Smart City Wien Framework Strategy

2019–2050

Vienna's Strategy for Sustainable Development

City of Vienna | Smart City

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The Smart City Wien Framework Strategy 2019–2050 was adopted by Vienna City Council on 26 June 2019. The present document includes some minor adjustments which do not change the meaning of the original text.

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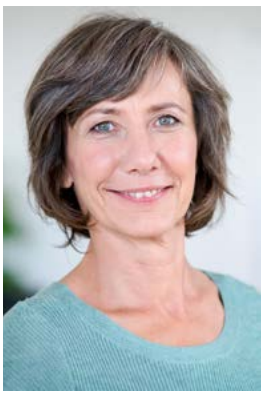
The Smart City Wien Framework Strategy is based on the 17 Sustainable Development Goals (SDGs) set out in the UN 2030 Agenda.

The future starts now!

The year 2050 can only mean one thing, and that is the future. Yet even though another three decades lie ahead between now and then, the coming years are of decisive importance. The consequences of the climate crisis are already becoming evident today, with torrential rainfall, droughts and heatwaves. This crisis is one of the major challenges of the 21st century, and one that will have a far-reaching impact on all our lives – in our cities as well as in the countryside. All the more important, then, that we as a city take our future into our own hands rather than letting events take their course. With the Smart City Wien Framework Strategy, Vienna is doing precisely that. Vienna City Council approved the original policy document back in 2014, and this revised and updated version reaffirms our commitment to combating the consequences of the global climate crisis. At the same time it demonstrates our own capacity for action, as the federal capital and as the city with the highest quality of life in the world. With these revised and updated Smart City objectives for 2050, the City of Vienna has not only kept the focus firmly on people and their needs, but elaborated a sustainability strategy for the coming decades that will serve as a future blueprint for other cities too.

The numerous targeted measures to cut greenhouse gas emissions, such as reducing the volume of motorised private transport, are an opportunity waiting to be seized. The overarching goal of the Smart City Wien Framework Strategy is to combine maximum conservation of resources with social and technical innovation to safeguard our city's outstanding quality of life. Attaining this goal calls for one thing above all others: the engagement of everyone involved. Close cooperation between representatives of the municipal administration and its associated enterprises and organisations, plus involvement of external stakeholders, was of decisive importance in the revision and update process, and this ongoing partnership will likewise play an essential role in bringing the strategy to life.

Dr. Michael Ludwig
Mayor



Birgit Hebein
Deputy Mayor and Executive City Councillor for Urban Planning, Traffic & Transport, Climate Protection, Energy and Public Participation

Editorial

In June 2014, Vienna City Council adopted the Smart City Wien Framework Strategy – and in doing so set a milestone for the city's future development. Against the backdrop of global challenges, foremost among them being the global climate crisis, and in view of the new opportunities that go hand in hand with the advancing digital revolution, the Framework Strategy brought all of the City of Vienna's policy-making teams, specialist departments and enterprises together behind a shared vision for the first time: Vienna as a city that is constantly able to reinvent itself and develop innovative solutions to enable sustainable future development; and at the same time a city that remains true to its basic values, attaching the same importance to social inclusion and quality of life for everyone who lives here as it does to the climate and environment objectives. Vienna's definition of smart means amalgamating innovations and new technological and digital capabilities, climate action and resource conservation, high social standards and opportunities for participation into an overall vision that inspires people and prompts desire for change.

Quality of Life

Resources

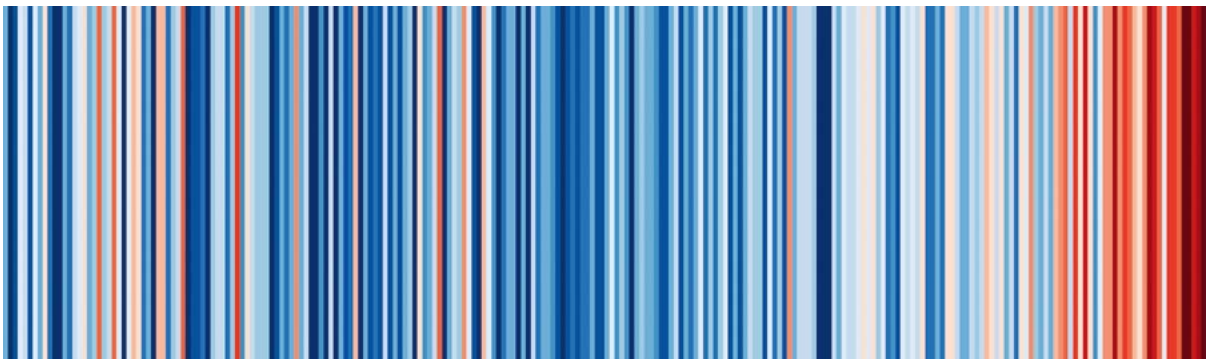
Innovation

Why a revised and updated version?

The Smart City Wien Framework Strategy is a long-term vision for the future, outlining perspectives up to the year 2050. So why produce a revised and updated version just five years after the initial one was adopted?

- **The global climate crisis calls for ambitious responses.** Global warming continues unabated, and the consequences of the global climate crisis are becoming ever more apparent. At the same time, the latest calculations show that the measures agreed so far are nowhere near sufficient even to curb global warming, let alone limiting it to 1.5°C. There is therefore a need for more far-reaching goals. The Paris Agreement on Climate Action of 2015 and the EU climate and energy targets based upon it were important milestones to this end. These targets now require all members of the international community to come up with significantly more ambitious strategies to implement them, and the Smart City Wien Framework Strategy also takes due account of this.

Figure 1: Our climate has already changed considerably



Author: Ed Hawkins (www.showyourstripes.info). Data: Central Institute for Meteorology and Geodynamics (ZAMG)

Average annual temperatures in Vienna, 1775–2018. Blue bars indicate temperatures below and red bars temperatures above the long-term average for the years 1970–2000.

- **Vienna wants to continue setting new standards**. With its adoption of the Smart City Wien Framework Strategy in 2014, Vienna became an international pioneer. In the meantime, many other cities have likewise developed new strategies or tightened up their climate and energy targets. Vienna wishes to retain its position of frontrunner within the network of responsible cities and to continue shaping the global debate as a member of international initiatives such as the Covenant of Mayors for Climate & Energy, the UN Agenda for Sustainable Development and the European Climate Alliance. To this end, appropriate adjustments to the objectives of the Smart City Wien Framework Strategy and a strong commitment to local implementation of the UN 2030 Agenda and its Sustainable Development Goals (SDGs) are imperative.

- **Vienna has used the first monitoring of the Framework Strategy as a learning process.** The first in-depth monitoring of the Smart City Wien Framework Strategy was carried out in 2017. Here too, Vienna set new international standards. The monitoring process showed that in many areas Vienna is well on track for attainment of its self-defined objectives. However, it also identified areas where additional efforts are required if the objectives are to be attained. Finally, it flagged up thematic fields in which the objectives themselves require adjustment: to eliminate conflicts between objectives, incorporate new subject areas and focus the objectives even more strongly on sustainable development. The recommendations and findings from the monitoring process were incorporated into the revised and updated Framework Strategy.

- **Global upheaval.** The fast pace of global change, the increasing complexity of the economy and society and the rapid advance of technological and digital developments, coupled with social innovations whose disruptive potentials are still difficult to foresee, create an environment in which conventional planning approaches need to be expanded and supplemented by new strategies. Long-term strategies like the Smart City Wien Framework Strategy therefore provide the necessary framework for medium- to long-term developments from today's perspective. However, the swift pace of change necessitates review and revision at relatively short intervals.

Updated thematic fields, objectives and methods

This revised and updated second version builds on the existing strategic guidelines, goals and objectives of the 2014 Smart City Wien Framework Strategy and develops them further. In the course of a one-year strategy review process involving over 130 individuals from virtually all areas of the municipal administration and its associated enterprises, as well as a large number of external experts from the fields of academia, business and representative bodies, all of the thematic fields were critically appraised, existing objectives were tightened up and new ones defined.

"Digitalisation" and "Participation" were incorporated into the strategy as **new thematic fields**. A stronger focus was placed on current developments and challenges, and especially on the overlaps between what are now **12 thematic fields**. In addition, a materiality analysis was performed on all 17 Sustainable Development Goals of the UN 2030 Agenda and their 169 targets, and the results taken as a basis for the revision process.

The thematic fields are no longer assigned to one of the **three dimensions** Quality of Life, Resources and Innovation. Instead, each thematic field now unites all these three headline goals, i.e. radical conservation of resources, contributing to quality of life and social inclusion, and the focus on innovation and digitalisation as the key instruments for viable sustainable development.

New subject areas such as adapting to and tackling the consequences of climate change, the circular economy and raw material consumption have been integrated into the strategy.

The **target values for CO_2 emissions** and the underlying calculation methods have also been adjusted: until now, the greenhouse gas reduction targets of the Climate Protection Programme of the City of Vienna (KliP) and the Smart City Wien Framework Strategy were always defined in relation to the baseline year 1990. As from this new revised version, 2005 will be taken as the baseline year, as it is used EU-wide as the baseline year for all CO_2 emissions targets which differentiate between emissions inside and outside the Emissions Trading System (ETS). Work on selection and definition of the **indicators** began in parallel with the definition of the objectives. The latter were reviewed and refined in line with the findings of the monitoring process carried out in 2017. A link to the adapted and agreed indicator structure is attached to the online version of the Smart City Wien Framework Strategy 2019–2050.

The principles, methods and tools applied in the **governance** (management, coordination, implementation and monitoring) of the Framework Strategy were reviewed and adjusted where necessary.

1. Why Smart City Wien?

Throughout history, cities have always been the drivers of scientific, technological, cultural and social renewal and innovation. Many cities have evolved into attractive living environments with high quality of life. Already today, life in a city like Vienna is in many respects more sustainable than in many other types of settlement. On account of the dense urban fabric, short distances and high public transport coverage, etc., city life often results in significantly lower resource consumption per head of population. On the other hand, however, urban areas are responsible for a high percentage of global greenhouse gas emissions, waste and energy consumption. The 21st century is already being called "the century of cities", so strong metropolises have a crucial role to play in framing the major issues of the future. The great importance of the world's urban conurbations in resolving global problems that cut across national borders is also set out in the UN 2030 Agenda and the Sustainable Development Goals (SDGs). And the world's cities are increasingly embracing this role. All over the globe, Smart Cities are becoming the pioneers of sustainable future development. Vienna can flag up opportunities for responsible action in cities throughout Europe and beyond, maintaining its outstanding position in international city rankings to secure a liveable future for its citizens, both now and in years to come.

Smart City Wien sets out the local response to global challenges.

Cities are growing. Across the world, people are moving to live and work in urban agglomerations. In 2008, for the first time in human history, there were more people living in cities than in rural areas. Forecasts predict that two-thirds of the global population will be living in cities by 2050. Not all cities in Europe are seeing population growth, however, but only the more attractive ones. Vienna, too, has seen robust growth in recent years: in 1995 the city's population was still at approx. 1.5 million, whereas even with moderate growth it is expected to reach two million before 2030. This trend towards urbanisation gives additional impetus to Smart City Wien, but it also entails the challenge of providing infrastructure and urban services on a whole new scale while simultaneously conserving limited natural resources.

The global technological revolution is rapidly gathering pace. Today's children grow up with and take for granted an array of technologies that were science fiction to their parents not all that long ago. These technological opportunities are giving rise to new patterns of communication, new business models, new occupational profiles and forms of work, and these in turn require members of the workforce to acquire new skills and qualifications and repeatedly change direction. What some seize upon as a career opportunity, others experience as stressful, a source of anxiety or even as a threat. Smart City Wien utilises new technologies and innovations, but in doing so it always places the focus on how they benefit people.

End-to-end digitalisation is penetrating all spheres of life. This phenomenon raises a host of new issues, for instance regarding the transparent handling and careful treatment of large quantities of data, the ethical and moral boundaries associated with the use of digital innovations such as artificial intelligence, and equitable distribution of the benefits and opportunities afforded by new technologies. On the other hand, digital technologies also equip Smart City Wien with a new tool to elaborate innovative solutions for an array of future urban issues, open up new avenues for public participation, or simply make life easier and more convenient.

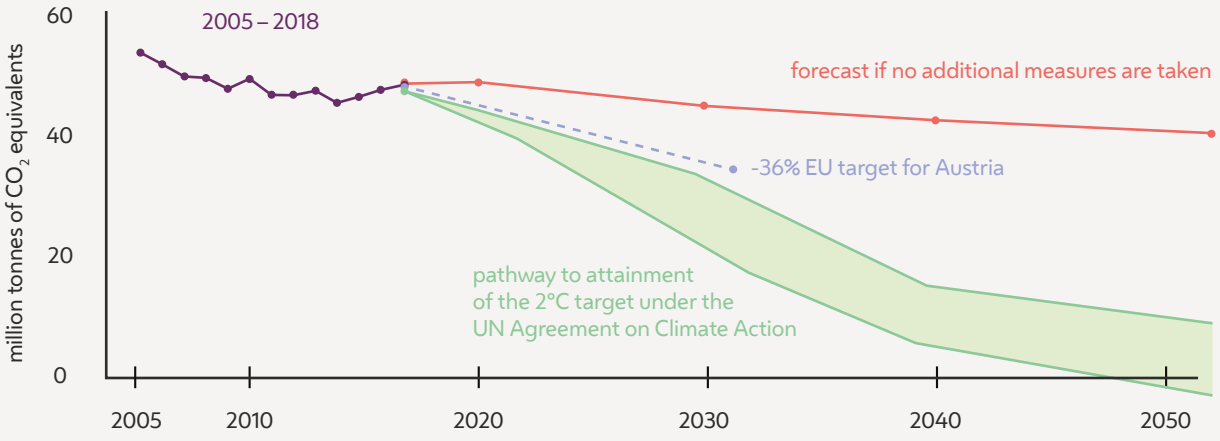
The global climate crisis is rapidly getting worse. It is one of the most, if not THE most, pressing challenges of our time and of the future. The concentration of greenhouse gases in the Earth's atmosphere is constantly increasing, and global warming is intensifying as a result. The Earth's temperature is already rising faster than at any point in the past 10.000 years. Since the 1970s the average global temperature has risen by 0.85°C[1], and the temperature in Austria by up to 2°C[2]. What is more, the Earth is rapidly approaching some critical global warming thresholds, so-called "tipping points", which – once crossed – could lead to uncontrollable "runaway" warming; these include, for instance, the complete melting of the Arctic ice cap, the thawing of the permafrost in Siberia or the dying off of the rainforests around the Equator. Even today, the consequences are being seen and felt ever more clearly. Global warming has triggered a sharp increase in extreme weather events in recent years. Both heatwaves and torrential rainfall are increasingly necessitating repair work and investment in preventative measures. The growing number of very hot days is a health hazard, especially for children and elderly people.

Because global emissions are still on the increase, the available "carbon budget" – i.e. the maximum permissible amount of greenhouse gas emissions required to avert climate disaster – is rapidly dwindling. In order to meet the international climate targets, greenhouse gas emissions need to be reduced to about one tonne per person and year[3]. In Austria the figure is currently around 9 tonnes[4], and if we also factor in the CO_2 emissions generated abroad during production of imported goods, it rises to a hefty 15 tonnes[5].

Vienna cannot halt the climate crisis by itself, but it can make a substantial contribution towards tackling it: by developing models for sustainable solutions, creating perspectives that motivate as many individuals and institutions as possible to do their part and drafting strategies that work locally but also set an example globally.

1 NASA (2018) Long-Term Warming Trend Continued in 2017
2 APCC (2014) Austrian Assessment Report on Climate Change
3 Lukas Meyer, Karl Steininger (2017) Das Treibhausgas-Budget für Österreich
4 Environment Agency Austria (2018) Klimaschutzbericht 2018
5 Environment Agency Austria (2017) Klimaschutzbericht 2017

Figure 2: Austria's remaining CO_2 budget – non-ETS greenhouse gas emissions



Own diagram by Urban Innovation Vienna (2019). Data sources:

2005 – 2018:
Environment Agency Austria (2018): Klimaschutzbericht 2018; Environment Agency Austria (2019): Nahzeitprognose der österreichischen Treibhausgasemissionen für das Jahr 2018 (Nowcast 2019)

Pathway to 2020 target:
Environment Agency Austria (2018): Klimaschutzbericht 2018

Pathway to 2030 target:
Federal Ministry for Sustainability and Tourism (BMNT) (2018): Entwurf des integrierten nationalen Energie- und Klimaplans für Österreich, Periode 2021-2030

Forecast if no additional measures are taken:
Federal Ministry for Sustainability and Tourism (BMNT) (2018): Entwurf des integrierten nationalen Energie- und Klimaplans für Österreich, Periode 2021-2030

Emissions budget:
Wegener Center (2019): Wo steht Österreich in Richtung Pariser Klimaziele? Appendix to the "Stellungnahme des Vertreters der Wissenschaft im Nationalen Klimaschutzkomitee (NKK) gem. § 4 (4) KSG"

In 2018, Austria's greenhouse gas emissions amounted to approx. 79m tonnes. Climate scientists calculate that Austria may only emit another 1,000m to 1,500m tonnes by 2050 if it is to fulfil its contribution to attaining the 2°C target defined by the Paris Agreement on Climate Action. If emissions remain at the current level, this carbon budget will already have been used up by the mid-2030s.

Around a third of Austria's carbon emissions, namely those from power generation and major industrial plants, are covered by the EU Emissions Trading System. The remaining two-thirds, including e.g. emissions from buildings, transport, agriculture and the waste management sector, have to be reduced through measures to be taken by Austria's federal, regional and local authorities. Vis-à-vis the EU, Austria has committed to reducing these emissions by 36% in the period 2005 to 2030. The Smart City Wien Framework Strategy clearly outlines Vienna's contribution to achieving this target. However, as the graph shows, further additional efforts will be required to keep Austria on track for attainment of the Paris climate targets.

Consumption of resources is increasingly exceeding the tolerable limits. The global control variables for CO_2 emissions, as well as those for land system change and nitrogen and phosphorus cycles, have already exceeded the tolerable ecological threshold[6]. Due to human interference in the Earth's ecosystem, our planet is currently in the midst of its sixth mass extinction of plant and animal species. Humans are consuming vast quantities of natural resources, many of which are non-renewable, and which after use end up as waste and pollutants in air, water and soil. Vienna will live up to its responsibilities and significantly reduce its ecological footprint, not only in terms of goods and services produced in the city, but also including those that are consumed here.

Smart City Wien cannot resolve these global challenges by itself, but will require appropriate supportive measures on the part of the Austrian federal government and the EU. Nevertheless, with its Smart City Framework Strategy, Vienna is mapping out paths towards sustainable future development – and implementing measures that will immediately start to have a positive impact: energy costs fall. Distances get shorter, the air is cleaner and high-quality recreation and leisure facilities are available everywhere and close to home. Housing is both comfortable and affordable. There are greater opportunities for personal development and participation for all. For companies there are numerous market openings in energy, thermal technology, transport and the circular economy, among other sectors. All Viennese citizens derive direct personal benefit from Vienna's local responses to global challenges.

[6] Stockholm Resilience Center: www.stockholmresilience.org/research/planetary-boundaries.html

The Smart City goals are governed by a framework of national and international agreements.

In autumn 2015 the international community adopted the UN 2030 Agenda for Sustainable Development including the 17 Sustainable Development Goals, followed in December 2015 by the historic conclusion of the Paris Agreement on Climate Action. This has been in force since November 2016 and is thus binding under international law. Its goal is to keep human-induced global warming to well below 2°C above pre-industrial levels, striving for 1.5°C if possible, and to reduce global greenhouse gas emissions to zero by the middle of the 21st century. To this end, states have to put forward plans detailing their national contributions to climate change mitigation, implement and track progress, and progressively enhance the ambition of these plans every five years.

As their contribution under the Paris Agreement, the EU member states jointly agreed to cut emissions in the EU by at least 40 per cent below 1990 levels by 2030.

Further EU-wide targets and policy objectives under its 2030 climate and energy framework include increasing the share of renewable energy in the EU to at least 32 per cent of final energy consumption and increasing energy efficiency by at least 32.5 per cent. Energy-efficient renovation measures to improve the energy performance of buildings are also to be accelerated.

These targets form part of the 2018 "Clean Energy for All Europeans" legislative package, which also comprises a series of key directives and guidelines for their implementation and governance. A framework is also being put in place for continuous monitoring of the National Energy and Climate Plans at EU level, including provision for consequences in the event of non-compliance with the national and EU targets.

At the end of 2015 the European Commission likewise adopted the EU Circular Economy Action Plan, which aims to help accelerate the EU's transition to a circular economy. The plan's 54 measures range from production and consumption to waste management and the market for secondary raw materials. It also identifies priority sectors, including plastics, food waste, critical raw materials, construction and demolition, biomass and bio-based materials, and establishes legally binding targets for waste recycling and the reduction of landfilling.

Based on the EU targets and the corresponding implementing regulation, Austria's CO_2 reduction target for 2030 is a 36 per cent reduction compared to 2005 levels for emissions that are not covered by the EU Emissions Trading System. The measures required to meet the targets are set out in the "National Energy and Climate Plan for Austria" (NECP), which is being drawn up in an iterative process with the European Commission by the end of 2019.

The Austrian federal government's Climate and Energy Strategy "mission2030" is based on the EU targets and defines an additional goal of 100 per cent renewable electricity by 2030.

With its Smart City Wien Framework Strategy, Vienna is making an explicit commitment to the national and international targets and contributing to their attainment. By the same token, in order to realise its Smart City goals Vienna requires a suitable framework, and this has to be created by the federal government and the EU.

Smart City Wien provides a long-term perspective for sustainable future development.

All of these megatrends and global challenges have far-reaching ramifications – and they are visibly gathering pace. The swifter the change and the less foreseeable the direct and indirect consequences of it, the more resilience – i.e. stability and adaptability – is required. Another essential prerequisite for this openness to change and learning processes is a clear, shared picture of the basic direction of travel. The challenge of climate change, in particular, calls for new, long-term perspectives for sustainable development which are founded upon stable values and will continue to enable a good life for all in the future. With its Smart City Wien Framework Strategy, Vienna has defined the parameters for this.

By setting targets for the years 2030 and 2050, the Smart City Wien Framework Strategy deliberately takes a medium- and long-term perspective and is designed as a long-term orientation framework for the sustainable development of the city. This far-sighted view allows long-term development pathways to be mapped out across legislative periods, thus laying the foundations for long-range courses of action. This is essential, notably in sectors with long investment cycles such as construction and renovation of buildings, energy and transport.

Resilience

Throughout history, cities have always had to deal with crises and disasters that have posed a huge threat to the prosperity and quality of life of their citizens and to the functioning of the urban system itself. These threats may come in the form of shocks, i.e. sudden catastrophes such as epidemics, earthquakes, attacks or political conflicts, or they can be longer-term crises such as persistent unemployment, political instability, or shortages of natural resources. The increasing overheating of cities is one consequence of the global climate crisis that is already making itself felt and which will have an array of negative impacts on cities or individual urban districts. People in frail health and children are most severely affected and therefore require special protection.

Resilient cities are characterised by their pronounced adaptability and robustness in the face of such shocks and crises. This not only includes comprehensive disaster management and civil protection systems, but above all the capacity to prepare for and respond appropriately to evolving trends and changing circumstances.

Organisations with comprehensive resilience programmes offering guidance and a structured framework for the development of urban resilience strategies include the OECD, UN Habitat and the international network "100 Resilient Cities".

Vienna has a large number of strategies and programmes aimed at ensuring a high level of resilience and thus at safeguarding the all-round quality of life enjoyed by the city's population. The spectrum covered ranges from public safety, disaster management and civil protection to economic and social issues like innovation, digitalisation, education, health, nursing and care services, right through to ecological issues and climate action. The Urban Heat Islands Strategic Plan and the Adapting Infrastructure to Climate Change (INKA) programme have been developed to prepare Vienna for the consequences of the climate crisis at an early stage and take appropriate countermeasures.

The Smart City Wien Framework Strategy is an umbrella strategy that brings all these efforts together. Its focus on high quality of life, social inclusion, maximum conservation of resources and an extensive capacity for innovation in all fields addresses future challenges and thus makes a vital contribution to ensuring the city's long-term resilience. This also entails ensuring broad public participation by all the city's citizens to help foster active civic engagement. From today's point of view, the ramifications of many future developments are still uncertain. The climate crisis, in particular, will have largely unforeseeable direct and indirect impacts in an array of different sectors. All of this calls for a very high degree of adaptability and ability to learn. The Smart City Wien Framework Strategy defines the framework for this and provides guidance for future action.

Smart City Wien is in accordance with the basic values and targets agreed by the international community.

At global level, the international community has taken on the task of outlining a broad and universal policy agenda for sustainable future development: the UN 2030 Agenda for Sustainable Development, adopted in 2015, defines 17 Sustainable Development Goals (SDGs) which give equal weight to the economic, environmental and social dimensions of sustainable development and in doing so call for respect for human rights and the rule of law, transparent and effective governance and global peace and security.

Vienna has pledged its commitment to these global SDGs. As the sustainability strategy for Vienna, the Smart City Wien Framework Strategy is simultaneously the City of Vienna's strategic policy document for delivering the UN 2030 Agenda. In Vienna, the processes around development, local implementation and monitoring of the Smart City goals and the UN SDGs are therefore very closely interlinked.

In addition, the Framework Strategy is aligned with the time horizons and targets of international and Austrian agreements and strategies such as the UN Paris Agreement on Climate Action, the EU climate and energy targets and the Austrian Climate and Energy Strategy "mission2030". It is thus one of the key tools by means of which Vienna will contribute to reaching those goals and targets and implement the measures necessary to do so.

Vienna is committed to the UN 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals.

The UN 2030 Agenda for Sustainable Development, adopted by all 193 member states of the United Nations in September 2015, is a milestone towards a sustainable world. At its heart are the 17 Sustainable Development Goals (SDGs) and their 169 targets, which were developed in a multi-year process taking the United Nations Millennium Development Goals and the climate goals agreed at the UN Paris Climate Conference as the starting point. All states have pledged to implement the SDGs at local, national and international level.

Vienna, too, became a signatory to the UN Agenda back in 2016.[7] With its Smart City Framework Strategy, Vienna is making an explicit commitment to the content of the UN 2030 Agenda.

The majority of the SDGs are directly linked to local services of general interest, hence a large part of the 2030 Agenda content is already covered by the City of Vienna's existing strategies and fields of work. The SDGs have now been fully incorporated into all thematic fields of the Smart City Wien Framework Strategy.

The preamble to the 2030 Agenda, from which the following excerpts are taken, explains why it was necessary:

"We recognise that social and economic development depends on the sustainable management of our planet's natural resources.

We can be the first generation to succeed in ending poverty; just as we may be the last to have a chance of saving the planet.

Sustainable development recognises that eradicating poverty in all its forms and dimensions, combatting inequality within and among countries, preserving the planet, creating sustained, inclusive and sustainable economic growth and fostering social inclusion are linked to each other and are interdependent.

We recognise that sustainable urban development and management are crucial to the quality of life of our people."

The 17 Sustainable Development Goals

[7] https://www.wien.gv.at/politik/international/sdgs.html

Smart City Wien – a vision that sets things in motion.

The Smart City Wien Framework Strategy brings together all topics of relevance for the city's future. Its intention is to offer a joint strategic package for all relevant policy areas, guiding both political decision-making and the actions of the municipal administration. In doing so it builds on the city's existing programmes and activities and makes use of their well-established structures. On the other hand, it also offers a higher-level orientation framework, so that all sectoral strategies, programmes and specialised thematic concepts take due account of the goals and principles of the Framework Strategy. In this way, the Smart City Wien Framework Strategy creates a common platform for cooperation and dialogue which also allows new thematic aspects to be incorporated and conflicting objectives to be flagged up for negotiation on an ongoing basis.

The Framework Strategy outlines possible options for attainment of the objectives but deliberately avoids prescribing specific sets of measures, thus allowing scope for flexible approaches. Milestone targets and related implementation projects and activities are set out in the City of Vienna's sectoral strategies, programmes and specialised thematic concepts.

However, as a vision for a liveable future the impact of the Framework Strategy extends far beyond local government and the municipal administration: Vienna's evolution into a sustainable, liveable city can only succeed if everyone who lives and works, teaches and studies, produces and consumes, cares and is cared for in Vienna plays their part in realising this vision for the future. To this end, Vienna intends to initiate partnerships between the public and private sectors, provide opportunities for broad public participation involving all the city's residents, incentivise investment in sustainable business models and mobility options and flag up pressing research questions. First and foremost, however, it aims to encourage people to think creatively about new urban lifestyles. Artists and creatives, with their highly sensitive antennae and broad vision, can also play a crucial role in this. The Smart City Framework Strategy is designed to set things in motion!

Culture and the arts create spaces for debate about values and blueprints for the future.

The road to the post-fossil age is all about radical change and upheaval, seismic shifts in society, values and new designs for future living. Culture and the arts can play a major role in facilitating and co-shaping this transformation.

The Smart City needs facts and fantasy, science and the arts. The arts are imaginative, creative and radical. The arts open up new vantage points, perspectives, interstices, approaches and hidden aspects and thus broaden the scope for solutions in Smart City Wien. The freedom of artists and culture producers harbours vast creative potential. Smart City Wien leverages this potential by encouraging more intensive collaboration among science, research and the arts to explore alternative approaches and concepts for the future.

"Urban cultural labs" – as concrete decentralised cultural initiatives – can slot themselves into the existing network of protagonists in the cultural field and create synergies through new forms of collaborative partnership. The aim here is to build on what is already available while simultaneously creating, testing, reviewing and refining independent new approaches.

Having the ability to touch hearts and minds alike, artists and creatives can thus drive the paradigm shift in society and win people over to the Smart City project in the interests of social transformation. The arts serve as a social resonance chamber and space for discourse, allowing us to reflect upon our own activities and intentions and use artistic means to question why and how we do things.

