Federal Government and the federal provinces, primarily by adopting the planned Renewable Heat Act.



LEVER 1

Creating the framework for phasing out fossil heating systems

The key to decarbonising heating supply in Vienna is the phase-out of fossil heating systems. To this effect, several fundamental measures have to be implemented so that clarity prevails among citizens and businesses on the one hand and a strategic framework providing orientation is defined on the other hand.

- **Creating a clear legal framework:** Specific rules are needed for phasing out oil and gas heating systems on a legislative basis. Vienna's endeavours are currently supported by the negotiations on the Renewable Heat Act at the federal level. It is planned to regulate the phase-out of fossil heating systems at the federal level while also laying down reliable and adequate provisions cushioning the social impacts. On this basis, Vienna will adopt legislation adding important details and rules specifically necessary for densely built-up urban space.
- **Creating data bases:** The collection and compilation of a robust basis of data at the building and apartment level is essential for the gradual and spatially co-ordinated replacement of fossil heating systems as well as other fossil-fired system, for example in craft businesses. The legal basis for these efforts will be created at the provincial level.
- **Supporting tools of integrated spatial and energy planning:** Among others, one essential regulation that still needs to be introduced in the Building Code for Vienna is the extension of integrated spatial and energy planning from new buildings¹⁷ to existing buildings and heating systems. At the transition to the citywide phase-out of fossil heating systems, integrated spatial and energy planning is an opportunity for advancing

¹⁷ See Article 2b of the Building Code for Vienna.

the switch – differentiated in space and time – to district heating or renewable energy systems and supporting a co-ordinated modification of energy infrastructures that satisfies spatial demands and comes at the best cost possible. What is envisaged at present is a zone model that prioritises different heat supply options depending on infrastructure availability and shows the time of availability in a phased approach within the framework of the integrated spatial and energy plans for existing buildings. The related ideas are to be specified in concrete and partly also in spatial terms in the “Heating and Cooling Vienna 2040” strategy by the end of 2022.

- **Decarbonising district heating:** In a large part of the densely built-up urban area, a switch from gas heating systems to district heating is the most important measure for decarbonising the building sector. From an overall perspective (also taking account of the emissions of the energy and ETS sectors), however, this strategy only makes sense if district heat is produced without fossil fuels. The way in which this can be accomplished and which measures will be taken by Vienna (also including the additional framework conditions required) is explained in Chapter 4.6 “Electricity and district heat generation”.

Reducing energy consumption and using renewable heating systems



LEVER 2

In order to accomplish the desired reduction of final energy consumption, the number of flats that are thermally rehabilitated per year has to be increased to 25,000 in the next few years and then kept at this level until 2040. A similar development is needed for non-residential buildings. On average, each rehabilitation project should, if possible, halve the energy used for heating and optimise the energy used for hot water supply, as the latter will increase on average as a result of the frequent centralisation of hot water systems. In addition to thermal rehabilitation measures, heating systems, too, are to switch to district heating or renewable energies in the course of energy-related refurbishment, which frequently requires the centralisation of hot water supply.

Tailored programmes are needed that offer and support appropriate solutions for buildings. Both the type of climate-neutral energy supply and meaningful thermal rehabilitation measures depend, first, on the location of a building in one of the zones identified in the integrated spatial and energy plans and, second, on the type of building (e.g. historical office building or residential building from the 1960s).

Therefore, we are working on the following measures and programmes:

- **Programmes promoting thermal rehabilitation and boiler exchange:** Building on decades of experience and on the reflections on the integrated spatial and energy plans for existing buildings, appropriate, targeted promotion programmes are to be developed and framework conditions are to be adapted. The aim of promotion always

has to be both the provision of incentives and the equally vital cushioning of social effects of a switch to renewables or district heating — as far as possible in combination with meaningful thermal rehabilitation measures. Within the framework of the heating strategy, the Federal Government signals additional funding lines that also are to address multi-storey buildings and will provide financial support to people obligated by regulatory requirements to make investments. Here, it is important to ensure that **promotion programmes are co-ordinated** between the Federal Government and the federal provinces and that adequate funding is provided for Vienna's plans (e.g. centralisation of heating systems and replacement of gas boilers). The budget volumes have to be sufficiently high for achieving the objectives and secured in the long-term and should be co-financed by the federal level. In particular, the financial support provided has to ensure the very generous cushioning of social effects for people who cannot afford the conversion of their heating system.

¹⁸ Thermal rehabilitation (e.g. by means of thermal insulation) reduces energy consumption; energy-related refurbishment refers to the switch to climate-friendly heating systems.

¹⁹ These are in part "additional effects" because thermal and energy-related measures taken for buildings and heating systems already trigger investments amounting to several hundreds of millions of euro per year today.

- The investment volume unleashed by the planned thermal rehabilitation and energy-related refurbishment drive¹⁸ amounts to significantly more than one billion euro per year.¹⁹ At the same time, such a programme strengthens numerous economic sectors and creates or secures in excess of 15,000 jobs. These effects stimulating the labour market are to be supported by appropriate **training programmes and labour market initiatives**.
- **Pilot programmes, such as "100 buildings: Bye, bye gas boiler, hello renewables":** Work is to be performed on various programmes and demonstration projects. In this context, however, numerous technical, organisational, legal and financial aspects of the business models still have to be clarified. The pilot and demonstration programme "100 buildings: Bye, bye gas boiler, hello renewables" is to develop solutions for the particular challenge of switching from gas boilers to renewable energies. In addition, we need a promotion and networking programme that supports pilot projects implemented at the interface between research, demonstration and dissemination and is backed and funded by the City of Vienna (ideally with co-funding from the Federal Government and/or the EU). This programme is to be set up soon. What is especially important here is the full transparency of planning, the evidence obtained and the implementation of such pilot projects, as this is a requirement for a broad rollout, including the provision of training to energy consultants and authorities.
- **Accompanying programmes, such as consulting, dissemination of information, awareness raising:** In Vienna, for example, the "Hauskunft" counselling service is to be upgraded into a one-stop shop for all issues related to the refurbishment of buildings and the switch to new heating systems. Vienna will also prepare a timely, comprehensive information campaign with a broad impact in order to make the building owners concerned as well as citizens and the enterprises needed for implementation aware of the new legal requirements and the related financial or other support offered by the City of Vienna.

- Voluntary agreements – so-called **“climate alliances”**²⁰ – between the City of Vienna and large building owners and managers or enterprises are to create a platform for mutual assistance on the way to an oil- and gas-free building stock.
- **The City of Vienna and its undertakings as a role model:** The aim is to heat buildings occupied by municipal authorities exclusively by means of climate-friendly energies by 2035 and to equip them with photovoltaic systems wherever technically feasible in the next few years. By 2025, municipal undertakings are to draw up a plan on how their building stock can be decarbonised by 2040 and which buildings are to switch from fossil fuels to district or renewable heating by 2030.

²⁰ Climate alliances are strategic partnerships and co-operation agreements with enterprises active in Vienna that aim at decarbonising the city by 2040. The stakeholders and the City of Vienna commit to agreed climate targets, CO₂ reduction paths, long-term co-operation, exchanges of information and experiences, regular dialogues for the adjustment of framework conditions (funding, legal framework) and joint activities. This is to give the enterprises planning security for adapting their business models and product portfolios to the Paris climate goals.

Interplay of Federal Republic and federal provinces

Vienna's efforts to decarbonise the heating sector are currently supported by the development of a joint heating strategy of the Federal Government and the federal provinces that aims at “decarbonising the heating supply of buildings (residential and non-residential buildings) by 2040 through a switch to renewable energies and a further reduction of energy consumption.”



The following aspects are of special significance:

- **Regulatory measures of the Federal Government and, additionally, at the provincial level with regard to the phase-out of gas- and oil-fired heating systems.**
- **Common long-term framework promoting the switch to other energy sources and cushioning social impacts:** Creation of an appropriate and long-term promotion framework allowing for the desired conversion to district and block heating or — in case of low heat densities — heat pump solutions along with energy-related refurbishment measures in the building sector as well as ensuring the required cushioning of social impacts. According to current estimates, the funds to be provided in Vienna will have to amount to at least 600 million euro per year.
- **Regulatory relief in housing law for thermal rehabilitation and the use of climate-friendly energies** on the basis of a coherent overall concept for buildings. Rehabilitation roadmaps towards the objective of CO₂ neutrality by 2040 identifying implementation steps that are economically viable and meaningful in terms of contents.

- **Amendments to other federal legislation to make the heating transition possible.**
This includes, in particular, an end to obligatory network connection under the Natural Gas Sector Act, the promotion of the expansion of district heating networks and the improvement of framework conditions for the development of deep geothermal energy systems as well as adjustments to the Landlord and Tenant Act, Condominium Act and Non-profit Housing Act to facilitate the implementation of measures. With regard to standardisation, especially the standard on calculating heating energy requirements for dimensioning heating systems has to be revised so that inefficiencies resulting from oversized systems can be avoided.
- **Tax measures** enhancing the attractiveness of thermal/energy-related measures and the use of renewable and climate-friendly energies.

4.3 Waste management

Vienna's waste and wastewater management system is seen as a role model throughout Europe, also with regard to climate protection. Recyclables and waste materials are collected separately and recycled to a great extent. This permits the use of secondary raw materials in the production of goods, saves primary raw materials and energy and reduces CO₂ emissions.



Moreover, the Pfaffenu, Spittelau, Flötzersteig and Simmeringer Haide waste plants and the central wastewater treatment plant **produce around 1,100 GWh of district heat and 150 GWh of electricity annually** — as a by-product of the proper disposal of waste and wastewater, so to speak.

Although this gives rise to around 400,000 tonnes of greenhouse gases per year, these plants nevertheless contribute to climate protection because if these electricity and heat volumes were produced from other sources — e.g. from natural gas in power plants and district heating plants²¹ —, emissions would still be released at least to a similar extent. Additionally, Vienna's waste management sector contributes to substitution effects resulting from the recycling of paper, glass, metals and plastic materials — predominantly at production sites located outside Vienna — so that more than 70,000 tonnes of CO₂ are avoided [29].

On average, **waste management was responsible for some 10 percent of Vienna's greenhouse gas emissions relevant for the respective headline goal** in the years 2014 to 2018. Since 2005, they have been rather stable at just above 500,000 tonnes of CO₂ equivalents per year (see Figure 15). Per-capita emissions show a slightly downward trend. Essentially, greenhouse gas emissions are attributable to **two sources**: The lion's share stems from the **thermal recovery of petroleum-based residual materials** and, hence, is of fossil²² origin. The smaller share relates to **diffuse methane emissions of closed-down landfills**, which continue to decrease further year after year, as well as to **emissions released in the wastewater treatment plant and in sewers**.

The decarbonisation of the waste management sector faces the following challenges:

- CO₂ will be generated in incineration plants as long as plastic waste of fossil origin is handed over for treatment to the waste management sector.
- The City of Vienna only has very limited possibilities of influencing the transformation of (European or global) flows of goods and resources towards the circular economy or bio-based products but is willing to do its best in this field.
- On principle, diffuse methane emissions generated by old landfills are hardly avoidable but, due to the landfilling ban imposed in Austria and owing to the strict provisions of the Landfill Regulation of 2008, they are decreasing sharply.
- A decline in combustible waste reduces district heat output and widens the gap in district heating that needs to be covered by climate-neutral energies while the demand for district heating goes up.

²¹In contrast to plants of the energy sector, waste treatment plants are not covered by the EU emission trading system (EU ETS). As a result, the greenhouse gas emissions released during the generation of electricity and district heat in waste treatment plants are relevant for Vienna's headline goals, whereas they would be irrelevant if they were produced in plants of the energy sector because those plants fall under the scope of the EU ETS.

²²CO₂ released during the incineration of biogenic waste materials is considered to be CO₂-neutral and is not taken into account in the greenhouse gas balance.

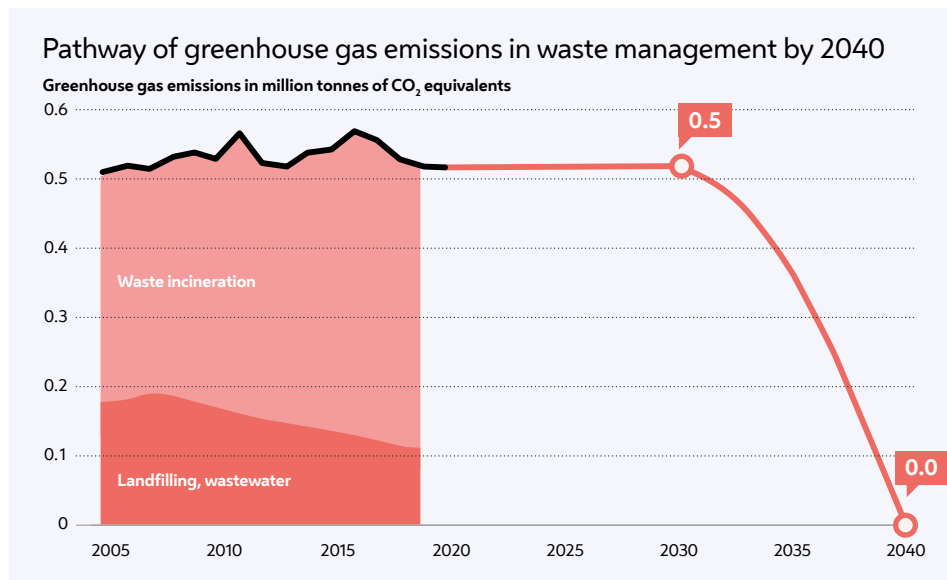
4.3.1 Our objectives

The following CO₂-relevant objective is laid down for waste management in the Smart City Wien Strategy:

- Vienna's waste management system achieves net zero by 2040 [30].

Moreover, the Smart City Wien Strategy also sets further goals for waste management that build on strategies already defined in the Vienna Waste Management Plan and the Vienna Waste Prevention Programme for the planning period 2019-2024 on the one hand and provide guidance for their next updates on the other hand:

- Less waste is produced thanks to a wide range of waste prevention measures.
- Vienna exceeds the EU target of a recycling rate of 60 percent by 2030 and recycles 100 percent of unavoidable wastes by 2050.
- The products manufactured in Vienna are durable, easy to repair, reusable and recyclable. Their production causes minimal waste and pollutant emission.
- Food waste is reduced by 50 percent by 2030 and, on an ongoing basis, to a minimum by 2050.



LEVER 1

Avoiding waste

LEVER 2

Collecting and separating waste

LEVER 3

Treating waste

LEVER 4

Adjusting product design and composition

Integrated into the national and European framework

Figure 15
Greenhouse gas emissions of the Vienna waste management sector from 2005 to 2019 and pathway to climate neutrality from 2020; own chart based on the pollutant inventory for Austria's federal provinces published by Environment Agency Austria, 2021 [21], for 2005–2019 and on estimates drawn up by UIV in consultation with the City of Vienna – Municipal Department 48 - Waste Management, Street Cleaning and Vehicle Fleet for 2020–2040

4.3.2 Pathway to the objectives

The CO₂ reduction objectives defined for Vienna for 2030 and 2040 as well as the city's greenhouse gas budget result in the pathway towards climate neutrality for waste management in Vienna shown in Figure 15. It expects and foresees that the development of greenhouse gas emissions will remain constant up to the early 2030s. In the course of the 2030s, emissions will gradually decrease to nearly zero as measures taken by Vienna and, above all, policies adopted by the EU and the Federal Government will make an impact.

4.3.3 Key levers for attaining our objectives

The following directions are to be pursued in order to reduce greenhouse gas emissions in waste management:

LEVER 1

Avoiding waste

- **Waste-preventing services for citizens and businesses:** Repair of reusable waste electrical equipment dropped off at waste collection centres; further development of the Vienna Repair Voucher and the Vienna Repair Network; continuation of municipal reuse sales (48er-Tandler second-hand store); sale of vehicles and IT equipment no longer used by the City Administration; provision of support to private repair and second-hand initiatives; passing on foodstuffs at markets; implementation of as many events as possible as environmentally friendly ÖkoEvents, for example by strengthening the services offered, such as the mobile tableware service “Geschirmobil”, the Viennese reusable cup rental system and reusable plastic plates and cutlery.
- **Public institutions leading by example:** Prevention of food waste in Viennese hospitals, kindergartens and schools; promotion of reuse systems within the City of Vienna; expansion of the ÖkoKauf Wien criteria to include components and construction materials.

LEVER 2

Collecting and separating waste

- **Waste collection:** Improvement of the separate collection of waste materials based on modified recycling banks.
- **Waste separation:** Development of measures to ensure that recyclable materials that are misplaced in residual waste are separated out before energy recovery. Thereby, recyclable fractions, in particular plastics, could be sorted out and recycled — with a positive impact on the recycling rate and a reduction of fossil CO₂ emissions.

Treating waste



LEVER 3

- **Recycling of materials contained in incineration residues:** The recovery of valuable resources (metals, glass, mineral substances and nutrients such as phosphorus) can save primary raw materials and reduce transports and, thus, CO₂ emissions.
- Before 2040, measures will be taken to **capture carbon** from flue gas flows. If biogenic CO₂ emissions are captured at the same time — 60 percent of carbon contained in waste already has a biogenic origin today —, waste management can even achieve “negative emissions” totalling up to 300,000 tonnes per year [31] and, hence, a carbon sink effect in Vienna.

Adjusting product design and composition



LEVER 4

Circular economy: The circular economy is a production and consumption model in which existing materials and products are shared, leased, reused, repaired, reprocessed and recycled as long as possible. Thereby, the lifecycle of products is extended. Whether it is possible to close product and raw material cycles or not as well as the expenditure and efforts involved depend on product design. Consequently, circular design principles, such as durability, maintainability, reparability, modularity, easy disassembly, use of recyclable materials and elimination of problematic chemicals, are of crucial significance for making cycles possible in the first place and minimising wastes. Relevant regulations fall under the competence of the EU or the Federal Government. Both the EU — the circular economy is a goal of the European Green Deal — and the Federal Government have adopted related objectives and announced relevant initiatives. Their implementation will also play a crucial role in the achievement of Vienna’s waste management and climate goals (see also Chapter 4.7.1).

- The **volume of products based on fossil raw materials must be reduced** so that, subsequently, a decline of (fossil) CO₂ emissions released by the incineration of these products can be achieved. In addition to the above-mentioned circular economy strategy, it will also be necessary to replace fossil with bio-based product constituents. This, too, will require regulations at the EU or federal level.
- Through the implementation of the planned **OekoBusiness Hub**, a platform will be created that allows businesses, industry, academia, NGOs and the City of Vienna to work together on appropriate product solutions.



Interplay of Federal Government and federal provinces

Vienna will advocate that the following regulatory measures and incentives are provided at the federal level:

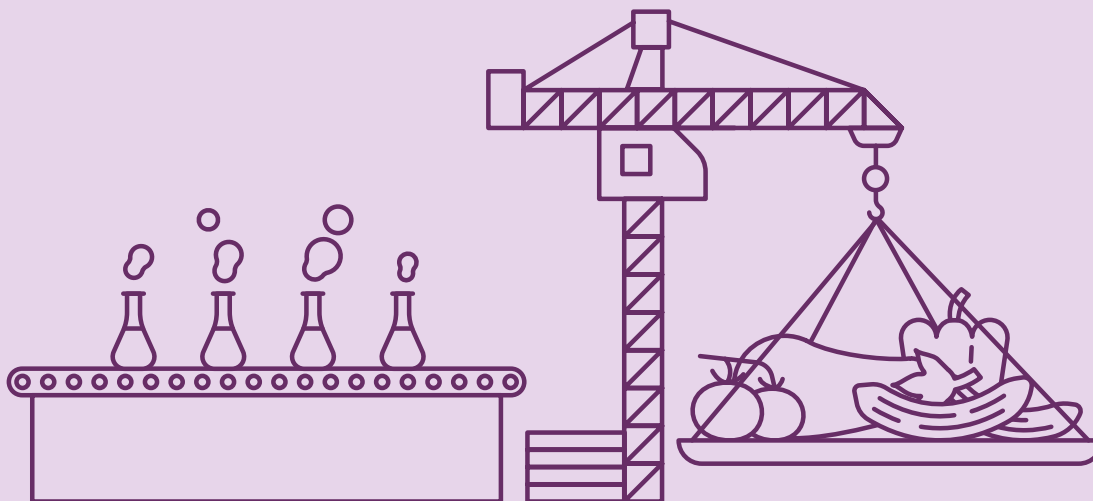
- Increase of reuse quotas.
- Counting of reprocessed incineration residues (metals, glass, mineral fractions and salts) towards the EU recycling quota for municipal and packaging wastes.
- Support from the Federal Government for resolving the technical, legal and financial challenges related to carbon capture, which has not been implemented on an industrial scale to date.
- The landfilling of residues from waste incineration can be avoided in the future if slags and ashes are processed to such an extent that they do not pose any hazards to health and the environment and can be used as a product (e.g. in road construction). This requires appropriate standards and legal bases at the federal level. They are also an important prerequisite for the emergence of a market for these residual materials and for the economically efficient operation of processing plants.

4.4 Production sector (industry, trade, agriculture)

Industrial production generates over one fifth of Vienna's value added²³ and, on average for the period from 2014 to 2018, accounted for roughly seven percent of the greenhouse gas emissions of relevance for the respective headline goal²⁴. In recent years, this volume, which presents a downward trend over the long term, has been relatively constant at close to 400,000 tonnes of CO₂ equivalents. Approximately 85 percent result from the use of fossil energies; the largest emitters are the construction sector (mainly because of diesel fuel), the food, beverages and tobacco industry and the chemical industry.

²³ Including production-oriented services, this increases to about one third.

²⁴ Since 2013, industrial plants are not covered by EU emission trading anymore; hence, this percentage refers to the entire sector.



²⁵ These areas are attracting more and more interest with a view to urban development. Optimum solutions are to be chosen to foster sustainability.

²⁶ However, the contribution of carbon sinks from agriculture and silviculture should not be overestimated. Even at a global level, they can compensate for only a minimal portion of fossil CO₂ emissions. This applies even more to urban areas.

²⁷ See "VIENNA 2030 – Economy & Innovation" strategy and thematic concept *Produktive Stadt* (Productive City).

²⁸ The remainder is due to electricity and district heat. The related CO₂ emissions come under the EU emission trading sector.

²⁹ Energy occurs in different forms. These can be converted from one into another only to a limited degree. Exergetically efficient forms of energy are defined as energy forms that can be flexibly used and converted. They include mechanical and electrical energy. Both can be entirely converted into heat. By contrast, the conversion of heat into mechanical or electrical energy entails losses.

³⁰ As compared to 2019.

For a metropolis, Vienna also boasts a significant share of agricultural production on its municipal territory, which contributes substantially to the sustainable food system of the city.²⁵ However, the climate-relevant emissions from agriculture traditionally play a minor role, not least because Vienna's agricultural sector mainly consists of farms specialising in horticultural produce and permanent crops; only very little livestock is kept (see Chapter 4.7.2). Vienna's farms account for around 0.5 percent of emissions of relevance for the respective headline goal and have been rather stable for decades at roughly 30,000 tonnes of CO₂ equivalents, of which close to two thirds result from the use of fossil energy (e.g. fleets of agricultural vehicles and gas heating of greenhouses). In the longer term, humus formation on agriculturally and silviculturally used soils, which for many reasons is advantageous and desirable, also offers the possibility of storing carbon, which in this way is removed from the atmosphere.²⁶ Moreover, the long-term use of wood – for example, for buildings or bridges – can lead to the formation of additional carbon sinks in the city (see Chapter 4.7.1).

Vienna wants to remain a "producing metropolis".²⁷ In a highly condensed city, production sites must be well integrated into their environment. To achieve this purpose, it is crucial to employ suitable methods to deal with noise, air pollution, business traffic and the local residents. Decarbonisation is another ambitious task, for petroleum products and natural gas continue to account for more than half of the energy consumption of production enterprises²⁸; thus, substituting them is the biggest challenge faced by this sector. This means:

- Electrification of large parts of the production processes. Switch from gas to district heat for low-temperature processes (e.g. drying, greenhouse heating).
- Stepping-up of district cooling as an efficient infrastructure for the cooling of buildings.
- Conversion of mobile equipment (e.g. construction vehicles, agricultural machinery) to climate-friendly energy sources.
- Provision of (exergetically) efficient renewable energy sources²⁹ to cover the residual demand for high-temperature heat.
- Use of the waste heat of high-temperature applications as well as from the cooling of, in particular, data centres for district and local heat generation.
- Adaptation of the power line and pipe infrastructures required for this purpose (e.g. power grid reinforcement, adaptation of gas distribution system).

4.4.1 Our objectives

It is a strategic objective of the City Government to keep industrial and agricultural production in the metropolis and to make sure that it is sustainable and resource-conserving. To this end, the Smart City Wien Strategy defines the following targets:

- The material efficiency of Vienna's economy increases by 30 percent by 2030 and by another 10 percent by 2040.³⁰

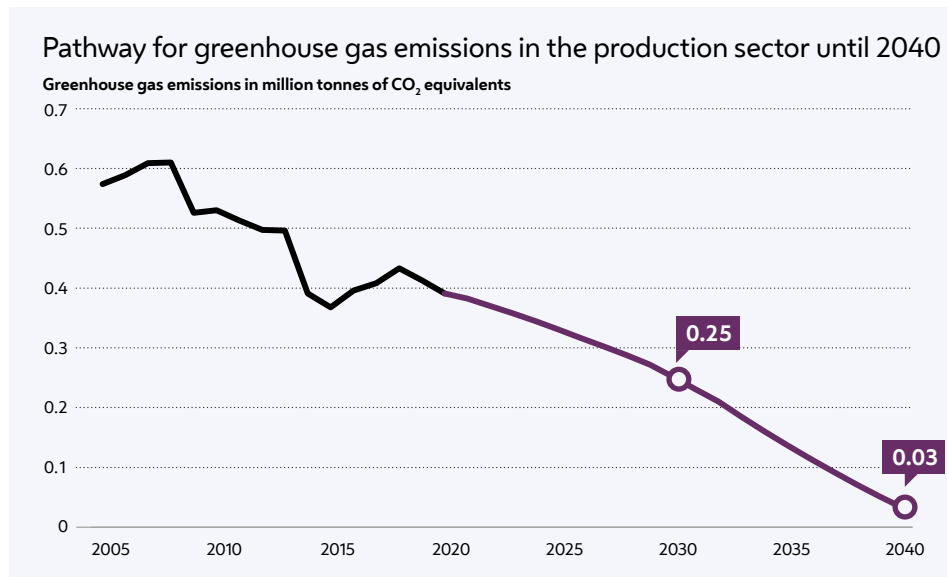
- The products manufactured in Vienna are durable, easy to repair, reusable and recyclable. Their production causes minimal waste and pollutant emission.
- In 2030, Vienna enjoys a global reputation as the centre of a circular and resource-efficient economy and attracts investments and talents in this field.
- Vienna fosters a sustainable urban economy by means of statutory frameworks, targeted subsidy programmes, the creation of experimental spaces and as a public customer.

The government agreement of 2020 announces the “transformation of the economic system into a circular economy”; the “VIENNA 2030 – Economy & Innovation” business location strategy states:

- “The systematic ecologisation of production processes and products from Vienna sets global standards and in this way becomes an exportable location asset.”
- “Vienna specifically supports the innovation of production processes as well as all innovations regarding goods and services that entail a relevant reduction of greenhouse gas emissions or foster practices for climate change adaptation.” [32].

4.4.2 Pathway to the objectives

The goal lies in reducing greenhouse gas emissions by at least 60 percent per capita by 2030 as compared to 2005. By 2040, fossil energy sources will have been entirely substituted by climate-friendly sources; only a small portion of process-related emissions will remain.



LEVER 1

Switching from fossil to renewable energy supply

LEVER 2

Mobilising renewable energy potentials on site

LEVER 3

Planning a possible supply with green gas

Integrated into the national and European framework

Figure 16
Pathway to climate neutrality for Vienna's production sector; own chart for 2005–2019 based on the air pollutant inventory for Austria's federal provinces published by Environment Agency Austria, 2021 [21], and for 2020–2040 on estimates by UIV

4.4.3 Key levers for attaining our objectives

As a federal province and a city, Vienna only has limited competences to reduce emissions in the production sector and mainly pursues the following measures:

LEVER 1



Switching from fossil to renewable energy supply

- **Strategic planning of the use of renewable energy**, including instruments for integrated energy and spatial planning and location policy, starting with a location-specific survey of gas-fuelled process heat generation and the identification of alternatives (switch to district heat, electrification, green gas). The objective is to create a co-ordinated plan for energy infrastructure conversion. Moreover, the use of district cooling as an energy-efficient alternative to conventional cooling is to be evaluated.

LEVER 2



Mobilising renewable energy potentials on site

- **Subsidies, statutory regulations and consultations to mobilise renewable energy potentials** at the locations of production enterprises – for example, solar power generation and in-house use of waste heat and ambient heat.

LEVER 3



Planning a possible supply with green gas

- **Supporting Vienna's enterprises in decarbonising their process heat generation:** Increased promotion of research, innovation and implementation; if required, also support of company transfers to sites connected to a green gas network if green gas is indispensable (e.g. starting at a process heat demand in excess of 700 degrees Celsius).

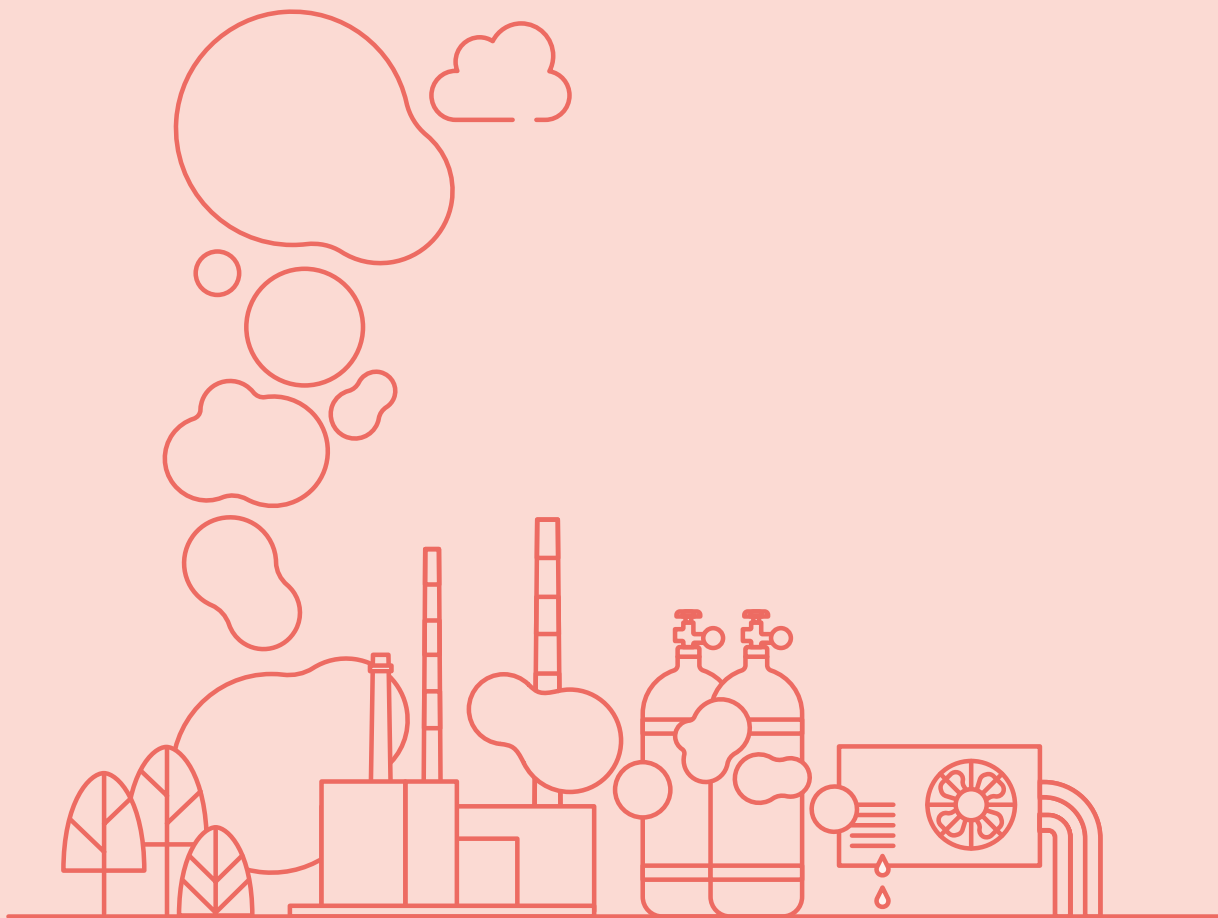


Interplay of Federal Republic and federal provinces

Moreover, Vienna advocates ambitious and effective framework conditions at both the federal and EU levels:

- Adaptation of statutory provisions enacted at the federal level to bring about the heat turnaround. In particular, this concerns putting an end to obligatory network connection under the Natural Gas Sector Act as well as promoting a further expansion of district heating and district cooling systems.
- Tax incentives to render measures for greater energy efficiency more attractive and foster the use of renewable energy sources. Targeted subsidy programmes, support of pilot projects.

4.5 F-gases



³¹Under this heading, the Climate Change Act of the Republic of Austria summarises the climate-relevant emissions of all fluorinated greenhouse gases (HFC, PFC, SF₆) that result from industrial production and product use.

“F-gases”, or fluorinated gases³¹, are very potent greenhouse gases; in the period from 2014 to 2018, they accounted on average for about seven percent of Vienna’s greenhouse gas emissions of relevance for the headline goals. This group is composed of a great variety of gases used in manifold, highly diverse fields of application. With regard to their relevance for the climate, the most important aspect for Vienna concerns their use as refrigerants in cooling and air-conditioning systems, as insulating agents in soundproof windows and in foamed materials (such as insulating panels or assembly foam).

The resulting climate-relevant emissions increased markedly and steadily over recent decades, also because F-gases are often employed instead of ozone-depleting chlorofluorocarbons (CFCs), which have been outlawed. Since 2019, however, F-gas emissions have been on the wane. This trend will continue as the EU F-gas Regulation is beginning to take effect.

Despite this, challenges remain:

- In the future, heat pumps will play an important role in replacing oil- and gas-fired heating systems; thus, the number of heat pumps and, hence, the use of refrigerants will increase significantly (see Chapter 4.2).
- It must be expected that the number of cooling and air-conditioning systems will likewise increase as a result of global warming and because of a demand for greater comfort.
- Since F-gases are often bound or used in durable consumer goods, from which they escape in the course of time or when disposed of, climate-relevant emissions will still occur.
- For certain applications, substitutes are not yet in sight.

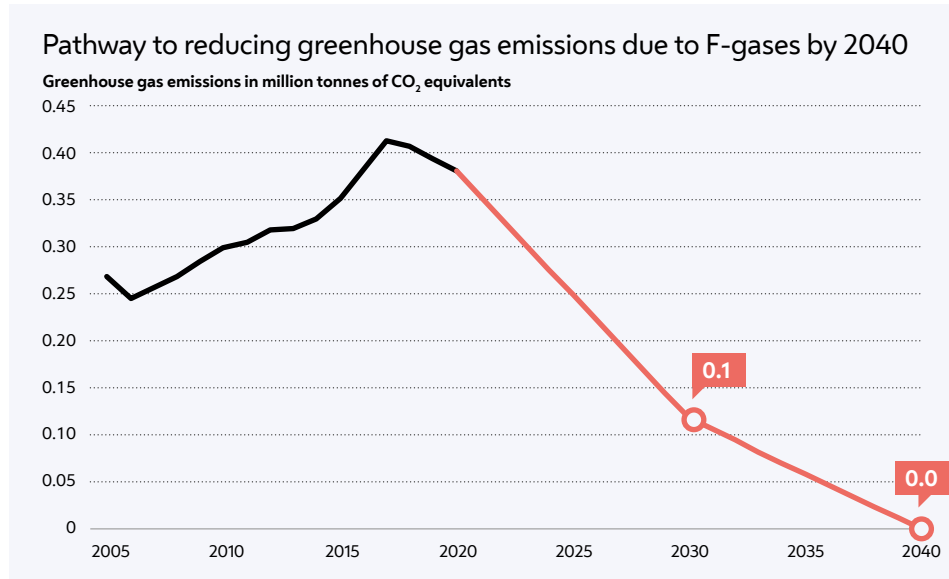
4.5.1 Our objectives

Vienna will make the best possible use of the framework conditions laid down by the EU and the Republic of Austria to reduce the emission of F-gases and champion a further tightening of the relevant provisions.

4.5.2 Pathway to the objectives

It is envisaged to reduce per-capita emissions in this field by at least 60 percent by 2030 as compared to 2005 and to eliminate them entirely by 2040, with the exception of small residual quantities.

4.5.3 Key lever for attaining our objectives



LEVER 1 Reducing the demand for air conditioning

Integrated into the national
and European framework

Figure 17
Pathway for the reduction of F-gases
in Vienna; own chart for 2005–2019
based on the air pollutant inventory
for Austria's federal provinces pub-
lished by Environment Agency Aus-
tria, 2021 [21], and for 2020–2040 on
estimates by UIV

Reducing the demand for air conditioning

- Vienna will take its own measures³² to contribute to reducing the need for air conditioning in buildings and will conduct checks to curb the uncontrolled proliferation of self-installed air-conditioning devices purchased at DIY stores as far as this is possible.

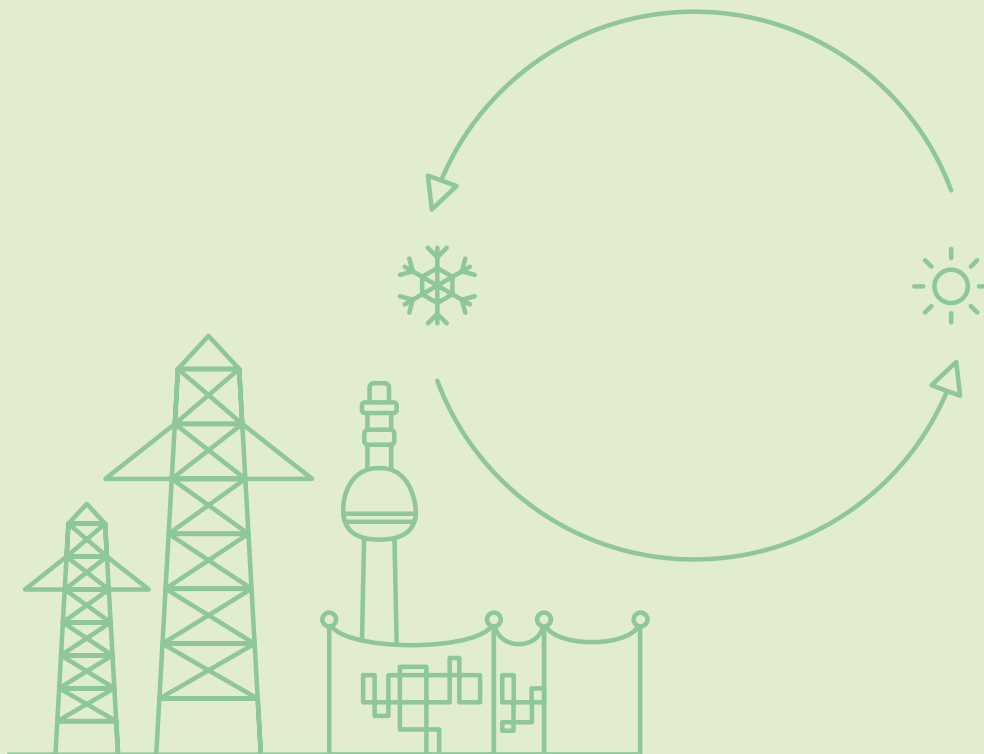
The EU F-gas Regulation is by far the most important instrument to limit greenhouse gas emissions in this field, since it gradually restricts above all the quantities and climate impact of F-gases newly placed on the market. As a result of the ongoing revision of the Regulation and the further tightening of the EU framework conditions under discussion, an improvement of the state of the art and, hence, even more significant specific greenhouse gas reductions may be expected.



³²See measures to counter the over-
heating of buildings and mitigate
heat islands in the city.