2. The Smart City Wien Framework Strategy

Mission and
Key Principles

Mission statement

Smart City Wien is committed to the vision of a city in which it is possible to live a good life. However, because Vienna conserves natural resources and uses them responsibly, this good life does not come at the expense of the environment and future generations. With reference to the UN 2030 Agenda, the Smart City Wien Framework Strategy is thus Vienna's **sustainability strategy**, designed to guarantee the city's future sustainability in all spheres of life.

Sustainable development is in no way a contradiction of urban quality of life; on the contrary, it is actually a basic requirement if the latter is to be maintained and improved in the long term. Radical conservation of resources, a focus on sustainable behaviours and lifestyles and active, considered use of modern technologies create new qualities that make the city a pleasant place to live.

In Smart City Wien, living a good life means high **quality of life for all**. Having said that, of course, city life, being concentrated in a confined space, has always brought together a great diversity of interests, needs and lifestyles. Recognising this diversity and exposing, balancing and negotiating conflicts of interest has already been a Viennese strength in the past, and one that will continue to be sought after in future. In Vienna's interpretation, a Smart City is one that never loses sight of the "human scale"; a city that places the focus on the needs of local people in their diverse communities and lifestyles while opening up equal personal development opportunities for all.

Sustainable use of resources and working to create a sustainable, liveable city are only successful when everyone benefits – but equally, only when everyone plays their part. It is this socially sensitive and target group-oriented approach that sets Vienna's Smart City strategy substantially apart from the technology-led approaches of numerous other cities.

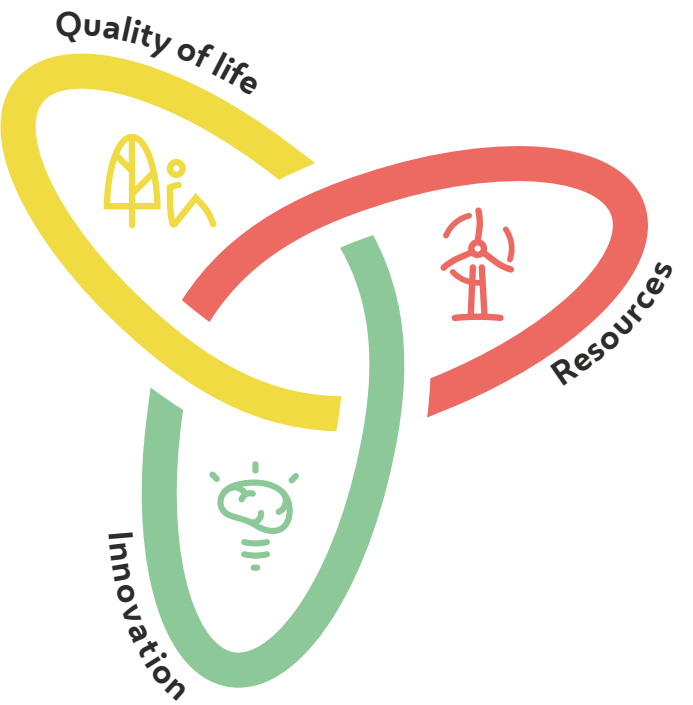
In Vienna as elsewhere, new technologies and technical solutions have a useful role to play. The city makes active, careful use of the associated opportunities, particularly those offered by digitalisation, to realise its goals.

Smart City Wien means rethinking the city: high quality of life is not an achievement that can be maintained through occasional minor readjustments. Smart City Wien is developing new perspectives for the liveable city of tomorrow. This process calls for creativity, imagination and expertise, and in many areas it means treading new ground, being open to change and letting go of entrenched patterns of behaviour and consumption. The key tool for this purpose in the Smart City Wien Framework Strategy is thus wide-ranging **innovation** in all areas, but always with the focus on people, their quality of life and their opportunities in life. With this approach, Vienna is also positioning itself on the international stage as a city that promotes innovation, where tomorrow's issues are being discussed and viable solutions developed today.

The Smart City Wien mission in a nutshell:

High quality of life for everyone in Vienna through social and technical innovation in all areas, while maximising conservation of resources.

Figure 3: The principle behind Smart City Wien



The three dimensions of Smart City Wien are closely interlinked and mutually reinforcing.

Vienna's vision

The more distant the future, the harder it is to predict; yet all the more scope is available for farsighted policy-making. In this spirit, we see our vision of Smart City Wien in 2050 as a guideline for active management of the far-reaching changes that will take place under the banner of our Smart City mission in the next 30 years. Because the future is what we make of it!

In 2050, Smart City Wien is •••

••• **a vibrant, cosmopolitan metropolis** – Vienna recognises social diversity as a strength that boosts the city's creativity and capacity for innovation;

••• **a liveable city for all** – thanks to a wide range of good employment opportunities, a plentiful supply of affordable housing, a high level of material security, comprehensive public services and social cohesion;

••• **a thriving location for business** – Vienna's expertise and Smart City products and services are exported worldwide;

••• **a digitalisation capital** – Vienna actively utilises digitalisation to drive innovation while keeping a focus on people's needs. Vienna's policy of responsible, inclusive digitalisation has evolved into a further USP for the city;

••• **aware of its responsibilities** – the actions of the public, the business community and the city's policy-makers and administrators are guided by a high level of environmental awareness;

••• **largely carbon neutral** – new technologies and changed behaviour have drastically reduced energy consumption and there has been a successful shift to renewables;

••• **a city of short distances and lively neighbourhoods** – streets full of parked cars have been transformed into play areas and shared spaces with a high feel-good factor;

••• **more mobile than ever** – everywhere in Vienna is within easy reach, by bike or on foot, by public transport, vehicle sharing or self-driving e-taxis – with all that on offer, who needs their own car?

••• **firmly in the green zone** – a wide range of parks and green spaces in all neighbourhoods, intact countryside and clean waterways provide space for recreation and physical exercise, while street planting and green facades make for a pleasant urban microclimate;

••• **well built** – many of the buildings generate more energy than they consume; this helps both the environment and the citizens of Vienna, who benefit from cheaper housing costs;

- **largely waste free** – consumer goods are durable, easily repaired and recyclable at the end of their life; old buildings are "mined" as a major source of raw materials;

- **in good health** – not only are people living longer, but healthy life expectancy has also increased; the healthcare system focuses on staying healthy and active ageing;

- **well fed** – the agricultural enterprises in Vienna and its surrounding region supply high-quality organic produce that covers a large share of the urban population's food requirements;

- **a learning community for sustainable development** – sustainable development of a liveable city is a key element of educational curricula; high-quality education and training and needs-based qualification programmes are accessible to all and act as incubators for innovation;

- **open to creative, unconventional solutions** – culture and the arts are essential forces in society; the city leverages their creative potential to drive social change;

- **an internationally recognised research centre of European standing –** Vienna attracts high-profile, top-flight experts, institutes and research teams from all over the world;

- **open to experiment** – major societal issues are tackled in an interdisciplinary fashion; technical and social innovations are piloted in local "urban labs";

- **a fair city** – women and men enjoy equal opportunities in all spheres of life, paid and unpaid work is equally shared, and people can occupy diverse social roles regardless of their gender or cultural background;

- **a "we" project that benefits everyone** – the people of Vienna use a varied range of participatory formats to engage in joint discussion of future perspectives and play an active role in co-shaping Smart City Wien;

- **forever young** – Vienna unites the achievements of the past with a bold openness to change and a clear-sighted vision for the future.

Building on values and strengths

Vienna has a long tradition to build upon: for generations now, a firm foundation of stable values has underpinned the work of the city's policy-makers and administrators. The quality of public services and wide access to services of general interest are a keystone in Vienna's high quality of life, which is evidenced by numerous international studies. Assuming municipal responsibility for comprehensive provision of public services has long been a part of Vienna's DNA. Far-sighted long-term planning of infrastructure and the seamless continuity of social programmes create a solid basis for the development of the Smart City.

This is illustrated by a number of outstanding examples:

- **Vienna's stock of social housing** – i.e. in municipal and non-profit housing association complexes – comprises over 400.000 high-quality dwellings spread across the entire city. Thousands of subsidised flats are added every year. Over 60 per cent of the Viennese population live in a home that was built or renovated with the aid of public funding, which plays a decisive role in ensuring a good social mix and affordable housing for all.

- The **public transport system** is very extensive and provides fast access to almost all parts of city. The route network covers around 1,200km and is continuously being extended, while the low fares and excellent reliability and quality ensure a high level of acceptance.

- Vienna's **water** is of unparalleled quality for a major city. The high level of supply security and the efficient drinking water distribution network are the result of sustained investment by the City of Vienna for over 100 years or more. 30 million euro per annum are invested in Vienna's mains network alone.

- The city's **waste disposal and management infrastructures** serve as an example of best practice for many other cities, ranging from waste water treatment and use of the resulting sewage sludge for energy generation, to end-to-end logistics for waste separation and collection, through to combined waste incineration and energy generation for the district heating network.

- In spatial terms, Vienna is a compact city – yet at the same time it succeeds in maintaining the **share of green space** at over 50 per cent. The safeguarding of Vienna's extensive Green Belt and long-term infrastructure projects like the Danube Island combine environmental quality with superlative leisure and recreation opportunities; the Danube regulation project does all the above while also protecting the city against flooding.

- Vienna was the first city in the German-speaking region to publish open data and is a European pioneer in the field of **open government**. The City of Vienna offers numerous administrative procedures in digital as well as analogue form: both types of process are of high speed and quality to ensure swift, efficient handling and provide legal certainty.

And there is another Viennese characteristic that the Smart City can build upon: throughout its history, Vienna has repeatedly been confronted with a dramatically changed scenario, turning necessity into a virtue to reinvent itself on more than one occasion. Thus the unbridled growth of the late 19th century produced infrastructure that is still in operation today; the housing shortage of the interwar years gave birth to the tradition of municipal housing provision; the successful model of sensitive urban renewal emerged from the economic shrinkage during the Cold War, and the fall of the Iron Curtain saw the city reposition itself as a metropolis at the very heart of Europe.

This expertise in change management will be of great benefit in the coming years too, with Vienna in the process of launching its next phase of far-reaching transformation as it implements the Smart City goals.

The dimensions, headline goals and thematic fields of the Smart City Wien Framework Strategy

It is only through the combination and interplay of the three dimensions **Quality of Life, Resource Conservation and Innovation** that Vienna's Smart City approach unfolds to its full effectivity. Vienna's sustainable development strategy therefore calls for a hitherto unprecedented degree of cross-departmental, interdisciplinary collaboration among the city's various stakeholders.

Based on the Smart City Wien mission statement **"High quality of life for everyone in Vienna through social and technical innovation in all areas, while maximising conservation of resources"** a total of seven closely interlinked headline goals have been defined for the three dimensions.

Building upon and further substantiating the headline goals, 65 individual objectives have been defined in twelve thematic fields.

All twelve thematic fields of the Smart City Wien Framework Strategy are geared towards the mission and the headline goals and thus contribute respectively in varying degrees to the three dimensions.

There are close thematic and operational interdependencies between the thematic fields that should be taken into account in the implementation of the objectives. Objectives and measures in different thematic fields often reinforce one another. For instance, eco-friendly forms of transport also improve traffic safety, reduce noise pollution and promote health by encouraging physical exercise. By the same token, the integrated approach means that any conflicting objectives can be quickly identified and resolved. Cross-cutting issues such as strategies and measures for adapting to climate change or cooperation across municipal boundaries within the Smart Region touch upon a number of thematic fields.

When implementing projects in the respective thematic fields, it is therefore important to consider their impact on the three dimensions of Smart City Wien as well as on individual objectives in the other thematic fields, and ensure that they are as mutually conducive as possible.

Graphics at the appropriate points show which UN Sustainable Development Goals are covered by the respective thematic fields.

Quality of life

- Vienna is the city with the **highest quality of life** and **life satisfaction** in the world.
- Vienna focuses on **social inclusion** in its policy design and administrative activities.

Resource conservation

- Vienna reduces its local per capita **greenhouse gas emissions** by 50 per cent by 2030, and by 85 per cent by 2050 (compared to the baseline year of 2005).
- Vienna reduces its local per capita **final energy consumption** by 30 per cent by 2030, and by 50 per cent by 2050 (compared to the baseline year of 2005).
- Vienna reduces its **material footprint of consumption** per capita by 30 per cent by 2030, and by 50 per cent by 2050.

Innovation

- By 2030 Vienna is an **innovation leader.**
- Vienna is Europe's **digitalisation capital.**

Energy supply	**Water and waste management**	**Education**
Buildings	**Environment**	**Science and research**
Mobility and transport	**Healthcare**	**Digitalisation**
Economy and employment	**Social inclusion**	**Participation**

3. The Smart City Wien Headline Goals

Quality of life

HEADLINE GOAL: VIENNA IS THE CITY WITH THE HIGHEST QUALITY OF LIFE AND LIFE SATISFACTION IN THE WORLD.

Quality of life is an aggregation of many different variables. These include economic and social factors such as access to the labour market, fair pay that ensures a decent livelihood and a good level of social security; opportunities for personal development based on a wide range of education and training options, a broad spectrum of job opportunities that allow a good work-life balance and the opportunity for social participation; access to public services such as good healthcare and nursing & care facilities; a diverse and widely accessible range of cultural and leisure activities, and public safety and social peace.

Smart City Wien builds on Vienna's existing qualities in these areas as well as introducing new aspects: quality of life may involve, for instance, completely new ways of using street space, which for a long time was primarily designed for the needs of car traffic – for pavement cafés, for play and sport, or as an "extended living room". Quality of life likewise means being able to use a wide range of mobility options without having to buy and maintain a private vehicle. Or products with a longer useful life that don't have to be discarded as irreparable the first time they develop a fault.

Environmental quality – from clean air and water to access to intact countryside and recreation areas to the urban climate – has always been a recognised strength of Vienna as a major city. Having said that, however, Vienna cannot remain entirely immune to the impact of the global climate crisis. In order to keep city life pleasant despite global warming and the growing incidence of heatwaves and extreme weather events, strategies are required to limit the consequences of climate change and deal with them more effectively.

Already today, Vienna's high quality of life is a significant economic pull factor that sets the city apart from its international competitors. The more important sectors such as research and development (R&D), knowledge-based services and the creative industries become to Vienna, the more will pull factors that are often misleadingly described as "soft" – from environmental quality to education and training options to social calm – play a key role in attracting international corporations and start-ups, skilled professionals and young talents to the city.

Essentially, Smart City Wien does not see quality of life as a "state" that can be precisely quantified using a set of objective indicators. The decisive aspect is ultimately personal life satisfaction, which is derived from all of the factors cited above; how people living in Vienna subjectively feel about their current life situation, but also their prospects for the future. The life satisfaction of Viennese citizens is surveyed at regular intervals, analysed in detail and duly taken account of.

Maintaining quality of life will mean adapting to climate change.

Global climate change continues unabated and the impact is now being clearly felt in Vienna, as elsewhere. The Paris Agreement adopted in December 2015 therefore emphasises adapting to climate change as a second, equal pillar of global climate policy.

Above all, cities like Vienna have to be prepared for rising temperatures. Heatwaves, which had an average duration of five days back in the period 1970-2000, will last for around 15-28 days towards the end of the 21st century.[8] On account of the urban heat island effect, Vienna's inner districts will be more severely affected by this than those on the outskirts. High temperatures can have a huge negative impact on health, and hence on people's quality of life. Elderly people with few social contacts and low incomes, the chronically ill and children are particularly severely affected by heatwaves. As a result, cooling and air-conditioning are increasingly becoming a social issue. The performance of Vienna's technical infrastructure can also be compromised by rising temperatures. In addition, we are also seeing a greater frequency of other extreme weather events such as torrential rainstorms. Due to the more frequent periods of drought and increased evaporation, the ground is able to absorb less and less water, resulting in a risk of local flooding.

Alongside these direct impacts, however, the indirect consequences of the climate crisis should not be underestimated either: these range from price increases, e.g. as a result of crop failures, to migration flows. The levels of climate-induced migration clearly show that climate change is exacerbating poverty and social inequality worldwide.

In order to counteract summer overheating, especially in inner-city districts, higher-level spatial plans are to make provision for fresh air corridors, link up green and open spaces, and preserve and expand the existing bodies of water and green spaces within the municipal boundaries. This will necessarily also involve close consultation with other authorities in the wider metropolitan area. Renaturalisation of streams in the Vienna Woods or the River Wien could help prevent flooding. At local level, buildings and public spaces can be "passively" cooled by greening of facades and measures to create shade – from a city-wide perspective this is significantly more efficient than installing air-conditioning. Cooling from renewable sources (e.g. renewable district cooling systems, cooling using heat pumps) is another energy-efficient alternative. Rainwater management measures provide surfaces that allow precipitation to trickle away or evaporate naturally, thus humidifying the air while simultaneously relieving the burden on sewers.

Heat is not the only problem, however: the growing concentration of low-level ozone and new pathogens entering the region due to the changed climatic conditions can create an additional burden. This requires both comprehensive public information measures and relevant training for healthcare professionals and care staff, coupled with consistent preventative action.

The crucial point here is that the advance of climate change necessitates far-sighted long-term planning in all areas. Where necessary, the current standards need to be adjusted so that they are not based solely on historical values, but also factor in reliable scientific projections (e.g. of temperature and precipitation trends).

[8] Heatwaves are defined as periods of at least three consecutive days with daily minimum temperatures exceeding 18°C and daily maximum temperatures reaching or exceeding 30°C.

Figure 4: Climate action and adapting to climate change

Climate action

Measures to reduce greenhouse gas emissions (e.g. increased use of renewable energy sources, sustainable mobility, reinsulation of buildings)

Climate change adaptation

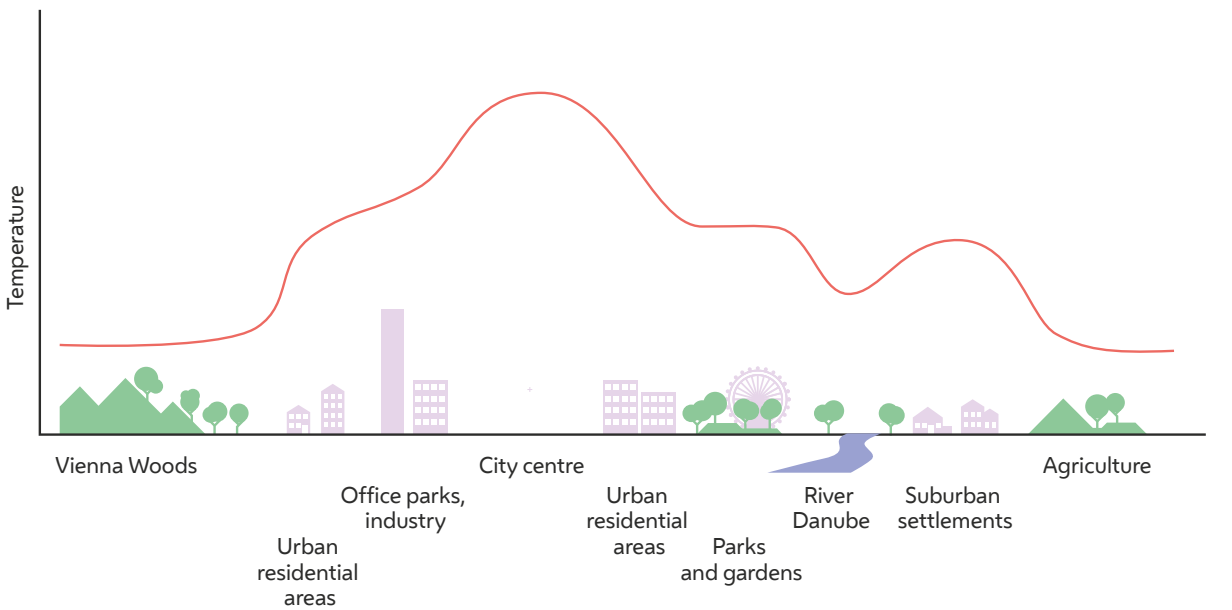
Measures to mitigate the unavoidable consequences of climate change (e.g. greening and shade to reduce the urban heat island effect, rainwater management, renaturalisation of waterways)

Synergies

Measures that contribute to protecting the climate as well as adapting to climate change (e.g. designing public spaces with high amenity value that are attractive for sustainable modes of transport)

Climate protection and mitigating the unavoidable consequences of the global climate crisis each call for different measures; however, some measures also make a positive contribution towards both objectives.

Figure 5: Urban greenery instead of air-conditioning



The so-called urban heat island effect occurs in densely built-up urban areas. However, it is strongly influenced by factors such as the structure of the urban fabric, the existence of green and open spaces and bodies of water, fresh air corridors and greening of buildings.

HEADLINE GOAL: VIENNA FOCUSES ON SOCIAL INCLUSION IN ITS POLICY DESIGN AND ADMINISTRATIVE ACTIVITIES.

A distinctive feature of Smart City Wien is that it takes account of the differing lifestyles and everyday realities of women and men, young and old, long-term residents and newcomers alike, so that all sectors of the Viennese population can look forward to a continued improvement of their living conditions. Smart City Wien is not an exclusive project for the benefit of selected social groups: it will only succeed if it is actively co-developed and supported by the entire Viennese population.

Broad participation and the opportunity for active engagement are therefore essential prerequisites. Vienna is committed to social inclusion as a keynote theme in all policy areas: inclusion has been the secret of Vienna's success to date, and it should remain the signature feature of Smart City Wien going forward. Universal equality in political, social and economic terms is simultaneously the goal and the foundation of the Smart City.

Vienna's wide-ranging public services make a significant contribution to social inclusion. The City of Vienna continues to use the assets in its ownership – from municipal housing to public utilities and transport providers – for the common good of the entire Viennese population and refrains from large-scale sell-offs.

Vienna is only smart if ...

- ... it systematically considers the specific needs of different social groups. Smart City Wien means recognising diversity. The City of Vienna and its municipal agencies take care to ensure that processes of change are effected in a socially inclusive, equitable manner, balancing out disadvantages wherever possible and maintaining a high level of social security.
- ... it enables high quality of life, even on a lower income. Smart City Wien means broad access to public services, affordable housing and public transport, extensive, publicly accessible green spaces and recreation areas, a highly developed healthcare system and much more. Vienna's future development is a development for everyone and should be subjectively perceived as such.
- ... people can participate and have a say in the city's development. Smart City Wien means creating space for locally tailored solutions and individual initiative, giving people the opportunity to contribute their own ideas and input to the development processes taking place in the city.
- ... innovation and progress have a social component. Smart City Wien ultimately means helping to usher in the new.

Resource conservation

HEADLINE GOAL: VIENNA REDUCES ITS LOCAL PER CAPITA GREENHOUSE GAS EMISSIONS BY 50 PER CENT BY 2030, AND BY 85 PER CENT BY 2050 (COMPARED TO THE BASELINE YEAR OF 2005).

With this headline goal,[9] Vienna is once again strengthening its ambitions in terms of climate action. This is because the need for action has become significantly more pressing.

The target pertains to the share of carbon emissions in Vienna that are not covered by the EU Emissions Trading System, while the per capita calculation takes account of the city's strong population growth.

The key areas of leverage for attainment of the Smart City Wien climate action goal are reducing energy consumption and shifting to renewable energy sources. This applies first and foremost to the transport sector (currently responsible for around 43 per cent of greenhouse gas emissions in the non-ETS sector) and heating, air conditioning and hot water supply in buildings (28 per cent of CO_2 emissions)[10]. That said, however, other thematic fields likewise give high priority and systematic consideration to conservation of resources and reduction of CO_2 emissions.

The transition from a fossil-based society to a sustainable one can only succeed if all stakeholders work together to address all aspects of the issue – at both national and international level. Vienna is committed to this collaborative process and plays an active role in creating an optimum national and international framework for it. After all, Vienna cannot achieve decarbonisation – i.e. phase out the use of fossil fuels in its energy, transport and economic systems – all by itself.

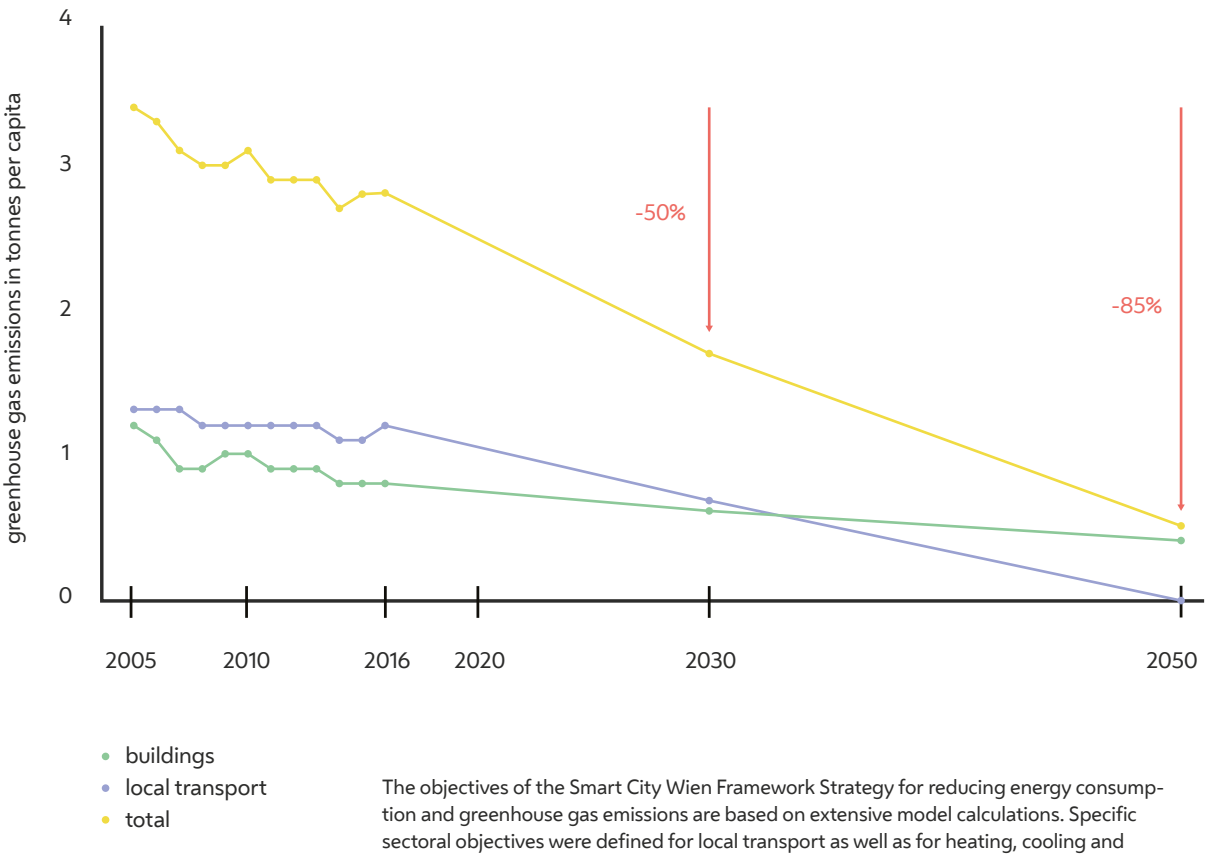
This necessary transformation of energy, transport and economic systems also presents the Austrian economy with a huge opportunity to carve out an international profile in these sectors. A straightforward climate and energy policy to strengthen the domestic market would lend important support to this endeavour.

Emissions trading: The EU Emissions Trading System (EU ETS) covers the CO_2 emissions from power generation in large thermal power stations, from various energy-intensive industrial sectors and from commercial aviation within the EU. How it works: operators in the relevant sectors have to surrender one emissions allowance for every tonne of greenhouse gas emitted. However, the number of new allowances issued is reduced every year. Allowances can be traded, i.e. operators can sell their surplus allowances or have to buy additional ones if needed. Hence, carbon emissions have a price. The higher this price is, the greater the incentive for operators to cut their CO_2 emissions.

[9] This target can only be achieved if Vienna's activities are backed up by a framework of relevant measures on the part of the federal government and the EU.

[10] Energy Report of the City of Vienna

Figure 6: Development of greenhouse gas emissions in Vienna from 2005 to 2016 and pathway to target



Own diagram by Urban Innovation Vienna (2019). Detailed documentation of the model calculations can be downloaded from the Smart City Wien website (https://smartcity.wien.gv.at/site/files/2019/06/Dokumentation-der-Berechnungen-zur-Aktualisierung-der-Smart-City-Wien-Rahmenstrategie.pdf – in German only).

The objectives of the Smart City Wien Framework Strategy for reducing energy consumption and greenhouse gas emissions are based on extensive model calculations. Specific sectoral objectives were defined for local transport as well as for heating, cooling and hot water supply in buildings, since Vienna as a federal province and municipality holds decisive policy-making competences for climate protection measures in these areas. In addition, the model calculations also factored in the city's energy consumption in other fields and the resulting CO_2 emissions (e.g. from household appliances, IT systems, trade and industry) as well as emissions from the waste management sector and agriculture.

For total greenhouse gas emissions Vienna's policy-makers defined an even more ambitious pathway than the one suggested by the model calculations. Even greater emissions reductions are thus required across all areas in order to attain the overall objective.

Here, Vienna could potentially be assisted by developments in new technologies that are hard to predict at present (e.g. "green gas"), and notably also by an ambitious legal framework at federal or EU level.

Smart City Wien as part of a network of ambitious European cities

Vienna is not alone with its Smart City Framework Strategy and ambitious energy and climate goals. Numerous cities have set themselves similar objectives in the past few years, some of which go significantly beyond the binding European and national targets. Although the differing baseline years and calculation methods mean that the goals are not fully comparable, they do clearly demonstrate the cities' intention to assume responsibility for sustainable development.