4.6 Electricity and district heat generation

Communication, production, mobility, heating and cooling – no sphere of work or life is conceivable without electricity. The **power grid** is the bloodstream of modern societies. Digitalisation, but even more the electrification of further sectors - above all of road traffic and parts of the low- and high-temperature heating sector - will markedly boost electricity consumption. At the same time, electrification results in significant improvements of energy efficiency and, thus, helps to curb overall energy consumption.



District heating provides the second energy backbone of the city; for hundreds of thousands of people, it is and remains indispensable. Already today, district heating is the most important form of heating in Vienna, ahead of gas-fired installations. Its importance will increase further when hundreds of thousands of dwellings still heated with gas will switch over to district heating.

Climate protection is the greatest task of our times. Therefore, Vienna is to become climate-neutral by 2040. While energy generation is still dominated by coal elsewhere, Vienna opted for a different approach already many years ago. For decades, our highly efficient power stations, combined with waste incineration plants and waste heat utilisation, have made us a pioneer in the field of environmentally friendly, safe and affordable supply with electricity and district heating. It is now the task of the hour to step up our leadership and render Vienna's electricity and district heat production entirely CO₂-free by 2040. The transformation of the entire energy system is a mammoth venture, but if we all work together, I am confident of success.



Peter Hanke

Executive City Councillor of Finance, Business, Labour, International Affairs and Vienna Public Utilities

Decarbonisation and the massive expansion of electricity and district heating systems entail challenges, as renewable energy sources must be integrated to an unprecedented degree within a relatively short timeframe. In its turn, this calls for the expansion and restructuring of the respective grid and storage infrastructures. Achieving this ambitious goal while preserving the reliability and affordability of energy supply will make high demands on all parties involved. At the same time, it is clear that the renewable energy sources to be tapped in order to reach this goal must be CO₂-free and should originate largely in Vienna and the surrounding region. This makes us less dependent on geopolitical imponderables in the countries of origin of petroleum and gas or along transport routes. The regionalisation of energy supply will also enable us to face occasionally skyrocketing energy prices on the world markets with some serenity and allow us to expect more stable energy costs with long-term affordability.

This chapter goes beyond the narrow parameter of “emissions of relevance for the headline goals”. When considering emissions from heat and electricity generation, the European and Austrian climate policy makes a distinction between emissions from plants with an installed capacity of less than 20 megawatt, which come under the national scope of responsibility³³, and those from larger plants with an installed capacity in excess of 20 megawatt, which are covered by EU emission trading (see detailed explanation in the info box in Chapter 4).

³³In EU terminology, this is called “effort sharing” or “non-ETS sector”. This concerns plants with an output of less than 20 MW, which account for close to three percent of the emissions of relevance for Vienna's headline goals in the period 2014-2018. The other emissions related to energy supply (approx. 2 million tonnes of CO₂ per year) are subject to the ETS provisions.

Thus, although the emissions of this sector are subject to different control regimes, this chapter is to provide an integrated overview of the strategies, guides and measures for decarbonisation and the massive expansion of electricity and district heat generation (with the specific inclusion of green gas). In this respect, the Climate Guide does not follow the otherwise crucial "logic of environmental accounting" so much as it specifically considers the combined sector of electricity and district heat generation, in particular with a view to Vienna's position as a pioneer at the national and international levels.

4.6.1 Our objectives

Since the way towards CO₂ reduction in electricity and district heat generation is strongly influenced by EU emission trading³⁴, the Smart City Wien Strategy does not set any fixed targets for 2030 or 2040 to be complied with by Vienna's energy sector. However, targets for the expansion of the renewable energy generation sector within Vienna's municipal territory as well as for the share of renewables in the final energy consumption³⁵ of the city were laid down and must be implemented essentially – but not exclusively – by the energy industry:

- By 2030, renewable and decarbonised³⁶ energy generation in Vienna³⁷ equals three times and, by 2040, six times the volume of 2005.
- Vienna's final energy consumption will be covered by renewable and decarbonised sources at a rate of 50 percent in 2030 and entirely by 2040³⁸.

In addition, the Vienna government agreement of 2020 defines short-term targets for expanding the photovoltaics sector within the municipal territory:

- Vienna increases its electricity generation within the municipal territory by means of photovoltaics (PV) at least to 250 MW_{peak} by 2025 and to 800 MW_{peak} by 2030. These targets will be reviewed in 2023 regarding their technical and economic viability and stepped up, if possible [27].

4.6.2 Pathway to the objectives

Switching from fossil fuels to renewables for energy supply on the one hand entails the reduction of fossil, emission-intensive energy sources and greater energy efficiency. On the other hand, it increases the demand for environmentally friendly forms of energy. The chart below gives an overview of how electricity and district heat generation, which currently is still largely based on fossil fuels, is to be transformed into a climate-neutral system by 2040.

³⁴ At the moment, the number of CO₂ certificates (emission permits) available for plants covered by EU emission trading (EU ETS) is reduced by 2.2 percentage points annually. In the context of the Fit for 55 package, the EU Commission submitted a set of legislative proposals to revise the EU ETS Directive in July 2021. Accordingly, the linear reduction factor is to be raised to 4.2 percent per year in order to curb the emissions of the European ETS sector by 61 percent (instead of currently only 43 percent) by 2030 as compared to 2005.

³⁵ This takes account of the reduced energy consumption of the individual sectors in Vienna as described in the previous chapters.

³⁶ The term "decarbonised" mainly refers to electricity or district heat generation based on fossil fuels, whose emissions are contained by means of carbon capture. This will prove relevant above all with regard to waste incineration.

³⁷ Including the potential use of geothermal energy from the environs of the city.

³⁸ Including the renewable shares of electricity, district heat and gas as well as residual volumes from the energy recovery from waste and heat.

LEVER 1

Tapping renewable electricity potentials on site

LEVER 2

Ensuring renewable district heating

LEVER 3

Using green gas to cover peak loads

Integrated into the national and European framework

Figure 18

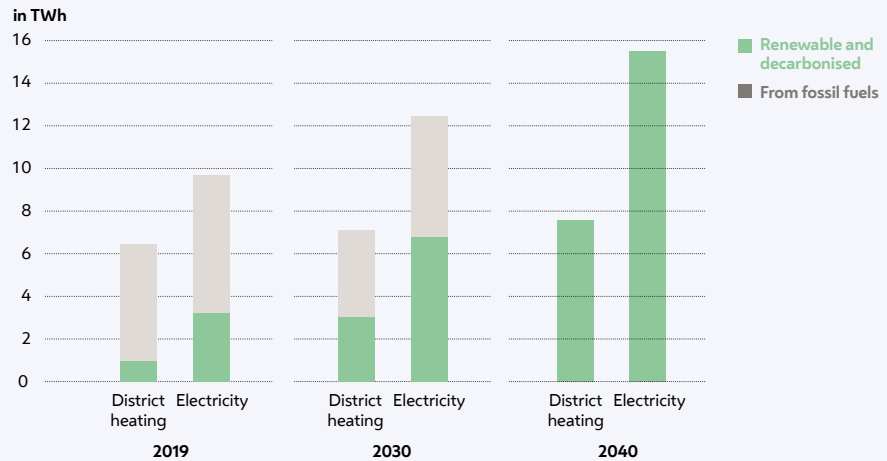
The demand for electricity and district heating is rising and will be covered by 2040 on the basis of renewables (or on the basis of energy from waste incineration, with decarbonisation achieved by carbon capture) at a gradually increasing rate; own chart based on Aue/Burger (2021) [31], electricity values for 2030 based on calculations by UIV

³⁹While electrification results in the need for greater electricity volumes from the environs of Vienna and the rest of Austria, it decreases the overall dependence on energy imports markedly because the forms of energy that currently account for the biggest volumes, such as petroleum products and natural gas, will no longer have to be imported from other (distant) regions of the planet.

Figure 19

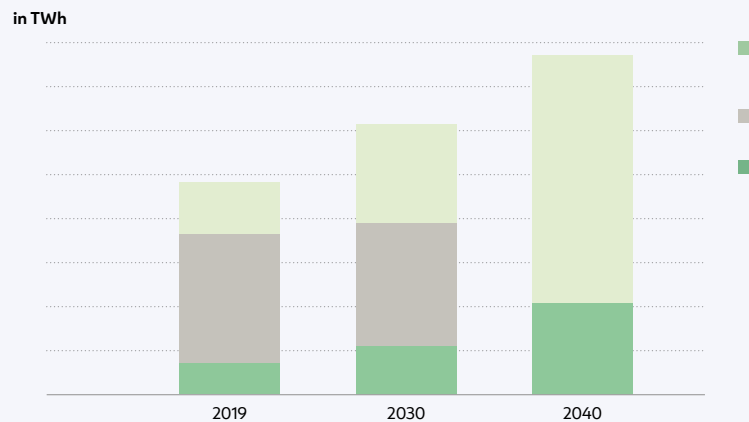
Vienna's electricity demand and its coverage; own chart based on Aue/Burger (2021) [31], values for 2030 based on calculations by UIV

District heat and electricity generation



The decarbonisation process described in the sections above causes a **massive increase of electricity consumption resulting from the electrification of road traffic, heating, air conditioning and production**. The biggest share of this growth is due to electric automobiles. But heat pumps and more and more air-conditioning systems also continue to drive electricity demand. Figure 19 shows how Vienna's electricity demand is likely to change until 2040 and how it is to be covered [31].³⁹

Electricity production



In accordance with the government agreement of 2020, it is envisaged to **significantly step up renewable electricity production in Vienna**: By 2030, the solar electricity capacity will have increased from 50 MW_{peak} (2020) to 800 MW_{peak}. In 2040, as much as 1,300 MW_{peak} could be installed, which would equal a plus of up to 1,200 GWh of solar electricity output as compared to 2020. The current volume of electricity production in Vienna based on hydropower, heat recovery from water and wastewater and biomass utilisation is to remain stable. Gas power plants and gas-fired co-generation plants, whose decarbonisation requires large volumes of green gases (above all hydrogen), will continue to play an important role. In the future, though, they will not produce base-load electricity but mostly cover **demand peaks** and contribute to stabilising the supraregional power grid far beyond Vienna's borders. Above all in periods of insufficient wind and solar electricity production, this will be a key role. Despite this, however, Vienna – like any city or large-scale industrial enterprise – will increasingly **depend on imported electricity**. These imports will largely come from the surrounding region or from Austria in general. The targets formulated in the recently adopted Renewable Energy Expansion Act foresee that, from 2030, Austria should produce as much electricity from renewable resources as is consumed in the country according to the annual energy balance. **Thus, electricity will become more important, greener and more regional.**

Moreover, the role of district heating will change as well. In the future, district heating will cover substantially more than half of the low-temperature heat demand in Vienna. The task lies in converting about **half a million dwellings or workplaces currently heated with gas to district or local heating systems or to decentralised solutions, such as heat pumps** installed in buildings. As indicated in Chapter 4.2 "Buildings", the "Heating and Cooling Vienna 2040" strategy, which is to be drawn up by the end of 2022, will present first reflections on where precisely in Vienna to prioritise which heating systems to what degree and until what deadline.⁴⁰ This will help to answer still open questions regarding the basic quantitative requirements for the expansion of the district heating and power grids.

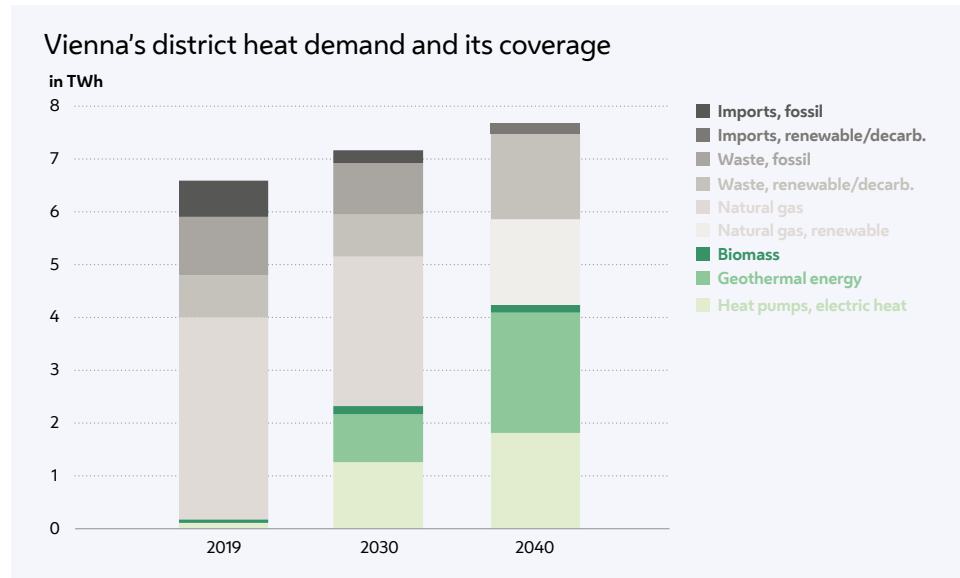
One potential **orientation to outline the increase in district heat demand** and its coverage is provided by the "climate neutrality in 2040" scenario (see Figure 20). Although this scenario assumes that only a moderate share⁴¹ of today's gas heating customers will become district heating users, the demand for district heating will still grow noticeably despite thermal insulation and global warming. It should be emphasised that this scenario defines district heating as the centralised integrated district heating grid. Hence, (local, energy) heating networks not connected to this grid, which could be operated with local renewable resources or waste heat in densely built-up neighbourhoods of polycentric Vienna as well as in compact urban quarters or individual blocks, are not included in this chart under "district heating".

The key energy resources and technologies for the total CO₂ neutrality of district heat are deep geothermal energy, large-scale heat pumps and the use of green gas, above all for covering peak loads.

⁴⁰ For more information on integrated energy and spatial planning, see Chapter 4.2.

⁴¹ In this scenario, the overwhelming portion of the market share currently held by gas heating systems is taken over by heat pumps. Apart from the connection of new buildings to the grid, the increase in district heat results mainly from the switch from gas to district heating in existing buildings which already are close to, or not too distant from, the district heating grid today.

Figure 20
Vienna's district heat demand and its coverage; own chart based on Aue/Burger (2021) [31]



⁴²Wien Energie plans to use thermal water stored in two geologically promising formations to the north and east of Vienna (Aderklaa conglomerate and main dolomite).

⁴³Large-scale heat pumps as a component of geothermal plants but also for the utilisation of many other low-temperature (waste) heat potentials in the city, such as industrial waste heat, heat from sewers and from the Danube or Danube Canal, etc.

Deep geothermal energy⁴² and large-scale heat pumps⁴³ are not only to replace the current predominant district heat production based on fossil resources but also to cover the increase in demand. Gas power plants and gas-fired co-generation plants will still be needed in the future to cover peak loads in the coldest winter months. Their operation requires large volumes of green gas, which will have to be imported via the suitably adapted gas network infrastructure.

Thus, Vienna will continue to require **gas-fired plants** even in the CO₂-free future in order to **maintain both electricity and district heat supply, above all during peak load periods**. From a current perspective, it must be expected that green gases (above all hydrogen, biomethane, synthetic hydrocarbons) will remain scarce all over Europe - and hence expensive - far beyond 2040, as they are, and will continue to be, partly indispensable in some areas of application that consume large quantities (chemicals, steel, aviation and navigation). In Vienna, green gas, whose advantage lies in seasonal storability, is above all crucial for covering peak loads of the electricity and district heating grids.

Therefore, Vienna is of the opinion that the scarce volumes of green gas should not be used for low- or medium-temperature applications, since several alternatives to gas combustion exist in these fields. Rather, the use of green gas must be given specific priority in those areas where gas cannot be replaced by any other resource or where it proves extremely difficult to abandon the use of fossil energy sources. From Vienna's perspective, it is essential to ensure that green gas will be available in due time and in sufficient quantities for those areas of application that are of strategic importance for Vienna and Austria as a whole (see Figure 21).

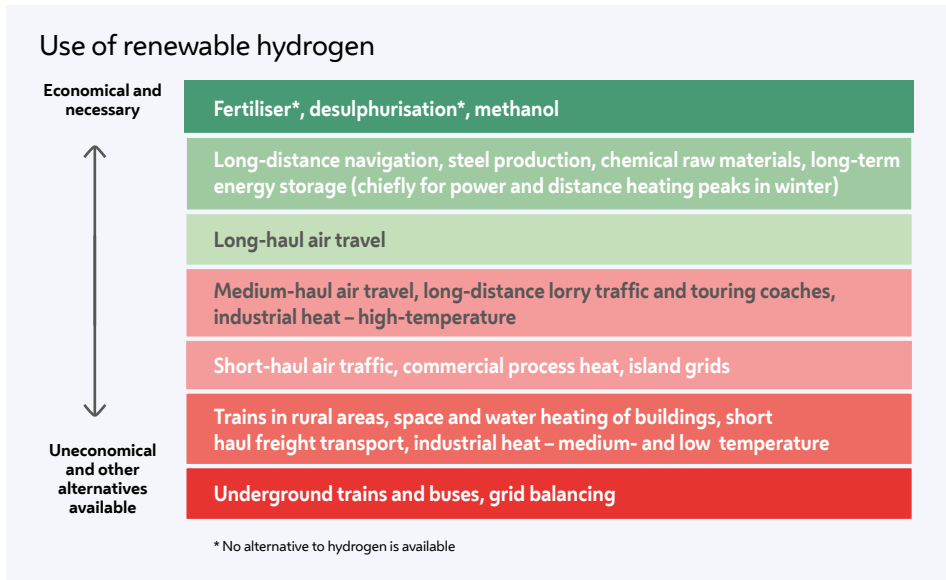


Figure 21
 Prioritisation of renewable hydrogen use in a climate-neutral world; seasonally stored gas for covering peak loads of power and district heating grids of special relevance for Vienna; own diagram based on The Economist with information furnished by Michael Liebreich [33]

4.6.3 Key levers for attaining our objectives

Tapping renewable electricity potentials on site



In the field of renewable electricity generation in urban areas, special importance must be assigned to photovoltaics (PV). Vienna plans to step up electricity production by means of PV within the city from currently 50 MW_{peak} (2020) to 250 MW_{peak} by 2025 and to 800 MW_{peak} by 2030. In this, Vienna will apply the following levers:

- **Mobilisation of surfaces on built structures and plots owned by the City of Vienna or associated facilities:** Evaluation of suitability by 2022, implementation of PV plants on buildings and land owned by the City of Vienna by 2025; target: 50 MW_{peak} on buildings owned by the Vienna City Administration.
- **Utilisation of all technical space potentials and fostering of the installation of innovative PV solutions well adapted to urban conditions:** In addition to roof and façade surfaces, this concerns above all plants in public and semi-public space, such as parking lots, noise barriers, motorways, underground and aboveground rail lines, shading installations for halls and outdoor areas.
- **Simplification of approval procedures and adaptation of legal framework conditions** in the Vienna Electricity Management Act and in provisions under construction law.

- **Special subsidy programme for community PV plants:** In highly condensed urban agglomerations such as Vienna, the roofs of apartment buildings are of enormous importance for increasing the PV volume. The installation and maintenance of such plants is substantially more costly than that of PV plants mounted on other surfaces. Therefore, a subsidy bonus could prove a key investment incentive to step up such installations.
- **Increase of subsidies and creation of new subsidy programmes,** e.g. innovation funding for multi-purpose plants including PV plants on parking lot roofings or carports, building-integrated or floating PV plants; subsidies for lightweight and foil modules to tap large-surface potentials on halls; combined subsidies for PV-cum-storage devices.
- **Mobilisation of owners of large-scale roof surfaces suited for PV installation** (housing developers, industry and trade): Assistance provided through customised information and support packages; Solar Prize of the City of Vienna.
- **Wider obligation to install PV plants** on all newly built structures as well as for all larger structural modifications of roofs.
- **Support of further network expansion** in integrating additionally created PV capacities.
- **Broad awareness raising and solar energy campaigns:** "My City, My Power Plant"; Vienna invites all citizens to become part of the Vienna PV offensive; counselling for renewable energy communities; development of a centre for renewable energy resources to provide advice and information about subsidies and necessary approvals related to renewable energy resources.