Copenhagen aims to be entirely CO_2 neutral by 2025. Any remaining CO_2 emissions in the city will have to be compensated for by surplus production of renewables inside and outside the city boundaries. In accordance with the "CPH Climate Plan 2025", total emissions are to be reduced by 83 per cent and per capita emissions by 86 per cent by 2025 (baseline year: 2011). The calculation includes all emissions produced within the city boundaries, including traffic emissions, but not fuel exported in vehicle tanks. Copenhagen's CO_2 emissions have gone down by 40 per cent since 2005. Also noteworthy is the fact that the city council sold off all shareholdings linked to fossil fuels back in 2016.

Berlin: According to the Energy Transition Act, total carbon dioxide emissions in Berlin are to be reduced by at least 40 per cent by 2020, by at least 60 per cent by 2030, and by at least 85 per cent by 2050 compared to total emissions in 1990. In absolute terms this is equivalent to a per capita reduction from 11 tonnes in 1990 to 1.7 tonnes in 2050. Both the emissions produced in Berlin and all the emissions caused by Berlin are taken into account. This means, for example, that electricity imports to Berlin and a share of the aircraft emissions at the airports in Brandenburg are assigned to Berlin.

Paris uses a set of target indicators: greenhouse gas emissions (in absolute figures, not per capita) are to be reduced by 25 per cent by 2020 and by 50 per cent by 2030, as compared to the baseline year of 2004. CO_2 emissions are to be reduced completely to zero by 2050. As in Berlin, emissions from the Greater Paris region which can be assigned to Paris are also included. The "global carbon footprint", which also includes Paris's "grey energy" consumption, is to be reduced by 40 per cent by 2030 and by 80 per cent by 2050. At the same time, energy consumption is to be drastically cut (35 per cent reduction by 2030, 50 per cent reduction by 2050) and the share of renewables increased; by 2050 the energy system is to be switched completely to renewables, with 20 per cent produced locally.

Amsterdam likewise plans to halve its carbon emissions by 2030 (compared to 1990 levels) and to reduce them by 85-100 per cent by 2050. Here again, the targets are expressed in absolute figures and not per capita. The calculation takes into account the energy consumed by the citizens of Amsterdam, i.e. it includes emissions from industrial facilities and power plants producing fuel or electricity for Amsterdam.

Stockholm aims to be 100 per cent fossil free by as early as 2040. By that date, CO_2 emissions are to be reduced to zero, and the same target applies for Sweden as a whole. This means that all energy "imports" to Stockholm must also be CO_2 free by then, if not before.

HEADLINE GOAL: VIENNA REDUCES ITS LOCAL PER CAPITA FINAL ENERGY CONSUMPTION BY 30 PER CENT BY 2030, AND BY 50 PER CENT BY 2050 (COMPARED TO THE BASELINE YEAR OF 2005).

Vienna's ambitious climate action target can only be achieved through a radical reduction in energy consumption in all areas – transport, heating and cooling of buildings, industry and communication. It can be done with the aid of highly efficient technologies and technical innovations, which will also be required to generate and supply the necessary energy as efficiently as possible. However, it also requires changes in behaviour.

To achieve the desired reduction in energy consumption, the energy-saving potentials of the individual sectors are to be leveraged, with per capita final energy consumption in the two major consumption sectors to be reduced as follows:

- For room heating, hot water and air-conditioning in buildings: 22 per cent reduction by 2030 and 36 per cent reduction by 2050 (in each case compared to the average for the years 2005 to 2010)

- In the transport sector: 40 per cent reduction by 2030 and 70 per cent reduction by 2050 (as compared to 2005 level).

Alongside increased use of renewables, security of supply, social impact and cost-effectiveness, improved energy efficiency is one of the key parameters for the future design of Vienna's energy system.

HEADLINE GOAL: VIENNA REDUCES ITS MATERIAL FOOTPRINT OF CONSUMPTION PER CAPITA BY 30 PER CENT BY 2030, AND BY 50 PER CENT BY 2050.

Vienna is aiming for radical conservation of resources, and that means not only fossil fuels, but all material resources. This is because everything from extraction and further processing of raw materials to manufacturing processes and their end products and services, plus all the many transports in between, all have a direct and indirect environmental and social impact. All resources that enter Vienna's economic system exit it again later on as solid waste, waste water and effluent, emissions or goods for export. Material consumption is one of the main causes of greenhouse gas emissions.

Material resources are materials such as biomass, fossil fuels, metallic and non-metallic minerals and the commodities produced from them. **Natural resources** comprise the above together with water, air and land.

Careful, efficient use of material resources is a key factor in a sustainable city. A significant future reduction in material consumption along the value-added chain will reduce the impact on the environment throughout the entire life cycle of the materials, improve security of supply, create new jobs and strengthen the economy.

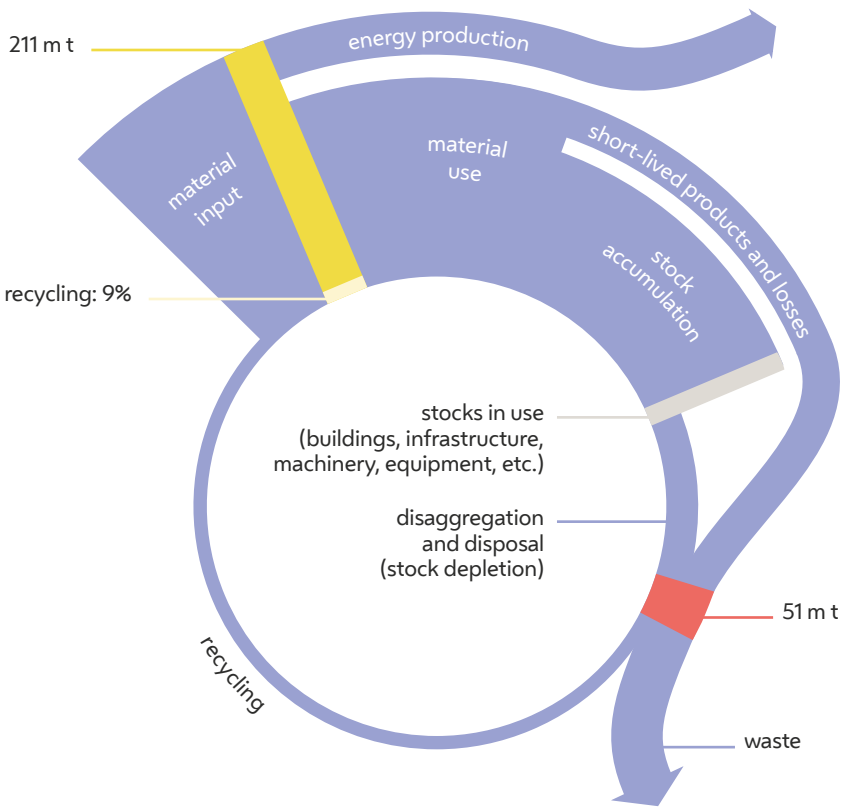
The city's material consumption and the associated greenhouse gas emissions are to be drastically reduced, primarily through consistent alignment with the principles of a circular economy. Sustainable, resource-efficient patterns of consumption also play an essential role here.

Vienna uses a consumption-based approach to calculate its material footprint. This approach not only factors in the goods produced in the city, but also those that are consumed here; the latter are often produced elsewhere and leave a corresponding material footprint in those places.

The material footprint takes account of the environmental impact of imports and looks at the entire life cycle of the goods consumed. The consumption-based approach reflects Vienna's global responsibility in accordance with the UN 2030 Agenda for Sustainable Development and supports the Austrian Resource Efficiency Action Plan and the EU policy on resource efficiency.

Alongside domestic extraction of materials, the **material footprint of consumption** also takes into account the total amount of raw materials used outside a particular territory (country, city) to produce and transport the goods and services consumed or used inside that territory.

Figure 7: Material flows in Austria



Own diagram (2019) based on: Jacobi et al. (2018): Providing an economy-wide monitoring framework for the circular economy in Austria: Status quo and challenges. https://doi.org/10.1016/j.resconrec.2018.05.022

Simplified diagram of overall material flows in Austria. Over 90% of the material input consists of domestically produced raw materials (e.g. agricultural products, timber, extracted minerals, sand and gravel) and imports. At present only around 9% of the materials are recovered and reused (recycling). About a quarter of the input materials are used for energy production. A reduction in energy consumption would thus also make a significant contribution to reducing material consumption. Approx. three-quarters of the input are processed for material use, though only a small proportion of this is used to produce short-lived consumer goods. The lion's share goes into the accumulation of "stocks" (buildings, infrastructure, machinery, equipment, etc.), from which materials are only recovered for potential recycling after a long useful life.

Circular economy

In our current economic system, large quantities of mostly non-renewable resources are extracted from the natural environment all over the planet to produce goods of all kinds. Most of these materials cannot be reused or recycled after use, so they end up as waste in the air, in water, and in the soil – with all the well-known negative consequences for the environment. In our current linear economic system, only 10 per cent of resources are reused or recycled. If we carry on with the traditional linear model of "take – make – use – dispose", global consumption of natural resources is projected to double again by 2050. Many of those resources are already scarce today.

Sustainable development therefore calls for a new economic approach: the circular economy aims to keep materials and their value circulating within the economic system for as long as possible. In future, products of all kinds must be designed to be durable, reparable and easily recyclable ("eco-design") and manufactured using efficient, low-waste processes. Where possible these processes will use recycled materials and waste as secondary raw materials and renewable energy sources and materials that can be regenerated or replenished in natural biological cycles. Usage of existing goods and infrastructure must be substantially intensified, for instance through shared use. At present, for example, cars stand unused for 92 per cent of the time, 60 per cent of all offices in Europe stand empty even during office hours, and a third of the world's food is lost or wasted. In future, buildings and built structures will also have to be recycled for raw materials once their useful life is over.

The circular economy thus aims at radical conservation of resources and a significant reduction of environmental impact. Furthermore, it maximises local and regional added value, thus reducing transport distances, reduces dependency on external sources of raw materials, promotes cooperation among different stakeholders and drives innovation.

Full conversion to a circular economic model requires significant changes and adjustments: in future, all the various sectors – from product manufacturers to logistics providers and the waste management industry – will have to work together to reorganise processes and develop new business models. Policy-makers have to create the relevant framework so that businesses adopting a circular model are at least on a level playing field with others, or receive better incentives.

The EU gave the conversion process a political and legislative boost with its 2015 Circular Economy Package, and the circular economic model is also seen as a key tool in implementing the UN 2030 Agenda for Sustainable Development (SDGs).

The circular economy offers numerous opportunities for Vienna, but it also entails challenges. It calls for a strategic approach, to be jointly elaborated by the municipal administration, the business community and other stakeholders. In this way, decision-making and planning processes are to be increasingly geared towards circular business models. Regulatory frameworks such as the Vienna Building Code and subsidy schemes can both be employed to facilitate the transition to a circular economy. Public procurement is another key tool that can be leveraged. "ÖkoKauf Wien" is a well-established and expanding programme for this purpose, along with "OekoBusiness Wien", the City of Vienna's consultancy service to support Viennese companies in their transition to a circular business model. A wide range of information, advice and training is provided to create the necessary awareness and build expertise in sustainable business practices.

Innovation

HEADLINE GOAL: BY 2030 VIENNA IS AN INNOVATION LEADER.

Smart City Wien's capacity for innovation depends on its ability to consistently develop the expertise and potentials available in Vienna. At this point it is virtually impossible to envisage many of the challenges the city will face in the coming years and decades, let alone find solutions for them. It is thus all the more important to invest in the city's basic capacity and willingness to innovate, doing even more than before to make Vienna a place where innovation can flourish.

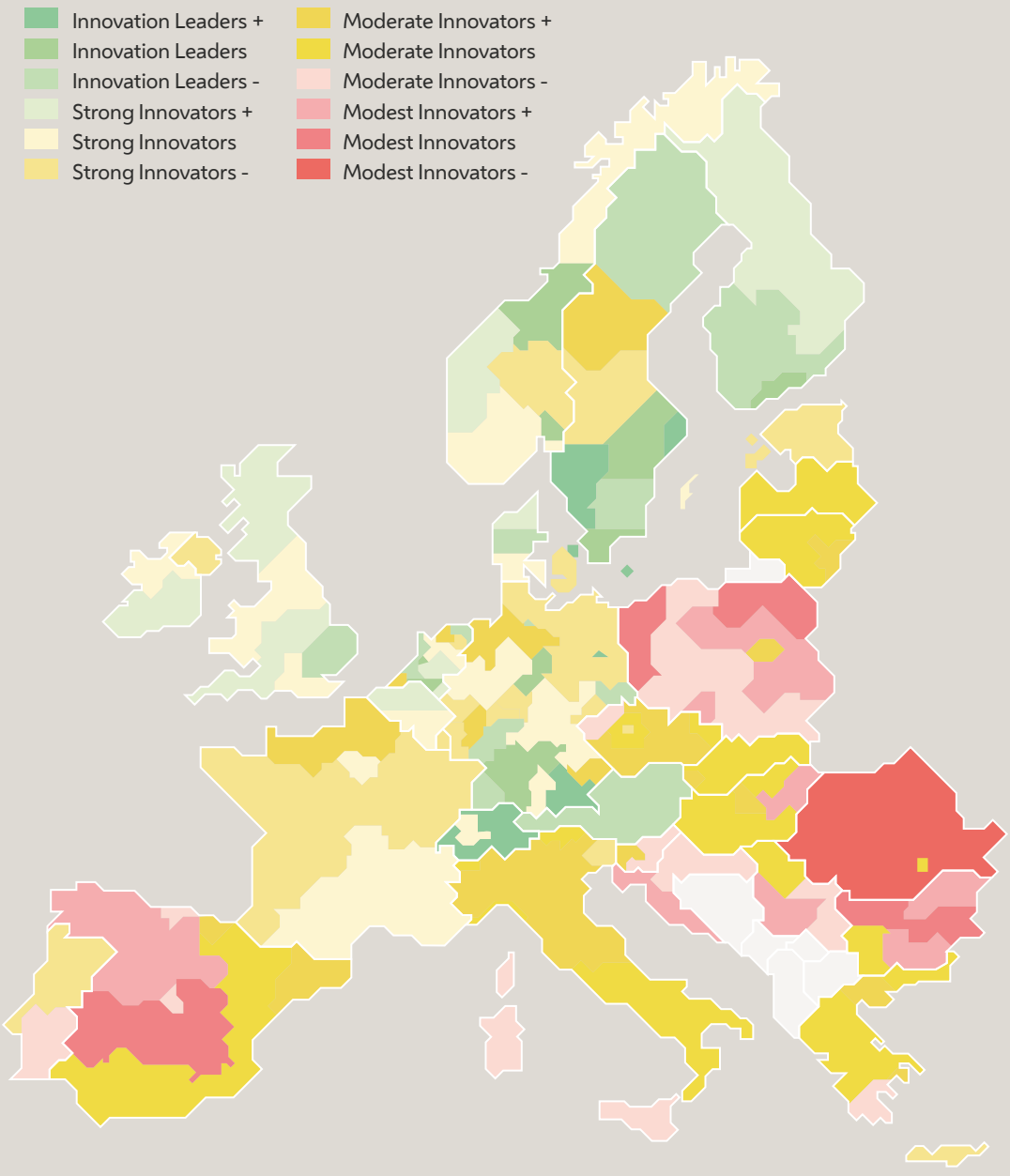
New technologies often act as a catalyst here, but social innovations are playing an increasingly prominent role. Unlike purely technological developments, these are more strongly inspired by the needs of local people, more broadly accepted, and are especially focussed on collaboration between different individuals and organisations. Open innovation, the involvement of external stakeholders in urban innovation processes, plays an important role in Smart City Wien.

In the European context, Vienna and Austria's eastern region already rank among the group of "strong innovators". There is still some work to do in order to break into the top group of "innovation leaders" – notably joint efforts on the part of federal and local government to consistently promote basic research, support the development of research findings into marketable innovations and provide the necessary infrastructure.

Vienna has the potential to become one of Europe's major innovation hubs. Already today, the city boasts institutions, companies and individuals in both basic and applied research who rank among the world leaders in their field. In future, the development of innovative solutions for sustainable cities, in particular, could become a recognised Viennese strength in fields such as combining new technologies with social innovations, developing urban infrastructure and services, and evolving new forms of public participation and balancing of interests.

This opens up vast opportunities for science and research organisations as well as start-ups and the wider business community. Vienna's growing reputation as an innovation leader, and particularly as a competence centre for Smart City solutions, increases the opportunities for local companies and institutions to land international contracts and projects or recruit high-calibre talents from all over the world to join their staff. By the same token, Vienna becomes attractive to new research institutions and as a target for international investments.

Figure 8: Innovative capacity of European regions



Illustrative diagram based on the European Commission's Regional Innovation Scoreboard. 2019 data.

Regional Innovation Scoreboard: The EU's Regional Innovation Scoreboard assesses the strengths and weaknesses of innovation systems in the individual member states at national and regional level. The assessment is based on input indicators (such as R&D spending) and indicators measuring innovation output (e.g. number of patent applications) in science and research organisations as well as in companies. Out of over 200 regions assessed in the latest Scoreboard (2017), 53 were categorised as "innovation leaders"; Eastern Austria (Vienna, Lower Austria and Burgenland) was ranked with 60 other European regions among the "strong innovators", ahead of the "moderate" and "modest innovators".

Top-level innovation must be underpinned by broad, firm foundations. The more diverse the city, the greater its creative potential. In order to leverage this potential, the population of Vienna in all its great diversity must be involved in the innovation and transformation processes of the evolving Smart City; people must be presented with as many opportunities as possible to develop their talents and interests. Good education, training and qualification options at all levels and for all age groups are a vital prerequisite for this, as is non-discriminatory access to the labour market.

Ultimately, though, it is also a question of business, society and the municipal administration being willing and able to adopt innovations, from Vienna and anywhere else in the world, at an early point in time and deploy them in a smart manner. This in turn depends on all stakeholders having a considered but basically open attitude towards scientific findings and technological innovations.

Social innovation

A Smart City needs new lifestyles and patterns of consumption, new forms of organisation and ways of behaving – new ways of achieving its goals. Social innovations of this kind emerge from society and are primarily initiated, evolved and carried forward by the city's citizens. Social innovations often go hand in hand with technical ones. The internet and smartphones allow farmers to employ new direct marketing methods, for instance, as well as fostering new forms of community-based agriculture. Sharing schemes have only become widespread with the advent of digital platforms.

Social innovations can make a substantial contribution to conserving resources, protecting the environment and enhancing quality of life. An example of this are "repair cafés": temporary self-help workshops for the repair of everyday objects and household appliances which help to conserve resources while facilitating social interaction in the local neighbourhood.

Another are "pedibus" initiatives, in which primary school children walk to school in a group, supervised by trained adults, with a fixed "timetable" of stops and a predefined route. The pedibus is an effective way of promoting safe, sustainable mobility choices.

Social innovations also play a pivotal role in the shift towards green energy. The widespread use of solar panels in Austria, for example, very clearly had its roots in the activities of DIY groups back in the 1980s. Community power plants and energy cooperatives allow private individuals to acquire a stake in solar and wind farms and tap new sources of funding for the operators.

Vienna seeks out and promotes social innovations that can contribute to the attainment of its Smart City goals, be they in civil society, in organisations and enterprises or within the municipal administration. Further efforts to this end are required, however, such as the establishment of "social innovation labs" to act as a central public contact point and information exchange, provide systematic support for innovation processes and put local people in touch with relevant municipal bodies and private initiatives.

HEADLINE GOAL: VIENNA IS EUROPE'S DIGITALISATION CAPITAL.

Vienna seizes the opportunities offered by digitalisation to advance the development of society and the economy, and hence city life in general, in an innovative way. We are currently standing on the brink of swift and profound changes, the ramifications of which cannot be foreseen at present. The combination of new technologies and applications in the fields of data capture, networking, artificial intelligence and robotics will allow the municipal administration and its associated enterprises, as well as private companies, to develop new products and services that have not even been thought of yet today. Digitalisation offers vast potential in terms of innovation processes, public participation and new lifestyles, but it also entails challenges regarding protection of data and critical infrastructure, for instance, or ethical approaches to digital culture and technologies.

- Vienna sees digitalisation as a tool for improving quality of life and responsible use of resources; its aim is to become Europe's digitalisation capital. For this reason, the municipal administration actively steers the process of digitalisation in all areas and expedites changes for the benefit of the Viennese population. The following key principles guide Vienna's digitalisation policy: digitalisation serves the needs of people. All citizens of Vienna have access to the benefits provided by digitalisation and the city's digital services.

- Digitalisation drives Vienna's evolution into an open, participatory city. An open approach to public data (open government data) creates transparency and provides an insight into the thought processes and actions of local government and the municipal administration. At the same time, digital platforms and communication channels are used to increase public engagement and participation. The City of Vienna, businesses and local people work together on creative, innovative solutions to improve the urban living environment.

- In all areas, consideration is given to the potential for application of information and communication technologies. The city promotes a culture of innovation and creates a suitable framework to support social and technological innovation.

New technologies and their applications mean that old occupations will disappear and new ones emerge. Smart City Wien will help its citizens to make the most of the opportunities offered by the digital revolution. To this end it will expand its provision of digital education for all age groups, from children to the elderly, and focus on promoting vocational training to give people the skills to succeed in the digitalised labour market.

Digitalisation is a key tool for transforming the city's energy and mobility systems, driving the transition to a circular economy and supporting measures to protect the urban ecosystem. Digital technologies allow the development of more effective monitoring and control mechanisms to help boost resource efficiency in all spheres of life. Information and communication technologies are the nervous system of the Smart City. Having said that, however, Smart City Wien also takes care to ensure that new digital infrastructures, products and services are only used if they are harmless to both the environment and public health. Likewise, the benefits they provide must be greater than their costs in terms of consumption of energy and resources.

On its path to becoming a digitalisation capital, Vienna will build on and selectively develop its existing strengths:

- The information and communication technologies (ICT) sector already ranks among Vienna's strongest, in research as well as in the number of companies. The wider ICT industry (including downstream sectors) now accounts for some 30.000 Viennese companies employing nearly 190.000 people – over one quarter of the entire workforce.

- Under its DigitalCity.Wien initiative, launched in 2014, the City of Vienna has set up sound structures for collaboration with pro-active companies and specialists from the fields of education, training and research.

- Vienna provides free access to its open government data so that companies can use it to develop innovative applications and services.

- The municipal administration has already rolled out digital urban services and digital applications, and their use is being broadly expanded.

- A broad portfolio of digital applications and services is becoming an established part of everyday life for patients in Vienna's healthcare institutions. In this regard, utmost priority is attached to quality, security, and the protection of sensitive personal data.

- Long-term collaborative research projects such as Aspern Smart City Research set up "living labs" for new technologies; real-time data collected from end users in a pilot district are analysed in detail and the results used in the development of new applications.

Vienna's Digital Agenda is a comprehensive, periodically updated guideline programme for sustainable digitalisation.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Urania Sternwarte
Strandbar Herrmann
Uraniastraße
Franz-Josefs-Kai
Adagio
Bundesministerium f. Verkehr, Innovation und Technologie
Blendend Shisha & Lounge Bar
Hintere Zollamtsstraße
Universität für angewandte Kunst in Wien
Justizzentrum Wien Mitte
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4. Thematic Fields

Energy supply

Vienna 2050

The energy supply of Smart City Wien is based almost exclusively on renewable energy sources that are also used locally: solar installations on rooftops and facades generate power and heat. Efficient heat pumps allow waste and ambient heat to be used for heating and cooling of buildings. Deep drilling draws hot water from a depth of 3.000 metres underground and feeds it into the district heating network. Wind turbines, photovoltaic installations, hydro-electric and biomass plants both inside and outside the city use renewables to meet the city's daily energy requirements. Expensive energy imports are no longer required, so the money stays in the region.

Electricity is the dominant fuel. It allows energy to be exchanged and hence enables joint optimisation of the once separate sectors of heating, transport, electrical applications and industry. The days when electricity was only generated in a few large power stations and distributed via a radial grid are long since over. A large number of energy consumers – both private households and companies – are now involved in energy production themselves, either via their own plants or via community energy generation schemes. With the advent of "prosumers", power generation has been decentralised; the same applies to the many different kinds of energy storage facilities, which include electric cars.

Smart grids allow the networked interconnection of all these actors, optimising coordination of energy consumption and generation and guaranteeing a supply of clean energy for all residents of Vienna; energy poverty is a thing of the past.

Radical improvements in energy efficiency mean that overall energy consumption and emissions of greenhouse gases have drastically declined, despite economic and population growth. This has been achieved thanks to smart use of new technologies, new business models and long-term surveillance of costs, coupled with changes in people's consumption habits and mobility behaviour. After all, public expertise and environmental awareness is ultimately another important source of energy.

Our Agenda

A secure, affordable, environmentally sound, needs-based energy supply is and remains one of the most important prerequisites for the city's high quality of life and economic development. At the same time, the city's energy system requires radical transformation if CO_2 emissions are to be reduced to the necessary extent. Massive investments are therefore being made to improve energy efficiency throughout the entire system, from power generation to distribution to end consumers. In parallel with these efforts, the urban energy supply is undergoing a continuous shift from fossil fuels to renewables.

If the energy supply is to be sourced largely from renewables, per capita final energy consumption will have to be halved by 2050. This will be achieved through investments in energy efficiency and new technologies, especially in the transport and building sectors, as well as through appropriate changes in the consumption behaviour of the Viennese population as a result of comprehensive awareness-raising, information and education measures.

This transformation can only be achieved, however, if a suitable framework is put in place by the federal government and the EU.

OBJECTIVE: VIENNA'S LEVEL OF ENERGY SECURITY REMAINS HIGH.

The security of energy supply to the Viennese population and businesses, especially from grid-bound energy carriers, is to be kept as high as possible.

Vienna's power stations, which supply both electricity and district heating, are key elements of the energy system during the transformation phase. They use natural gas, the current energy carrier, in a highly efficient way and supply power to balance out the fluctuations in supply from renewables when insufficient storage capacity or other compensatory measures are available.

The necessary investments are made available for the construction, expansion and maintenance of the power generation and grid infrastructure in order to ensure a reliable supply, including at peak times, and to be prepared in the event of outages. The security of the city's electricity supply has absolute priority here, as the expected knock-on effects would be most severe in the event of a blackout. As regards gas, the priority is to ensure security of supply to the strategically important power and heat cogeneration plants. This requires flexible power generation plants, an overarching coordination system and secure, stable and sufficient storage facilities and distribution grids.

A smart grid uses state-of-the-art communication technologies to network the growing number of energy consumers, producers and storage facilities with one another in a safe, secure and cost-optimised manner. This allows energy consumption and fluctuating generation from solar and wind farms to be balanced out and provides the basis for technical and economic optimisation of the grid structure.

Smart meters are essential components of a smart grid. The devices can transmit as well as receive data, providing customers with near real-time information about their energy consumption so they can manage their use accordingly and benefit from off-peak energy tariffs.

OBJECTIVE: VIENNA HAS SMART ENERGY GRIDS THAT ALLOW A DECENTRALISED, RENEWABLES-BASED ENERGY SUPPLY.

In order to make the transition to a more efficient, renewables-based energy system, the distribution networks for electricity, district heating and gas need to be upgraded into smart grids as swiftly as possible. To this end, new technologies are being developed and piloted and the necessary organisational and regulatory adjustments undertaken. One important step in this direction are the smart meters currently being installed by Vienna's power utility Wiener Netze.

OBJECTIVE: RENEWABLE ENERGY PRODUCTION WITHIN THE MUNICIPAL BOUNDARIES DOUBLES BETWEEN 2005 AND 2030.

The available potentials for renewable energy production within the municipal boundaries will be systematically evaluated, expanded, and – where technically and economically feasible and environmentally and socially acceptable – extensively exploited in the long term. These include using highly efficient heat pumps to exploit groundwater and geothermal energy, photovoltaic and solar thermal installations to exploit solar energy, and conversion of organic waste and biogenic by-products into thermal energy for district heating and bio-methane. Special attention will be given to converting the district heating network to as-yet-untapped sources of renewable energy and waste heat via large-scale heat pumps. Above all, however, attainment of the target will require the successful tapping of deep geothermal energy, the geological feasibility of which is currently being assessed.

Existing renewable energy installations are to be maintained, modernised and, where possible, expanded.

The district heating network will be extended to densely built-up newly developed districts while simultaneously increasing the number of customers along existing pipelines. This strategy will be supported by area-based spatial energy planning, which integrates energy planning into urban development processes and thus provides all stakeholders with a sound basis for planning, both within the existing urban fabric and in newly developed areas.

OBJECTIVE: IN 2030 30 PER CENT, AND IN 2050 70 PER CENT OF VIENNA'S FINAL ENERGY CONSUMPTION ORIGINATES FROM RENEWABLE SOURCES.