LEVER 2



Ensuring renewable district heating

As owners and operators of central infrastructure facilities, the City of Vienna and the Vienna Public Utilities (municipal enterprises) find themselves in the favourable position of being able to shape the transformation of energy generation to a significant extent. At the same time, it is evident that entrepreneurial decisions need conducive framework conditions in this area as well – especially since this will involve investments totalling several billions of euro until 2040. And these framework conditions must be delivered by both the City of Vienna and the Republic of Austria!

The possibilities open to Vienna include the following:

- Unlimited support by the City of Vienna, also in its capacity of owner, for decisions to be taken by the managements of the Vienna Public Utilities (Wien Energie, Wiener Netze) regarding

- **Tapping and integration of large-scale deep geothermal energy potentials,**
 - **Integration of ambient and waste heat potentials by means of large-scale heat pumps,**
 - **Expansion of the district heating network,** specifically in inner-city areas, but also in zones with high thermal density independent of the centralised integrated grid (local neighbourhood heat networks, anergy networks),
 - **Implementation of heat storage units.**
- **Quick and optimised support of projects designed to enhance the share of renewables,** to be extended by the City of Vienna in the course of administrative procedures (under water law, construction law, law on industrial and commercial plant operation, land use law).
 - **Incentives and/or regulatory frameworks for the rapid connection of existing buildings** and all dwellings inside them to district heating as soon as the district heating grid is available in the area in order to safeguard that investments in the district heating grid can be quickly refinanced.
 - **Integrated Spatial and Energy Planning 2.0:** Extension of this approach combining climate protection and spatial planning (see Article 2b of the Building Code for Vienna) to the existing building stock; development of planning materials for optimising the selection of suitable energy sources and technologies for fossil-free heating by 2040 in co-ordination with existing settlement structures and infrastructures as well as heating providers.

Using green gas to cover peak loads



LEVER 3

- **Conscious utilisation of green gas:** In the future, green gas is to be used in Vienna for co-generation plants or other applications of high energetic benefit, but not for space and water heating.
- **Continued operation of power plants and co-generation plants fuelled by green gas** to cover peak loads and for stabilising the power grid in and around Vienna.



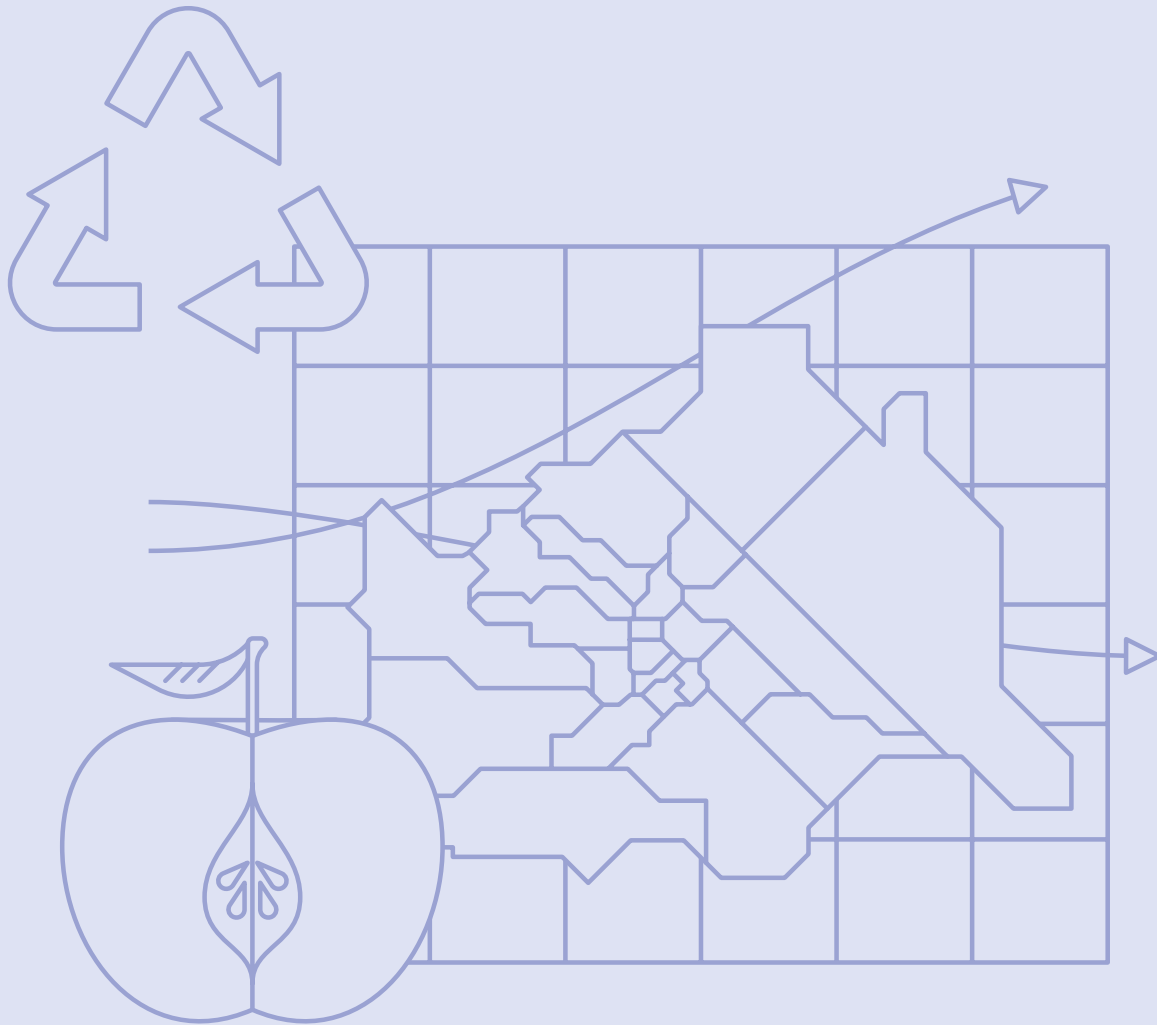
Federal support is needed

Due to the division of competences, Vienna's efforts to decarbonise the electricity, district heating and gas sectors require support by the Republic of Austria. The following federal measures are of particular importance for Vienna:

- Support of the expansion of the geothermal sector by ensuring that the complexity and length of administrative procedures reflect the importance of this technology for the decarbonisation of Vienna's energy system.
- Drilling for hot water (deep geothermics) must be given a better or at least equal legal status as compared to drilling for petroleum and gas.
- Reduction of the fiscal burden (taxes and levies) for electricity used in large-scale heat pumps or geothermal plants for district heating, hence contributing to the decarbonisation of the heating sector.
- Technology-specific incentives to tap resources required for decarbonising district heating (large-scale heat pumps, geothermal plants and carbon capture).
- Timely creation of framework conditions that steer the future use of renewable gases to those areas of application where the utilisation of gas is indispensable for climate neutrality by 2040 (chemicals, steel, aviation as well as electricity and district heat production above all during peak load periods).
- Framework conditions for the gradual decommissioning of parts of the gas distribution system (gas package, Natural Gas Sector Act, regulations) without creating excessive financial burdens for the remaining gas customers on the one hand and the gas system operators on the other hand.
- Optimisation of the legal framework conditions for existing and newly built plants generating clean electricity and heat as well as for grid and storage facilities and energy communities.
- Framework conditions that make it possible to provide sufficiently flexible electricity generation capacities in the medium to long term for the uninterrupted safeguarding of electricity supply, e.g. by means of co-generation plants.

4.7 Transregional aspects

The previous chapters have offered a detailed examination of those areas where Vienna will assume responsibility and is able, in accordance with national and international provisions, to make a contribution to climate protection. In addition, however, we aim at **launching activities beyond our borders** in order to become an even more climate-efficient city.



The potential **extension of the production-based approach** to the consumption-based approach plays a critical role in this context. After all, a production-based greenhouse gas balance – as chosen quite deliberately within the scope of the Vienna Climate Guide – does not take account of all emissions we are “responsible” for. Rather, apart from the emissions produced within the city limits, the consequences of urban consumption, too, impact the climate, as they have an effect that goes beyond Vienna’s borders. Thus, a **consumption-based balance** covers **all greenhouse gas emissions that are caused by us**, no matter where in the world these emissions actually originate [34].

EXAMPLES OF CONSUMPTION-BASED GREENHOUSE GAS EMISSIONS

- CO₂ emissions resulting from the production, transport and recycling of construction materials used to build dwellings in Vienna
- Methane and CO₂ emissions of cattle consumed as beef in Vienna
- CO₂ emissions caused by inhabitants of Vienna as a result of intercontinental flights

According to estimates, the average carbon footprint of Europeans increases by approximately 30 to 50 percent if consumption-based greenhouse gases are added to production-based emissions in the overall calculation [35; 36]. Due to global interdependencies and the high complexity of supply chains, however, **there is a dearth of exact calculations at the global, European, national and local levels.**⁴⁴ Therefore, the consumption-based emissions of the City of Vienna might be significantly higher than stated in estimates in the following three areas:

- 1 Vienna is not a major industrial centre and, hence, is a net importer of **consumer and capital goods**, production of which is energy- and CO₂-intensive.
- 2 Vienna obtains a large share of all **agricultural products** from external sources and, as a result, shifts the greenhouse gas emissions related to agriculture and other environmental impacts to other regions.
- 3 The Viennese travel the major part of their **car or plane trips outside the city limits** and, in this way, affect the emission balance of third parties. These emissions must be juxtaposed with those produced by commuters to Vienna.

⁴⁴ See also “The Carbon-neutral Helsinki 2035 Action Plan”.

Despite this, the focus of the Climate Guide is on the production-based greenhouse gas emissions of Vienna, in line with the following arguments:

- 1 A number of measures and instruments within the sphere of activities of the City of Vienna are available for “steering” local processes and behaviour patterns. Beyond this scope, however, Vienna’s possibilities to exert influence are limited. If climate protection and climate adaptation are to be implementation-oriented and efficient, these measures must by necessity focus primarily on Vienna as the “territory” where the City Administration or, respectively, the Federal Province of **Vienna can act directly**.
- 2 The lion’s share of Vienna’s **imports arrives from other federal provinces of Austria or the EU**. Both Austria and the EU are committed to climate neutrality and have formulated framework conditions to attain this goal. Thus, the climate-damaging emissions of imported goods and, hence, of Vienna’s consumption are decreasing of their own accord.
- 3 With regard to production-based emissions, **valid annual data** that correspond to the requirements of international environmental accounting are prepared by Statistics Austria and the Environment Agency Austria. If climate policy is to be rooted in facts, it must be in accordance with incontrovertible and internationally agreed emission balances.
- 4 The use of production-based emissions as target indicator may not only look back on a roughly twenty-year history in Vienna but is also **common at the level of international and European climate agreements**. For example, the EU Effort Sharing legislation, which establishes the contributions to be made by the Member States to the EU climate goal, adopts (i) 2005 as the base year and covers (ii) production-based greenhouse gas emissions in (iii) non-ETC sectors.

Irrespective of this, however, awareness of this issue must be intensified while keeping a close watch on our actions outside Vienna, specifically with respect to the circular economy and the question of food and nutrition. Wherever possible, the City of Vienna will therefore try, through its own activities, to live up to its responsibilities also outside municipal borders. Accordingly, the issue is discussed in this chapter in the spirit of the motto: **Think globally, act locally!**

4.7.1 Circular economy

In addition to the necessary reduction of greenhouse gases to attain climate neutrality and the adaptation to the new climatic conditions to boost climate resilience, the third key goal of Vienna’s City Government lies in decreasing **resource use by applying the instruments of the circular economy** [27]. Hence, the conservation of resources is an additional,

Doughnut economics

Safeguarding a good life while respecting the boundaries of nature

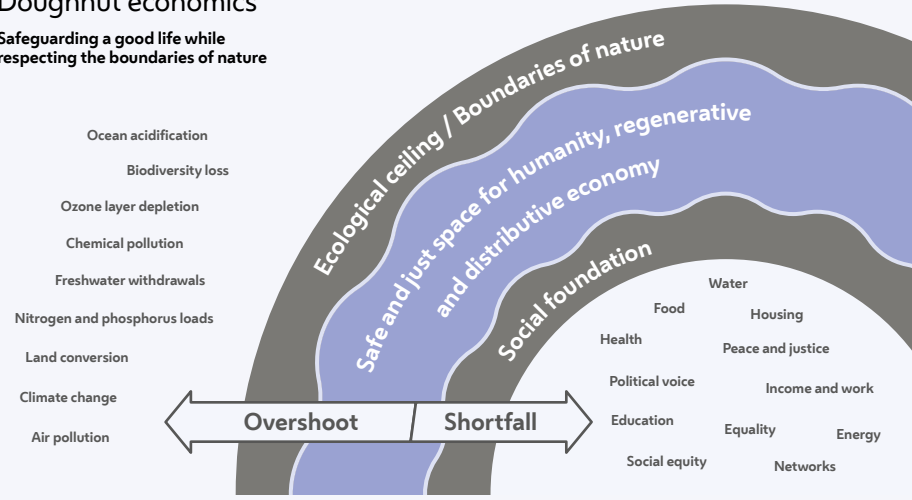


Figure 22
Doughnut economics chart:
 The approach of Doughnut economics, which is pursued, among others, by the City of Amsterdam, is to safeguard a good life while respecting the boundaries of nature.

independent goal and respects the limitations imposed by our planet as clearly expressed by the concept of Doughnut economics [27; 37; 38]. According to this concept, emission reductions for the purpose of climate protection are a positive side effect but not the sole reason for resource-conserving action.

Moreover, the circular economy does not merely aim at waste avoidance and separation and the recycling of glass, metal and plastics (see Chapter 4.3.3). Rather, it strives for the all-around transformation of product development, manufacturing, trade, services, consumption and reuse before recycling.

TEN CORE PRINCIPLES OF THE CIRCULAR ECONOMY [39]

REFUSE

Do not procure new materials, components and products.

REDUCE

Use fewer primary resources, materials, product components and products.

RESELL/REUSE

Reuse or resell used products.

REPAIR

Repair used products (or have them repaired).

REFURBISH

Reprocess, refurbish, rehabilitate and improve used products.

REMANUFACTURE

Dismantle, check, clean and repair products and replace components.

REPURPOSE

Reuse scrapped products in novel ways.

RECYCLE

Sort and process waste to recover pure secondary materials.

RECOVER

Extract and use the energy contained in waste streams.

REMINE

Selectively recover valuable material fractions from multi-component products.

In particular, the material input for the construction and alteration of buildings in Vienna produces significant quantities of greenhouse gases at production sites (e.g. concrete, steel, bricks, glass, timber, plastics and insulating materials) [40]. Few of these production sites are situated in Vienna. Vienna takes the problem posed by the high carbon and material footprint of its built environment seriously and accordingly champions low-energy, low-emission and resource-conserving construction methods.

Towards this goal, Vienna pursues the vision of a nearly waste-free and, hence, circular city of the future. For the sustainable city as a whole, this equals a massive reduction of the material footprint, which is to be achieved, among other approaches, by applying the principles of the circular economy. This means that the built environment should be viewed as a materials warehouse instead of as a materials consumer, as is still the case [41]. For this purpose, the Smart City Wien Strategy outlines the urgently needed switch to comprehensive resource conservation, since 70 percent of components and building materials from demolitions and major refurbishment projects must be reused or recycled from 2040 onward [30].

CIRCULAR CITY VIENNA

As a circular city, Vienna strives to create prosperity, increase liveability and improve the resilience of the city and its inhabitants while trying to decouple value creation from the consumption of finite resources [41]. The four elements of Vienna's circularity – socio-economics, building construction, infrastructure, urban planning – are interlinked to attain this purpose.

Thus, it is a long-term objective of Vienna's circular economy to integrate the entire resource cycle of the built environment (buildings, infrastructure, open spaces) from production to disposal, reuse or recycling into a sustainability concept while concurrently avoiding waste and the inefficient use of resources and energy. Vienna pursues the following priority actions to reach this objective:

- **DoTank Circular City Wien 2020–2030:** The “DoTank Circular City Wien 2020–2030” programme was set up to attain the goal of a circular economy for the built environment. This programme defines itself as a holistic, cross-departmental hub and will establish circular planning and construction as part of a newly interpreted Viennese building culture.
- Until the end of 2023, a **circular economy-based strategy for buildings and infrastructure** will be gradually developed and concomitantly implemented. The following are just some steps that will be taken to bring this about:

- Screening and revision of municipal subsidy and tendering procedures;
- Promotion of co-operation projects of Viennese institutions, enterprises and research facilities aimed at developing solutions for circular construction with the strong involvement of waste and resource management experts;
- Development of an interdisciplinary hub for the definition of measures conducive to improving the circularity of the built environment, for both users and entrepreneurs (new business models for the transition to a circular economy);
- Consideration of resource conservation, deconstruction and lifecycle extension already during the planning phase of construction projects;
- Increased flexibility in the use of buildings by means of location analyses, centre formation (e.g. neighbourhood centres) and needs assessments (e.g. use of ground-floor zones) to extend the lifecycle of future built structures to a maximum;
- Analysis of supply chains of the most frequently used construction products, with special account taken of their origin and the related logistics concepts;
- Further development of planning and construction processes by digital means to create standardised handover processes (e.g. accurate digital building models, also called "as-built models") for the operation of buildings (facility management);
- Preparation of reuse potential analyses for larger deconstruction or refurbishment projects.

In addition to the built environment, the City of Vienna launches initiatives for the procurement and repair of goods and the use of recyclables and will try to further step up and support such programmes in the future. Although this aspect was already partly dealt with in the previous chapters (in particular with regard to waste management), it is detailed once more in the section below:

- **ÖkoKauf:** ÖkoKauf Wien is the eco-friendly and sustainable public procurement programme of the City of Vienna. For more than 20 years, the Vienna City Administration has been purchasing and using products in the most environmentally friendly manner possible – from textiles to organic food and from cleaning agents and disinfectants to office supplies, furniture or construction materials. In this context, the most important criteria are resource conservation, ecological production methods, energy efficiency, reparability and the avoidance of emissions as well as of hazardous and toxic materials [42].
- **Repair Network Vienna (RNW):** Repairs and repair services are a key factor for the development of a resource-efficient circular economy. Repairing means reducing the negative environmental impacts of our throwaway mindset by extending the useful life of items and also generates local added value. From an ecological viewpoint, the extension of the useful life of items or appliances should always be preferred over the purchase of new ones, since this is the only way to attain the goals of resource conservation, CO₂ emission reduction and waste avoidance. With the Vienna Repair Voucher

launched in 2020, which subsidises 50 percent of repair costs up to a maximum of 100 euro, it was possible to render the repair of still functioning items and appliances more financially attractive than purchasing them anew [50]. The RNW was initiated together with 23 enterprises as a truly pioneering project in 1999 and today counts over 140 enterprises, which make an important contribution to climate protection by annually avoiding the production of over 880 tonnes of waste [43].

- **48er-Tandler:** Taking still attractive and functioning used items to waste collection centres or purchasing such items at the 48er-Tandler second-hand shop supports social projects. Where required, these items are also donated to various social facilities. Moreover, 48er-Tandler contributes considerably to qualitative and quantitative waste avoidance in Vienna. Reuse helps to conserve resources and significantly extends the useful life of items [55].
- **OekoBusiness Wien:** The circular economy concept is also essential for production enterprises domiciled in Vienna. OekoBusiness Wien supports enterprises in adopting methods that lead to a circular economy.
- **Sharing economy:** Projects like community gardens, private car and food sharing or the Citybike rental system are on the rise. In addition to private and nonprofit services, the importance of commercial providers, too, is increasing.

4.7.2 Food and nutrition

Vienna makes a substantial contribution to its own food supply. Over 5,000 hectares of Vienna's municipal territory are used for agriculture, with tomatoes, cucumbers, lettuce, bell peppers and wine among the key produce. Hence, about one third of the vegetables consumed in Vienna are also grown here. Moreover, one of the country's biggest organic farms is situated in the Austrian capital [44].

However, it is mainly **animal products** including meat, eggs and milk, which are **mostly imported to Vienna**, that contribute to food-related emissions, with the most decisive factor being emissions from **(animal feed) production and the processing and distribution of animal products**. Conversely, plant-based food, such as grain, fruit and vegetables, is far less emission-intensive [45]. This disproportion shows that greater awareness in eating behaviour can influence emissions beyond provincial borders. By the same token, the consumption of organically produced, regional and seasonal products can exert a positive effect on the emission balance.