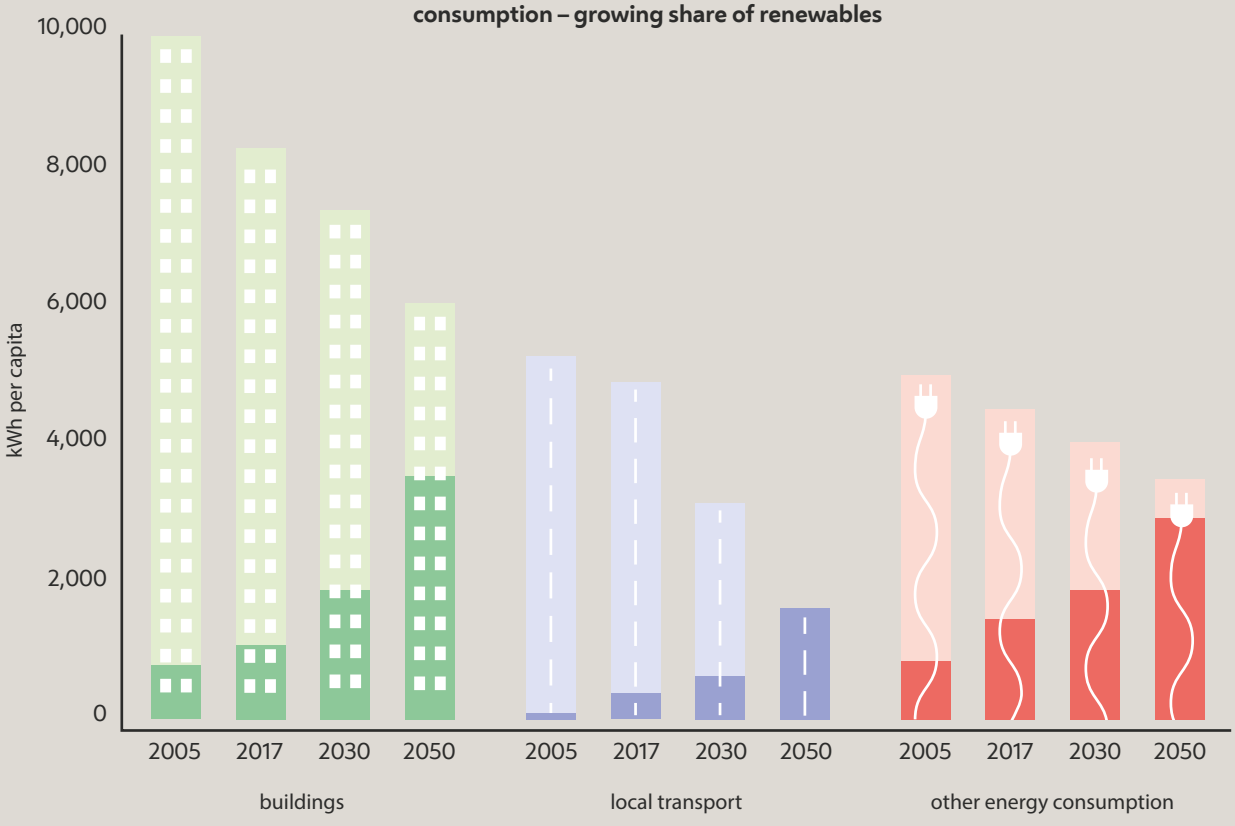
The transition to renewable energy carriers will be expedited as a priority in all areas, firstly through investment in energy generation plants within the municipal boundaries, and secondly by importing renewable energy from the surrounding region and/or via long-distance cables.

In the electricity sector, the share of renewables in Austria is already high and should account for 100 per cent of the national energy budget by 2030. The share of renewables in Vienna's total electricity consumption will also rise sharply as a result. At present it is foreseen that the transition from fossil fuels to renewables in the transport sector will be effected by switching to electric propulsion systems. One major challenge is heating, with half of Viennese homes currently heated by gas central heating. The conversion of these households firstly requires an adequate supply of district heating and renewable electricity. Secondly, older housing and other homes that cannot be converted in this way require "green gas" from renewable sources.

Green gas refers to biogas, hydrogen and synthetic gas. Biogas is produced from agricultural and forestry waste, food industry waste, household food waste and sewage sludge. Hydrogen is produced by electrolysis using surplus solar or wind power ("power-to-gas") and either used directly or converted into synthetic gas. The latter is chemically identical to natural gas and can thus be fed into the existing gas supply grid.

Green gas will also play an important role in applications where few alternatives are available (at present): in combined electricity and district heating generation, in heat generation for manufacturing processes, and in propulsion systems for heavy vehicles. Vienna is therefore expediting the development and expansion of its green gas supply.

Figure 9: Envisaged trend of energy consumption in Vienna: fall in energy consumption – growing share of renewables



Share of renewables in total energy consumption

9%	17%	30%	70%
2005	2017	2030	2050

To attain the objectives of the Smart City Wien Framework Strategy, a twofold approach is called for – a clear reduction in energy consumption combined with a step-by-step conversion to renewables. This requires an interplay of different factors: in future, per capita energy consumption for heating, hot water and air-conditioning in buildings is to be further reduced by one per cent per year, which is equivalent to a 22% reduction by 2030 and a 36% reduction by 2050 (compared to the average for 2005–2010). At the same time, the share of renewables is to be increased to 25% by 2030 and to almost 60% by 2050 – through gradual conversion from gas and oil-powered heating systems to district heating, which is increasingly generated from renewable energy sources and waste heat, as well as to heat pumps, solar energy, etc.

The per capita final energy consumption of Vienna's local transport sector should fall by 40% by 2030, and by 70% by 2050. This is to be effected by shifting to eco-friendly modes of transport and through gradual electrification of motorised private and goods transport. Moreover, the transport sector is to be fully converted to renewables – essentially electricity from renewable sources – by 2050.

Other energy consumption, such as electricity for lighting or electronic devices and the energy consumed by trade and industry, however, is only expected to decline very slightly. The growing importance of electricity in these sectors, which increasingly will be generated from renewable sources, will augment the share of renewables.

These objectives have been deducted from detailed model calculations. Own diagram by Urban Innovation Vienna (2019). Detailed documentation of the model calculations can be downloaded from the Smart City Wien website (https://smartcity.wien.gv.at/site/files/2019/06/Dokumentation-der-Berechnungen-zur-Aktualisierung-der-Smart-City-Wien-Rahmenstrategie.pdf - in German only).

Mobility and transport

Vienna 2050

First and foremost, the city offers an array of opportunities for encounter and interaction. Everyone in Smart City Wien has access to flexible, safe, barrier-free mobility options, regardless of their income, gender, ethnicity, age and physical abilities.

In 2050, mobility is to a large extent virtual: everything from the latest news to education is accessed via the Web. A large proportion of work-related communication is done digitally, and production plants are digitally controlled. As a result, many people work where they live.

Mobility options are primarily used for physical exercise, recreation and social interaction. In the city of short distances, green spaces, cultural institutions, schools and nurseries, shops, restaurants and cafés are all within walking distance. Other parts of the city are likewise easy to reach. Everywhere in Vienna is easily accessible via public transport. There is also an extensive network of cycle routes. Autonomous electric vehicles offer new additional options and are used on a shared basis. Private vehicle ownership has drastically declined. Mobility is a service, consumed as and when required. The space required for motorised traffic is therefore minimal. Streets have thus been transformed into play areas and shared spaces; trees and community gardens improve the urban climate, even in densely built-up districts, and help cool the city down on hot days.

Transfer between the different modes of transport is seamless, barrier free, and hence much more convenient – not least for the elderly and other people with limited mobility. All public mobility options are integrated into the city's mobility platform. Automation and networked interconnection of the different modes of transport mean that accidents involving injury to people are now very rare. All modes of transport are powered by renewables and are resource efficient in their production and use. The shift to eco-friendly modes of transport has significantly reduced energy consumption.

Goods are transported into the city by suitable electric vehicles operating out of communal logistics centres on the outskirts. Inner-city distribution hubs and a dense network of collection points allow efficient, coordinated goods deliveries. New technologies allow growing numbers of everyday necessities to be produced locally again, with production increasingly based on closed cycles. As a result, the volume of goods traffic has declined significantly.

Our Agenda

Mobility and transport are of pivotal importance to the city. They have a decisive impact on people's quality of life and are a major driver of Vienna's success as a location for business. Smart City Wien allows convenient, safe, barrier-free, affordable mobility for all, whether or not they have their own car.

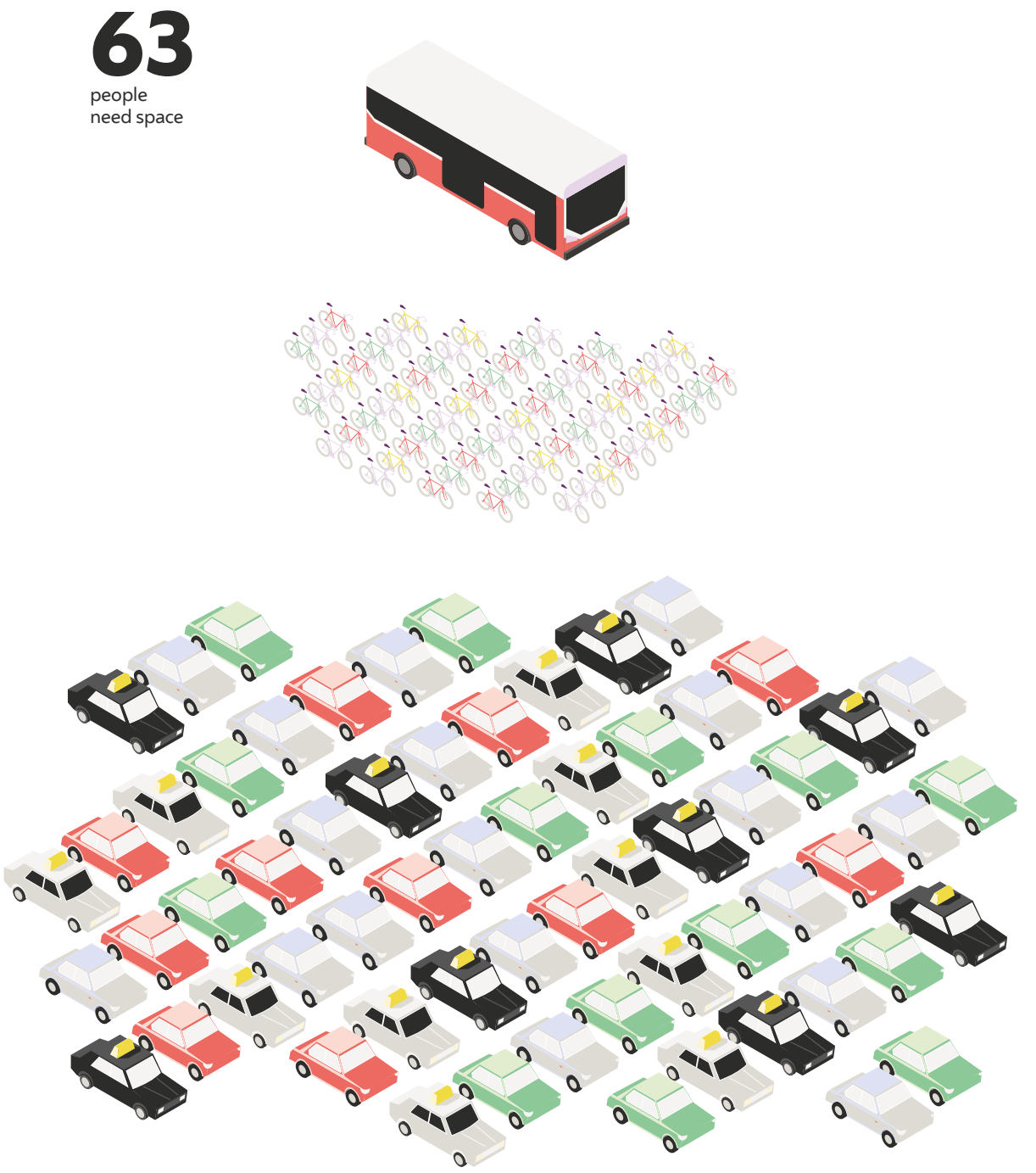
Along with the population growth in the city and wider region, the volume of traffic has substantially increased in recent years. The range of mobility options is growing. However, motorised traffic is a major burden on the environment (consumption of natural resources, greenhouse gas emissions, air pollution, noise) and takes up a lot of space. It is therefore essential to rethink mobility and transport from a Smart City perspective.

Thanks to digitalisation, virtual mobility is already replacing physical mobility to some extent. For instance, flexible modes of employment that are not tied to a particular location can reduce the share of work-related journeys.

The same applies to education or accessing government agencies. Nevertheless, even in future many people will still need to make various everyday journeys within the city. Radical conservation of resources and preventing traffic-related carbon emissions means reducing the need to travel wherever possible, shifting journeys to efficient modes of transport, and making the transition from fossil fuels to carbon-free propulsion systems for all vehicles. Urban neighbourhoods must be designed to ensure an attractive local mix of functions – housing, education, employment, shopping and leisure – within a short distance.

Shifting travel away from private motor vehicles also frees up more space for walking, cycling and public transport. The aim is to achieve a more equitable layout and use of traffic thoroughfares and public space. The street space, which to date has been primarily geared to the needs of car traffic, especially parking, must be redesigned to meet the needs of the urban population and made available for a wide range of different uses. The design of public space is also of key importance for climate protection and quality of life, as well as for adapting to climate change. The City of Vienna utilises the development of automated vehicles to improve efficiency and traffic safety. New mobility options using automated vehicles – perhaps in combination with sharing schemes – can also help reduce the number of private motor vehicles. The City of Vienna will work with operators to ensure that such options are designed so as to reduce the amount of public space taken up by vehicle traffic. There are also special requirements in terms of the ability of automated vehicles to navigate safely and independently in complex traffic situations. Urban infrastructure will be expanded as necessary in line with requirements – the focus here is on traffic management (e.g. routing systems) as well as on safety considerations for all road users.

Figure 10: Fair sharing of public space



A sustainable transport system needs to be highly efficient in its use of the scarce resource of public space. The diagram shows the amount of space taken up by different modes of transport – electric vehicles are a step in the right direction in terms of climate protection but take up no less space than conventional cars.

OBJECTIVE: PER CAPITA CO_2 EMISSIONS IN THE TRANSPORT SECTOR FALL BY 50 PER CENT BY 2030, AND BY 100 PER CENT BY 2050.

OBJECTIVE: PER CAPITA FINAL ENERGY CONSUMPTION IN THE TRANSPORT SECTOR FALLS BY 40 PER CENT BY 2030, AND BY 70 PER CENT BY 2050.

In Vienna as elsewhere, transport is the sector responsible for the greatest share of total greenhouse gas emissions. Close to a third of Vienna's final energy consumption is attributable to transport.

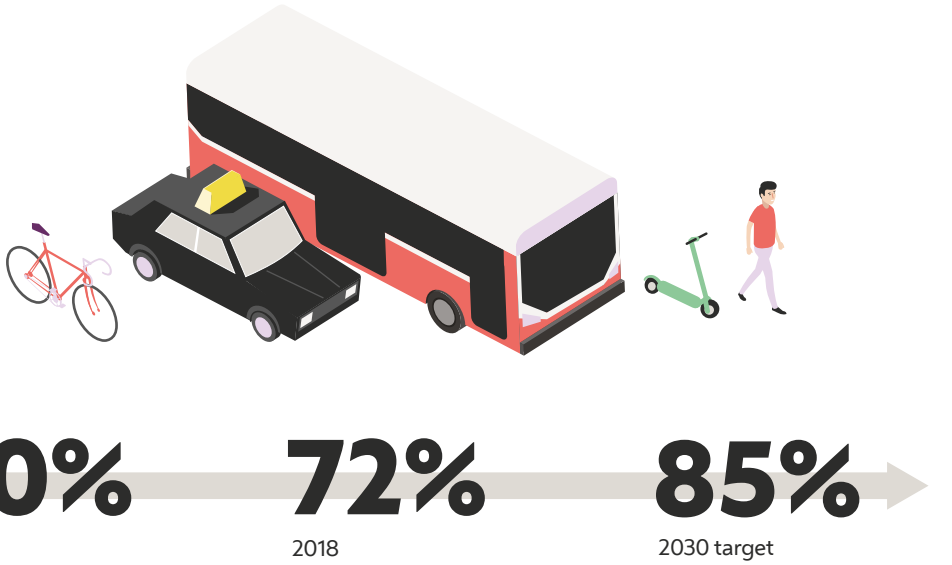
Ambitious organisational measures such as shifting transport to eco-friendly modes of transport (walking, cycling, public transport) rapidly reduce transport-related CO_2 emissions in Vienna and massively increase energy efficiency. The transition to new technologies such as electric propulsion reduces the emissions produced by the remaining motorised vehicles. Commercial vehicle fleets, in particular (e.g. delivery services, taxis, transport and courier services) are to be swiftly converted to electric propulsion. The City of Vienna plays a pioneering role in this by expediting the conversion of its own vehicle fleets to zero emission vehicles.

The targeted reduction of carbon emissions in the transport sector by 2030 presupposes that the EU regulation on commercial vehicle fleets will succeed in halving CO_2 emissions per kilometre, as expected from today's point of view (in reality and not just under test conditions) and that measures by the federal government and the provinces of Lower Austria and Burgenland will support the shift from private motor vehicles to eco-friendly modes of transport.

OBJECTIVE: THE SHARE OF JOURNEYS IN VIENNA MADE BY ECO-FRIENDLY MODES OF TRANSPORT, INCLUDING SHARED MOBILITY OPTIONS, RISES TO 85 PER CENT BY 2030, AND TO WELL OVER 85 PER CENT BY 2050.

Vienna implements attractive schemes and a wide range of measures to promote walking, cycling and public transport ("ecomobility") as the key modes of transport within the city, and interconnects their networks for maximum efficiency. Compared to cars, for example, public transport is very energy efficient and kind to the environment. Just 5–6 per cent of energy consumption in the mobility sector is caused by public transport. In terms of CO_2 emissions the comparison is even starker, given that around two-thirds of the energy consumed by public transport is electricity. Affordable fares for all sectors of the population make it even more attractive. Furthermore, walking and cycling are active mobility options that promote a healthy lifestyle.

Figure 11: Promotion of energy-efficient, eco-friendly modes of transport



Data: Wiener Linien (Vienna Public Transport)

Journeys in Vienna made on foot, by bike, by public transport or using shared-use schemes (such as e.g. car sharing or car pools).

The figures for 1993 and 2018 are based on pedestrians, cyclists and people using public transport. Journeys made using shared-use schemes will also be included in the survey in future.

Nine out of ten Viennese citizens agree that "In Vienna it's possible to manage perfectly well without your own car". (Source: City of Vienna, Wiener Lebensqualitätsstudie 2018)

The urban infrastructure for walking, cycling and public transport is further densified and expanded. This also includes redesigning public thoroughfares to create the necessary space for ecomobility and ensure a high amenity value. In parallel with this improvement of the ecomobility infrastructure, suitable measures are implemented to manage demand for private motorised transport. This combination of push and pull factors, elaborated and coordinated within the context of sectoral strategies, ensures that the objective is attained. The results of the first Smart City Framework Strategy monitoring process likewise show that further innovations in this thematic field are imperative, but also that Vienna's success in this regard is strongly affected by external conditions.

The wider definition of **ecomobility** encompasses walking, cycling and public transport plus shared-use schemes such as car sharing und car pools.

In recent years, the boundaries between individual and public transport have become increasingly blurred: individual transport has become "more public" with the advent of sharing schemes, while customised services ("mobility as a service") are making public transport "more individual". As well as promoting ecomobility, Vienna is pursuing a range of other urban transport options, notably public hire schemes. These are developed collaboratively by providers and the municipal administration and can be selected and combined as and when required. New usage models such as car pools are also being

piloted, which make more efficient use of private vehicles, as well as new mobility options involving driverless vehicles.

OBJECTIVE: BY 2030, PRIVATE MOTOR VEHICLE OWNERSHIP FALLS TO 250 VEHICLES PER 1,000 INHABITANTS.[11]

Mobility in Vienna is designed for efficient use of resources and space. Private cars take up large amounts of public space, which is a limited commodity, especially in a growing city; as such it is to be increasingly made available for ecomobility and other uses (e.g. greening and planting) in future. To this end, the number of journeys made by car is to be significantly reduced, along with the overall number of cars registered in the city.

Besides providing a comprehensive public transport network, Vienna additionally uses digitalisation as a tool to promote inter- and multimodality, i.e. smart combinations of different modes of transport.

Digital mobility platforms and apps provide easy access to the various options and also incorporate walking routes and the user's own transport. At the same time, the data generated are used to enhance the efficiency of planning and traffic management measures. Vienna thus enables people to get around safely and conveniently without their own car.

OBJECTIVE: AT LEAST 70 PER CENT OF ALL JOURNEYS IN VIENNA CONTINUE TO BE SHORT DISTANCES OF UP TO 5KM, AND THE MAJORITY ARE MADE BY BIKE OR ON FOOT.

It is comparatively easy to encourage people to make short, everyday journeys on foot or by bike rather than by car. The prerequisite is that everyday services and amenities are within walking or cycling distance.

In order to create this "city of short distances", Vienna's far-sighted urban development policy ensures that key everyday infrastructure such as childcare facilities and schools, shopping and leisure facilities, parks and recreation areas is close to residential areas and that individual districts, neighbourhoods and building complexes have a good mix of housing, workplaces and outdoor space. It additionally provides for circulation areas and attractive places to linger, improved permeability and connectivity, and traffic management measures that favour cyclists and pedestrians.

[11] From around 370 vehicles per 1,000 inhabitants at present (2018).

Annual average daily traffic (AADT) is an indicator of traffic volume within a 24-hour period. It measures the total volume of vehicle traffic crossing the municipal boundary in a year, divided by 365 days.

OBJECTIVE: THE VOLUME OF TRAFFIC CROSSING THE MUNICIPAL BOUNDARIES FALLS BY 10 PER CENT BY 2030.

Many people from the entire eastern region of Austria travel to Vienna for work and education. At the same time, increasing numbers of Viennese work outside the city. This is reflected in the high volume of traffic crossing the municipal boundaries, which is likely to increase further in view of the growing population of the city and wider metropolitan region. The majority of these journeys are currently made by car – a trend which has reached the limits in more ways than one.

Measures to shift traffic within the municipal boundaries to eco-friendly modes of transport also have an effect on commuter traffic. Significantly more wide-reaching strategies and measures are also needed, to be jointly elaborated within the Smart Region in consultation with the neighbouring local authorities and the federal provinces of Lower Austria and Burgenland. These include, in particular, the coordinated expansion of the public transport network and attractive new mobility options, but also appropriate measures to manage private vehicle traffic.

OBJECTIVE: COMMERCIAL TRAFFIC WITHIN THE MUNICIPAL BOUNDARIES IS LARGELY CO_2 FREE BY 2030.

Given Vienna's thriving economy and the growing volume of traffic, especially in the retail sector, discussing the design of the transport system for commercial traffic in consultation with the companies concerned and the logistics sector is a central concern of the municipal administration. In particular, suitable measures are to be developed and implemented to expedite the conversion of commercial vehicle fleets to low-carbon propulsion systems, giving priority to crafts and trades, delivery services and the urban logistics sector. In parallel to this, the efficiency of commercial traffic is to be increased and eco-friendly transport and logistics systems developed, e.g. by avoiding empty trips and establishing coordinated logistics hub systems for shared use by a number of different suppliers.


SMARTER
TOGETHER
SIM BIKE
SIM BIKE
BESV

Buildings

Vienna 2050

Urban growth and spiralling demand for housing in the first half of the 21st century have moulded the cityscape of Smart City Wien. Concurrently with this the world of work has changed dramatically, as have the expectations and lifestyles of the urban population. All of these changes have had an effect on the design of buildings, which usually combine multiple functions now that work, home life, leisure time and social life are much more strongly integrated.

But the focus is not solely on functionality and efficiency: careful attention has also been given to architectural and aesthetic quality, green and outdoor spaces and the design and amenity value of urban neighbourhoods. The high quality of buildings gives them a long useful life. The interior layouts of buildings can be adapted to changing uses.

Consumption of energy and resources in the construction sector has been drastically reduced in recent years. Green building materials ensure healthy indoor air quality, highly effective ventilation systems ensure minimal energy loss, and smart home technology ensures efficiency and comfort. A refurbishment drive has also drastically reduced energy consumption in the existing building stock. Both new builds and refurbishment projects are planned from the outset to minimise consumption of materials and energy throughout the entire life cycle of the building. Nevertheless, all technical developments focus first and foremost on the well-being of the residents.

In many cases, the energy consumed by buildings is generated on site from renewable sources. Building shells are used both for solar energy generation and for greening. Recent developments in materials have vastly expanded the scope for innovative design. On the facades, energy-generating sections alternate with planted sections, which are tended by the residents and also serve as vertical vegetable gardens. Water circulates around roofs and facades, cooling through evaporation and irrigating the plants. Rooftop gardens serve as recreation areas, social zones and open-air workspaces. Bikes are easily accessible for convenient use. There are now much fewer private cars, so many indoor car parks are no longer needed and now serve other purposes – from charging station for e-vehicles to fitness centre.

Our Agenda

The combination of historic built fabric and numerous new buildings both shapes Vienna's cityscape and underpins its unique atmosphere. Some 90 per cent of the 170,000 or so buildings are used for housing. In view of the forecast population growth, at least 75,000 additional dwellings will be needed by 2030. A sufficient supply of affordable, high-quality housing thus has to be provided while simultaneously substantially reducing consumption of energy and resources and carbon emissions.

To this end, new buildings are constructed to near-zero-energy standard, existing buildings are fully reinsulated, and heating and energy systems are gradually being converted to non-fossil fuels. The same applies to commercial buildings.

Integrated design means that future planning of buildings promotes the use of eco-friendly building materials which are used as efficiently as possible with an eye to resource conservation and can be largely reused or recycled at the end of the building's useful life. When selecting materials, their material footprint and carbon footprint are also taken into account. In line with the concept of a city of short distances, a good functional mix is striven for within neighbourhoods and, where possible, also within buildings. The use of eco-friendly modes of transport is supported by provision of attractive, easily accessible parking facilities for bikes, scooters, etc., either inside the building or close by.

Building information modelling simplifies the planning and execution of construction projects by creating a collaborative digital model for use by all parties involved, from architects to installation technicians and facility management. The model contains comprehensive information across the entire life cycle of the building for the purposes of maintenance, operation and recycling, allowing construction projects to be designed in a more economic, resource-efficient and sustainable way.

A greater emphasis is also placed on protecting residents – particularly vulnerable groups such as socially isolated elderly people – from the heatwaves caused by the climate crisis. To this end, both in new builds and refurbishment projects emphasis will be placed on suitable installations in individual buildings and neighbourhoods, e.g. external sun blinds, shading and external water cooling, greening and planting or rainwater circulation systems.

In the existing building stock, and especially in municipal and cooperative housing, major refurbishment programmes under way since the 1990s have also helped bring about considerable reductions in energy and carbon consumption. Subsidies from the City of Vienna – even when low energy prices resulted in a less favourable cost-benefit ratio – have helped increase the refurbishment rate, and especially the quality of thermal insulation post-refurbishment. This has not only enhanced quality of life for hundreds of thousands of people but also lowered energy costs and thus made housing more affordable. The housing refurbishment drive also provided a boost for several sectors of the economy.

Leading by example, stringent energy efficiency and ecological standards are applied in the construction and refurbishment of buildings owned by the City of Vienna itself or its associated institutions and enterprises.

OBJECTIVE: PER CAPITA FINAL ENERGY CONSUMPTION FOR HEATING, COOLING AND HOT WATER IN BUILDINGS FALLS BY 1 PER CENT PER ANNUM, AND THE ASSOCIATED PER CAPITA CO_2 EMISSIONS BY 2 PER CENT PER ANNUM.

Around half of Vienna's final energy consumption is required for heating, cooling and hot water in residential and commercial buildings. The fossil fuels burnt in these buildings' boilers are responsible for about a third of Vienna's non-ETS sector emissions.

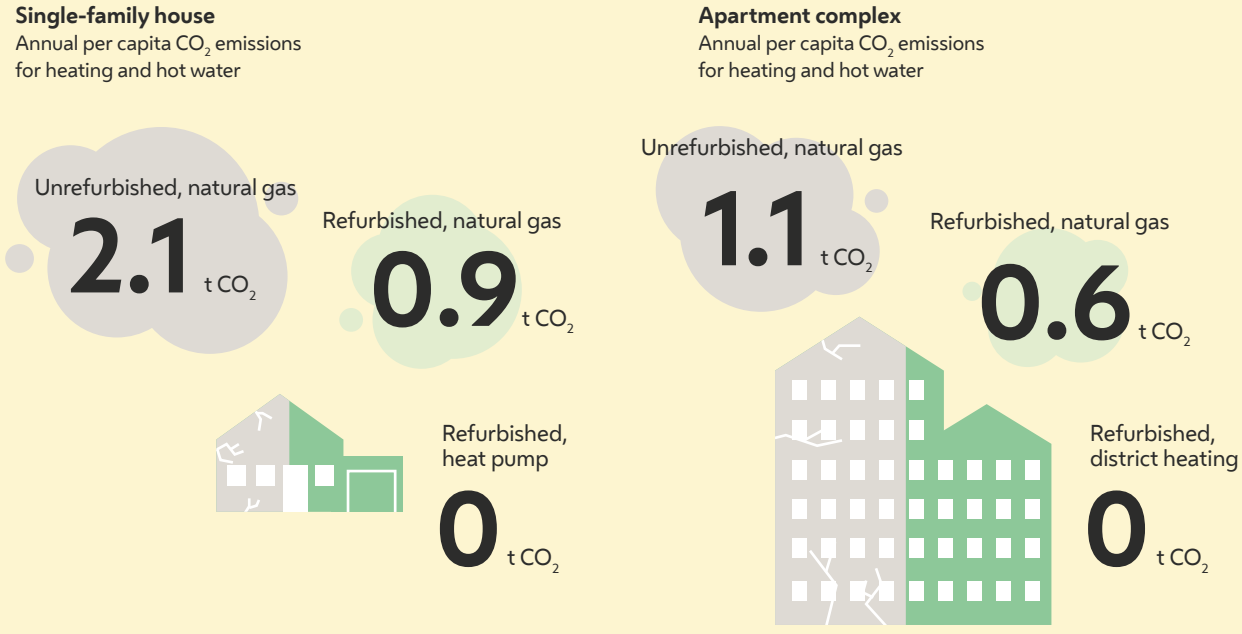
Through reinsulation of existing buildings and high energy efficiency standards in new ones – the cost-optimised near-zero-energy standard applies from 2021 – per capita final energy consumption in buildings is being continuously reduced. However, the targeted annual reduction in carbon emissions[12] is only attainable if final energy consumption is lowered accordingly and the positive progress made in transitioning from fossil fuels to district heating and renewables continues. This requires adequate funding to subsidise refurbishment programmes, coupled with ongoing development of spatially targeted regulatory instruments to support the expansion and utilisation of district heating, waste heat and renewables. The 2018 amendment to the Vienna Building Code created the legal framework for these "Spatial Energy Planning Zones". Additional legislation is also required on the part of the federal government, however, for instance housing and tax law provisions to support refurbishment activities in commonhold properties and/or in the private rented sector as well as incentivising the transition to district heating and renewables.

The City of Vienna will continue to lead by example in its own buildings, prioritising the use of district heating and renewables for heating, hot water and air-conditioning.

Furthermore, in order to keep housing in Vienna as affordable as possible and guard against energy poverty, the municipal administration will step up its provision of gender-sensitive and diversity-sensitive advisory services to help residents optimise their energy requirements for heating and cooling.

[12] The target refers exclusively to non-ETS sector carbon emissions.

Figure 12: Effects of building refurbishment on greenhouse gas emissions (in the non-ETS sector)



Own diagram by Urban Innovation Vienna (2019).

Scenarios based on the following assumptions:

Emission factors for the direct CO_2 emissions: natural gas 199 g/kWh, heat pump and district heating 0 g/kWh (any emissions from electricity and district heating generation come under the energy sector and are thus covered by the Emissions Trading System)

Hot water: 1,400 kWh per capita and year

Single-family house: Ø net floor space* = 111 m^2, Ø 2.4 occupants*, HWB=200 kWh/m^2 per annum, 65% reduction through refurbishment

Flat in apartment complex: Ø net floor space*= 69 m^2, Ø 2.0 occupants*, HWB=120 kWh/m^2 per annum, 65% reduction through refurbishment

*Data for Vienna taken from Statistics Austria (2013): Primary residence dwellings 2011 by net floor space, type of (residential) building and federal province

Reducing the greenhouse gas emissions of existing buildings is a two-step process: high-quality reinsulation can reduce energy consumption for heating by around two-thirds, while also enhancing home comfort.

An additional switch to an alternative fuel source can bring about a further significant reduction in emissions. Converting to renewables-based systems such as heat pumps and solar thermal collectors or district heating, for instance, cuts direct emissions to zero – the energy supply to the building then consists exclusively of electricity or district heating from outside, with no further CO_2 emissions produced on site. The generation of electricity and district heating still produces emissions at present, though these are offset under the Emissions Trading System. However, even these will be phased out in the medium to long-term as a result of the step-by-step transition to renewables.

OBJECTIVE: FROM 2025 ONWARDS, THE HEATING ENERGY REQUIREMENTS OF NEW BUILDINGS ARE COVERED BY RENEWABLES OR DISTRICT HEATING AS STANDARD.

Compared to existing older buildings, it is comparatively easy and cost effective to heat new buildings constructed to near-zero-energy standard without fossil fuel heating systems. Large parts of the city have the technically and economically sensible option of connection to the district heating network, and a range of other renewables-based systems are also available. "Smart" new builds and their technical installations can be digitally controlled, making them particularly suitable as flexible, cost-effective storage facilities for volatile renewables.

Here too, the 2018 amendment to the Vienna Building Code leads the way: with only few justified exceptions, it stipulates that where connection to the district heating network is impossible or unfeasible, the heating requirements of new builds must be covered by renewables. The subsidy scheme which has meanwhile been established for "fossil-free" new builds of this kind outside the district heating grid is intended to build expertise in this field among all relevant stakeholders, produce new, innovative solutions and showcase the future of energy supply to buildings. By 2025, this approach – currently restricted to the subsidised housing sector – is to be extended step by step to privately financed new housing and all other building categories, taking due consideration of existing local infrastructure, energy density and potentials.

OBJECTIVE: BUILDINGS ARE USED FOR GREENING AND FOR THE GENERATION OF SOLAR ENERGY.

The external surfaces of buildings, especially roofs, are an important resource that should be utilised. Roof terraces are valuable "local recreation areas". Planted roofs and facades mitigate temperature increases in heatwaves caused by climate change and contribute to biodiversity. And, finally, the target of doubling renewable energy generation in Vienna can only be attained if roofs and facades are used for large-scale installation of solar panels.

To this end, a systematic survey will be undertaken to identify suitable surfaces in existing buildings and new-build projects, concepts and technologies to optimise use of these potentials will be further developed, and suitable measures will be implemented to expedite greening initiatives and solar energy installations.

OBJECTIVE: FROM 2030 ONWARDS, SITE- AND USE-SPECIFIC PLANNING AND CONSTRUCTION PROCESSES TO MAXIMISE CONSERVATION OF RESOURCES ARE STANDARD PRACTICE IN NEW BUILDS AND REFURBISHMENT PROJECTS.

Alongside fossil fuels, a major share of the resources consumed in Vienna are raw materials used for the construction and maintenance of buildings. Throughout the entire planning process, starting with the architects' plans, the focus is placed on optimising the material footprint of the building.

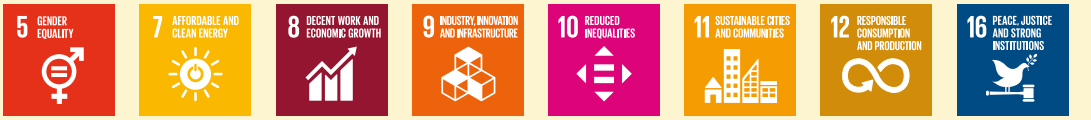
This includes utilising any climatic advantages of the site as well as natural daylight and ventilation, opting for raw materials from renewable sources that are recyclable and low in pollutants, and planning to maximise the useful life of the building. Relevant specifications also form an integral part of public tenders, competition briefs and urban design contracts.

New buildings are planned using an integrated approach that encompasses the entire design and planning process and ensures the simultaneous involvement of all specialist disciplines and stakeholders. Digital building information modelling (BIM) tools are increasingly used for this purpose.

OBJECTIVE: IN 2050, 80 PER CENT OF BUILDING COMPONENTS AND MATERIALS FROM DEMOLITIONS AND MAJOR REFURBISHMENT PROJECTS ARE REUSED OR RECYCLED.

The construction industry plays an important role in the circular economy as it accounts for 71 per cent of the total weight of waste in Austria. An average 100 m^2 flat contains around 7,500 kg of metals.

New buildings are thus planned and built so as to allow optimum reuse of their various parts and recycling of the component materials at the end of their useful life. The material composition of the buildings is documented in detail in a "materials passport". The potential yield of secondary raw materials in existing buildings is to be assessed and evaluated as far as possible. In addition, suitable technologies and processes will be developed for dismantling, extraction and recycling of these raw materials.



Digitalisation

Vienna 2050

Smart City Wien is Europe's digitalisation capital, albeit with a typical Viennese people-centred focus.

Working with expert partners from research and industry, the city has learned how to seamlessly integrate innovative solutions into the everyday life of the city in order to enhance and facilitate community life. Vienna has taken a clear stance regarding use of technologies and processing of data, ensuring that people retain sovereignty over their personal data and can actively control and manage how they are used. Vienna's approach to digitalisation is characterised by openness to new technologies and their useful, resource-efficient application. Vienna utilises digitalisation in a targeted manner to drive innovation for the city's future and as an effective tool for attainment of its climate goals.

Digital Vienna sets international trends by combining its historical achievements – from far-sighted planning of infrastructure to comprehensive service provision for the local population – with innovative solutions and applications. Vienna sees digitalisation as a challenge facing society as a whole, and one that requires urgent policy intervention: in a highly efficient and increasingly interconnected city, the municipal administration and its associated enterprises place the focus on people and their specific needs while opening up new digital platforms for active engagement and participation across all social groups.

Vienna's policy of responsible, inclusive digitalisation has evolved into a further USP for the city.

Our Agenda

Digitalisation and automation are the twin forces driving the current transformation of city and society. They permeate economic life, working life and community life and are transforming the contemporary urban infrastructure. The City of Vienna faces up to the challenge of actively managing digitalisation in all these spheres of life, providing up-to-date infrastructure, supporting stakeholders and keeping the municipal administration and its associated enterprises fit for the future.

In doing so, it focuses on the rights and needs of everyone living in Vienna: Vienna does not view its digitalisation efforts as an end in themselves, but leverages the new technological possibilities to create equality of opportunity and an inclusive urban society. It provides low-threshold access to digital information, public services and barrier-free participation and engagement for all social groups and supports social innovation processes. The basis for this is digital education and targeted training to equip everyone with the necessary digital skills, accompanied by special efforts to close the "digital divide" with regard to sex, age, ethnicity and people with special needs. The City of Vienna takes measures to raise awareness of all the various aspects of digitalisation among the Viennese population and actively educate people in the context of their respective life situation. For this purpose, all the city's information and participation channels will be utilised to establish a dialogue on digitalisation and how Vienna is tackling the digital transformation process. At the same time, in the interests of equal opportunities and resilience the municipal administration will continue to provide services and information via non-digital channels.

Small and medium-sized enterprises form the backbone of the Viennese economy. The City of Vienna therefore uses business subsidies with a strong focus on digitalisation to help companies from all sectors to flourish. Digital portals and digital administrative processes will help minimise the administrative burden on businesses. The City of Vienna actively promotes women in IT and the digital industries to ensure gender equality in the digitalisation process. Young women should be encouraged and inspired to enter tech careers.

Last but not least, the digital revolution is changing people's expectations of urban services. These need to be fast, easy to understand, available everywhere and at any time, and tailored to people's individual life situations. Digitalisation drives the upgrading of the existing range of e-government services into a comprehensive high-quality municipal service package, paying special attention to safety, security & privacy. This increases efficiency and effectiveness and enhances workplace quality for staff of the City of Vienna. It also frees up time for direct face-to-face contact and for creative tasks.

Safety, security & privacy are the three key components of digital safety: safety means protecting against digital system failure caused by software faults and is growing in importance in view of the increasing degree of automation in our society. Security, on the other hand, means protecting against cyber-attacks, i.e. deliberate attempts to compromise the confidentiality, integrity and availability of systems and data. Privacy, finally, is synonymous with data protection and usually refers to responsible handling of people's personal data to protect against unauthorised access and misuse.

OBJECTIVE: AS PART OF A JOINT DIGITALISATION STRATEGY, THE CITY OF VIENNA AND ITS MUNICIPAL ENTERPRISES USE DIGITAL DATA, TOOLS AND ARTIFICIAL INTELLIGENCE IN APPLICATIONS THAT HELP CONSERVE RESOURCES AND MAINTAIN THE CITY'S HIGH QUALITY OF LIFE.

Vienna's municipal administration and its associated enterprises actively leverage the opportunities brought by digitalisation to help achieve the Smart City goals. Appropriate tools and applications – from traffic control sensors to smart energy grids – are to be developed and used specifically for this purpose. The basis for this is a joint digitalisation strategy for all municipal bodies and institutions which provides the framework for joint projects to develop and implement integrated solutions. Uniform specifications define how aspects such as data collection, exchange, sovereignty, safety, security and privacy are to be organised and managed. All strategic decision-makers responsible for digitalisation within the municipal administration pursue the common goal of making Vienna Europe's digitalisation capital in all thematic fields covered by Smart City Wien.

OBJECTIVE: BY 2025, ALL PROCESSES AND SERVICES OF THE MUNICIPAL ADMINISTRATION AND ITS ASSOCIATED ENTERPRISES ARE DIGITALISED AND FULLY AUTOMATED WHEREVER POSSIBLE.

By 2025 Vienna will utilise all the potentials of digital administration, with the emphasis on efficient, digital processes and ease of use. Following a detailed analysis of current and future requirements, municipal procedures and services will be fully automated where possible across agencies using digital solutions. This will make a significant contribution to achieving a city of short distances and save the Viennese people time and money.

OBJECTIVE: VIENNA HAS A MODERN, NEEDS-BASED DIGITAL INFRASTRUCTURE DESIGNED FOR ENERGY- AND RESOURCE-EFFICIENT OPERATION.

In terms of "digital services of general public interest", the City of Vienna ensures that the digital infrastructure for members of the public, businesses and academic and scientific institutions is quickly raised to a standard that meets the current requirements of a modern municipal administration, a competitive location for business, science and research and a digital living environment. Alongside computer centres and data transmission networks, this digital infrastructure also includes "digital twin" technology, i.e. digital replicas of physical infrastructure such as power grids and transport networks.

The installation and expansion of this infrastructure is to be effected in cooperation with all stakeholders and enterprises, including in the form of public-private partnerships (PPP) in accordance with pre-defined rules. The needs-based installation and expansion of high-grade digital infrastructure is given due consideration in all relevant urban and economic development processes. By 2030, 75 per cent of the energy requirement for digitalisation

and the provision of digital services will be covered by renewables, rising to 100 per cent by 2050. This also includes the energy supply for computer centres, workplace PCs, etc. Potential health factors (e.g. exposure to radiation) are also to be taken into account when planning IT infrastructure.

OBJECTIVE: THE CITY OF VIENNA USES DIGITAL DATA (MINED USING STATE-OF-THE-ART TECHNOLOGIES AND ANALYTICAL METHODS) TO SUPPORT DECISION-MAKING AND FOR REAL-TIME MANAGEMENT OF URBAN SYSTEMS.

The City of Vienna uses data analysis to support decision-making, for real-time modelling and simulation, for forecasting purposes and to manage urban (development) systems and processes, the aim being to promote careful use of resources and improve quality of life for all. For example, population and climate data for individual districts can be amalgamated and used to develop targeted measures to mitigate urban heat islands.

Artificial intelligence refers to the attempt to reproduce certain decision-making capabilities of the human brain. It involves programming digital systems to deal with problems in a relatively independent fashion (or at least simulate intelligent behaviour with the help of algorithms). Artificial intelligence utilises various techniques including simulation of neuronal networks, which are roughly inspired by the structure of the human brain. It is the prerequisite for numerous applications, for instance language recognition or driverless vehicles.

Data are captured in many different ways, e.g. via sensors (Internet of Things), and analysed using state-of-the-art data analytics and artificial intelligence in self-learning systems (such as neuronal networks based on deep learning and machine learning). Data processing tools will be created for this purpose and evaluated at regular intervals. In generating, analysing and utilising these data, the City of Vienna retains its independence and legal capacity. At the same time, Viennese citizens retain full sovereignty over the data captured by public bodies and institutions. With due regard for the data protection legislation, the City of Vienna determines which data it will process and crosslink itself and in which application scenarios and on what terms it will cooperate with third parties.

OBJECTIVE: THE CITY OF VIENNA USES DIGITAL TOOLS TO CREATE TRANSPARENCY, ENABLE PARTICIPATION AND POSITION ITSELF AS A PIONEER IN THE FIELD OF OPEN GOVERNMENT.

The City Council, the municipal administration and its associated enterprises engage with the public and the business community in order to achieve greater transparency, increase participation, intensify cooperation, boost innovation and strengthen community input. Digital options for public participation – from participatory strategy development to involvement in the design of specific projects at neighbourhood level – will become an inherent part of development processes. Gender and diversity considerations are an integral part of these participatory projects in a deliberate attempt to avoid transposing stereotypes into the digital world.

OBJECTIVE: THE CITY OF VIENNA ACTIVELY MAKES AVAILABLE THE DATA IT GENERATES AS OPEN GOVERNMENT DATA, ESPECIALLY FOR SCIENTIFIC, ACADEMIC AND EDUCATIONAL USE.

The City of Vienna sees reliable information and data as being of pivotal value – for the city's population, for businesses and for academic research. With its pro-active data policy, Vienna will continue to create transparency, facilitate the development of a wide range of services for the benefit of local people, and at the same time make a decisive contribution to maximising the efficiency of the municipal administration. To this end, the administration will make relevant, anonymised, clearly presented data available to the public in machine-readable open formats for unrestricted further use. Data specifically for scientific, academic and educational use will be made available in line with guidelines specially elaborated for this purpose.

Open government data requires the trust of local citizens. As digitalisation advances, the digital footprint we all leave behind as we go about our daily lives grows bigger and bigger. The great diversity of data generated is among the most valuable resources of the knowledge society. Within the city's own sphere of action these data are used democratically, openly, transparently, and in accordance with clear rules. Protection of personal data and comprehensive information about how these data are used and processed provide a cast-iron basis for all digital transformation processes.

OBJECTIVE: THE CITY OF VIENNA ACTIVELY SEEKS COLLABORATION WITH THIRD PARTIES IN ORDER TO PILOT DIGITAL APPLICATIONS, TECHNOLOGIES AND INFRASTRUCTURE IN PRACTICE-BASED "URBAN DIGITAL LABS" AND PREPARE THEM FOR ROLL-OUT ACROSS THE ENTIRE CITY.

The City of Vienna supports and promotes digital entrepreneurship and digital business models, especially in the field of Smart City applications. To this end, Vienna uses its own sphere of influence to create a field for experimentation that attracts innovative companies and research institutions and allows them to flourish; one that supports the evolution of economic life in general and Vienna's start-up ecosystem in particular. Practice-based "urban digital labs" allow innovative solutions to be developed swiftly and with a minimum of bureaucratic obstacles (albeit in compliance with all consumer, data and environmental protection legislation) before being rolled out to the real-world infrastructure.

Economy and employment

Vienna 2050

The economy of Smart City Wien is based on "creating value(s)" in the truest sense of the phrase – with the input of and in the interests of the local people. This is just one of the reasons why Vienna in 2050 is one of the most economically successful cities in the European Union. The level of prosperity is high and enables a high level of material security, a high standard of living, good working conditions and equitable opportunities for personal development for everyone living in Vienna.

To this end, Smart City Wien places special emphasis on creating a thriving yet sustainable economy that secures the basis for a good life, both now and for future generations. How? Economic prosperity has long since ceased to be linked to increased consumption of energy and resources and a growing burden on the environment; instead, it is now aligned with social and ecological principles.

This consistent alignment with the principles of the circular economy means that consumption of natural resources, materials and energy has drastically declined, both in production and in services. Smart, energy-efficient production processes, durable products, regional value chains, the renaissance of the repair economy and proper reuse and recycling of materials and waste create added value without placing an additional burden on the environment. The "use, not own" approach that underlies the sharing economy has significantly lengthened the useful life of infrastructure, buildings and products of all kinds, yet still allows for their technical evolution.

Adequate provision of services and amenities in the local neighbourhood creates the necessary basis for the "city of short distances", in which products and services can be conveniently accessed without long vehicle journeys. Many services of general public interest are still provided by municipal enterprises for the common good; affordable and of high quality, they allow a good life for all regardless of individual income. Effective support is also provided for the nursing and care services.

In 2050, Vienna's economy is thus as sustainable as it is resilient and competitive. What is more, Smart City Wien has successfully established itself as a leading centre of the circular economy and smart added value whose expertise is sought after worldwide.

Our Agenda

A diverse economic structure, a well-trained workforce, a pronounced capacity for innovation, social calm and the maintenance and expansion of modern, fit-for-purpose infrastructure are prerequisites and conducive factors for a competitive and resilient metropolis.

In Vienna, knowledge-based and technology-led services account for by far the largest share of regional added value. At the same time, the city boasts a highly productive industrial base. Conducive conditions and a supply of attractive sites and premises are to ensure the continued presence of a broad sector of service providers and producers of material goods that also have the capacity to innovate. Manufacturers with environmentally sustainable circular production processes, in particular, should be encouraged to remain or set up operations within the city boundaries.

Unusually for a major city, Vienna also has a thriving agricultural sector within the municipal boundaries which makes a substantial contribution to the city's sustainable food supply system. This agricultural production is also to be safeguarded for the future and geared towards maximum resource efficiency and environmental sustainability.

An essential factor in the city's quality of life and economic attractiveness is the excellent provision of public infrastructure and services, which are affordable, of high quality, and available to all Viennese citizens and companies. Digitalisation will help make these services still more easily and widely accessible. Vienna is committed to actively shaping future developments by pursuing an active policy of investment to ensure the continued capacity for innovation of its municipal services of general public interest. With the aid of gender budgeting, Smart City Wien pursues a policy of fair, gender-aware distribution of benefits and access to municipal services.

Vienna's evolution into an environmentally and socially sustainable location for smart businesses will entail profound structural changes. The central guiding principle here is the transformation from the linear economic model we have at present to a circular economy.

A prerequisite for this structural change is that all stakeholders play their part: public and private companies, whose capacity for innovation is required to develop new resource-efficient, circular processes, products and business models; the municipal policy-makers and administration, who can ensure transparent rules to create a reliable framework for business as well as providing incentives through subsidy schemes, collaborative partnerships and as a consumer; and, last but not least, the Viennese public, whose forward-looking consumer behaviour ultimately makes the transformation possible.

OBJECTIVE: THE PRODUCTIVITY OF VIENNA'S URBAN ECONOMY CONSTANTLY INCREASES, UNDERPINNING THE CITY'S PROSPERITY, RESOURCE EFFICIENCY AND COMPETITIVENESS.

The labour productivity of the Viennese economy and the gross regional product per employee are currently about a third above the EU average. High labour productivity results in high wages and hence material prosperity, which also benefits the Viennese people in the form of funding for urban programmes, facilities and infrastructure. Employees and companies thus give Vienna the capacity to compete internationally as a location for business, and further increases in labour productivity will ensure that this continues to be the case in future.

OBJECTIVE: THE INCOMES AND JOB SATISFACTION OF VIENNESE CITIZENS CONSTANTLY INCREASE, WHILE SOCIAL INEQUALITY DECLINES.

The opportunity for productive participation in the labour market is a decisive factor in terms of high quality of life. The growing city must provide enough jobs for all, and ones that meet the "decent work" criteria: an open-ended contract with a living wage, a work pattern that suits the employee (e.g. full-time/part-time, needs-based parental leave models, etc.) and in line with the collective agreement rules for the respective sector. Subjective job satisfaction is increasing. As a location for smart businesses, Vienna itself becomes a driver of jobs the more the public and private sectors invest in eco-friendly technologies and services and the circular economy.

In Smart City Wien, the inequality between rich and poor is diminished: Vienna guarantees low-threshold, non-discriminatory access to the labour market for all, and especially for disadvantaged individuals. People with disabilities are integrated into the primary labour market. Women and men have equal career opportunities, contribute equally to generating prosperity and receive equal pay for equal work. Schemes and projects target people who are unable to work for various reasons – be it childcare duties, education and training or illness – and support their (re)integration into the labour market. The number of people obtaining educational and vocational qualifications beyond compulsory schooling is growing, and professional skills acquired elsewhere can easily be expanded and deployed appropriately in the labour market.

OBJECTIVE: THE MATERIAL EFFICIENCY OF THE VIENNESE ECONOMY INCREASES BY 30 PER CENT BY 2030.

In future, products and services must be manufactured and delivered in such a way that the resources used and their associated carbon emissions are drastically reduced, or, conversely, that their material efficiency is substantially improved. In the medium term, resource consumption must be fully decoupled from economic output, so that even when quantities produced or economic output increase, the associated overall resource consumption declines.

To this end, local stakeholders learn how to make a step-by-step transition to resource-efficient production and operation using secondary raw materials; at the same time, processes as well as products are designed in such a way that they not only allow economic production, but drive added value. This calls for a wide-ranging package of measures, from legal frameworks and incentives to new structures and collaborative models, to be jointly developed and implemented by the business and research communities and the municipal administration. The construction industry is a key sector in this context, as its consumption of resources is especially high.

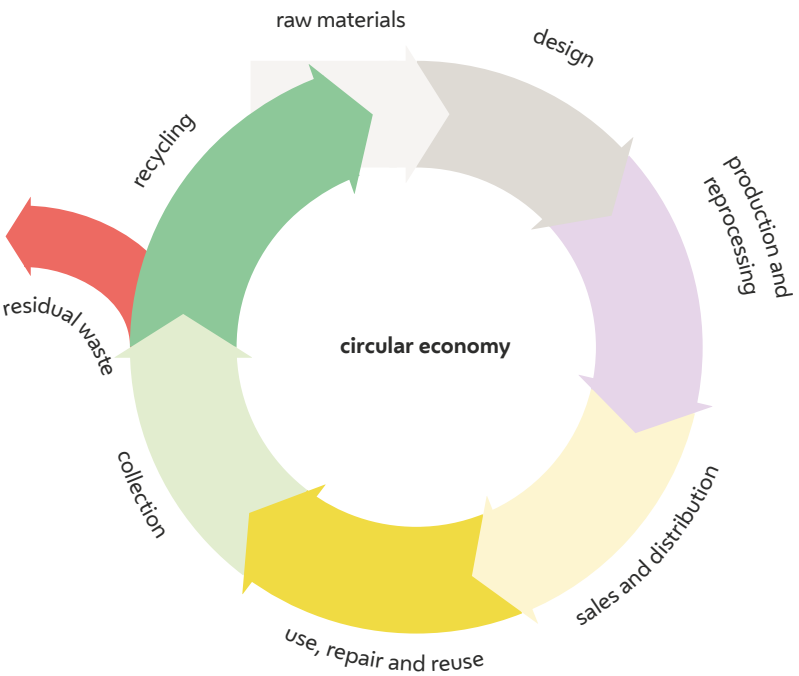
The **material efficiency** of the Viennese economy is defined as the gross regional product divided by regional material consumption.

OBJECTIVE: PRODUCTS MANUFACTURED IN VIENNA ARE DURABLE AND RECYCLABLE AND THEIR PRODUCTION PROCESSES ARE LARGELY WASTE AND POLLUTANT FREE.

Research projects, advisory and training services and funding programmes support businesses in the development of circular products, waste-free production processes and the use of secondary raw materials, the latter to be coordinated with the waste management sector. Enterprises, agencies and associated organisations of the City of Vienna play a pioneering role here.

The development of circular products and production chains is also driven by public demand for them, stimulated by awareness-raising and public information campaigns as well as through regulatory measures and consumer incentives. Another major means of leverage to foster demand for circular products and services is public procurement. Sustainable procurement criteria (the "ÖkoKauf" programme) are expanded further in line with circular economic principles and mandatorily applied throughout the municipal administration and its associated agencies and enterprises.

Figure 13: The principle behind the circular economy



Circular products have a long useful life and can be repaired and upgraded; at the end of their useful life they can be dismantled and largely reused or recycled. Remaining parts that cannot be reused or recycled are generally biodegradable. Circular products are manufactured in energy- and resource-efficient processes using secondary raw materials and reusable parts of other products. Biogenic products and raw materials are embedded as seamlessly as possible into natural cycles.

OBJECTIVE: IN 2030, VIENNA HAS A GLOBAL REPUTATION AS THE HUB OF A RESOURCE-EFFICIENT CIRCULAR ECONOMY AND ATTRACTS INVESTMENT AND TALENT IN THIS SECTOR.

In future, innovative business models, resource-efficient production and smart urban technologies, coupled with social innovation processes, are a key strength for which Vienna and the Viennese economy are known worldwide. Vienna thus becomes an attractive target for investment, innovative companies, start-ups and high-calibre professionals from the Smart City sector, as well as for the development of social and eco-friendly business models.

This international profile opens up new market opportunities for the many Viennese companies that are active in these sectors. With a structured subsidy policy and numerous strategic partnerships throughout the metropolitan region, the city also helps these companies to position themselves in the regional market and use Vienna as a springboard into global markets.

Water and waste management

Vienna 2050

Waste prevention and the circular economy are accorded high priority in Smart City Wien. Products and buildings are designed and fabricated so as to be durable and repairable; at the end of their useful life they can be easily dismantled and their component parts and materials reused or recycled. Production processes are largely waste free.

Non-avoidable waste is separated, and – using new technologies – cheaply processed into high-quality, highly sought-after secondary raw materials. These now cover the lion's share of raw materials requirements. Old landfill sites, buildings, cables and underground pipes are the new urban "mines", which are systematically inventorised and exploited. Old products and equipment, components and parts of buildings are also reused wherever possible. Only a small proportion of residual waste remains, the material composition of which is such that it can be used for waste-to-heat energy recovery for the district heating network without adding extra fuel.

The high quality of the drinking water supply and the waste water and sewage system is guaranteed. Thanks to state-of-the-art technologies, the sewage treatment plant is energy self-sufficient and produces energy that is fed into the electricity and district heating grids.

Smart City Wien is well prepared for the greater frequency of torrential rain. Smart rainwater management prevents flooding and ensures that the water can trickle away or evaporate where it falls, hence improving the urban microclimate.

Our Agenda

Ensuring the city has a secure supply of high-quality drinking water and reliable, environmentally sound disposal of all waste, waste water and sewage are key urban services and major factors in Vienna's high quality of life. Collection and disposal of household waste is done by the City of Vienna, which is also responsible for the drinking water supply and waste water management. Commercial waste is also handled by private waste management firms.

Compared to other countries, the quality of Vienna's water and waste management services and the associated infrastructure is very high and should remain so. The capacity for this is either already in place or being upgraded with a view to future needs. With its spring water mains from protected mountain springs in the Rax, Schneeberg and Hochschwab ranges, the reserve capacity from the Lobau und Moosbrunn pumping stations and its extensive drinking water supply network, Vienna has sufficient water supply capacity for the long term, even with ongoing population growth and the growing incidence of heatwaves due to climate change. Vienna's very extensive modern sewer network and the main sewage treatment plant in Simmering ensure the eco-friendly disposal of municipal waste water and sewage.

Waste management plays a key role in the transformation to a circular economy.

OBJECTIVE: LESS WASTE IS PRODUCED THANKS TO A WIDE RANGE OF WASTE PREVENTION MEASURES.

Effective waste prevention measures should continue to be implemented and promoted and new ones developed. Priority is to be given to reuse of products and materials, upcycling, consistent promotion of reusable packaging, avoidance of food waste, avoidance of waste in the planning of events and optimised use of materials in the construction industry.

Procurement criteria, information and training measures and conducive legal and organisational frameworks are the key means of leverage to promote waste avoidance and are employed across all areas.