CLIMATE-FRIENDLY NUTRITION

Everything in its season – seasonal
Best to buy regional products – regional
Food from organic farming, if possible – organic
Less meat, more fruit and vegetables

However, this is not simply about what we eat, but how we deal with food. On average, each Viennese throws approximately 40 kilograms of still edible food per year into the waste bin [46]. A change in this behaviour, too, can contribute to emission reduction and, hence, to climate protection.

Therefore, Vienna takes the following measures:

- Promotion of **organic agriculture** by Vienna's municipally owned farm.
- **Meals served by large kitchens and canteens:** The ÖkoKauf criteria ensure that hospitals, old-age homes and education facilities of the City of Vienna procure sustainable food and prepare healthy, climate-friendly meal plans. This also serves as a good example to follow.
- Event organisers are awarded the **ÖkoEvent** label only if organically produced, seasonal and regional food is served by them.
- **Wien isst G.U.T.:** The *Wien isst G.U.T.* food action plan is a shared umbrella and information hub for many activities that foster sustainable ways of dealing with and consuming food in Vienna.
- **GenussBox:** GenussBox provides Viennese restaurants with an opportunity to offer their guests an eco-friendly alternative made of paper to pack leftovers and take them away for eating later on at home or at the office, in this way saving food from being wasted. The City of Vienna regularly makes free-of-charge quotas of GenussBox containers available.

5

**Climate adaptation:
Vienna becomes
climate-resilient**





Cities in particular are faced with great challenges because of ever-increasing climate change. Risks for their inhabitants, municipal infrastructure facilities or urban green zones will continue to augment due to extreme temperatures and droughts, torrential rain and storms. For this reason, the Paris Agreement of 2015 places emphasis on adaptation to climate change as the equally important second pillar of climate policy.

Consequently, the City of Vienna has set itself the overarching goal of preventing or mitigating the negative impacts of climate change as far as feasible while making the best possible use of positive effects. Moreover, Vienna pursues the explicit objective of protecting all – and, specifically, vulnerable – population groups from the health-related consequences of climate change [30].

The protection of health and the preservation of quality of life in the face of the progressing climate crisis are cross-cutting issues that touch on different policy areas – from social affairs and public health to urban development and housing. In each area, it is crucially important to adopt a comprehensive view that **embraces all of Vienna**.

The following core priorities for Vienna's climate policy can be derived from this approach:

- **Protection from negative health effects** by means of prevention, information and education as well as implementation of measures in the event of hot spells
- Preservation and strengthening of **ecosystems, green spaces and recreation areas**, also for the benefit of biodiversity
- Creation of **climate-adapted as well as resource-saving urban structures** with the aid of smart planning
- **Climate-sensitive design of buildings and public spaces** that takes account of specific needs of the population
- Strengthening of the **climate resilience of key urban infrastructure facilities and services of general interest**

Many priority measures and tools mentioned in the following chapter have a positive effect on climate protection in addition to the intended "adaptive effect". Such synergies are explicitly aimed for; hence, overlaps with the previous chapter on climate protection are unavoidable.

5.1 Health and wellbeing

Increasingly frequent extreme weather events and natural disasters – from forest fires to storms and floods - dramatically remind us of the threats posed by the progress of climate change and of our vulnerability. Even if it is above all these events and the resulting deaths, injuries and damage to property that attract the attention of the media and the general public, a special and often still underestimated **health hazard** is caused by **heatwaves** that occur with ever-increasing frequency in cities like Vienna.



The main relevant factors in this context are both the air temperature measured and what is called “thermal sensation”, i.e. the temperature perceived by the individual, which also takes account of direct sunlight, humidity, airflow (draughts, wind), etc.

Sustained hot spells and stuffy heat even during night hours result in enormous stress for the body. If the human capacity for temperature regulation is overextended, heat cramps, heat syncope and heat exhaustion as well as, in extreme cases, heatstroke may be the outcome. Environmental stressors, such as atmospheric pollutants (ozone, particulate matter or nitrogen oxides) as well as noise, further exacerbate the negative effects.

The perceived temperature or “**physiological equivalent temperature**” (PET) is defined as the temperature corresponding to the thermal sensation of a person wearing typical light clothing and engaged in light physical indoor activity with an air velocity of 0.1 m/s, a water vapour pressure of 12 hPa (corresponding to a humidity of 50 percent at 20 degrees Celsius) [47]. PET is also used for heat warnings issued by ZAMG and by the preventive heat alert service since this coefficient expresses diurnal heat stress better than the air temperature measured. Conversely, the “normal” air temperature measured is highly relevant particularly for the night hours: Relaxing sleep and, hence, adequate regeneration only become possible if temperatures drop to a sufficient extent.

According to studies, mortality in Vienna during hot spells already augmented by 13 percent above all among persons aged 65 and over in the period 1998–2004 [48]. Since the 2010s, the **number of heat-related deaths in Austria has been regularly higher than that of traffic fatalities**. A worst-case scenario for the climate period around 2030 estimates that more than 1,000 persons will die in Vienna because of heat-related complications every year; for the period around 2050, almost 3,000 heat-related deaths per year are expected.⁴⁵ This would correspond to a tenfold increase compared to today.

⁴⁵ This is based on mortality figures for Kysely days. A “Kysely day” is defined as a day within a period of at least three subsequent days with a daily maximum temperature in excess of 30 degrees Celsius [58].

The consequences of climate change affect all of us – but definitely not to the same degree. Thus, the risk of heat-related diseases is dependent on a number of factors:

- **Children and the elderly** are characterised by only partly developed or, respectively, decreasing thermal regulation capacity – and, due to their age, often find it hard to shield themselves against heat.
- **Persons suffering from chronic diseases**, such as high blood pressure as well as heart, lung or kidney diseases or neurological and psychiatric disorders, but also from obesity, malnutrition or drug and alcohol abuse are particularly affected by heat.

- Moreover, the **intake of certain types of medication** equally reduces a person's thermal regulation capacity.
- Often, too, **social isolation** is further exacerbated by excessive heat in public space.
- A **low socio-economic status** means low income and minimal assets as well as often cramped dwellings without the possibility to move to cooler rooms. Lower educational attainments and a lack of knowledge regarding heat-related hazards and ways of protection against these further complicate the situation.

In addition, climate change favours the spread of domestic - as well as the introduction of non-domestic - disease-carrying animal species and allergy-triggering plants. Higher temperatures also lengthen the vegetation period and, hence, lead to increased exposure to allergens caused by foreign species introduced into Austria (such as ambrosia/ragweed).

5.1.1 Our objectives

Against this background, the Smart City Wien Strategy formulates the following goals relating to human health:

- All social groups, especially vulnerable ones, are protected against the health risks associated with climate change.
- Health literacy is fostered at both the individual and the organisational level; Vienna advocates health promotion and prevention.
- Vienna offers high quality of life in all neighbourhoods due to investments in public infrastructure, climate protection and climate adaptation, the strengthening of local communities and a wide range of participation options for citizens.
- In 2030, the healthy life expectancy of Vienna's population has increased by two years.

5.1.2 Key levers for attaining our objectives

The following measures and tools mainly address the issue of foresighted preparation for the emergency of severe heatwaves and other health hazards resulting from climate change. They range from targeted long- to medium-term planning by relevant institutions or the creation of temporary "cool spaces" to the provision of information and the raising of public awareness. Structural adaptations in the fields of urban and green space planning, public space, housing or urban infrastructure – all of which ultimately exert a strong influence on the quality of life and wellbeing of citizens - are dealt with in the following sections of this chapter.

In addition to the COVID-19 pandemic and such perennial topics as lifestyle-associated and chronic diseases, climate change is an increasingly important aspect of relevance for human health. Rising temperatures cause health problems for many persons, in particular for vulnerable groups, which include the very aged as well as small children. In the context of public health, climate adaptation measures are therefore also measures of health promotion. We will meet these challenges with a mix of organisational, infrastructural and communication activities.



Peter Hacker

Executive City Councillor for Social Affairs, Public Health and Sports

LEVER 1 Providing information and raising awareness regarding heat impacts

- **Targeted raising of public awareness** of the impacts of heat, providing objective information about heat-adapted behaviour and specific risk factors as well as about municipal services and specialised counselling points.
- **Broad communication of heat warnings:** 2010 marked the introduction of the preventive heat alert service of the Vienna Health Board, which co-operates with ZAMG (Central Institute for Meteorology and Geodynamics) to advise citizens as well as medical, nursing and care facilities of expected heat events. The following factors are decisive for this purpose:
 - Broad dissemination via **different channels targeted at various groups** and in conjunction with multipliers, such as schools and other educational facilities, healthcare and (mobile) nursing services, senior citizen representatives at district level and influencers;
 - Taking account of **linguistic and cultural barriers**;
 - **Ongoing updating and digital editing** of information material, such as the Vienna Heat Manual (*Wiener Hitzerratgeber*, which provides information about cool spaces in the vicinity, to cite just one example).

LEVER 2 Providing cool spaces in case of heat events

- Providing **"cool spaces"** as places of retreat for particularly vulnerable groups during severe heatwaves. Such spaces need not necessarily be created from scratch. Rather, the goal is to identify suitable premises (in office buildings, museums, shopping malls, public transport stations, car parks, churches, etc.) and rendering them accessible.

Important criteria: Drinking water, seating and toilets must be available. Information about “cool spaces” in the vicinity is provided by means of digital tools (e.g. the *Cooler Wien* app) in user-friendly fashion.

Preparing facilities and institutions to cope with hot spells



LEVER 3

- **Integrating health-relevant aspects of climate change into basic and advanced training;** culturally and gender-sensitive counselling of healthcare and nursing professionals; targeted training to facilitate spotting heat-related hazards or diseases as well as for prevention and therapy.
- **Development and realisation of heat action plans** to ensure medium-term preparation for hot spells and the implementation of emergency measures in case of heat-waves, **in particular for public and private facilities taking care of vulnerable groups:** Hospitals, nursing and healthcare facilities, mobile nursing services but also kindergartens, schools and other institutions concerned with youth work. Healthcare facilities can draw on a manual detailing Vienna's measures taken to combat heat (*Leitfaden Hitzemaßnahmenplan*) [47] by the Vienna Health Board; at the same time, the specific needs and actual circumstances of the various target groups must be taken aboard (for example in risk and vulnerability analyses). Key elements of plans detailing measures to combat heat include:
 - **Definition of threshold values** for specific guidelines and measures
 - **Identification of risk levels** of clients
 - Definition of **preparatory, protective and emergency measures** in case of hot spells and of standard procedures in case of heat warnings
 - Adaptation of facility-specific **training concepts** (see above)
 - Establishment of **employee protection measures**
 - Designation of **staff members in charge** of implementing these measures
- Ongoing **evaluation** of plans detailing measures to combat heat by the facility operators. In case of private facilities receiving support from the City of Vienna, suitable guidelines and measures must be defined as quality standards and reviewed by the competent authorities (e.g. Vienna Social Fund).
- Construction and renovation of buildings operated by the Vienna Health Association **according to uniform energy standards and binding criteria** to reduce the heating and cooling demand and, hence, greenhouse gas emissions (also see Chapter 4.2 “Buildings”) while preventing overheating in summer and discomfort in winter.

- Surveying and monitoring the spread of **native and newly introduced animal and plant species that might trigger allergies or transmit diseases** (e.g. mosquitoes); developing measures for containment or risk minimisation (raising awareness and informing the population about methods of self-protection, prevention in public green spaces, etc.).
- By **linking the urban climate analysis with small-scale socio-economic data**, it becomes possible to identify areas that are not only physically but also socio-economically vulnerable and thus give rise to a particular need for action.

5.2 Ecosystems, natural and recreation areas

The natural areas in and around Vienna contribute significantly to the city's high quality of life. The City of Vienna defines natural and green areas as a service of general interest that is provided at a high quality level, protected in the long term and preserved and improved on an ongoing basis for the benefit of all. It was with this idea in mind that the first segments of the Vienna Green Belt were placed under protection already in 1905; since then, these protection zones were steadily extended.



Especially in times of progressive climate change, natural, green and recreation areas assume particular importance. On the one hand, green spaces – above all forests – contribute to containing climate change by binding CO₂ and producing oxygen. On the other hand, functioning ecosystems are key for mitigating the consequences of climate change:

⁴⁶Calculations by Municipal Department 49, based on Biosphärenpark Wienerwald Management GmbH: Regionalökonomische Analyse Biosphärenpark Wienerwald, 2020 [59].

- Forests store water, provide shade and exert a general cooling effect. The Viennese part of the Vienna Woods achieves roughly the same cooling performance as two million air-conditioning systems. Without forests, summer temperatures in the city could be higher by up to six degrees Celsius.⁴⁶
- Forest soil binds rainwater, prevents erosion and, in case of heavy rainfall events, soil loss and landslides. Humus formation in the soil binds large quantities of carbon.
- Bodies of water and adjacent green areas likewise help to cool cities. Moreover, water bodies like the Danube, the New and Old Danube or Wien River serve as major fresh air and cold air corridors and in this way allow for the ventilation and night-time cooling of the urban environment.
- Being recreation areas, green spaces fulfil an increasingly important social function for city dwellers, in particular for the inhabitants of especially overheated neighbourhoods.

However, ecosystems, too, are exposed to pressure because of climate change, as forests are increasingly affected by heat and droughts. Their susceptibility is the higher, the lower their biodiversity (e.g. with regard to tree species, age of trees and gene pool). Warmer winters also exacerbate pest-related problems, as the latter benefit from higher temperatures and, in particular, from drought stress of host trees. Longer vegetation periods entail a greater need for plant maintenance and irrigation and lead to colonisation by invasive thermophilic species. Bodies of water, too, react massively to global warming; as a result, maintenance activities (such as the mowing of underwater vegetation in the Old Danube) must be constantly reviewed and adapted. Thus, it is essential to strengthen the resilience of ecosystems in order to counteract environmental destabilisation.

In the longer term, increasing droughts and heat also pose the threat of forest fires in and around Vienna, thus seriously jeopardising the tremendous cooling effect of the Vienna Woods.

5.2.1 Our objectives

The Smart City Wien Strategy defines the following objectives regarding ecosystems, natural and recreation areas:

- The share of green spaces in Vienna is maintained at over 50 percent in the long term.
- Vienna creates additional forests and green spaces for the recreation of its growing population and to improve the urban climate.
- The natural functions of the soil are maintained by preserving existing unsealed surfaces and creating new ones.
- Vienna promotes biodiversity.

5.2.2 Key levers for attaining our objectives

The twelve principles of the Vienna Wood and Meadow Charter lay down the basis for a comprehensive package of measures aimed at the protection and quality improvement of Vienna's natural areas. With regard to climate adaptation, the following measures acquire special importance:

Protecting, maintaining and strengthening Vienna's woods, meadows and water bodies



LEVER 1

- **Active silvicultural techniques with small-scale management measures** for existing forests and reforestation projects aim at maximum diversity of domestic, site-appropriate tree species in order to ensure high forest stability and resilience.
- On **at least ten percent of Vienna's woodland, forests are to develop naturally, without silvicultural interventions** (core zones of Wienerwald Biosphere Reserve, Donau-Auen National Park and natural forest reserves).
- **Restoration of natural watercourses and near-natural design of riverbanks.** This calls for reconciling the objectives of habitat and species conservation and the requirements of flood control with the needs of different population groups regarding recreation and active mobility (e.g. riverbank vegetation providing shade for leisure-seeking visitors and for the water bodies themselves; cycleways along Wien River and barrier-free access to the watercourse).
- **Implementation of pilot projects for the active climate adaptation of ecosystems⁴⁷:** Here, the objective lies in enhancing the resilience of ecosystems to the negative effects of climate change while at the same time reducing maintenance and management efforts as well as the related CO₂ emissions and costs.

⁴⁷ Example: LIFE DICCA – Climate Change Adaptation of the Ecosystem Danube Island.

- **Adaptation and streamlining of protection zone regulations**, in particular for older nature reserves in the Vienna Woods, and harmonisation with the objectives of the Biosphere Reserve.

In addition to measures within the City of Vienna's own sphere of activities, unified regulations at the federal level will be needed in the future in order to attain the objectives of climate protection and adaptation, e.g. by offering private parties monetary incentives for reforestation projects (also for the purpose of climate protection) and the ecologically sustainable management of forests and meadows (taking account of the goals of biodiversity and landscape preservation).

LEVER 2



Safeguarding, enlarging, designing and networking recreation areas

- **Networking and safeguarding green spaces in and around Vienna:** This calls for close co-ordination with Lower Austrian regional planning ("Green Ring" project) and the various neighbouring municipalities in the greater Vienna region.
- **Additional recreation areas** (such as Norbert-Scheid-Wald or DreiAnger Regional Park) **are systematically safeguarded and designed as recreation zones** on the basis of land purchases, zoning or contractual agreements. Green corridors linking large-scale recreation zones to the urban area contribute to providing the population with green spaces and allow for sustainable leisure mobility.
- **Safeguarding free access to water bodies:** Riverbanks are kept free of further construction activities and privatisation (through appropriate zoning regulations).
- To avoid habitat overload, a **balanced differentiation of leisure offerings** for various population groups (e.g. meadows for recreation, mountain bike trails, off-leash dog parks) and smart visitor channelling are essential. Moreover, more large-scale land purchases will be necessary in the medium term, e.g. around the Lobau wetlands, in order to relieve the stress on the already heavily overburdened Viennese part of the Donau-Auen National Park through the creation of new, attractive recreation areas (see above).
- Systematic facilitation of the **access to recreation areas by means of environmentally friendly means of transport:** Further upgrading of safe, high-quality bike links to green spaces; public transport stops should be, as a rule, situated closer by than car parks; on principle, car parking spaces in and near green zones will be made available only in small numbers and in line with protection and recreation purposes.



- **Forests and meadows are managed in a way that impacts them as little as possible** to protect the soil and improve the biodiversity of animal habitats. In case of contracts awarded to third parties, organic management methods and soil protection are embedded in the respective agreements.
- Improvement of farmland and avoidance of soil erosion through **humus formation and sustainable soil management** (e.g. with organic fertilisers): Support of private agricultural businesses in their conversion to organic farming and counselling on long-term development options (e.g. plants that can be successfully grown in the medium term without excessive need for irrigation in view of foreseeable climatic conditions).
- The **use of pesticides is reduced** to the absolutely essential minimum in all areas - from commercial cultivation to private gardens - by means of statutory provisions as well as subsidies and counselling services ("Pesticide Reduction in Vienna" initiative).
- **Circular soil:** In case of construction projects, valuable excavated soil is to be reused, where possible, on site (e.g. for green space modelling). This also reduces the danger of inadvertently spreading invasive plant species (e.g. knotweed, tree of heaven). Relevant objectives and measures can be laid down in soil protection concepts and integrated into tendering procedures for construction projects.

5.3 Urban development and planning

Due to its topography, Vienna finds itself in a relatively favourable position regarding its urban climate when compared to other cities situated in basins. In particular, the Vienna Woods and the Danube valley supply the metropolis with ample fresh and cold air.



However, an analysis of Vienna's urban climate paints a clear picture of highly divergent heat conditions in the individual parts of the city. This analysis as well as thermal scans not only identify those parts of the city where dense development and a high degree of urban soil sealing have a particularly strong impact on the microclimate; the latter concerns above all locations within the Gürtel ring-road and heavily sealed areas in industrial and business zones. Both built-up and undeveloped spaces that have a marked effect on ventilation and thermal load reduction are of special relevance as well (e.g. fresh air corridors, cold air production zones).

Depending on the location and category, these zones are susceptible to changes in use to varying extents; additional new buildings and soil sealing can sometimes have a significant negative effect on climatic conditions in the city.