Alignment with the principles of the circular economy means that Viennese manufacturing companies increasingly employ low-waste production processes and make durable, reusable and recyclable products.

The people of Vienna increasingly prioritise waste avoidance in their consumer decisions. This ranges from choosing reusable instead of disposable packaging to opting for shared-use schemes in many spheres of life.

OBJECTIVE: VIENNA'S WASTE COLLECTION SYSTEMS ENABLE AN INCREASINGLY LARGE PROPORTION OF WASTE TO BE RECYCLED OR REUSED AS SECONDARY RAW MATERIALS.

In order to maximise waste recovery as part of the transition to a circular economy, the entire waste management process chain for both commercial and household waste – from production of waste through to processing of recyclates for use as secondary raw materials – is to be given a more customer-oriented focus. This not only applies to waste produced on an ongoing basis, but in future also to potential existing sources of secondary raw materials such as buildings or landfill sites. These are to be systematically inventorised and reclaimed through "urban mining". Wherever possible, the production of secondary raw materials from Vienna's waste will be carried out in the region.

Recycling rates and facilities for separation of recyclates continue to be improved, with the aim of recovering as high a proportion of waste as possible, of as high a quality as possible, for secondary use.

OBJECTIVE: HIGH STANDARDS OF WASTE MANAGEMENT ENSURE RELIABLE, SAFE DISPOSAL OF WASTE TO MINIMISE THE BURDEN ON THE ENVIRONMENT.

In order to ensure continued safety, reliability and self-sufficiency in waste disposal, all steps in the municipal waste management process from collection through to landfill will be carried out by the City of Vienna. The Vienna Waste Management Plan and the Vienna Waste Prevention Programme are elaborated in a participatory process involving environmental organisations, external experts and the Viennese public alongside all the relevant municipal waste management agencies and facilities.

Self-sufficiency in waste disposal: Municipal waste produced in Vienna is chiefly handled in Vienna. To ensure safe, reliable disposal of municipal waste for which no handling facilities are available in the city (e.g. for recycling of refrigerators), long-term contracts are concluded with plant operators outside the municipal boundaries. The latter are required to use the best available technology and adhere to the most stringent environmental standards.

Ongoing maintenance and modernisation measures guarantee the highest environmental standards at the municipal waste incineration plants and landfills. If materials cannot be reused or recycled, the residual waste is used to generate energy in the form of district heating or electricity. Residual waste that cannot be fed back into the economic cycle is landfilled in an environmentally sound manner so that it does not pose a risk or hazard to future generations.

Vienna advocates a European framework that allows existing waste-to-energy plants to be operated in a way that makes macroeconomic sense.


ABUS

OBJECTIVE: VIENNA'S WATER SUPPLY AND WASTE WATER MANAGEMENT INFRASTRUCTURE IS MAINTAINED AND OPERATED TO A HIGH STANDARD AND IN A RESOURCE-EFFICIENT MANNER.

Vienna's high quality standards in water supply and waste water management are guaranteed for the long term through consistent maintenance, refurbishment and needs-based expansion of infrastructure such as the sewer system and drinking water supply network, coupled with optimum operational management. The necessary financial and personnel resources are made available for this purpose. The springs and protected zones in the Alpine region and the Lobau wetlands continue to be safeguarded.

Vienna continuously expands its own energy supply from renewables. Waste and residual materials are recycled and reused to the maximum possible extent. Air, water and soil pollutants from the treatment plants are continuously reduced where possible.

OBJECTIVE: IN VIENNA, AS MUCH RAINWATER AS POSSIBLE IS FED BACK INTO THE LOCAL NATURAL OR NEAR-NATURAL WATER CYCLE.

Rainwater management measures are intensified to ensure that as much precipitation as possible is channelled from sealed surfaces into a near-natural water cycle. In the planning and installation of infrastructure, preference is given to solutions for near-natural runoff of rainwater rather than conventional discharge into the sewer system. In addition, research is undertaken into new technical options for rainwater management, the legal framework is developed accordingly and practicable solutions are piloted in practice. Through careful use of land as a natural resource within the city boundaries and prioritising renaturalisation of sealed surfaces, extensive natural drainage of rainwater is to be restored wherever the soil quality allows.

Figure 14: Sustainable rainwater management

Rainwater management ensures that runoff from sealed or built-up surfaces is channelled into a near-natural cycle. It is not discharged into the sewer system, but, where possible, trickles away or evaporates where it falls. Technical installations such as green roofs or under-road structures mimic the storage function of the soil, reducing the burden on the sewer system, the sewage treatment plant and natural bodies of surface water and lowering the risk of flooding after torrential rain. Rainwater irrigates the city's soil and vegetation and replenishes its groundwater. Evaporated rainwater captures dust particles, humidifies and cools the air and thus counteracts the overheating of the city.

Key benefits of a sustainable urban water cycle:
- rainwater irrigates soil and vegetation and replenishes groundwater;
- water evaporates, humidifying and cooling the air and capturing dust particles;
- this relieves the burden on sewers, sewage treatment plants and natural bodies of surface water.

Environment

Vienna 2050

In response to strong population growth, large amounts of new housing, workplaces and industrial and commercial premises have been built in Smart City Wien over the past decades. Throughout this process, emphasis has been placed on careful use of land as a natural resource: new buildings have been designed with more compact layouts, and substandard buildings have often been replaced by denser developments.

As a result, the city still has ample room for green and open spaces, including extensive recreation areas like the Vienna Woods, Norbert-Scheed-Wald and the Lobau wetlands as well as numerous small parks and gardens. The outer shells of buildings are used for a wide range of different planting methods, as are unsealed surfaces in the public space. Green spaces are within walking distance in all neighbourhoods, allowing individual social interaction and leisure activities. The municipal administration and the public work together to maintain the high quality of the city's green spaces, which are an important habitat for flora and fauna and promote and conserve biodiversity. Green spaces, fresh air corridors and pools of cool air additionally help to mitigate the overheating in densely built-up areas caused by the climate crisis.

A large number of journeys are made on foot or by bike. Public transport and motor vehicles are fully electrified and cause much less noise and zero local emissions. The same applies to the energy supply. Clean air and waterways, a large number of newly planted trees in the streets, intact countryside and functioning ecosystems ensure that people can live a good life in Smart City Wien.

The agricultural enterprises in Vienna and its surrounding region now all produce high-quality organic produce that covers a large share of the urban population's food requirements. New processing and ordering systems ensure that goods are produced in line with demand. Vertical gardens, community and neighbourhood gardens tap new opportunities for home vegetable growing and have further increased awareness of healthy eating. The volume of waste has thus been drastically reduced.

The high degree of environmental awareness guides the actions of the local public, policy-makers, businesses and the municipal administration.

Our Agenda

Minimal environmental pollution and intact ecosystems are essential for healthy living conditions and a high quality of life in the city. Prevention and reduction of air, water and soil pollution and of heat and noise are thus central pillars of Smart City Wien, alongside the preservation and expansion of green spaces and countryside, soil functions and biodiversity and a healthy, sustainable diet and food production. Another key contributor to the healthy living conditions in Vienna are the environmentally aware mobility habits and consumer behaviour of the Viennese people.

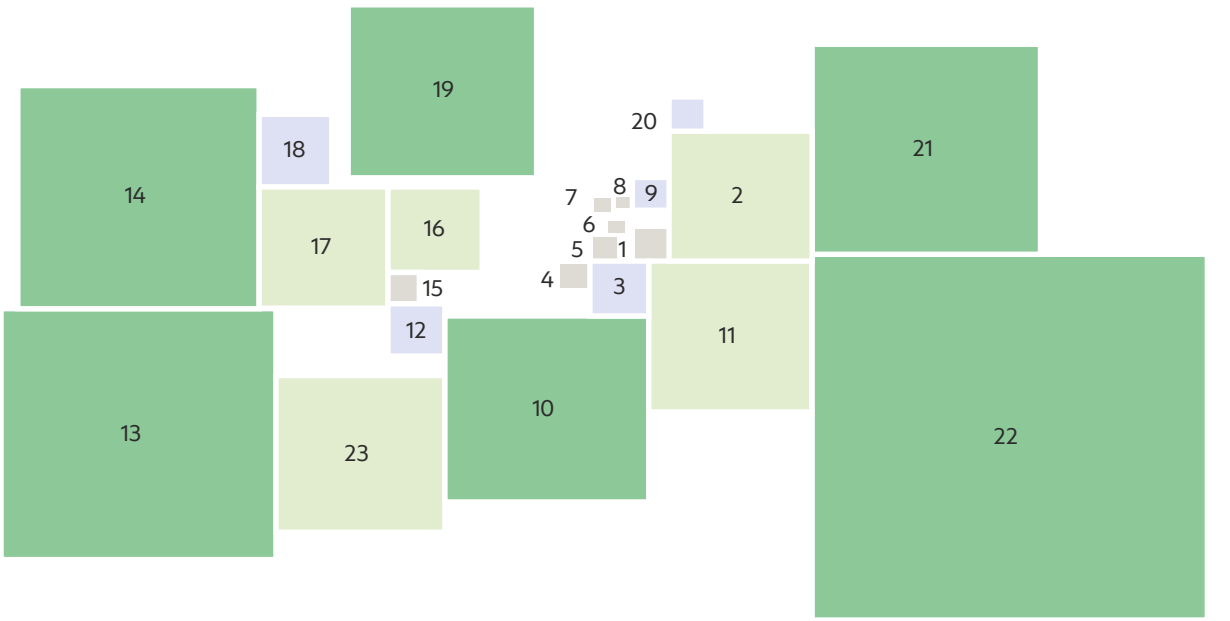
Very hot days are days where maximum temperatures are in excess of 30°C. Very warm nights are those where temperatures do not fall below 20°C.

Even today, climate change is already giving rise to an increasing number of very hot days and very warm nights, which impair people's health and quality of life and have a high cost to the economy. Far-sighted planning and timely prevention and protective measures are required to minimise the impact, which in turn calls for close collaboration, especially with the federal government and the EU.

OBJECTIVE: THE SHARE OF GREEN SPACE IN VIENNA IS MAINTAINED AT OVER 50 PER CENT UNTIL 2050.

Green space acts as a "green lung" and is thus an essential factor in Vienna's high quality of life. The city depends on the functioning of the ecosystems that surround and permeate it. Even in a growing city, then, there must be adequate provision of green and open spaces of sufficient quantity and quality within the urban fabric – quick and easy to reach by eco-friendly modes of transport, barrier free and, where possible, with free public access. Safeguarding of the share of green space firstly consists in preserving the large-scale conservation zones and interconnecting them with one another and with neighbourhood parks and green spaces serving individual residential areas. Secondly, it also pertains to local networks of green and open spaces as well as to smaller areas of planting in the street space, particularly trees.

Figure 15: Half of the municipal territory is green space



Green space per municipal district. Diagram from Vienna Chamber of Labour (AK Stadt 02/2019). Data: Municipal Department MA 18, land use map (2016).

Naturally, the city's green spaces are very unevenly distributed. The 22nd district, with large expanses of land used for agriculture, is the clear frontrunner, but the 13th and 14th districts also have extensive green areas. Some of the inner districts, on the other hand, only have a 2–3% share of green space. This makes it all the more important to gradually expand provision of outdoor spaces in densely built-up areas and make them more conducive to public use.

Open spaces comprise public, semi-public and private outdoor spaces. These include balconies, green and outdoor spaces in housing complexes and micro open spaces in streets, as well as parks and larger recreation areas. In the urban context, **green space** basically refers to any planted surface which can absorb precipitation; in the narrower sense it chiefly means parks and gardens which can be used for recreation and/or for social interaction and as a place to linger. Depending on their size and location, green spaces can have an urban or countryside character. Alongside their recreational function, bigger contiguous **recreation areas** with large expanses of grassland, woodland or water (such as e.g. the Danube Island or the Lainz Game Reserve) also play an important role in the urban ecosystem by helping to cool the city down at night.

OBJECTIVE: VIENNA CREATES ADDITIONAL RECREATION AREAS IN LINE WITH POPULATION GROWTH.

As an essential factor in urban quality of life, additional modern multi-use urban recreation areas are to be acquired through purchase, land use designation or contractual agreement, landscaped accordingly and opened to the public. A key consideration here is the interlinking of green spaces, as with the "DreiAnger" regional park and the Norbert-Scheed-Wald; in future this project will link up the green spaces in northern Vienna, creating a further building block in the city's green infrastructure. To this end, Vienna's regional landscape planning activities in collaboration with the neighbouring local authorities and the province of Lower Austria will also be continued and expanded.

OBJECTIVE: THE CITY'S ONGOING PROVISION OF LOCAL GREEN AND OPEN SPACES FOR DIFFERENT TARGET GROUPS WITHIN THE EXISTING URBAN FABRIC KEEPS PACE WITH POPULATION GROWTH.

This will be done both by expanding the surface area and by upgrading existing green and open spaces that are very intensively used, as well as through greening and planting of buildings. In addition, by redesigning the space, reorganising traffic flows and planting more trees it will actually be possible to use the street as a space in which to linger, interact and exercise.

Soil sealing means covering the ground surface with a layer that is impervious to water. This reduces the soil to its load-bearing function; it thus loses its many and diverse ecological functions as a habitat for all kinds of plants and animals, a filter for pollutants, a reservoir for carbon and a body for drainage and evaporation of rainwater. It is also lost as land for agricultural production. Fully sealed surfaces are those on which a structure has been built, as well as open areas such as car parks or industrial premises where the ground has been paved, concreted or asphalted.

OBJECTIVE: THE NATURAL FUNCTIONS OF THE SOIL ARE MAINTAINED THROUGH PRESERVATION OF EXISTING UNSEALED SURFACES AND CREATION OF NEW ONES.

In the city, land is a scarce resource. Additional land is needed for housing, road construction and expansion, and also for commerce and industry. This results in a significant proportion of the natural soil surface being sealed. Efficient urban expansion in which land use is minimised through compact building design, infilling and regeneration of brownfield sites, for instance, reduces the extent of soil sealing. Sites that are no longer used are unsealed again.

OBJECTIVE: VIENNA PROMOTES BIODIVERSITY.

A large proportion of different kinds of green spaces and unsealed surfaces are a vital prerequisite for urban biodiversity. Habitat management and biotope protection measures under the auspices of "Netzwerk Natur", Vienna's species and habitat protection programme, preserve the many and diverse animal and plant habitats in Vienna. Additional habitats are created wherever possible. Hazards to wildlife such as major roads, projecting glass structures and glass facades and excessive and disruptive forms of artificial lighting are reduced. The use of biocides is limited as far as possible. To counteract species extinction and biodiversity loss, stringent legislation is in place to protect endangered animal and plant species and their habitats.

Awareness-raising measures, information campaigns and appropriate procurement criteria ensure that attention is given to the global challenge of changing patterns of consumption in the interests of preserving biodiversity.

OBJECTIVE: IN THE INTERESTS OF PEOPLE'S HEALTH AND WELL-BEING, AIR, WATER AND SOIL POLLUTION, NOISE AND HEAT POLLUTION AND LIGHT POLLUTION ARE ALL MINIMISED AS FAR AS POSSIBLE.

The main causes of noise and air pollution are motorised vehicle traffic, building heating systems and power generation. The city's strategies and measures in these areas help to significantly reduce these emissions. As an absolute minimum, pollution should be below the legal limits throughout the entire city. Good cooperation throughout the Smart Region is also necessary here, given that around three-quarters of the particulate pollution in Vienna, to cite one example, originates from sources outside the municipal boundaries.

Near-natural expanses of open water not only serve as recreation areas for local people but are also a habitat for animals and plants and help to lower ambient temperatures. A comprehensive water protection programme preserves the city's bodies of surface water and groundwater reservoirs and protects them against impairment and input of pollutants.

Suitable measures are in place to minimise the rise in inner-city temperatures during hot summers (known as the "urban heat island" effect). These include tree planting, extensive greening of roofs and facades as standard, community gardens, and small-scale green areas and scattered groups of trees, all of which have a cooling effect thanks to evaporation. In addition, buildings are positioned so as to stimulate air circulation and create fresh air corridors across the city. Green and blue infrastructure, the choice of cladding materials and facade installations and the positioning and design of buildings are considered from an integrated perspective and optimised using microclimate simulation models.

Artificial night-time lighting enhances people's feeling of safety and is a key urban design element during the hours of darkness. At the same time, however, it causes sky glow over the city which has a disruptive effect on flora and fauna and can also impair human health. Environment-conscious planning and design of outdoor lighting across all areas reduces this light pollution without compromising the desired effects.

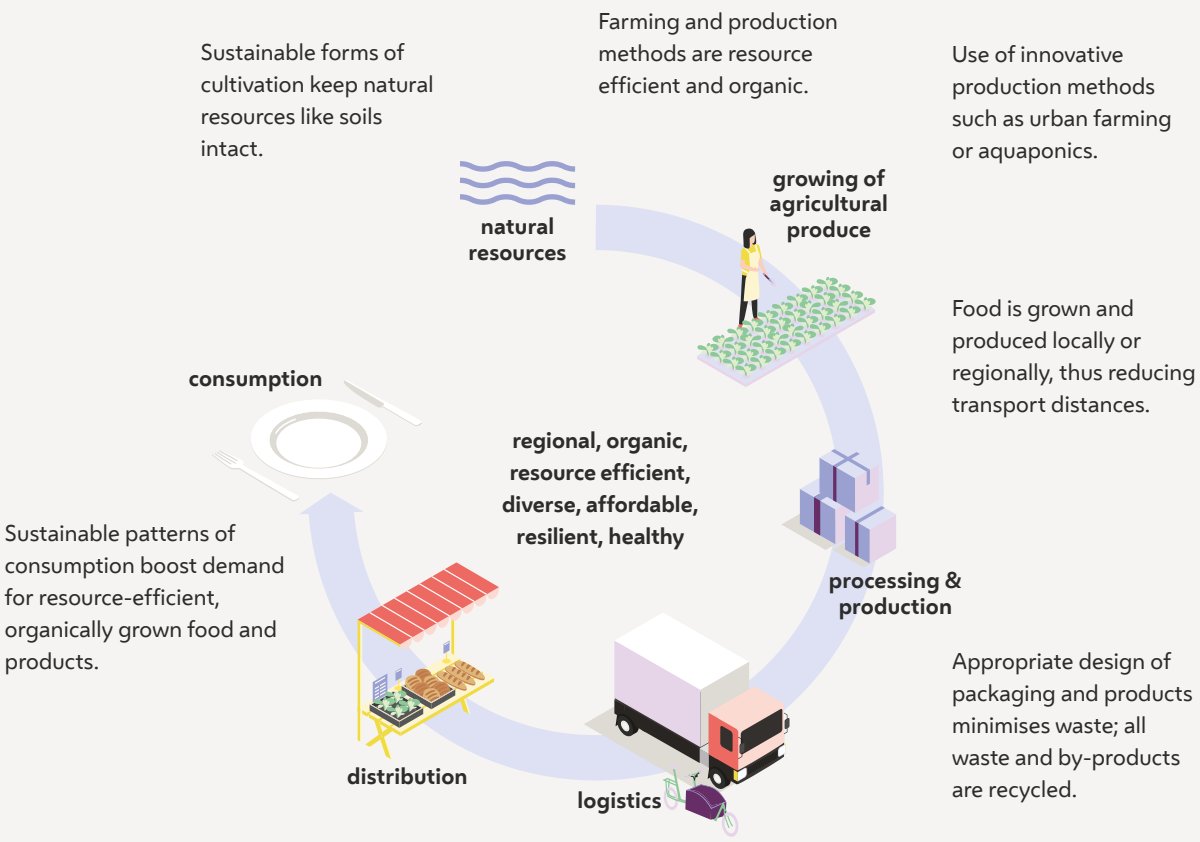
OBJECTIVE: THE CITY OF VIENNA PROMOTES A SUSTAINABLE FOOD SYSTEM. THE CITY'S FOOD SUPPLY IS LARGELY SOURCED FROM THE CITY ITSELF AND THE SURROUNDING REGION, PREFERABLY FROM ORGANIC PRODUCERS.

The city's food supply system comprises all processes from food production through processing, transport, sale and consumption to food waste and accounts for a significant share of Vienna's ecological footprint. In cooperation with all relevant shareholders it is to be evolved into a sustainable, integrated, resilient, safe and secure, diversified and resource-efficient food supply system that preserves biodiversity.

Awareness-raising activities, information campaigns and appropriate supporting measures in partnership with the business community significantly reduce food waste along the entire production chain.

Vienna, a co-founder of the "Organic City Network Europe", facilitates public access to organically produced food, sourced from the local region wherever possible, and promotes organic farming. Agricultural land within the municipal boundaries is largely preserved, while new sectors such as urban farming, aquaponics with appropriate species and community gardening are also developed. Overall, agricultural production in Vienna is as sustainable and resource efficient as possible. To this end, the City of Vienna cooperates with the agricultural enterprises within the municipal boundaries and throughout the wider region, facilitating a range of distribution channels such as farmers' markets and collection points to ensure a good neighbourhood food supply. The share of regional, organically produced food is significantly increased, especially in municipal institutions, facilities and associated enterprises.

Figure 16: A sustainable food system – from the field to the plate



Healthcare

Vienna 2050

In 2050, it is no longer unusual for centenarians to live active, independent lives well into old age. Not only are people living longer, but healthy life expectancy has also increased. The focus of the healthcare system is no longer solely on treating illnesses, but on staying healthy and active. The city's clean air, healthy food, wide range of sports facilities and recreation areas, cool green spaces and bodies of water are all conducive to this.

In Smart City Wien, health promotion starts in childhood. Every school campus has its own health centre, where specialist staff from various disciplines actively support children and young people in developing a healthy lifestyle. Health coaches also provide advice later on in life.

The funding system based on mandatory contributions ensures that everyone living in Vienna has access to the city's high-quality healthcare facilities. Interdisciplinary primary care centres are available to all throughout the entire city. If necessary, the latter refer the patient to appropriate specialist facilities. High-tech procedures in hospitals allow precise diagnosis and individually tailored therapy, promising very high chances of a swift recovery. Vienna is a leader in the development of personalised medicine, and thanks to long-standing efforts in R&D has regained its global reputation in the life science and biotechnology sector.

Digital healthcare services and applications reflect the needs of patients in Vienna and are broadly and firmly established in the city. Here, quality and security are always the topmost priority.

With increasing life expectancy, demand has also grown among older people for preventive programmes to help them stay fit and healthy for as long as possible. Above all, active healthy ageing gives people choices: alongside various forms of community and assisted living, older people also have access to numerous digital tools which allow them to stay in their own homes for as long as they wish to. The mix of different age groups in public housing has given rise to a new wave of supportive neighbourly relationships and significantly enhanced social well-being.

Our Agenda

Good health is seen by many as the most important commodity, and is thus essential to individual well-being and life satisfaction. The city's health policy activities therefore focus on maintaining, promoting, improving and, where necessary, restoring the health of the Viennese population.

The basis and guideline framework for this are Vienna's Healthcare Goals, which cover living and working conditions as well as the urban environment and cut across all policy fields. Key principles include equality of opportunity for all sectors of the population – including socially disadvantaged groups – and taking due account of the specific needs and health risks of women, as set out in the Vienna Women's Health Programme.

A particular challenge in terms of health are the changed environmental conditions brought on by climate change, most notably the growing incidence of extreme weather events such as unusually long periods of hot weather, drought and torrential rainfall. The related changes in vegetation zones mean that allergenic plants and disease-carrying insects which were previously absent or rare in Vienna will become more widespread in the city and surrounding region. The impact of airborne pollutants is growing. A comprehensive package of measures for climate action and adaptation to climate change in all thematic fields of the Smart City Framework Strategy is therefore of prime importance if Vienna is to achieve its healthcare objectives.

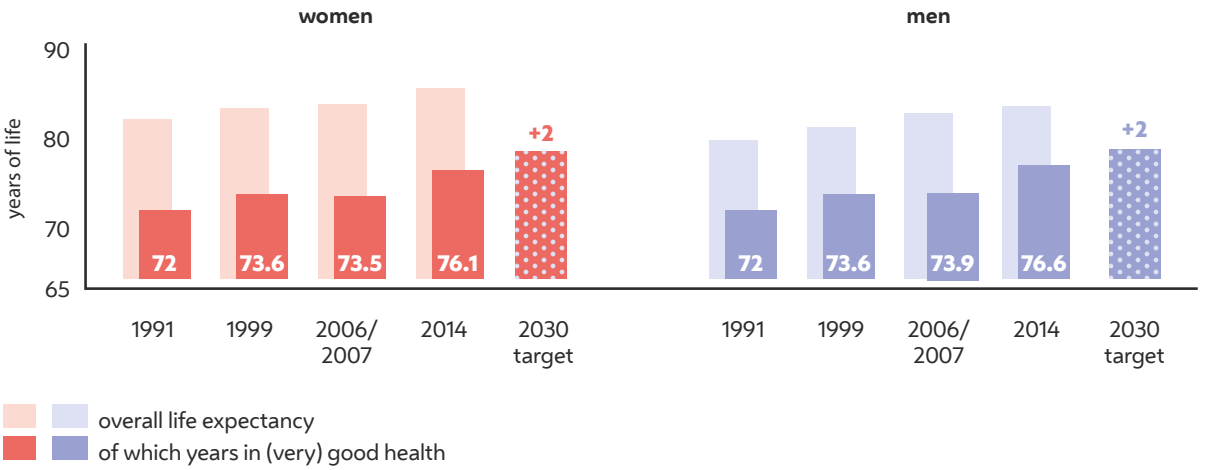
OBJECTIVE: IN 2030 THE HEALTHY LIFE EXPECTANCY OF THE VIENNESE POPULATION HAS INCREASED BY TWO YEARS.

Life expectancy in Vienna has risen rapidly in recent decades and continues to increase. In future, however, more people should be enjoying these additional years of life in good health; particular emphasis here is to be placed on the higher life expectancy of women, many of whom do not spend their extra years in good health at present.

To this end, healthy living, working and environmental conditions are maintained and improved for all age groups, communities and lifestyles in Vienna. Key factors in this endeavour include provision of recreation areas and outdoor spaces close to people's homes; minimal environmental pollution, intact ecosystems and a healthy diet based on produce from the local region; promotion of sport, physical exercise and active forms of mobility such as walking, jogging and cycling through appropriate design of public spaces; and stable working conditions with fair pay and a decent level of social security. Awareness-raising measures, information campaigns, education and training address individual lifestyle habits and health behaviours.

Healthy life expectancy (HLE), also known as years free of disability or ill health, is an estimate of expected years of life in good health for persons at a given age.

Figure 17: The focus of the healthcare system is on staying healthy and active



Life expectancy – here the remaining life expectancy at age 65 – has seen a strong increase in Vienna over the past decades and continues to rise, as does healthy life expectancy.

Own diagram by Urban Innovation Vienna (2019) based on data from Statistics Austria,- published in:

City of Vienna (2008): Österreichische Gesundheitsbefragung 2006/07 – Ergebnisse für Wien.

Statistics Austria (2016): Lebenserwartung in Gesundheit nach Bundesland, Geburtsland und Schulbildung.

Best point of service means cost-effective and efficient service provision that guarantees high-quality medical and nursing care at the right time and in the right place.

OBJECTIVE: PROVISION OF HIGH-QUALITY MEDICAL CARE IN VIENNA IS GUARANTEED.

All citizens of Vienna have access to high-quality medical services as and when they require them. From primary care to specialised outpatient services to in-patient care, treatment and care services are needs-based and delivered at the best point of service. Digitalisation enhances the quality and efficiency of health and social care. Healthcare for all is guaranteed by a public health system funded through mandatory contributions.

Another aspect of the high standard of medical care in Vienna is that healthcare facilities, particularly hospitals, health centres, nursing homes and therapeutic facilities, are operated with a view to maximum environmental sustainability. After all, the healthcare sector is not only of great economic and social importance; on account of its substantial consumption of resources and the considerable quantities of carbon emissions, pollutants and waste it produces, it is also highly important in terms of its impact on the environment. Resource conservation and climate action programmes are therefore elaborated and implemented for all the city's healthcare facilities, with the emphasis on energy-efficient operation, renewable energy supply, sustainable transport and procurement, efficient use of materials, waste prevention and use of digital tools.

OBJECTIVE: SMART CITY WIEN SUPPORTS HEALTHY ACTIVE AGEING – CARE-DEPENDENT VIENNESE CITIZENS RECEIVE HIGH-QUALITY CARE AT HOME OR CLOSE TO HOME FOR AS LONG AS POSSIBLE.

Active & assisted living (AAL), digital technologies and mobile services allow elderly people to continue living an independent life in their own home for as long as they wish to. This is further supported by barrier-free, age-appropriate design of housing and the living environment and opportunities for social interaction and physical exercise in the local neighbourhood. All citizens of Vienna have access to high-quality care and nursing services whenever they need them, delivered in the most suitable form for the respective situation. Those who are care-dependent are cared for at home or close to home for as long as possible.

OBJECTIVE: HEALTH LITERACY IS PROMOTED AT BOTH THE INDIVIDUAL AND ORGANISATIONAL LEVEL.

Health literacy is an individual's ability to access, understand, evaluate and act upon health-related information in order to make sound health decisions in the context of everyday life. The structures and policy framework prevailing in the healthcare system also decisively affect health literacy, which furthermore largely correlates with level of education and income. Promoting health literacy therefore promotes equality of opportunity in healthcare.

Suitable measures are undertaken to raise awareness of preventive health services, especially among disadvantaged groups. These also include supporting a broad range of sporting activities and educating people about the health benefits of an active, sustainable lifestyle, also with a view to combating all forms of nutritional deficiency. At the same time, efforts are made to facilitate access to readily understandable, unbiased, scientifically sound information. Vienna promotes the development of gender-sensitive, health-literate healthcare organisations and launches initiatives to promote health literacy in schools, youth centres, companies and facilities for senior citizens.

OBJECTIVE: ALL SOCIAL GROUPS, ESPECIALLY VULNERABLE ONES, ARE PROTECTED AGAINST THE HEALTH RISKS ASSOCIATED WITH CLIMATE CHANGE.

The growing incidence of sustained heatwaves caused by climate change will lead to an increase in health problems among vulnerable groups, including infants and young children as well as elderly, care-dependent people and the chronically ill. Furthermore, women are more negatively impacted by overheating than men.

Timely preventive measures will thus be undertaken to meet the needs of all sectors of the population, especially vulnerable groups. These will include, inter alia, providing contacts in case of need as well as targeted support and care. Targeted measures will also improve the health literacy of at-risk groups. In Vienna's healthcare facilities, the need for additional preventive, emergency care und curative capacities to respond to extreme weather events, as well as to long-term health impacts such as the increasing incidence of chronic cardiovascular disease (respiratory disorders, tumours, allergies) and acute cardiovascular conditions, is to be assessed and capacities expanded where necessary.

Social inclusion

Vienna 2050

Vienna in 2050 is a vibrant, diverse, cosmopolitan city on a dynamic growth trajectory. This creates economic potential, opportunities for social mobility, gender equality and a good life for all. Economic, technological and social change have repeatedly posed challenges to the City of Vienna and urban society – Vienna has responded with continuous investments in social cohesion and opportunities for public participation.

Social inclusion is a palpable reality in Smart City Wien, not least because the local authority still has at its disposal a varied set of tools and mechanisms for socially responsible policy-making, which has a long tradition in the city and has been repeatedly and skilfully adapted to respond to current challenges. The comprehensive provision of public services of general interest allows quality of life that everyone can afford. This provision starts with education, healthcare and social infrastructure and extends to city-wide provision of multifunctional green and open spaces, a broad programme of affordable cultural events and affordable housing.

The city has learned to handle the friction that unavoidably arises from diversity and to understand and utilise social diversity as a strength that adds extra creativity and capacity for innovation. In this way, Smart City Wien seizes the opportunity to make its ongoing evolution into a sustainable city a shared project that everyone living in Vienna can benefit from, irrespective of income and education, age, gender, sexual orientation or ethnicity, but also one in which everyone plays an active role.

Our Agenda

Technological developments, digitalisation and automation, and above all advancing climate change, affect everybody – but not necessarily equally. Today more than ever, the focus of Smart City Wien therefore remains on social cohesion and equal opportunities.

In Smart City Wien, social inclusion also means digital inclusion. An explicit objective of Smart City Wien is to utilise new technologies and developments in the field of digitalisation to help promote social inclusion. Digital transformation should not be allowed to open up new social divisions, but must also benefit those groups who do not (or cannot) yet engage with new technologies in their everyday lives.

OBJECTIVE: VIENNA IS A DIVERSE CITY THAT PROMOTES GENDER EQUALITY AND OPPORTUNITIES FOR PARTICIPATION FOR ALL WHO LIVE HERE.

Smart City Wien fosters a good social mix and social cohesion as signature characteristics of quality of life in Vienna. Social cohesion is under threat, not least from growing differences in income. In this respect, Vienna cannot fully distance itself from global trends. Nevertheless, the Smart City is aware of the problems and challenges that stem from social inequality and pursues education, social, labour and economic policies that act as a counterbalance. Alongside this, a further significant aspect of the Smart City is prevention of hardship and the eradication of poverty in all its forms and dimensions.

Access to housing, education, health and infrastructure, as well as to a diverse cultural scene, must be guaranteed for all and remain so in future. Regardless of their individual life situation, all people living in Vienna, as assertive citizens, should be given a say in the city's development. Ultimately, Smart City Wien is a "we" project that needs everyone in Vienna on board.

OBJECTIVE: VIENNA PROVIDES HIGH QUALITY OF LIFE AND AMENITY VALUE IN ALL PARTS OF THE CITY BY INVESTING IN PUBLIC INFRASTRUCTURE, STRENGTHENING COMMUNITY COHESION AND FOSTERING URBAN COMPETENCES.

Smart City Wien places a strong emphasis on the quality of community life, both in local neighbourhoods and the city as a whole. The local neighbourhood as the centre of social life, a place of neighbourly interaction, participation and engagement is becoming increasingly important, and people's willingness to contribute is growing. Vienna utilises this potential and the creativity of local people to strengthen social cohesion and promote sustainable development, especially with regard to gender and diversity issues. More parks and high-quality outdoor spaces, traffic-calming measures and social infrastructure, a diverse local cultural scene and various shared-use schemes not only enhance quality of life, but are also key ways of conserving resources – because distances are short, items can be shared, and good recreation and leisure facilities are available right on the doorstep. In view of advancing climate change, investments in greening, planting and measures to create shade are also essential in order to maintain and enhance the amenity value of the public space.

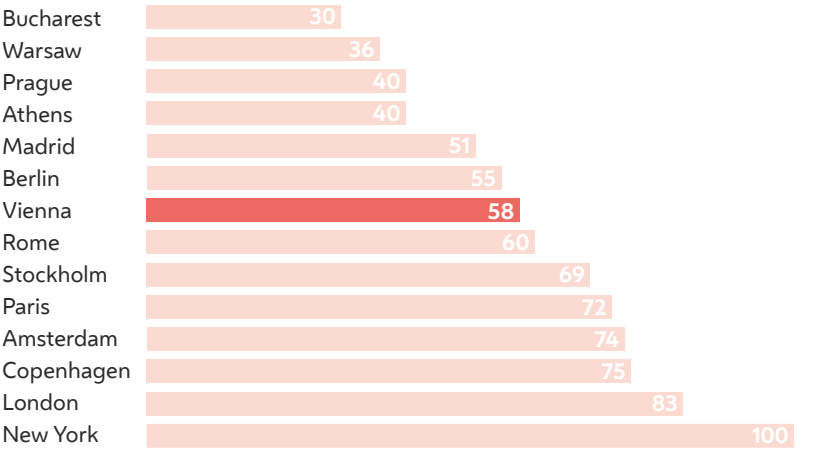
No urban district is neglected here; on the contrary, the measures are especially targeted at neighbourhoods that are disadvantaged today. Lower-income groups in particular benefit from the Smart City in their immediate neighbourhood, thanks to the resulting invigorated community life, a lively local cultural scene, and a healthier and more attractive living environment. Life is thus centred on the local neighbourhood. This also gives rise to new opportunities for participation and useful occupation (from "neighbourhood outreach worker" to "sharing manager").

Everyone living in Vienna, regardless of sex, age, education, income or physical and mental capability, should enjoy a high level of safety throughout the entire city as well as in their immediate living environment. People's subjective feeling of safety is an important indicator here. However, it should not be misused as an argument to play the needs of different groups off against each other and thus to foster processes of social disintegration. On the contrary, the City of Vienna aims to equip people with "urban skills", i.e. the ability to deal with the diverse communities, lifestyles and patterns of behaviour that coexist side by side in the city without perceiving them as a threat.

OBJECTIVE: VIENNA CONTINUES TO PROVIDE AN ADEQUATE SUPPLY OF HIGH-QUALITY SUBSIDISED HOUSING TO REDUCE THE PERCENTAGE OF PEOPLE WHO ARE OVERBURDENED BY HOUSING COSTS.

Affordable housing is a central pillar of Smart City Wien. The pressure on accessibility and affordability of housing is growing, primarily due to the upward trend in rent and price levels in the private housing sector. The loosening of rent regulations is exacerbating this tendency and making things difficult for tenants on lower incomes. In this context, the social housing sector comprising cooperative and municipal housing projects is more important than ever. In future, a large proportion of new housing will continue to be subsidised. The framework for the "Vienna Model" of social housing construction will continue to be regularly updated to ensure the programme combines high quality, high environmental standards (in both new builds and existing stock) and affordability for both the middle classes and low-income groups. To this end Vienna will utilise smart subsidy and funding schemes to ensure that costs such as higher initial investments in smart, resource-efficient technologies are balanced out over the entire useful life of the building, thus leveraging long-term savings for tenants as well as for non-profit housing developers.

Figure 18: International cost-of-living index (incl. housing), New York = 100



Own diagram (2019) based on: Municipal Department MA 23 (2018): Wien in Zahlen. Wirtschaftsstandort 2018. Data: Numbeo. The index shown takes into account the prices of consumer goods (food, restaurants, transport costs, public utilities) plus rent costs.

Economically, Vienna is among the strongest regions in the EU, yet the average cost of living is well below that of comparable cities in Western Europe such as Paris, London or Copenhagen. A key factor here is Vienna's comprehensive provision of public services for all of its citizens, which helps ensure both affordability and high quality of life.

Housing costs overburden rate: For most people, housing costs account for a considerable proportion of their total household budget – and for less well-off people in particular, who already have very little financial leeway anyway, the share that goes on housing costs is often especially high. According to the EU definition, housing costs overburden exists when households spend more than 40 per cent of their disposal income on housing costs. The EU definition of housing costs includes all expenditure on rent payments, service charges, heating, utilities and maintenance (minus any housing benefit) plus interest on mortgage payments or housing refurbishment loans.

Smart housing policy also means anticipating and utilising state-of-the-art technologies. In this regard it is above all important to ensure that technological advances (in digital building technologies, for instance) do not compromise residents' sovereignty and autonomy, but rather enhance them. Against this background Vienna aims to become an internationally recognised pioneer in the fields of digitalisation and sustainable building, strengthening the expertise already available in the city while also endeavouring to attract international investment and know-how from outside. International exchange and cooperation are imperative in finding solutions to urban challenges.

OBJECTIVE: VIENNA STANDS OUT FOR ITS FAIR WORKING CONDITIONS, ADEQUATE WAGES FOR GAINFUL EMPLOYMENT AND SOCIAL WELFARE SCHEMES, WHICH PERMIT A DECENT STANDARD OF LIVING FOR ALL.

Individual opportunities for personal development are closely associated with useful occupation and gainful employment. Smart City Wien strives to safeguard fair working conditions and adequate pay for all citizens of Vienna, especially with a view to gender equality. Efforts to close the gender pay gap are to be expedited. Vienna will therefore continue its decisive rejection of trends, policies and business models that contradict this objective. The use of digital processes in fields such as social and labour market policy must not be allowed to lead to discrimination or to exacerbate experiences of exclusion and marginalisation.

At the same time, however, it is also evident that the labour market is changing. Forecasts predict that digitalisation and automation may lead to a decline in traditional forms of employment. Within the scope available to it the City of Vienna actively shapes this development, using its resources and infrastructure to support the evolution of new forms of decent work and new occupational profiles. Wherever possible, this trend should favour occupations and occupational profiles that can make an active contribution to attaining the city's climate and consumption goals.

With the aid of social welfare schemes the city will fight poverty and social exclusion and ensure a decent life for all citizens of Vienna.

OBJECTIVE: MUNICIPAL SERVICES ARE ACCESSIBLE TO ALL CITIZENS OF VIENNA – TO AN INCREASING EXTENT IN DIGITAL FORM, AND, WHERE REQUIRED, IN ANALOGUE FORM AS PREVIOUSLY.

The digital revolution is transforming virtually all spheres of our lives; in many cases it is an enrichment and creates new opportunities for sustainability and conservation of resources. It also creates the basis for efficient, increasingly fast and interconnected municipal services that are tailored to the needs of the public. Digitalisation is also a major social challenge, however, and nobody should be left behind. This means ensuring active support for less tech-savvy individuals, so that everyone can participate and have a say in urban life. Digital tools introduced by the municipal administration, its agencies and enterprises are therefore designed to be readily accessible and to make everyday life easier for everyone in Vienna, with special attention given to gender and diversity considerations (cf. multilingualism). Furthermore, so long as there is a need for them the City of Vienna will continue to offer a high level of analogue services alongside the digital ones.

Education

Vienna 2050

In 2050, education and qualifications are still essential cornerstones of Smart City Wien: a high level of education and good quality training have increased the opportunities for personal development and self-determined participation of everyone living in Vienna – and thus improved the prerequisites for individual quality of life as well as for an inclusive society.

At the same time, education and training are an important basis for the innovative solutions the Smart City needs. In Smart City Wien, learning is enjoyable and provides a sense of purpose – children acquire confidence in their own capacity for innovation at an early age and thus develop an optimistic, forward-looking world view. The combination of inclusive education options for all age groups, teaching of digital skills, needs-based qualification programmes and career development opportunities acts as an incubator for change and innovation processes. The respective institutions and programmes are closely interlinked, giving rise to "learning communities" which significantly enhance the impact of educational activities and make learning a visible part of neighbourhood life.

Sustainability as both an ecological necessity and an opportunity to design a liveable city is a key element of educational curricula in Smart City Wien. This has established an awareness of our common responsibility to create a sustainable city for the future and a willingness to play an active role in doing so.

Our Agenda

Already today, Smart City Wien sees itself as a responsible "learning space" for a sustainable, resource-aware future; as a forum for discourse that provides room for a substantial debate about the kind of future development we aspire to in Vienna. This space not only generates understanding and support for the headline goals of resource conservation, sustainability and a community-based urban society, but also provides people with the capacity for independent action.

OBJECTIVE: EVERYONE ENJOYS LOW-THRESHOLD ACCESS TO HIGH-QUALITY, INCLUSIVE EDUCATIONAL FACILITIES AT THE EARLIEST POSSIBLE AGE AND CONTINUES HER/HIS EDUCATION BEYOND COMPULSORY SCHOOLING.

Vienna provides high-quality education options for all age groups, and a large number of organisations – from nurseries to adult education and from youth centres to cultural societies and sports clubs – share institutional responsibility in this learning space. Other social systems such as families or neighbourhood groups also influence the quality of this space.

The main emphasis here is on creating an equal playing field for all children and youngsters and overcoming educational disadvantage among individual social groups. Key factors in this are consistent challenging of stereotypes through gender-sensitive teaching and establishing an environment that promotes equality. These help create a Smart City where stereotypes no longer play a role in educational and career choices.

An appropriate framework is also to be created for the recognition of qualifications obtained abroad, as well as non-formal qualifications. In order to attain the objective of lifelong learning, education provision – from early years education to full-day schools and qualification programmes for adults – must be consistently expanded and further developed. This should also bring about a significant reduction in the number of early school leavers, i.e. the proportion of 18- to 24-year-olds with no educational qualifications beyond compulsory schooling.

OBJECTIVE: BY 2030 A CITY-WIDE NETWORK OF "BILDUNGSGRÄTZLN" ("LEARNING COMMUNITIES") HAS BEEN ESTABLISHED TO CREATE LEARNING SPACES THAT ARE TAILORED TO LOCAL NEIGHBOURHOODS, COMMUNITIES AND LIFESTYLES.

To strengthen the impact of educational work in the individual institutions, the City of Vienna will step up cooperation and coordination of the educational foci between the education providers at local neighbourhood level. "Bildungsgrätzl" are learning spaces with a visible profile in the local community that make optimum use of local resources – from suitable premises to the engagement, skills and linguistic capabilities of those involved – to help children and youngsters make the transition between the various educational institutions.

Figure 19: What is a "learning community"?

Vienna's "Bildungsgrätzln" ("learning communities") are networks to enhance interaction among nurseries, schools and non-school educational institutions such as libraries, youth centres and adult education centres in urban neighbourhoods. They expand and improve the range of educational options on offer for children, young people and adults in the respective neighbourhood while also creating spaces and structures for new forms of education and learning and making education a visible part of community life.

OBJECTIVE: VIENNA BOASTS A COMPREHENSIVE, NEEDS-BASED, INCLUSIVE PROGRAMME OF DIGITAL EDUCATION.

As a Smart City, Vienna is committed to providing inclusive digital education in all educational institutions. Digital education, as a universal learning process, helps increase the city's capacity for innovation and empowers the citizens of Vienna for successful economic and social participation in the digital society as well as for emancipatory, self-determined and considered engagement with digital media. City-wide installation of adequate digital infrastructure and broad provision of digital education programmes are to help give all sectors of the population access to digital education, regardless of sex, age, ethnic origin, social background or religion, with the aim of closing the digital divide in society. Special emphasis here will be placed on inspiring children and youngsters to choose educational pathways with a digital focus; media skills for girls and boys will be promoted from different perspectives. Support will be given to teachers to build their expertise in digital subjects, and parents will be made aware of the importance of training in the digital environment. The City of Vienna takes steps to amalgamate the relevant activities in the education and training sector (on the part of educational institutions and private educational initiatives, with the help of multipliers, and in partnership with the private business sector) with the aim of elaborating a joint educational initiative around digitalisation.

Digital divide: In today's society, access to the internet and digital information and communication technologies is unequal, both in terms of provision and usage. These disparities are frequently social in nature, i.e. they depend on education, income and social status, but also on age, sex and ethnic origin. By the same token, the digital divide also gives rise to unequal opportunities. In a nutshell: people with access to state-of-the-art communication technologies have better opportunities for social and economic advancement.

OBJECTIVE: A DIVERSE RANGE OF PUBLIC ENGAGEMENT PROGRAMMES OPEN UP ACCESS TO VIENNA'S MULTIFACETED ARTS AND CULTURAL SCENE.

Culture and the arts speak to people on an intellectual as well as an emotional level. With their creativity, imagination and nonconformism, the arts and culture open up spaces for an open dialogue about the future of our society, a dialogue which is absolutely vital given the universal processes of change that are under way in Smart City Wien. This makes it all the more important to ensure that the City of Vienna's broad cultural programme is accessible to the entire population. To remove barriers to access, Vienna employs a wide range of public engagement programmes as well as initiatives that offer people living below the poverty line free entrance to numerous cultural institutions. Individual organisations also offer programmes targeted at specific groups such as children, teenagers or working adults to arouse people's interest in contemporary art.

OBJECTIVE: RAISING AWARENESS OF SUSTAINABLE, RESOURCE-EFFICIENT DEVELOPMENT IS A STANDARD TEACHING OBJECTIVE IN ALL EDUCATIONAL INSTITUTIONS.

Vienna's educational institutions are committed to the UN Sustainable Development Goals and the contents of the Smart City Wien Framework Strategy. These form a central component of the teaching objectives and are taught in the individual institutions in a form appropriate to the respective age or target group. Schools also raise awareness of the consequences of advancing climate change among all age groups and show ways of dealing with them (e.g. with regard to the associated health risks).

OBJECTIVE: VIENNA'S EDUCATION, TRAINING AND QUALIFICATION PROGRAMMES REFLECT CHANGING OCCUPATIONAL PROFILES AND EQUIP THE WORKFORCE WITH THE EXPERTISE AND SKILLS TO APPLY NEW SMART TECHNOLOGIES AND PRACTICES.

Work environments and occupational profiles in the Smart City are changing as a result of the tech revolution. Vienna offers appropriate educational and qualification programmes to promote social and sustainable entrepreneurship as a prerequisite for attaining its Smart City goals. Furthermore, special emphasis is to be placed on training skilled workers in modern smart technologies and services (e.g. building refurbishment, heating technology, recycling and upcycling, etc.) as well as for newly emerging occupations. Particular attention will also be given to gender and diversity considerations, with a specific focus on measures to raise the previously low proportion of women entering these promising future sectors.

Science and research

Vienna 2050

Vienna is one of Europe's leading innovation hubs and is known as the research capital of Central Europe. This makes the city especially attractive to students and academics, researchers and innovative enterprises and start-ups. There is a lively exchange with other major international research centres and with research partners in the wider metropolitan region, especially in sectors that are among Vienna's key strengths and drive the city's progress as an incubator of innovation.

In recent years, Vienna has successfully endeavoured to promote excellence: a large number of respected top-flight experts, institutes and research teams have established themselves here and are sought-after partners for local and international collaborative projects. The cosmopolitan, tolerant and anti-discriminatory climate prevailing in Vienna significantly enhances the city's attractiveness.

At the same time, Smart City Wien has established a new culture of innovation in which the pressing questions associated with the transformation towards sustainable, socially equitable development are jointly identified and tackled in an interdisciplinary manner on multiple levels – from basic research through to specific application scenarios. This gives rise to technical and social innovations, which are piloted in local "urban labs".

Vienna has thus positioned itself as a globally sought-after research and innovation hub for Smart Cities.

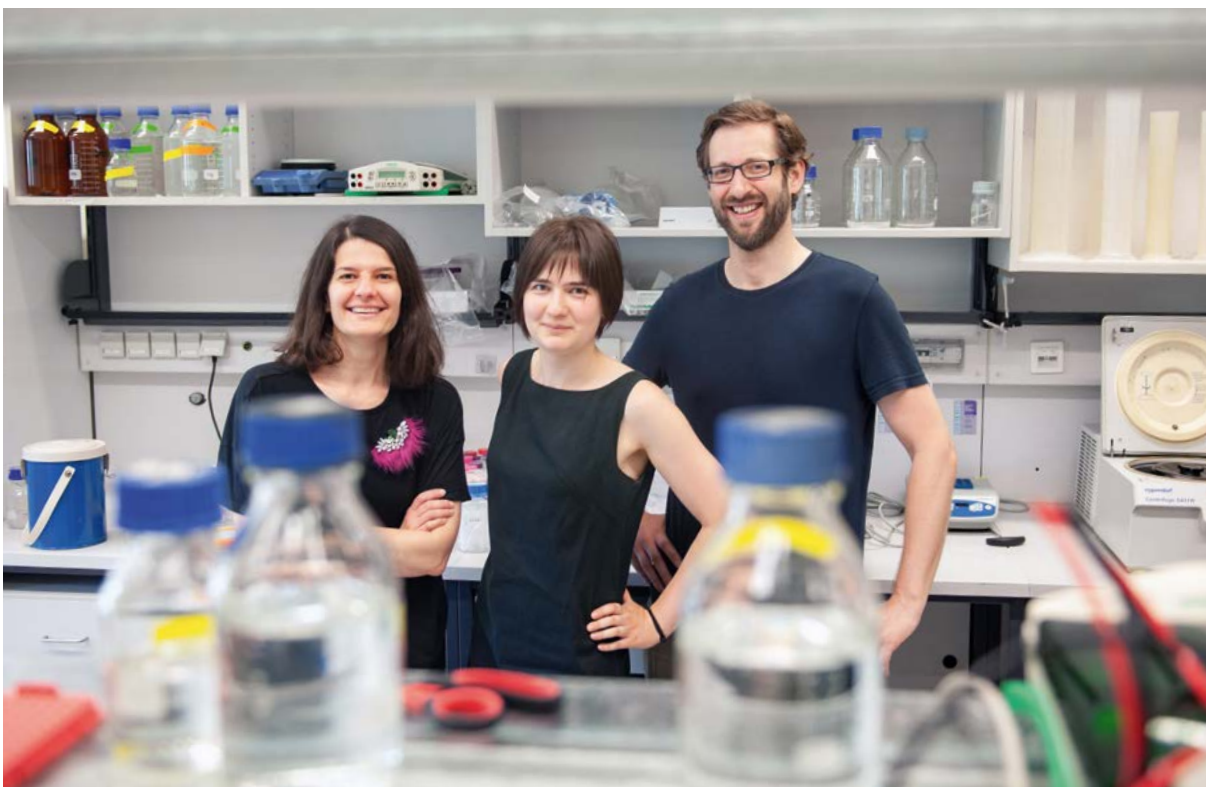
Our Agenda

Research and new technologies are key drivers of added value, creating a competitive economy and good-quality jobs – and thus delivering some of the essential prerequisites for Vienna's high quality of life. At the same time, research and innovation are key tools that will allow us to address the future issues facing the Smart City. Vienna must therefore be in a position to take up research findings from all over the world and use them productively; at the same time, it is essential that the city builds on its own capacities as a high-ranking innovation, research and higher education hub. Hosting some 200.000 students at present (2019) and around half of Austria's basic research facilities, Vienna has excellent institutional prerequisites and is by far the largest university city in Central Europe and the German-speaking region. Vienna is also the seat of numerous innovation-led companies and corporate headquarters which carry out R&D activities in the city.

Vienna has dense clusters of scientific activity, industrial capabilities and a dynamic start-up scene in fields such as the life sciences and information and communication technologies. Digitalisation, as a global trend, is a decisive factor in accelerating developments in business and research and will be a benchmark for innovation in many fields in future. It is giving rise to a structural transformation in many sectors, a challenge that Vienna is facing with confidence. In the academic field digitalisation will drive innovation across disciplines, thus generating new benefits for science, research and society. Targeted support will also be given to digital humanities (scholarly activity at the intersection of digital technologies and the humanities) and digital humanism (using findings from the humanities and social sciences in the development of digital solutions).

Finally, another important factor for Smart City Wien is research capability in the social sciences, looking at issues such as diversity, gender and distribution of power and assets and how they and social attitudes to them change over time.

Smart City Wien not only supports the application of digital technologies, but also creates the framework for the development of social innovations. Likewise, Vienna will step up its efforts to support women in science, research and in the start-up scene to play an equal role alongside men.



OBJECTIVE: IN 2030, VIENNA IS ONE OF EUROPE'S TOP FIVE RESEARCH AND INNOVATION HUBS.

In terms of its number of publications, patents and top-flight researchers, Vienna is already a major centre of research and innovation; however, it still needs to close the gap on the global leaders. With the ongoing evolution of Vienna's research and innovation strategy "Innovative Vienna", the City of Vienna, public research and innovation funding bodies and partner organisations from the science and research field are setting the agenda for this development process.

Key parameters of the strategy are as follows: top-grade research equipment infrastructure is available in Vienna and used by science, industry and SMEs alike. Special support is given to research and innovation efforts in fields that are particularly relevant to the Smart City, such as energy, mobility, climate and sustainability. Vienna places special emphasis on top-level research and further strengthening of fields that are already proving successful. Vienna makes appropriate resources available for research in line with the division of responsibility between the federal and regional authorities, paying special attention to knowledge transfer to business and society.

OBJECTIVE: VIENNA IS A MAGNET FOR TOP-FLIGHT INTERNATIONAL RESEARCHERS AND THE RESEARCH UNITS OF INTERNATIONAL CORPORATIONS.

This strategic orientation also enhances Vienna's attractiveness to top-flight researchers and the research units of international corporations. Vienna uses targeted incentives to continuously increase the number of employees in the R&D sector as well as the number of organisations conducting research in the city. Special emphasis will be placed on promoting women in the key future sectors. Another particular concern of the City of Vienna is the recognition of school and higher education qualifications obtained abroad by highly qualified foreign nationals.

OBJECTIVE: VIENNA INITIATES LARGE-SCALE MISSION-LED RESEARCH AND INNOVATION PROJECTS AS A CONTRIBUTION TO THE SOCIO-ECOLOGICAL TRANSFORMATION.

Mission-led research focuses on topics of high social relevance and is thus a key tool of Smart City Wien. The City of Vienna initiates and promotes major research and innovation projects with excellent local and international research partners to help find answers to pressing future issues in the interests of ecologically sustainable, socially equitable development.

OBJECTIVE: IN VIENNA, SPECIFIC CHALLENGES RELATING TO SMART CITY WIEN ARE IDENTIFIED AND RESOLVED COOPERATIVELY BY THE MUNICIPAL ADMINISTRATION, HIGHER EDUCATION AND RESEARCH INSTITUTIONS, COMPANIES AND END USERS.

In order to develop workable solutions, Vienna relies on the capacity for innovation of the city's research institutions, businesses and the municipal administration, as well as on social innovation. In practice, this means framing the issue so as to sharpen the focus on who is most acutely affected by problems and possible solutions and in what way, as well as involving a range of different stakeholders from the outset: from those who deliver innovations to the people on the receiving end, who usually have a good eye for current challenges and ultimately are the ones who will be using the new products or technologies.

The municipal administration and its associated enterprises use a series of tools to support innovation processes of this kind: the city initiates projects and provides support in the form of personnel and financial resources. Funding schemes for business, science and research and for start-ups and spin-offs have a targeted focus on Smart City issues. Research institutions are given access to municipal (data) infrastructure to support the development of pilot applications and in the context of "living labs". The City of Vienna also acts as lead client in the procurement of innovative products and contributes its expertise to regional research and innovation projects. The municipal administration, its agencies and enterprises utilise and promote their employees' capacity for innovation – with a special emphasis on promoting women – and drive technical, organisational and social innovation and the use of cutting-edge technologies in their own fields of activity in order to make an active contribution to achieving the Smart City goals.

Participation

Vienna 2050

The basic principles of the Smart City are broadly established in Vienna. Policy-makers and administrators are aware that a Smart City strategy, if it is to be truly effective, cannot be imposed from above. Smart City Wien is therefore the outcome of a collective design process that is coordinated by the municipal authority but sustained and supported by a great many individuals. It is founded on a shared awareness of the current challenges and a shared vision of the future that is worth committing to. It is also founded on a new appreciation of civic participation and engagement, elaborated in a dialogue between policy-makers, administrators and the general public. That is why the agreed quality standards and the newly created mechanisms for participation and engagement are now accepted by all. As a result, Smart City Wien has not only been broadly co-shaped by the Viennese people, but the Smart City initiative has strengthened and evolved Vienna's culture of participation. All social groups and a diverse spectrum of stakeholders are involved in civic life and are able to make a responsible contribution to the sustainable development of the city.

By employing an array of new participatory formats and initiatives, the City of Vienna invites people to join the debate about strategies, concrete measures and specific spaces in order to allow, facilitate and promote grassroots initiatives from civil society.

Our Agenda

Truly sustainable development can only be realised if everyone living in Vienna is able to play a part and indeed actively does so – in discussion processes, in the elaboration and implementation of projects, by contributing their knowledge and experience, and through responsible consumer behaviour and mobility choices.

For generations now, Vienna's policy-makers and the municipal administration, agencies and enterprises have endeavoured to make life as pleasant as possible for everyone, or to create the prerequisites for this, through timely provision of infrastructure and a broad spectrum of services. However, this service-led approach should not limit or substitute for the individual initiative of the Viennese people, in fact quite the opposite: precisely a sweeping initiative like Smart City Wien, which treads completely new ground in many areas, not only requires allies who back decisions, but indeed the creativity and know-how of as many people as possible. Smart City Wien is therefore to be evolved and implemented on a participatory basis.