Strategy documents, such as the current "Green and Open Spaces" thematic concept (2020), take account of this fact by highlighting areas that are exempted from urban development either permanently or in the long term or allow for it only under certain conditions. The population growth of recent years – between 2010 and 2020 alone, Vienna's net

Climate analysis map

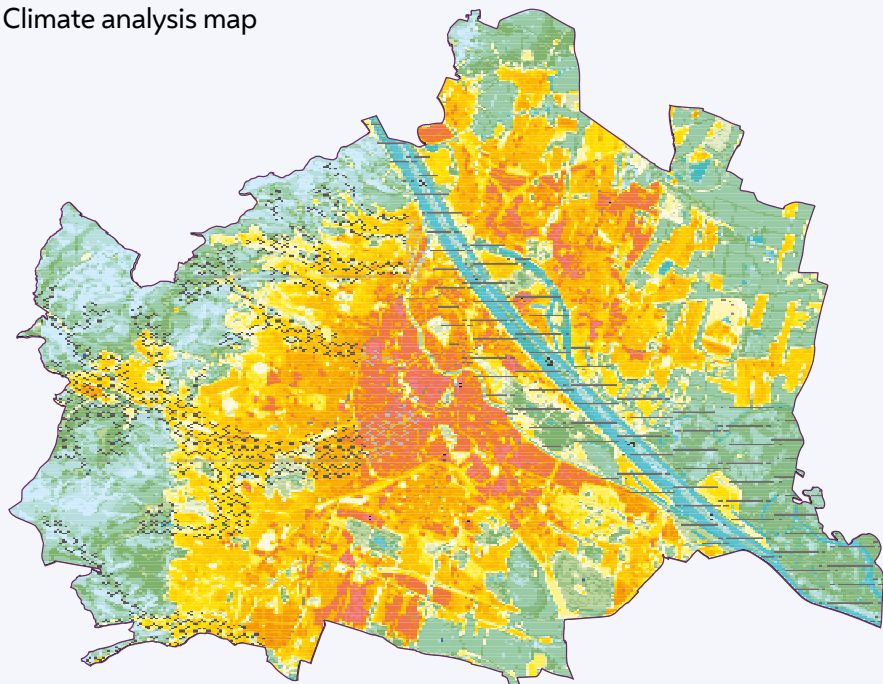


Figure 23
Urban climate analysis for Vienna,
2020 – Climate analysis map; areas
shown in the same colour present
similar microclimatic conditions,
from fresh air and cold air produc-
tion zones (blue and green) to the
"suburban climate" in danger of
overheating (light yellow) and areas
with moderate or marked overheating
(orange and red).
Illustration: City of Vienna –
Urban Development and Planning
(Municipal Department 18)

population growth equalled 230,000 persons – was accompanied by a marked increase in development pressure; this curve only began to flatten slowly in 2018. For this reason, the City of Vienna prioritises the conversion of unused inner-city traffic areas and brownfields and, where new developments are concerned, favours compact neighbourhoods with urban density, high-quality open spaces, mixed-use structures and short distances.



Foresighted policies and smart concepts have made Vienna what it is today – a city with superlative quality of life and of the environment. But we must not rest on our laurels, as the challenges posed by climate change are enormous. Speedy, courageous decisions and agendas are called for. Desealing, more green spaces in the city, future-oriented mobility concepts, sustainable neighbourhoods – with the Smart City Wien Strategy as our fundamental strategy document and the Vienna Climate Guide to indicate the direction, we are well prepared and have come another decisive step closer to making Vienna a climate model city.

Ulli Sima

Executive City Councillor for Innovation, Urban Planning and Mobility

5.3.1 Our objectives

Against this background, the Smart City Wien Strategy lays down the following objectives:

- Construction and urban development projects in Vienna are evaluated for their contribution to climate change adaptation and are accordingly optimised.
- To counteract overheating during the summer months, green and open spaces that influence the urban climate are preserved, created and structurally improved.
- All citizens of Vienna are provided with access to high-quality green spaces or a green street within a radius of 250 metres.
- When developing new urban quarters, high-quality, freely accessible green zones are secured and appropriately designed from the very beginning.
- Vienna implements and promotes the 15-minute city characterised by short distances, lively, mixed-use neighbourhoods and a redistribution of public street space in favour of active mobility (see also Chapter 4.1.3).

5.3.2 Key levers for attaining our objectives

It is a guiding principle of climate-resilient urban development that urban planning projects should, if possible, preserve or improve positive effects on the climate and exclude

negative consequences. With the Urban Heat Island Strategy [49], Vienna decided at a very early moment to define measures to counteract the overheating of the city at different planning levels.

LEVER 1



Embedding climate-adapted urban development as a binding principle during all planning phases

- **Defining and embedding concrete targets of climate-adapted urban development** in the relevant key strategy documents of the City of Vienna, above all in the Urban Development Plan as well as in urbanistic and neighbourhood development concepts.
- **Using the climate checklist** in order to implement the climate-relevant targets of urban development, design and project planning: The climate checklist comprises twelve climate criteria for urban development and urban design processes, which use a structured approach to integrate the central aspects of climate protection and climate adaptation into future planning processes. By means of these criteria, staff members of the City of Vienna can check whether planned changes are truly climate-friendly. These criteria apply to all levels of scale and are to be employed from large-scale urban development projects down to the planning of single objects, such as streets, squares or buildings.
- **Making climate adaptation criteria part and parcel** of public tendering procedures and competitions for urban design and development projects as well as redesign ventures. In addition to the orientation of built structures (with regard to heat and ventilation), this also addresses the degree of soil sealing, the desired scope of greening measures or the choice of surface materials. New construction projects are not to result in further heat islands but should ideally improve the urban climate.
- **Methodical development and establishment of a Viennese “climate adaptation check”:** On the basis of the findings of the climate analysis map, construction and urban development projects are examined for their effect on the microclimate and urban climate and then optimised as required.
- **Monitoring the accessibility of public green spaces:** Vienna's supply with publicly accessible green spaces is regularly evaluated for all categories (supply with both local and larger green spaces, accessibility of half-day or full-day excursion destinations by public transport) and continuously improved.
- **Mandatory implementation of detailed climatological assessments** (e.g. of wind comfort, ventilation, cold air outflow, on-site cold air production, hot spots during daytime hours and nocturnal heat islands) and of interactive simulations based on the steadily developing “digital twin” of the city.

Integrated interdisciplinary and transdisciplinary monitoring across all planning phases serves to devise methods of site-adequate urban climate management. A mix of measures appropriate for the respective location must be developed by taking account of the urban climate analysis, the natural and urban environment as well as (future) forms of use and the future climate.

The tools mentioned may be applied in individual projects with varying intensity and depth. A catalogue of criteria must be formulated for this purpose; in addition to the scope of the individual project (plot size, gross floor area) and the socio-spatial conditions (kindergartens/schools, nursing/retirement homes, etc.), it must also consider “climate sensitivity” (for example with regard to the project’s location within the city, heat, ventilation, infiltration capacity of the soil and flood risk).

Ensuring the sparing use of unsealed surfaces, safeguarding and enlarging the green infrastructure



LEVER 2

- Implementing **compact urban structures** by means of systematic development of the built stock and urban expansion according to the principle of **high-quality density** and with clearly defined settlement boundaries. Any densification of the built stock must be accompanied by a sufficient supply with green spaces, which is to be taken into account in plot rezoning (and may reduce the architectural exploitability of a plot).
- **Cautious management of areas of great impact on the urban climate** (e.g. safeguarding cold air production zones, considering and, if necessary, clearing fresh air corridors) in accordance with the urban climate analysis and the “Green and Open Spaces” thematic concept.
- **Climate-sensitive planning of new urban quarters** with a view to, among other factors:
 - Development structure and building typology: The height, arrangement and typology of buildings must allow for good ventilation and shading as well as good light incidence;
 - Adequately dimensioned street cross-sections; redistribution of street space in favour of active mobility, public transport and street areas that are kept free of built installations or left unsealed, thus allowing for greening (also at a later date);
 - Early provision with ample green spaces and water bodies that exert a positive effect on the microclimate and are already available as recreation zones when the first residents move in (“early green”); preservation of existing trees. In particularly heat-sensitive zones, green and open spaces are to be envisaged that, if possible, go beyond the parameters specified in the “Green and Open Spaces” thematic concept;
 - Green and open spaces should be sealed as little as possible and in any case comply with the stipulated minimum qualities or even exceed these.

Starting at a size of approximately 2.5 hectares, parks exert a measurable cooling effect on the surrounding cityscape. Contrary to more small-scale measures, large green areas of at least 50 hectares have an increased long-distance impact and also influence the citywide mesoclimate.

- **Implementation of structural action programmes** to mitigate overheating in already existing neighbourhoods, in particular with a view to the following:
 - Enlargement, linking and quality improvement of green and open spaces and safeguarding of their accessibility, specifically in densely built-up areas exposed to high utilisation pressure. Potentials lie in the conversion of traffic areas, in the desealing, greening and opening up of inner courtyards and providing them with paths and passageways as well as in ensuring the multiple use of open spaces (e.g. as sports grounds or retention areas);
 - Linking of open spaces and creation of green spaces along watercourses in order to preserve and create cold air flows [50];
 - When planning and implementing these measures, it is important to consider above all socio-spatial conditions and to set appropriate priorities.
- **Implementation of regulations for the design of green and open spaces in the spirit of climate adaptation.** Effective measures should be developed to define and enforce a maximum threshold for soil sealing in new construction projects as well as to achieve desealing effects in the built stock (possibly taking account of compensatory measures). This requires highly precise operationalisation (e.g. with regard to concretely formulated design criteria and regulations for the building of substructures under areas singled out for landscaping and horticultural design). One possible solution might be a "green/open space factor" as a yardstick for open space provision at the level of individual plots.

5.4 Public space and buildings

In different parts of the city – both in public space and in buildings –, heat manifests itself to varying extents. Overheating occurs quickly above all in densely built-up inner-city neighbourhoods with mostly sealed surfaces: Built surfaces are usually characterised by heat-absorbing materials (see description of albedo in the box below), which often are also impermeable to water. Thus, precipitation quickly runs off, and cooling caused by evaporation is prevented. The shape of buildings, too, has an exacerbating effect: Vertical surfaces absorb both direct sunlight and the radiation reflected by the surfaces of other buildings. Moreover, buildings impede the circulation of air. Finally, an additional heating effect may be produced by industrial waste heat, air-conditioning systems and motor vehicles.



Albedo is the percentage of solar radiation reflected by an object. It is described as the ratio between the reflected amount of light and the incident amount of light and always corresponds to a number between 0 (= total absorption) and 1 (= total reflection). Light-coloured surfaces (e.g. white walls) present a higher albedo than darker ones (e.g. asphalt). The higher the albedo, the lower the radiation energy absorbed by the surface and, hence, the less the heating-up of adjacent air layers [49].

Heat island effect in Vienna

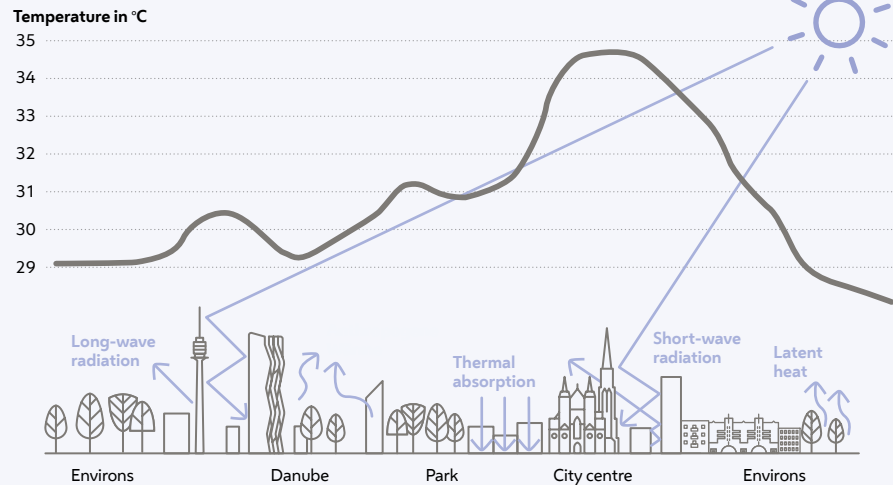


Figure 24
Schematic diagram of the heat island effect; own diagram based on [51; 49]

Building materials often store heat and, after sunset, radiate it to their surroundings, sometimes until the morning hours. Hence, temperature differences between individual parts of the city are frequently even more marked during night hours than in the daytime.

“Natural air-conditioning systems” - urban trees, parks, shade, soil desealing, reflecting surfaces as well as roof and façade greening - are the best strategy to counter overheating. For example, trees with high crown density can reduce the perceived temperature in the streetscape by up to 18 degrees Celsius during summer daytime hours [52]. On hot summer days, greened façades are able to “eat up” 40 to 60 percent of incident solar energy.⁴⁸ Hence, what is called for is a mix of different measures optimally attuned to local conditions.

⁴⁸ Calculation by Municipal Department 22.

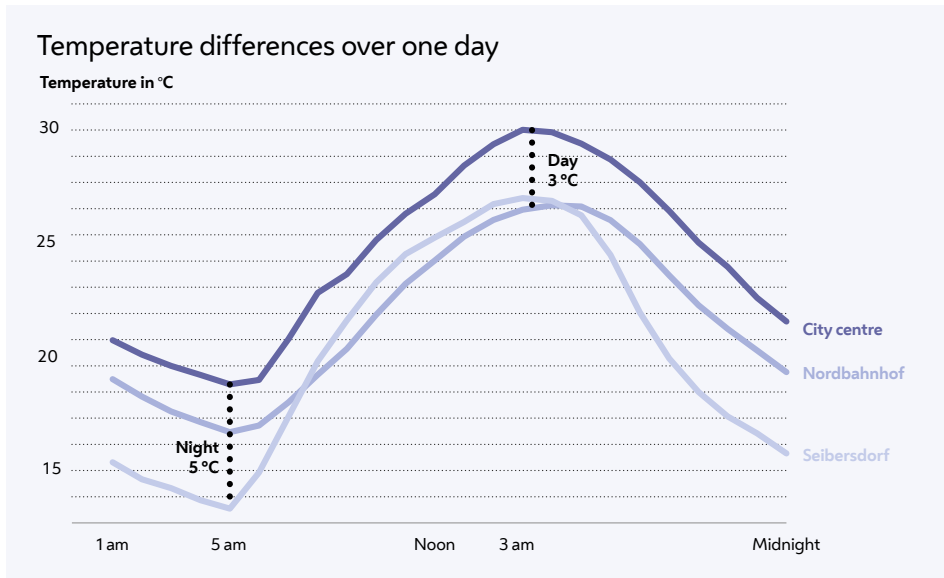


Figure 25
Temperature differences over one day in selected parts of Vienna compared to the city's environs (Seibersdorf); own chart based on Vienna University of Technology, from: Presentation of Municipal Department 22

5.4.1 Our objectives

Against this background, the Smart City Wien Strategy of the City of Vienna lays down the following objectives in order to create climate-adapted urban areas:

- 25,000 new trees for Vienna's streets.
- Greening, shading and other measures in public space reduce perceived temperatures in the summer months significantly and result in lively, climate-adapted neighbourhoods.
- The greening of buildings improves the microclimate above all in densely built-up parts of the city.
- The shielding of sealed surfaces by tree canopies is continuously increased all over the city.
- Vienna aims to return a maximum amount of rainwater to local natural or near-natural water bodies. Efforts to increase the share of evaporation in the annual precipitation volume are stepped up as this is the most important lever to cool the cityscape.

5.4.2 Key levers for attaining our objectives

The effective (re)design of climate-resilient buildings and public spaces calls for a result-oriented approach and – also because of the high costs of some individual measures – for its differentiated application in differently structured neighbourhoods of Vienna (e.g. densely built-up inner-city areas vs. peripheral locations). The mix of different

measures appropriate for individual areas can be derived, among other sources, from the urban climate analysis, with special consideration given to socio-spatial aspects.

The range of tools comprises implementation measures within the fields of competence of the public sector (such as the design of parks and streetscapes) but also the further development of the legal framework and of the subsidy instruments of the City of Vienna so as to ensure that aspects of climate change will be taken aboard in the construction of new buildings as well as in rehabilitation and renovation projects.

LEVER 1

Goodbye to asphalt – Increasing the share of green areas and ensuring the atmospheric quality of public space

- **Planting 25,000 trees** in new locations on streets and squares (see Chapter 4.1.3 above), e.g. instead of parking spaces for motorised vehicles or traffic lanes (including climate-sensitive choice of plants and sponge city principle).
- **Redesign of existing streetscape:** Conversely, streets and squares in densely built-up zones that already today present significant greening are particularly well-suited for redesigning through conversion and traffic-calming measures in order to become attractive spaces to linger in or engage in active mobility (walking, cycling).

Both types of measures result in a redistribution of the streetscape in favour of active mobility while improving the atmospheric quality of public space.

Key aspects:

- **Development and implementation of greening concepts fine-tuned for each site by means of climate-adapted tree species**, based on an ongoing monitoring of the impact of climate change on vegetation. In case of (compensatory) planting on private properties, too, only climate- and site-adapted trees should be permitted.
- **Comprehensive application of the sponge city principle** to ensure stable irrigation, faster growth and better anchoring of trees in the ground to withstand storm events.
- **Ensuring adequate care and maintenance** of new and existing “urban trees”⁴⁹ and other plants to safeguard their contribution to the ecosystem (e.g. cooling, shading and evaporation based on dimension and age).

⁴⁹This requires a clarification of liability issues: Information, education and, if necessary, legislative changes (Austrian Civil Code, Forest Act) are to increase the sense of responsibility and reduce liability risks.

When trees are planted in the streetscape according to the **sponge city principle**, their rhizosphere (root area) below the sealed surface (streets, parking lots, etc.) is enlarged and a layer of coarse gravel as well as of finer, water-retaining material is added. While the trees stand in normal tree pits, they have direct contact with the gravel layers and are therefore able to penetrate them with their roots. Rainwater, too, can directly seep into the tree pit or, via gullies and drainage devices, into the gravel layer and is therefore available to trees in sufficient quantity and over a longer period. At the same time, flooding in case of torrential rain is contained or even prevented.

Additional aspects:

- **Shading:** In addition to trees on streets and squares, other technical solutions (e.g. shade sails or PV modules) can be implemented in public space to provide shade for benches, playgrounds, waiting zones at public transport stops and street crossings (bicycle and pedestrian traffic) as well as for footpaths and footpath networks (making use of 3D solar analyses and simulations of sunlight incidence). Shaded footpaths could be visualised in a Viennese shade map or footpath app.

The preservation of the existing tree stock also includes **protection against excessive "anticipatory" or "liability" pruning**, i.e. felling or massive pruning to minimise the risk of liability in case of falling branches. With its commitment under the Austrian Tree Convention, the City of Vienna supports the creation of greater legal certainty and clarity regarding liability issues as well as the raising of awareness and the adoption of amendments to statutory provisions at the federal level. A similar situation applies with respect to liability for footpath maintenance: Here, too, Vienna presses for clearcut legal provisions – a key prerequisite to contain soil sealing and the use of de-icing salt.

- **Additional redesign measures for public space** and adaptation or redesign of existing parks to improve their atmospheric quality (with particular consideration of vulnerable groups) as well as the circulation of air and natural evaporation:
 - Planting of "roadside greenery", e.g. shrubs, meadow/grass strips (verges), greening of tram and train tracks and greening with "mobile plants" (in planters);
 - Where this is technically possible, sidewalks are built in a way that keeps the verge open and free for greening, giving rise to new green surfaces, but also allows for the easy greening of existing façades;

- Planting of new, climate-resilient vegetation in parks;
 - Additional water elements (e.g. water mists, watercourses, water playgrounds and drinking fountains);
 - Soil desealing (e.g. parking lots and access roads) and choice of suitable heat-mitigating materials that reflect sunlight to the desired extent and, where possible, are also permeable to water.
- **Active rainwater management:** The evaporation of precipitation is a key lever to cool the streets and residential areas of cities. Natural solutions for percolation, evaporation and water storage thus contribute significantly to improving the microclimate and at the same time relieve the stress on the sewer system caused by large rainwater volumes. Multiple-use retention zones (e.g. sports grounds) create alternative routes for rainwater in case of severe precipitation events. Stored rainwater (also from water tanks) is used to irrigate urban green spaces.

Implementation tools:

- **Climate-adapted design of parks, public spaces** and public buildings by municipal institutions
- **Restriction or contractual regulation** of the volume of **precipitation water introduced into the sewer system** by buildings
- **Promotion of conversion measures in public space** for the purposes of climate adaptation and improvement of atmospheric quality⁵⁰
- **Promotion of local civil society initiatives** including (greened) neighbourhood oases and community gardens by means of
 - Information services
 - Easier granting of permits (simplified procedures, “one-stop shop”)
 - Financial support
- In particular, redesign measures in public space can become the subject of **participatory and gender-sensitive processes** (e.g. in the framework of the Vienna Climate Team project) in order to be able, on the one hand, to take account of the needs of different groups of persons as efficiently as possible and, on the other hand, to mobilise these citizens to take an active part in shaping a climate-resilient city.

⁵⁰These include e.g. the environmental model city programme for Vienna (*Lebenswerte Klimamusterstadt*) or the thematic concept for public space [54].



- **Passive cooling of buildings** and building complexes – thus replacing inefficient air-conditioning systems – by means of:
 - External sun shading (without compromising the cityscape)
 - Building insulation
 - Screening of roof surfaces against solar incidence, e.g. by means of PV units and greening
 - Allowing for cross-ventilation and ventilation at night due to adequate building depth
 - Increasing the reflection of sunlight (albedo) by means of suitable surface materials
 - For new buildings: Passive cooling by means of component activation and floor cooling (combined with the utilisation of recovered summer heat via seasonal storage devices)

Implementation tools include:

- Adaptation of statutory requirements (Building Code)
 - Subsidisation of higher investment costs
 - Setting focuses in developers' competitions for subsidised housing
- **Greening of roofs, façades and inner courtyards**, above all in densely built-up inner-city districts: Roof and façade greening not only cools the respective building but also improves the microclimate in the surrounding streets when combined with other measures suitable for the individual site (see above). Roof greening should be implemented as intensively and at the same time as multifunctionally as possible to contribute to building insulation, enable the retention and natural evaporation of rainwater and at the same time fulfil the increasing, manifold requirements to be met by roof surfaces. Combined solutions (building utilities, greenery, atmospheric quality, energy generation by solar modules) are to be pursued. To ensure that greening will have the desired effect, sufficient supply with water and nutrients must be safeguarded even under changed climatic conditions.

Tools to promote the greening of buildings:

- Mandatory stipulation of measures for the greening of suitable building surfaces in development plans and in the Building Code for Vienna
- Continuation and, if required, topping up of current subsidy plans offered by the City of Vienna for the greening of roofs, façades and inner courtyards beyond 2023
- Technical advice and support in the submission of applications (one-stop shop) and simplification of submission procedures

- Creation of planting areas for private façade greening along sidewalks by the City of Vienna to enable interested parties to green their façades for the benefit of the urban climate with a minimum of cost and hassle. Plants and, if required, climbing aids and trellises must be provided by the private party. Compliance with minimum widths for pedestrian traffic needs to be observed.
- **Reduction of heat release into the urban environment through waste heat utilisation and the prohibition of direct release of the warm outgoing air of large-scale air-conditioning systems** into the surroundings, particularly in connection with construction projects for new office buildings and supermarkets.

5.5 Infrastructure and services of general interest

For many years, Vienna's municipal policy has been committed to the long-term safeguarding of services of general interest and suitably foresighted plans for the city's key infrastructure. These plans were partly based on visionary estimates regarding future demographic developments (such as Otto Wagner's General Regulation Plan, which was designed for a metropolis of four million inhabitants). Thus, Vienna's water supply is still based on the spring water mains taken into operation in 1873 and 1910, while Vienna's Green Belt goes back to nature protection regulations originally dating from 1905, and flood protection has its origins in the training of the Danube between 1870 and 1875 and between 1972 and 1988 (the latter intervention also led to the creation of Danube Island, a new urban recreation area with a length of 21 kilometres).



Progressive climate change also puts these infrastructure services, which are based on long-term investment and rehabilitation cycles, under pressure:

- **Volatility of renewable resources:** It is planned that by 2040 Vienna's energy supply will have switched entirely to renewables to avoid the further production of CO₂, which is harmful for the climate. At the same time, though, it is likely that climate change will entail massive fluctuations in the production of renewables – for example, if less energy from hydropower is available during long drought periods or if extreme heat curtails the efficacy of photovoltaic plants, while the energy demand for cooling continues to rise.
- **Rising demand for drinking and process water:** Heat and droughts will moreover pose new challenges for water supply – for example, as a result of high daily peaks for the irrigation of green areas, greened buildings and urban agriculture, accompanied by a continuously increasing demand for drinking water due to population growth (and paralleled by sinking groundwater levels).
- **Peak loads affecting the sewer system:** At the same time, extreme weather events, such as heavy rainfall, put massive strain on the sewer system. Local flooding (e.g. of underpasses or underground public transport stations) can be the consequence.
- **Damage containment in traffic and transport:** In this field, increasing heat necessitates air conditioning in public transport and the redesign of stations to keep heat-related stress low above all for vulnerable groups. Here, too, it is essential to act according to socio-spatial and location-specific criteria. At the same time, streets and tracks may be affected by physical damage due to heat-related deformation, leading to more frequent disruptions of service.

Against this background, resilience – i.e. robustness and capacity for resistance, adaptation and transformation – is increasingly gaining in importance, since strains and hazards in infrastructure planning cannot be fully anticipated.

5.5.1 Our objectives

In its government agreement, Vienna's City Government committed itself to “strong, publicly-owned municipal infrastructure so that the accustomed high-quality services of general interest will remain affordable for all inhabitants of Vienna” [27].

This comprises energy and drinking water supply as well as traffic, transport and the digital network infrastructure.⁵¹

⁵¹The Smart City Wien Strategy likewise defines detailed goals for the individual infrastructure sectors, such as water supply and wastewater management.

5.5.2 Key levers for attaining our objectives

Establishing resilience analyses and implementing civil protection



LEVER 1

- **Vulnerability and resilience analyses of critical infrastructure:** Development of scenarios and risk assessments involving experts from a variety of disciplines. The term "infrastructure" is viewed in the broadest sense and as such also comprises the Vienna Woods with their cooling function for the city.
- **Co-ordination of infrastructure planning** (e.g. decentralised depots) as well as of **emergency and operational plans** for task forces and emergency personnel in the event of disasters (e.g. forest fires or floods).
- **Mapping and reservation of unused (fallow) areas for unforeseeable crises** (e.g. Vienna Underground service tunnels as "cooling spots").

Safeguarding reliable energy supply



LEVER 2

- **Further development of the power grid and of the flexible and hybrid storage and network infrastructure** in order to permit increased feeding of energy from decentralised sources into the grid, cope with the growing energy demand caused by heat pumps, electric mobility and, in particular, peak load requirements and be prepared for potential blackout or failure scenarios (for details, see Chapter 4.6 "Electricity and district heat generation").

Ensuring secure water supply and wastewater management

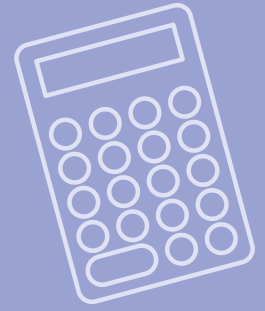


LEVER 3

- Vienna's drinking water supply is safeguarded by the spring water mains (complemented by 29 groundwater wells); systematic protection of the spring zones ensures high water quality. A long-term objective is the **ongoing renovation of the pipe systems and the preparation of the pipe network to cope with the future spatial distribution of a growing population**. To meet the rising demand, the available water volume can be augmented by means of **additional pipes at some springs**. At the same time, the ongoing enlargement of water reservoirs and their storage capacities creates a buffer to balance fluctuations in water consumption (e.g. during heatwaves).
- **Ongoing renovation and capacity adjustments of the sewer system;** concurrently, the pressure on the sewer network must be urgently eased by means of **rainwater management measures** (see Chapter 5.4).

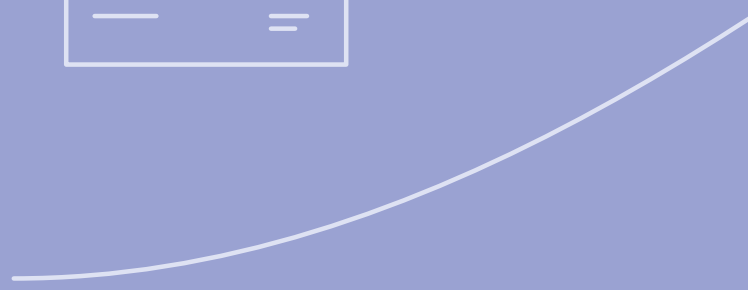


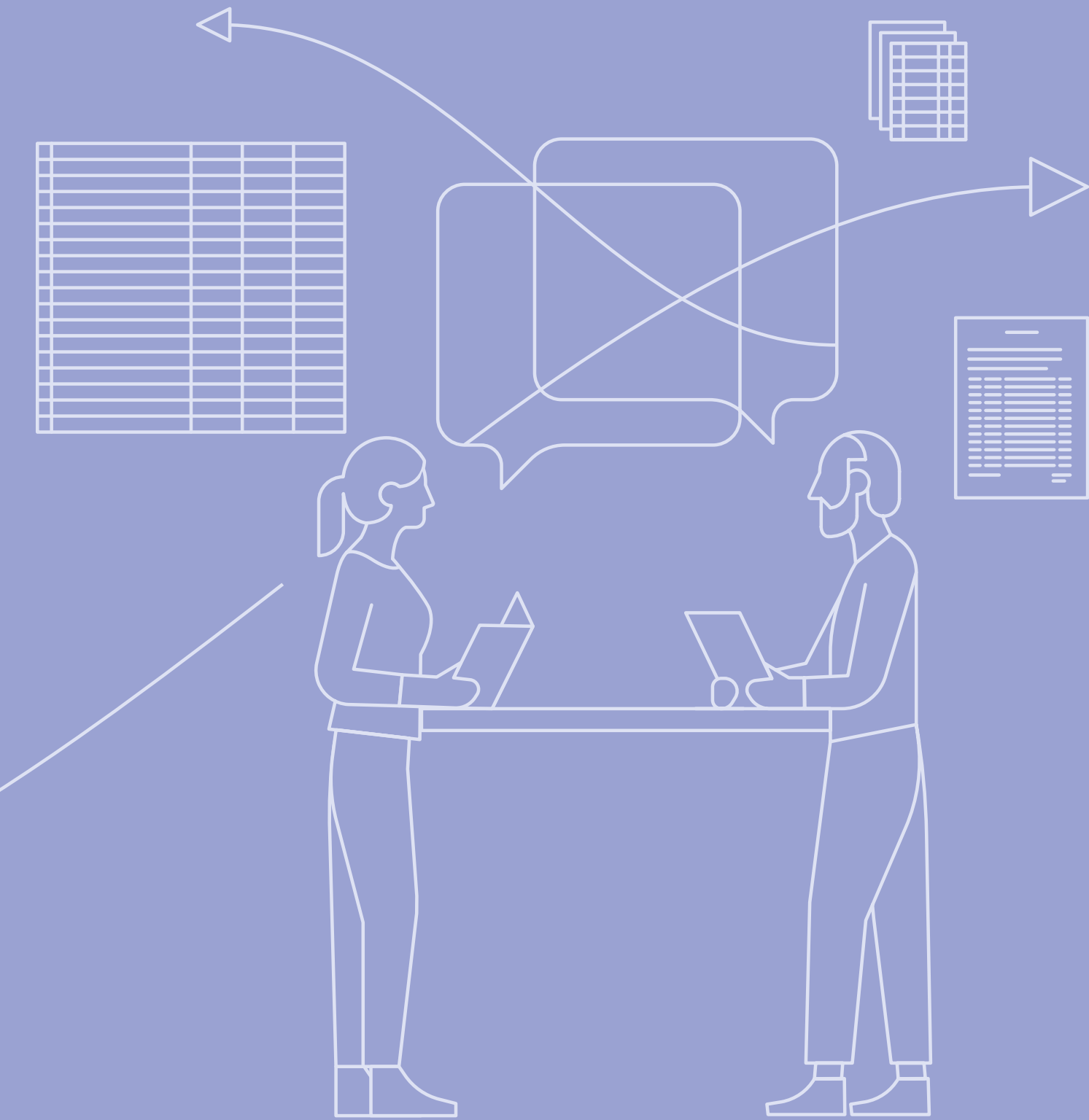
- **Reducing the susceptibility of the road and rail networks to failure** in case of extreme weather events.
- Gradual **provision of public transport and underground stations or stops with air-conditioning systems and redesign of aboveground stations or stops** with a view to ensuring optimum protection in case of diverse extreme weather events (e.g. greening and shading with plants and sun protection film on bus and tram shelters, protection against heavy rainfall/flooding).



6

Management structures and regulations





To be able to attain our ambitious climate goals, we make use of **strategy documents and climate policy instruments**.

As an umbrella strategy, the **Smart City Wien Strategy (SCWS)** is our long-term top-level orientation framework with the key goal of safeguarding and promoting "high quality of life for everyone in Vienna through social and technical innovation in all areas while maximising the conservation of resources".

Thus, the Vienna Climate Guide defines the way ahead for all climate-related issues. It describes our common journey towards attaining Vienna's climate goals until 2040⁵² to bring about a climate-conscious and climate-adapted city. The Climate Guide specifies the primary focuses and lists key (packages of) measures to be implemented as well as the necessary tools for climate protection and climate adaptation. The development of the Climate Guide was accompanied by a broad-based compilation of suitable measures specifically created for this purpose. It contains measures for climate protection and climate adaptation that lie within the sphere of activities of Austria's capital and were duly communicated by the experts of the city's municipal departments. The present draft constitutes a work in progress, not a final outcome. Rather, it should be possible to add or modify measures on an ongoing basis. In this way, the Climate Guide and its pool of measures also act as a link between the climate goals of the City of Vienna and the future Vienna Climate Budget.

The **Vienna Climate Budget** is to serve as the basis for year-by-year resolutions regarding the climate-relevant measures and tools to be implemented in the next calendar or budget year. Where necessary, budget coverage for these measures and tools will be decided concomitantly. Thus, the Climate Budget procedure provides for a sufficiently detailed description of the manifold measures communicated, which are then subjected to a preliminary evaluation according to various criteria⁵³ to support the policy decisions to be taken. It is the objective of this procedure to define a sufficient number of efficient measures and tools for climate protection and climate adaptation in the annual Vienna Climate Budget to ensure that Vienna's climate goals can be attained⁵⁴.

In addition to steering the official municipal budget, the general framework conditions must be adjusted so that private individuals and enterprises, too, will act in a climate-friendly manner. Appropriate regulatory requirements, incentives, subsidies, fees, charges, instruments under planning legislation, co-operation agreements, information and training activities as well as awareness-raising measures must be launched by the EU, the Federal Republic and the Federal Province of Vienna. Moreover, civil society and business circles need to be motivated to participate in joint efforts that make sure that Vienna's climate goals are attained together.

Central levers of this strategy are presented in the individual chapters of the Vienna Climate Guide.

⁵² The emissions relevant for the headline goals defined in the SCWS were chosen to monitor the level of attainment of the main target set, i.e. climate neutrality by 2040. These comprise the major part of the greenhouse gases produced in Vienna but leave out certain areas (see Chapter 4 and its sections 4.6 and 4.7). If a further development of the current emission balance should appear useful, it can be duly modified.

⁵³ This evaluation includes an assessment of the measures listed with regard to their potential for emission reduction and climate adaptation as well as related expenses and savings potentials but also looks at further co-benefits, such as social and ecological aspects. Issues like the circular economy and resource input can also be considered in this framework.

⁵⁴ The Vienna Climate Budget reflects the emission-related goals set by the Smart City Wien Strategy, above all the goals for greenhouse gas reductions by 2030 (minus 55 percent per capita as compared to 2005) and by 2040 (climate neutrality) as well as the greenhouse gas budget remaining before climate neutrality is attained (60 million tonnes of CO₂ equivalents from 2021). Moreover, it will be possible to monitor all emissions in Vienna, including those under the ETS system. This allows for a comprehensive picture of all climate-relevant emissions and enables Vienna to submit requests and proposals efficiently at the national and European levels.

Finally, the Climate Budget is to monitor national and international specifications and actions in order to make their effects visible at Vienna's level and permit the city to position itself accordingly vis-à-vis the Federal Republic and the EU.

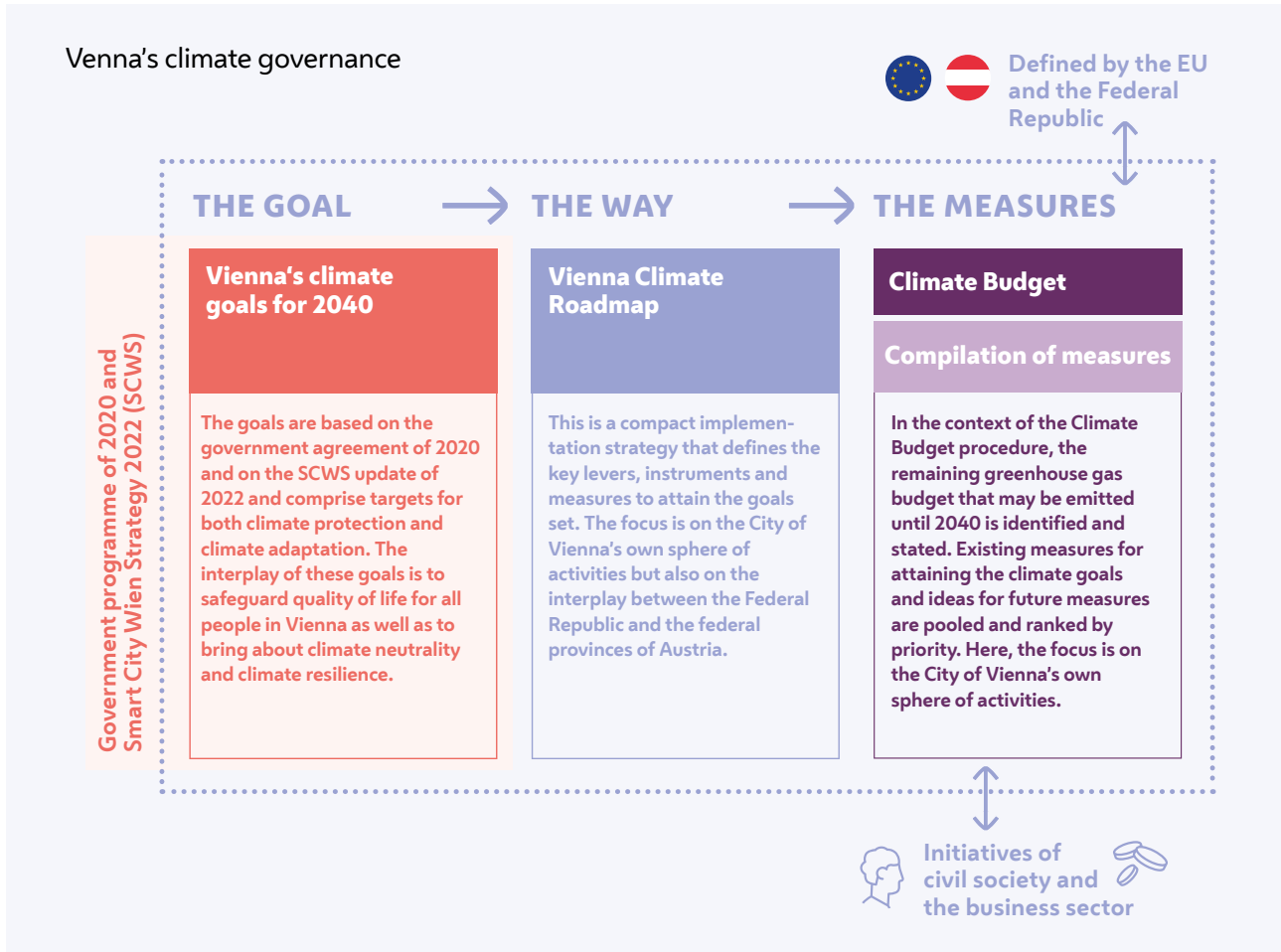


Figure 26
Vienna's climate governance from the Smart City Wien Strategy to the Climate Budget; own diagram

To complement the Climate Budget, the **Vienna Climate Team** pilot project is initiated. This is an innovative participation process specifically designed to launch projects for a climate-neutral and climate-resilient Vienna in a manner that cuts across different sectors and themes: All people living in Vienna are invited to submit their ideas for climate protection and climate adaptation projects. Together with the Vienna City Administration and political representatives at the city and district levels, citizens will develop particularly promising ideas. The project ideas thus developed will then be evaluated by a representative citizen's jury drawn by lot, selected by means of a citizens' vote and – after due approval – financed and implemented. This project will start in 2022 in the three pilot districts Margareten, Simmering and Ottakring.

Another tool of Vienna's climate policy that will be deployed is the **Vienna Climate Check**, which will serve to evaluate concrete projects in early planning stages with respect to their impact on the climate. This will apply, for example, to larger planning and construction projects or the adaptation of key framework conditions within the sphere of activities of the City of Vienna. The Climate Check will consist of several tiers and embody a reasonable balance of efforts and results. Hence, detailed evaluations - possibly also involving external experts - will only be conducted in case of projects that are likely to impact the city climate to a significant degree. Together with the other federal provinces of Austria, Vienna advocates the establishment of a uniform nationwide approach in this field.⁵⁵

All strategies and tools mentioned in this text – Smart City Wien Strategy, Climate Guide, Climate Budget, Vienna Climate Team and Vienna Climate Check as well as thematic strategies and concepts with a bearing on the climate – require regular **monitoring and evaluation procedures** to clarify whether Vienna is successfully pursuing its path according to the Climate Guide and, if this is not the case, whether this failure is due to measures taken within the city's sphere of activities or rather results from agendas set at the federal and EU levels. In many areas, this calls for data that are newer and of better quality than those currently available. In the beginning, these monitoring and evaluation efforts will, therefore, often have to rely on quantitative and qualitative assessments. All further developments will occur gradually and in co-ordination with the climate policy instruments specified above.

Another important pillar of Vienna's climate policy is provided by the **Vienna Climate Council** appointed in 2019 as an advisory body to the Vienna City Government. The Climate Council is composed of scientists and distinguished external experts, high-ranking officials of the City of Vienna and representatives of politics, business and civil society. The Vienna Climate Council is tasked with advising the Vienna City Government and the municipal administration on the development of climate policy projects and serves as a source of input and key support for the Austrian capital's road towards becoming a climate metropolis.

⁵⁵ Outcome of the 2021 conference of provincial climate protection officers.

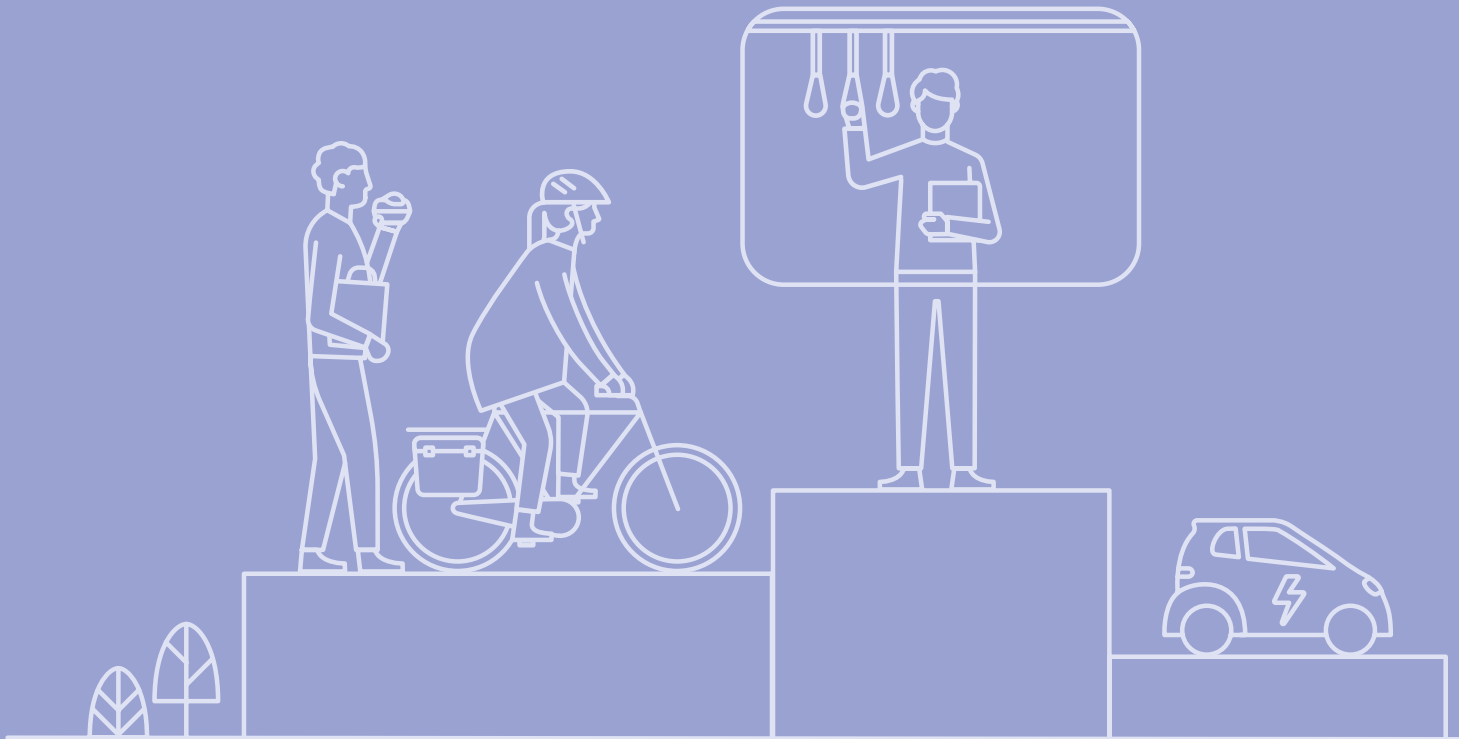
The abovementioned climate-relevant targets and provisions, definitions, instruments and governance structures are enshrined in the **Vienna Climate Protection Act**. At the time of formulating the Climate Guide, this document was still in preparation.

The actual degree of efficacy of these climate policy instruments will become evident in practical application. Hence, adjustments and modifications to render them more precise and concrete must be expected. After all, the governance structure and the Climate Guide itself are being developed during a period that may well be called the historically most dynamic phase of European and Austrian climate policy.

To be able to respond as effectively as possible to this dynamism while at the same time implementing the approaches outlined in the Climate Guide, the climate policy instruments identified above must be strategically co-ordinated. For this purpose, a new management structure that addresses climate issues and embraces the entire municipal administration was created in autumn 2021: A management unit reporting to the newly appointed **Director for Climate Matters** is to ensure that Vienna's climate policy instruments and measures will be developed and co-ordinated in cross-cutting fashion together with the different departments in order to permit their even more targeted implementation. This also entails such tasks as an ongoing exchange of information, networking with relevant stakeholders and the external representation of the City of Vienna in climate-related matters. The new management unit thus becomes an organisational hub and impulse generator to foster a comprehensive understanding of climate protection, climate adaptation and the circular economy both within the municipal administration and vis-à-vis policymakers, other local and regional authorities and, specifically, citizens.

7

And here
we go!



References

1. **H. Ritchie, M. Roser.** CO₂ and Greenhouse Gas Emissions. Our World in Data, 2020 [Online]. <https://ourworldindata.org/emissions-by-sector>.
2. **IPCC.** Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University: V. Masson-Delmotte, P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.), 2021.
3. **M. Smida, S. Russo, A. C. Costa, C. Granell, E. Pebesma.** Ranking European capitals by exposure to heat waves and cold waves. *Urban Climate*. 27, 2019, pp. 388–402.
4. **Municipal Department 23 – Economic Affairs, Labour and Statistics.** Statistisches Jahrbuch der Stadt Wien 2021. Own calculations based on data provided by ZAMG. Vienna: City of Vienna, 2021.
5. **J. Hiebl, A. Orlik, A. Höfler.** KlimaRückblick Wien 2020. Vienna: CCCA, 2021.
6. **Zentralanstalt für Meteorologie und Geodynamik (ZAMG).** Own calculations based on data provided by ZAMG. Vienna: s.n., 2021.
7. **Municipal Department 23 – Economic Affairs, Labour and Statistics.** Vienna in Figures 2021. Vienna: City of Vienna, 2021.
8. **B. Chimani, G. Heinrich, M. Hofstätter, M. Kerschbaumer, S. Kienberger, A. Leuprecht, A. Lexer, S. Peßenteiner, M. Poetsch, M. Salzmann.** ÖKS 15 | Klimaszenarien für Österreich. Vienna: s.n., 2015.
9. **Environment Agency Austria.** "Klimadoppel" – Interaktive Karte zeigt Klimaerwärmung in Städten, 2022. [Online] <https://www.klimawandelanpassung.at/newsletter/n134/kwa-klimadoppel>.
10. **J. S. Kikstra, P. Waidelich, J. Rising, D. Yumashev, C. Hope, C. M. Brierley.** The social cost of carbon dioxide under climate-economy feedbacks and temperature variability. *Environmental Research Letters*, 2021, Vol. 16, 9.
11. **K. W. Steininger, B. Bednar-Friedl, N. Knittel, G. Kirchengast, S. Nabernegg, K. Williges, R. Mestel, H.-P. Hutter, L. Kenner.** Klimapolitik in Österreich: Innovationschance Coronakrise und die Kosten des Nicht-Handelns. *Climate and Energy Fund*. Graz: Wegener Center Verlag, 2020.
12. **UBA (Environment Agency Germany).** Wer mehr verdient, lebt meist umweltschädlicher. Blinde Flecken oft bei Mobilität und Wohnen, 2016. [Online] <https://www.umweltbundesamt.de/publikationen/repraesentative-erhebung-von-pro-kopf-verbraeuchen>.
13. **WHO.** Gender, Climate Change and Health. Geneva: World Health Organization, 2014. ISBN 978 92 4 150818 6.
14. **Municipal Department 57 – Vienna Women's Affairs. Frauen.** Wissen.Wien. No. 10: Klima & Geschlecht. Warum Klima(politik) gender-relevant ist. Vienna: City of Vienna, 2020.
15. **Environment Agency Austria.** Klimaschutzbericht 2020. Vienna: Environment Agency Austria, 2020.
16. **K. W. Steininger, J. Mayer, G. Bachner, S. Duelli, E. Frei, W. Grossmann, R. Maier, S. Nabernegg, K. Williges, W. Streicher, F. Ochs, M. Magni, A. Tosatto, E. Venturi, A. Passer, H. Kreiner.** The Economic Effects of Achieving the 2030 EU Climate Targets in the Context of the Corona Crisis – An Austrian Perspective. Graz: Wegener Center Verlag, 2021.
17. **UIV.** Climate protection and energy transition: a comparison of federal states. *Urban Innovation Vienna*, 2020. [Online] <https://urbaninnovation.at/en/projekte/infografiken/>.
18. **Environment Agency Austria.** Bundesländer Luftschadstoff-Inventur 1990–2018: Regionalisierung der nationalen Emissionsdaten auf Grundlage von EU-Berichtspflichten (Datenstand 2020). Vienna: Environment Agency Austria, 2020.
19. **Statistics Austria.** Total population (annual average), 2018. [Online] https://www.statistik.at/web_en/statistics/PeopleSociety/population/population_stock_and_population_change/total_population_annual_average/index.html.
20. **Statistics Austria.** Regionale Gesamtrechnungen (RGR) 2019. [Online] https://www.statistik.at/web_de/statistiken/wirtschaft/volkswirtschaftliche_gesamtrechnungen/regionale_gesamtrechnungen/index.html. [Online] https://www.statistik.at/web_de/statistiken/wirtschaft/volkswirtschaftliche_gesamtrechnungen/regionale_gesamtrechnungen/index.html.

21. **M. Anderl, M. Gangl, S. Haider, S. Lambert, C. Lampert, K. Pazdernik, S. Poupá, W. Schieder, B. Schodl, M. Titz, M. Wieser, A. Zechmeister.** Bundesländer Luftschadstoff-Inventory 1990-2019. Regionalisierung der nationalen Emissionsdaten auf Grundlage von EU-Berichtspflichten (Datenstand 2021). Vienna: Environment Agency Austria. 2021. REP-0787.
22. **J. Dorner, R. Verwiebe.** Lebensqualität in einer wachsenden Stadt: Stadtentwicklung, Mobilität und Umwelt. Wiener Lebensqualitätsstudie 2018 – Sozialwissenschaftliche Grundlagenforschung III. Municipal Department 18 – Urban Development and Planning of the City of Vienna, Vienna University, IFES. Vienna: City of Vienna, 2020.
23. **Statistics Austria.** Mikrozensus Energieeinsatz der Haushalte 2005/06, 2005/2006. [Online] https://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/energie_und_umwelt/energie.
24. **Statistics Austria.** Mikrozensus Energieeinsatz der Haushalte 2017/18, 2017/2018. [Online] https://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/energie_und_umwelt/energie/energieeinsatz_der_haushalte/index.html.
25. **Environment Agency Austria and Graz University of Technology.** Modellberechnung. Emissionen des Verkehrs in Wien nach Verkehrsträgern 2016. Vienna, Graz: s.n., 2016.
26. **Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK).** Austria's Mobility Master Plan 2030 – The new climate action framework for the transport sector. Vienna: Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), 2021.
27. **Vienna City Government.** Die Fortschrittskoalition für Wien: Sozial. Mutig. Nachhaltig. Menschlich. Modern. Vienna: City of Vienna, 2020.
28. **Statistics Austria.** Nutzenergieanalyse Wien 1993–2020. 2021.
29. **ib frühwirth and Ökoplus GmbH.** Klimarelevanz der kommunalen Wiener Abfallwirtschaft. Vienna; on behalf of Municipal Department 22 – Environmental Protection, Municipal Department 48 – Waste Management, Street Cleaning and Vehicle Fleet and Wien Energie, 2017.
30. **Municipal Department 18 – Urban Development and Planning.** Smart Climate City Strategy Vienna, 2022. [Online] https://smartcity.wien.gv.at/wp-content/uploads/sites/3/2022/05/scwr_klima_2022_web-EN.pdf
31. **G. Aue, A. Burger.** Wärme & Kälte, Mobilität, Strom: Szenarien für die Dekarbonisierung des Wiener Energiesystems bis 2040. Vienna: Compass Lexecon, on behalf of Wien Energie, 2021.
32. **Municipal Department 23 – Economy, Labour and Statistics.** VIENNA 2030: Economy & Innovation. Vienna: City of Vienna, 2019.
33. **M. Liebreich.** Creating the new hydrogen economy is a massive undertaking. New York: The Economist, 2021.
34. **Environment Agency Austria.** Klimaschutzbericht 2019. Analyse der Treibhausgas-Emissionen bis 2017. Vienna: Environment Agency Austria, 2019. ISBN 978-3-99004-522-0.
35. **P. Munoz, K. Steininger.** Konsum-basierte Emissionen Österreichs, 2015. [Online] https://wegcwp.uni-graz.at/innovate/wp-content/uploads/sites/3/2015/12/Innovate-Fact-Sheet_2_Deutsch.pdf.
36. **Environment Agency Austria.** Klimaschutzbericht 2021. Vienna: Environment Agency Austria, 2021.
37. **European Commission.** A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy (Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. COM(2011) 21). Brussels: European Union, 2011.
38. **European Commission.** Guide to a Resource Efficient Europe (Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. COM(2011) 571 final). Brussels: European Union, 2011.
39. **Swiss Recycling.** Glossar Kreislaufwirtschaft. Drehscheibe Kreislaufwirtschaft Schweiz. [Online] <https://www.circular-economy.swiss/mitgliederbereich/intranet-sensibilisierung/>.
40. **Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK).** Ressourcennutzung in Österreich, Vol. 3. Vienna: Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), 2020.

References

41. **A.-V. Deinhammer.** DoTank Circular City Wien 2020–2030 (DTCC30) – Kreislaufwirtschaft in der gebauten Umwelt, 2021. [Online] <https://www.wien.gv.at/bauen/dotankcircularcity/index.html>.
42. **Municipal Department 22 – Environmental Protection.** ÖkoKauf Wien – Programme for sustainable public procurement of the City of Vienna. [Online] Municipal Department 22 – Environmental Protection, 2021. <https://www.wien.gv.at/english/environment/protection/oekokauf/>.
43. **EcoCounselling Vienna.** Repair Network Vienna. City of Vienna, 2021. [Online] <https://www.umweltberatung.at/repair-network-vienna>.
44. **Municipal Department 18 – Urban Development and Planning.** Gemüsehauptstadt Wien. Website of the City of Vienna, 2021. [Online] <https://www.wien.gv.at/stadtentwicklung/projekte/landschaft-freiraum/landschaft/landwirtschaft/gemuese.html>.
45. **World Wide Fund for Nature (WWF).** Achtung: heiß und fettig – Klima und Ernährung in Österreich. Auswirkungen der österreichischen Ernährung auf das Klima, 2015. [Online] https://www.wwf.at/wp-content/cms_documents/wwf-ernaehrungsstudie_langfassung.pdf.
46. **Municipal Department 22 – Environmental Protection.** Lebensmittelabfälle: Zahlen, Daten und Fakten. Municipal Department 22 – Environmental Protection, 2021. [Online] <https://www.wien.gv.at/umweltschutz/abfall/lebensmittel/fakten.html>.
47. **Vienna Health Board.** Leitfaden Hitzemaßnahmenplan. Vienna: City of Vienna, 2018.
48. **H.-P. Hutter, H. Moshammer, P. Wallner, B. Leitner, M. Kundi.** Heatwaves in Vienna: effects on mortality, in: Wiener klinische Wochenschrift. Wiener klinische Wochenschrift, 2007, Vol. 119, pp. 223–227.
49. **Municipal Department 22 – Environmental Protection.** Urban Heat Island Strategy – City of Vienna. Municipal Department 22 – Environmental Protection, Institute of Landscape Development, Recreation and Conservation Planning and Institute of Landscape Planning, both University of Natural Resources and Life Sciences, Vienna. Vienna: Municipal Department 22 - Environmental Protection, 2015
50. **Municipal Department 18 – Urban Development and Planning.** Thematic concept: Green and Open Spaces. 2015.
51. **A. Mahdavi, K. Kiesel, M. Vuckovic.** Urban Heat Islands. EU project "Urban Heat Islands". 2011.
52. **R. Stangl, A. Medl, B. Scharf, U. Pitha.** Wirkungen der grünen Stadt: Studie zur Abbildung des aktuellen Wissenstands im Bereich städtischer Begrünungsmaßnahmen. Berichte aus Energie- und Umweltforschung. Vienna: Federal Ministry for Transport, Innovation and Technology, 2019, p. 63.
53. **M. Smida, S. Russo, A. C. Costa, C. Granell, E. Pebesma.** Ranking European capitals by exposure to heat waves and cold waves. S.l.: Urban Climate, 2019. <https://doi.org/10.1016/j.uclim.2018.12.010>.
54. **Municipal Department 19 – Architecture and Urban Design.** Fachkonzept Öffentlicher Raum. Vienna: City of Vienna, Municipal Department 19 – Architecture and Urban Design, 2018. Werkstattberichte der Stadtentwicklung Wien (No. 175).
55. **Municipal Department 48 – Waste Management, Street Cleaning and Vehicle Fleet.** 48er-Tandler. MA 48 – Municipal Department 48 – Waste Management, Street Cleaning and Vehicle Fleet, 2021. [Online] <https://www.wien.gv.at/umwelt/ma48/beratung/abfallvermeidung/48er-tandler.html>.
56. **E. Chapman, G. Stiff.** C4S: Team up for Energy – Upgrading from SEAP to SECAP for integrated climate action: A quick access guide. S.l.: EU, 2019.
57. **Municipal Department 22 – Environmental Protection.** Wien repariert's – Ihr Reparaturbon. Vienna: Municipal Department 22 – Environmental Protection, 2021. [Online] <https://mein.wien.gv.at/wienerreparaturbon/#/>.
58. **W. Haas, N. Jacobi, K. W. Steininger.** Die Auswirkungen des Klimawandels für Wien: eine ökonomische Bewertung. Vienna: Vienna City Administration – Chief Executive Office, Executive Office for the Co-ordination of Climate Protection Measures, 2017.
59. **Biosphärenpark Wienerwald Management GmbH.** Regionalökonomische Analyse Biosphärenpark Wienerwald. 2020.

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