The City of Vienna actively promotes this participation by providing numerous different opportunities for engagement and space for discussion of different ideas and opinions, for co-creation and involvement in decision-making. These processes to negotiate the future of our city are likewise important learning processes. Dialogue brings to light different interests and needs, which can then be taken into consideration as a basis for useful solutions.

OBJECTIVE: THE CITY OF VIENNA CONTINUOUSLY WORKS ON ITS PARTICIPATION STANDARDS IN PARTNERSHIP WITH LOCAL PEOPLE, AND PARTICIPATION IS GENERALLY INCREASING OVERALL.

Transparent, inclusive, cooperative decision-making processes are required to allow as many people as possible to make a constructive contribution.

Vienna already has multiple formats for public information and dialogue, as well as a body of relevant experience to build upon. Processes for actual participation in decision-making are less well established, and rules and tools will have to be developed for this purpose. Between the poles of "top-down" policy-making and "bottom-up" initiatives from civil society there is a need to create shared perspectives, open up a level playing field for dialogue and reach agreement on the available scope for action – especially when the ideas of civil society initiatives do not tally with those of civic policy-makers.

Building upon the existing standards for participation, such agreements can only be arrived at by means of an open process involving the citizens of Vienna. This process will also have to clarify a number of issues: where is public participation required in order to arrive at good solutions? What are the limits to participation? In which areas is public engagement the order of the day and when do policy-makers have to make decisions in the common interest?

Figure 20: Members of the public have a say in how public funds are used

1.

Policy-makers (e.g. City Council) define clear rules (total budget, details of process, criteria for subsequent selection of projects, etc.).

Pool of ideas from the public

2.

Teams elaborate ideas into concrete proposals for submission.

3.

Panel consisting of randomly selected members of the public (none of whom have submitted a project themselves) and experts makes its selection from the projects submitted.

4.

Successful projects are announced and subsequently implemented.

Model procedure for an ideas competition with participatory budgeting

OBJECTIVE: ALL SOCIAL GROUPS HAVE THE OPPORTUNITY TO BECOME ACTIVELY INVOLVED IN CO-SHAPING SMART CITY WIEN.

All social groups, regardless of social status, age, sex or ethnicity, are to be given the opportunity to have a say and contribute to shaping the Smart City. To this end, special attention is to be paid to those groups who, for various reasons including language and educational barriers, lack of time and/or financial resources (cf. work-life balance, family and childcare commitments, etc.), only have limited choices and scope for decision-making and therefore tend to be under-represented in traditional public participation processes.

Awareness of different lifestyles and perspectives generates social cohesion among those involved and prompts changes in behaviour. Against this background various participatory methods are to be offered, primarily geared to different lifestyles, to enable the involvement of different social groups and a representative cross-section of the population. Analysis will be carried out in advance to identify and take account of the specific needs of various social groups, as well as their specific potentials. It is also important that everyone can afford to participate, so financial reward schemes will be developed to recognise people's contribution and compensate them for their time and effort; childcare facilities will be provided where necessary.

OBJECTIVE: VIENNA DEVELOPS AND EMPLOYS VARIOUS TOOLS TO GIVE THE PUBLIC A SAY ON BUDGETING AND USE OF PUBLIC FUNDS.

Giving the public an active say in how public funds are used not only strengthens local democracy and people's appreciation of the need for responsible use of limited resources. Processes of this kind also allow those involved to pool their collective knowledge, so that even neighbourhoods with a difficult status quo can jointly find and implement optimum solutions designed for long-term stability in the interests of the whole community. Models for transparent and participatory budgeting and allocation of funds are therefore to be piloted and actively utilised on the basis of the agreed participation standards. The public funds at the centre of these joint decision-making processes are primarily to be used for Smart City projects, design of public spaces, local infrastructure and activities to mitigate the consequences of global warming in Vienna. Gender and diversity considerations are also to be taken into account, refining and adapting the gender budgeting model for this purpose. It is important that sufficient funds and time resources are also earmarked for these processes.

Participatory budgets are public funds that are allocated collectively by means of a participatory consultation process. The sum available is set in advance. Participatory budgeting processes allow members of the public to submit project proposals, the merits of which are then compared and assessed by a panel – also composed of members of the public – and the implementation details (award of contracts, etc.) finalised. Participatory budgets can be set for the whole city, or earmarked for specific districts, neighbourhoods or social groups (e.g. young people).

Citizens' budgets allow members of the public – usually at city or district level – to have a say in the allocation of defined parts of the public budget by setting priorities for allocation of the funds available or submitting proposals for specific projects. The decision-making process is moderated by members of the municipal administration acting in an advisory capacity. The focus is on the processes of discussion, appraisal and communication involving policy-makers, administrators and civil society.

OBJECTIVE: THE OPPORTUNITIES FOR PUBLIC PARTICIPATION IN SMART CITY WIEN ARE VISIBLE AND ACCESSIBLE TO ALL.

One basic element of civic participation and community involvement is a good supply of information. The development of new technologies means that the range of tools for public information and participation is constantly increasing, along with people's opportunities for political and social engagement. The City of Vienna and its municipal agencies and enterprises utilise these new technologies to develop user-friendly information and communication tools and digital platforms for participation, facilitating access to municipal data and services and opening up additional opportunities for public engagement.

The essential factor here is that these new formats must be accessible to all sectors of the population with due regard for the respective social, economic and cultural background and that they can be used and understood by all. Digital tools are designed to meet the needs of people, and not vice versa. Conventional "analogue" forms of participation continue to be offered and supported alongside the digital ones. Finally, in order to establish a modern, inclusive culture of participation, the municipal administration also requires a common understanding and rules for the handling of public input, including prompt responses and open communication about its own actions.

OBJECTIVE: "URBAN LABS" AT NEIGHBOURHOOD LEVEL HAVE BEEN CREATED TO PILOT INNOVATIVE NEW METHODS AND PROCESSES FOR SMART CITY WIEN AND BUILD NETWORKS OF LOCAL ACTORS AND STAKEHOLDERS.

The shaping of Smart City Wien, including the development and implementation of the necessary innovation steps, calls for broad engagement and new partnerships between municipal and local district policy-makers, the municipal administration, businesses, local communities and pro-active citizens. The district and the local neighbourhood are the ideal settings for this: the benefits are quickly and immediately visible to all users; reaching agreement on common goals is most straightforward at this level, and it is here that new forms of participation, communication and decision-making are easiest to try out. New urban labs – both digital and analogue – are thus to be created at district and neighbourhood level; as open-use spaces for self-organised processes or as staffed neighbourhood drop-in centres; as platforms for bringing together expertise and local talent, building networks and strengthening community engagement. Innovative pilot projects will combine self-organised bottom-up processes with specific top-down participation schemes, engendering new neighbourhood partnerships in which pro-active local citizens cooperate closely with the municipal administration and other stakeholders.

Vienna's Smart City goals at a glance

Headline Goals

Quality of life

- Vienna is the city with the **highest quality of life** and **life satisfaction** in the world.
- Vienna focuses on **social inclusion** in its policy design and administrative activities.

Resource conservation

- Vienna reduces its local per capita **greenhouse gas emissions** by 50 per cent by 2030, and by 85 per cent by 2050 (compared to the baseline year of 2005).
- Vienna reduces its local per capita **final energy** consumption by 30 per cent by 2030, and by 50 per cent by 2050 (compared to the baseline year of 2005).
- Vienna reduces its **material footprint of consumption** per capita by 30 per cent by 2030, and by 50 per cent by 2050.

Innovation

- By 2030 Vienna is an **innovation leader.**
- Vienna is Europe's **digitalisation capital.**

Thematic Fields

ENERGY SUPPLY

- Vienna's level of **energy security** remains high.
- Vienna has smart **energy grids** that allow a decentralised, renewables-based energy supply.
- **Renewable energy production** within the municipal boundaries doubles between 2005 and 2030.
- In 2030 30 per cent, and in 2050 70 per cent of Vienna's final energy consumption originates from **renewable sources.**

MOBILITY AND TRANSPORT

- Per capita **CO_2 emissions** in the transport sector fall by 50 per cent by 2030, and by 100 per cent by 2050.
- Per capita **final energy consumption** in the transport sector falls by 40 per cent by 2030, and by 70 per cent by 2050.
- The share of journeys in Vienna made by **eco-friendly modes of transport, including shared mobility options,** rises to 85 per cent by 2030, and to well over 85 per cent by 2050.
- By 2030, **private motor vehicle ownership** falls to 250 vehicles per 1,000 inhabitants.
- At least 70 per cent of all journeys in Vienna continue to be **short distances** of up to 5km, and the majority are made by bike or on foot.
- The **volume of traffic crossing the municipal boundaries** falls by 10 per cent by 2030.
- **Commercial traffic** within the municipal boundaries is largely CO_2 free by 2030.

BUILDINGS

- Per capita **final energy consumption** for heating, cooling and hot water in buildings falls by 1 per cent per annum, and the associated per capita CO_2 emissions by 2 per cent per annum.
- From 2025 onwards, the **heating energy requirements** of new buildings are covered by renewables or district heating as standard.
- Buildings are used for **greening** and for the **generation of solar energy.**
- From 2030 onwards, **site- and use-specific planning and construction processes** to maximise conservation of resources are standard practice in new builds and refurbishment projects.
- In 2050, 80 per cent of **building components** and **materials** from demolitions and major refurbishment projects are **reused or recycled.**

DIGITALISATION

- As part of a **joint digitalisation strategy,** the City of Vienna and its municipal enterprises use digital data, tools and artificial intelligence in applications that help conserve resources and maintain the city's high quality of life.
- By 2025, all **processes and services** of the municipal administration and its associated enterprises are digitalised and fully automated wherever possible.
- Vienna has a modern, needs-based **digital infrastructure** designed for energy- and resource-efficient operation.
- The City of Vienna uses **digital data** (mined using state-of-the-art technologies and analytical methods) to support decision-making and for real-time management of urban systems.
- The City of Vienna uses digital tools to create transparency, enable participation and position itself as a pioneer in the field of **open government.**
- The City of Vienna actively makes available the data it generates as **open government data,** especially for scientific, academic and educational use.
- The City of Vienna actively seeks collaboration with third parties in order to pilot digital applications, technologies and infrastructure in practice-based **"urban digital labs"** and prepare them for roll-out across the entire city.

ECONOMY AND EMPLOYMENT

- The **productivity** of Vienna's urban economy constantly increases, underpinning the city's prosperity, resource efficiency and competitiveness.
- The **incomes** and **job satisfaction** of Viennese citizens constantly increase, while social inequality declines.
- The **material efficiency** of the Viennese economy increases by 30 per cent by 2030.
- **Products** manufactured in Vienna are **durable** and **recyclable** and their production processes are largely waste and pollutant free.
- In 2030, Vienna has a global reputation as the hub of a **resource-efficient circular economy** and attracts investment and talent in this sector.

WATER AND WASTE MANAGEMENT

- Less waste is produced thanks to a wide range of **waste prevention** measures.
- Vienna's waste collection systems enable an increasingly large proportion of waste to be recycled or reused as **secondary raw materials.**
- High standards of **waste management** ensure reliable, safe disposal of waste to minimise the burden on the environment.
- Vienna's **water supply and waste water management infrastructure** is maintained and operated to a high standard and in a resource-efficient manner.
- In Vienna, as much **rainwater** as possible is fed back into the local natural or near-natural water cycle.

ENVIRONMENT

- The **share of green space** in Vienna is maintained at over 50 per cent until 2050.
- Vienna creates additional **recreation areas** in line with population growth.
- The city's ongoing provision of local **green and open spaces** for different target groups within the existing urban fabric keeps pace with population growth.
- The **natural functions of the soil** are maintained through preservation of existing unsealed surfaces and creation of new ones.
- Vienna promotes **biodiversity.**
- In the interests of people's health and well-being, **air, water and soil pollution, noise and heat pollution** and **light pollution** are all minimised as far as possible.
- The City of Vienna promotes a **sustainable food system.** The city's food supply is largely sourced from the city itself and the surrounding region, preferably from organic producers.

HEALTHCARE

- In 2030 the **healthy life expectancy** of the Viennese population has increased by two years.
- Provision of high-quality **medical care** in Vienna is guaranteed.
- Smart City Wien supports **healthy active ageing** – care-dependent Viennese citizens receive high-quality care at home or close to home for as long as possible.
- **Health literacy** is promoted at both the individual and organisational level.
- All social groups, especially vulnerable ones, are protected against the **health risks associated with climate change.**

SOCIAL INCLUSION

- Vienna is a diverse city that promotes **gender equality** and **opportunities for participation** for all who live here.
- Vienna provides high **quality of life and amenity value in all parts of the city** by investing in public infrastructure, strengthening community cohesion and fostering urban competences.
- Vienna continues to provide an adequate supply of high-quality **subsidised housing** to reduce the percentage of people who are overburdened by housing costs.
- Vienna stands out for its **fair working conditions, adequate wages** for gainful employment and **social welfare schemes,** which permit a decent standard of living for all.
- **Municipal services** are accessible to all citizens of Vienna – to an increasing extent in **digital** form, and, where required, in **analogue** form as previously.

EDUCATION

- Everyone enjoys low-threshold **access to** high-quality, inclusive **educational facilities** at the earliest possible age and continues her/his education **beyond compulsory schooling.**
- By 2030 a city-wide network of **"Bildungsgrätzln" ("learning communities")** has been established to create learning spaces that are tailored to local neighbourhoods, communities and lifestyles.
- Vienna boasts a comprehensive, needs-based, inclusive programme of **digital education.**
- A **diverse range of public engagement programmes** open up access to Vienna's multi-faceted arts and cultural scene.
- **Raising awareness** of sustainable, resource-efficient development is a standard teaching objective in all educational institutions.
- Vienna's education, training and qualification programmes reflect **changing occupational profiles** and equip the workforce with the expertise and skills to apply new smart technologies and practices.

SCIENCE AND RESEARCH

- In 2030, Vienna is one of Europe's top five **research and innovation hubs.**
- Vienna is a **magnet for top-flight international researchers** and the **research units** of international corporations.
- Vienna initiates large-scale **mission-led research and innovation projects** as a contribution to the socio-ecological transformation.
- In Vienna, **specific challenges** relating to Smart City Wien are identified and resolved **cooperatively** by the municipal administration, higher education and research institutions, companies and end users.

PARTICIPATION

- The City of Vienna continuously works on its participation standards in partnership with local people, and **participation is generally increasing overall.**
- **All social groups** have the opportunity to become actively involved in co-shaping Smart City Wien.
- Vienna develops and employs various tools to give the public a say on **budgeting** and use of public funds.
- The opportunities for public participation in Smart City Wien are **visible and accessible to all.**
- "Urban labs" at neighbourhood level **have been created to pilot innovative new methods and processes for Smart City Wien and build networks of local actors and stakeholders.**

Overview of SCW thematic fields and their contribution to achieving the SDGs

Economy and employment
Environment
Healthcare
Social inclusion
Education

Environment
Healthcare

Environment
Healthcare

Energy supply
Buildings
Digitalisation
Science and research

Digitalisation
Economy and employment
Social inclusion
Education

Digitalisation
Economy and employment
Science and research

Energy supply
Mobility and transport
Buildings
Environment
Science and research

Environment

Water and waste
Environment

Economy and employment
Healthcare
Education
Science and research

Digitalisation
Economy and employment
Healthcare
Social inclusion
Education
Science and research
Participation

Water and waste
Environment

Digitalisation
Economy and employment
Healthcare
Social inclusion
Education
Participation

Energy supply
Mobility and transport
Buildings
Digitalisation
Economy and employment
Water and waste
Environment
Healthcare
Social inclusion
Science and research
Participation

Energy supply
Buildings
Digitalisation
Economy and employment
Water and waste
Education
Science and research

Digitalisation
Social inclusion
Participation

Social inclusion
Participation

5. Governance

From Strategy to Implementation

Courage to forge new paths

Two mindsets, above all, are important for Vienna's future as a Smart City: enabling steady and constant evolution and creating space for the new. The new – be it services, corporate plans and business models, forms of mobility, modes of social interaction or cultural expression – hardly ever fits into established structures and remits. A few innovations are easy to integrate into tried-and-tested mechanisms and quickly produce positive results. Others start out as a "challenge" for the existing set-up. Making a commitment to the Smart City also means that the management of the city, in particular, will be repeatedly put to the test and so must be ready to be very adaptable. What is required, first and foremost, is openness and a willingness to question established ways of doing things. This is the only way of ensuring that the successes and achievements of the past and present are carried forward into the future.

The innovation focus of Smart City Wien also calls for new tools and approaches in the design and delivery of municipal services. In this respect the municipal administration is setting the bar very high: the quality of services is to be maintained at the same high level while taking even greater account of the various needs of everyone living in Vienna, thus demonstrating how modernisation can be used to uphold and enhance quality of life.

Seeing the bigger picture

A particular effect of the Framework Strategy with its integrated approach is that the individual thematic fields und objectives should and will become more closely interlinked so that synergies emerge. It thus becomes clearly evident how activities in one area also produce a positive impact elsewhere, for example, when eco-friendly forms of mobility simultaneously improve traffic safety, reduce noise pollution and encourage healthy physical exercise. At the same time, seeing the whole picture also highlights conflicting objectives and allows an open debate on what should take priority.

In practice, an integrated approach of this kind is demanding in that it presupposes a high degree of dialogue and cooperation – between different municipal agencies and departments and between the municipal administration, businesses and civil society, in prioritising and implementing measures and monitoring their impact. The full potential of the Smart City approach can only be realised if tasks and challenges are viewed from a more interdisciplinary, inter-agency perspective, cutting across the boundaries between remits and working together on joint solutions. It is often local action – supported or facilitated by appropriate measures – that succeeds in overcoming these boundaries. Non-cooperation, on the other hand, incurs high costs due to inconsistencies, duplications or gaps that then require readjustments later on.

Management and coordination

The cross-cutting approach of the Smart City Wien Framework Strategy imposes special requirements on the various different tiers of action in terms of management and coordination of activities. As a higher-level umbrella strategy it defines a long-term framework (2050) which not only guides the actions of all the City of Vienna's agencies, institutions and municipal enterprises, but also invites the scientific and business communities and the citizens of Vienna to participate as partners in its implementation. To this end, Smart City Wien also employs well-established mechanisms and tools in the strategic management and implementation of the strategy, in order to ensure efficient and effective action towards the desired results. Overall management and coordination of the strategy is effected via a governance structure that reflects the complexity and breadth of content of the undertaking.

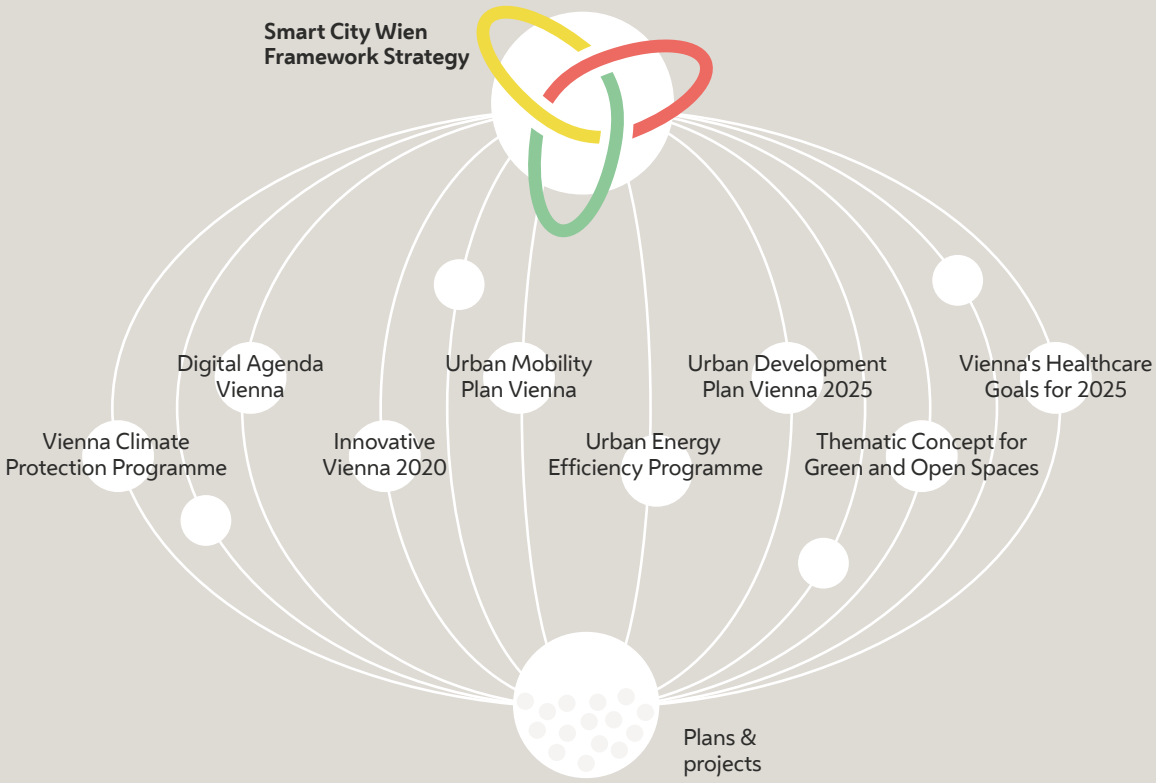
In particular, the Smart City governance structure is designed to perform the following functions:

- **Orientation for sectoral strategies and packages of measures:** The Framework Strategy provides a long-term higher-level orientation framework for all shorter-term specialised sectoral strategies and programmes of the City of Vienna. The latter translate the Smart City goals into suitable detailed specifications for operationalisation and implementation in the respective specialised areas, and – wherever appropriate – across departments and sectors and via collaborative partnerships. The Smart City governance structure ensures that the sectoral sub-strategies are compatible with the contents and time horizons of the Framework Strategy, involves the relevant actors and stakeholders in the consultation processes for coordination of objectives and measures and provides a platform for identification and resolution of any conflicting objectives. A regularly updated list of detailed sectoral strategies and specialised programmes of relevance to the Smart City headline goals can be downloaded from the Smart City Wien website.

- **Internal agenda-setting and awareness-raising:** A systematic, cross-departmental discussion about the goals of the Framework Strategy, current requirements and priorities and ongoing or planned projects, initiatives and measures by the various administrative groups, departments and enterprises of the City of Vienna plays an essential role in deepening understanding of Smart City agendas und firmly anchoring the goals, objectives and approaches of the Framework Strategy throughout the local authority.

- **Initiation of key cross-departmental projects:** Major, innovative, multi-dimensional beacon projects require inspiration and impetus to get them off the ground in the first place and coordinated partnerships within the municipal administration for their implementation, not least with regard to raising of funds and planning of resources.

Figure 21: The Smart City Wien Framework Strategy as an umbrella strategy



Sectoral strategies and measures developed by the City of Vienna are aligned with the content and objectives of the Framework Strategy.

- **Addressing stakeholders outside the public sector:** The Smart City Wien Framework Strategy is not only an expression of political will and a set of guidelines for the agencies and institutions of the City of Vienna; to a significant degree, its realisation also relies on initiatives by other stakeholders. The Smart City Wien governance structure aims at securing the active collaborative involvement and cooperation of a range of different stakeholders from business, R&D and civil society. Respectful interaction with these stakeholders on a level playing field, from exchange of expertise to implementation of innovative solutions, is an essential prerequisite for achievement of the Smart City goals.

- **Strategic and quality management through monitoring:** Regular monitoring assesses the extent to which the objectives of the Framework Strategy have been attained. Monitoring serves as a management tool for discussion of future priorities and focal points for action. At the same time, the monitoring process creates a platform for dialogue around progress with implementation and where cooperation is required, as well as a basis for effective PR and public mobilisation.

In order to perform these functions, Smart City Wien utilises personnel and financial resources on all the available levels:

- **The responsibility of the policy-making level** is to define a clear policy line for Smart City Wien. It issues policy instructions, approves planned measures and makes available the required resources.

- **The level of the Chief Executive Office** of the City of Vienna ensures the strategic coordination of Vienna's Smart City initiative. Among other things, this also includes ensuring that sectoral strategies are aligned with the Smart City goals, initiating cross-cutting projects and measures, evaluating the monitoring results, discussing strategic courses of action and resolving conflicting objectives. It also guarantees the regular exchange of knowledge within the municipal administration at the operational level and promotes the development of suitable measures and projects on priority issues.

- **The civil society,** and particularly representatives of the scientific and business communities, are to be assigned an even greater role in Smart City Wien in future: firstly through Smart City advisory boards or working groups, which both advise on content as well as publicising the Smart City ethos and recruiting partners for implementation activities within their respective networks; and secondly by recruiting ambassadors for Smart City Wien, who will widely disseminate the basic principles and goals of the Framework Strategy throughout the urban community and thus make their own contribution to establishing strategic partnerships. The main channel for this, however, will be through active involvement as part of participatory processes or through implementation of self-initiated projects and measures.

- The activities of the City of Vienna are supported by the **Smart City Wien agency**. The tasks of this municipal institution comprise operational matters such as initiating and coordinating projects, advising and supporting municipal actors, managing stakeholder enquiries as a point of liaison for new partnerships, communication and networking activities and providing support to the Smart City governance structure.

To ensure efficient, coordinated handling, dedicated coordination and management structures are to be established on all the above levels and existing tools and processes will be revised and updated on an ongoing basis as the background scenarios and challenges evolve over time.

Tools for implementation

Like the strategic management and detailed specification of the overarching Smart City objectives, the development and delivery of specific implementation measures in many cases also lies within the remit of the individual policy-making departments and the municipal agencies and enterprises.

In addition, however, the complexity and multidimensional nature of the objectives and thematic fields calls for more collaborative forms of implementation – not least because many tasks can only be performed by working together across the individual organisational units. Ultimately, Vienna's evolution into Smart City Wien can only succeed if the goals and targets receive widespread support far beyond the city's policy-making and administrative bodies and a broad spectrum of stakeholders participates in their realisation.

- **Interdisciplinary beacon projects:** Cross-departmental innovation projects with broad involvement of a number of different organisational units of the City of Vienna, sometimes together with private stakeholders, are launched to tackle major challenges. For projects of this kind it is advisable to appoint theme managers, individuals who act as the faces of the project and as ambassadors for Smart City Wien.

- **Public-private partnerships:** The impact of the Smart City initiative is enhanced by intensifying and deepening relevant partnerships with the scientific and business communities and civil society. Getting on board projects and schemes led by businesses, research institutions and civil society organisations is one option; alternatively, partnerships can be actively initiated by the City of Vienna. The aim in the medium term is also to create an institutional framework (such as project budgets jointly funded from public and private sector sources) to set up joint ventures and implement key projects.

Climate budgeting is a form of budgeting which shows the climate policy effect of each measure or cost position in the public budget (or parts thereof), usually in terms of the carbon emissions saved. This gives climate action strategies a solid funding base and enhances their transparency and credibility, since spending on combating climate change can be set off against the costs saved by avoiding the damage associated with climate change.

- **Pilot projects and living labs:** Pilot projects are used to test innovative solutions on a small scale. The spectrum here ranges from trials of technical applications through to applying the principle of climate budgeting when drawing up municipal budgets[13]. In living labs at local neighbourhood level, research institutions collaborate with local public sector and civil society stakeholders to develop technical and social innovations, new products or procedures and test them out in the local community. Sufficient personnel and financial resources also need to be earmarked for the coordination of projects of this kind.

- **Research partnerships:** The aim here is to strengthen cooperation between the City of Vienna, universities and other research institutions on Smart City issues. This can be effected by establishing longer-term partnerships (cooperation agreements), providing support in the recruitment of additional key staff at Viennese universities and research institutions, embedding Smart City issues as subjects in university teaching

[13] In its meeting of 26 June 2019, Vienna City Council approved the introduction of a municipal climate action budget.

syllabuses and research, and through major inter- and transdisciplinary research projects, which also facilitate access to European Innovation Platforms and funding from the EU Research Framework Programmes. The municipal government and administration act as initiators and sponsors of these efforts, and also as developers and users of innovations. Vienna's higher education institutions define research priorities with an explicit focus on Vienna and are open to exchange and engagement with the municipal administration and the general public.

- **Participatory formats:** The development of Smart City Wien not only requires wide public acceptance – it also opens up an array of new opportunities for public participation. Vienna is committed to a culture of active public participation and engagement in the Smart City project, which aims to involve everyone in the city. The spectrum of options ranges from introduction of a citizens' advisory forum to joint establishment of "neighbourhood innovation labs" and participatory decision-making on the allocation of Smart City budgets.

Activities to implement these options are to be coordinated across executive groups and departments and amalgamated in a joint action plan, the "Smart City Wien Roadmap". The roadmap is to be continuously updated.

Alliances and partnerships

Across the world, cities are increasingly becoming the focus of policy-making on innovation and around climate and energy issues. By forming alliances cities can join forces to advocate their common agendas, for instance with regard to safeguarding the principles of general public interest and provision of public services, or ensuring that their thematic priorities are incorporated in the EU funding programmes.

Alliances and partnerships for Smart City Wien:

- **Vienna metropolitan region – Smart Region platform:** Close coordination and collaboration with Vienna's neighbouring federal provinces and the local authorities within the "Smart Region". The "Platform for Energy and Climate Action (Smart Region)"[14] under the auspices of Planungsgemeinschaft Ost, the joint planning organisation of the three federal provinces of Vienna, Lower Austria and Burgenland, is the springboard for cooperative strategies and measures across the administrative boundaries.

- **Federal-local cooperation:** Active leverage of the Memorandum of Understanding concluded in July 2013 between the City of Vienna and the Federal Ministry for Transport, Innovation and Technology to coordinate activities at the municipal and federal level and identify potential synergies.

[14] Policy paper on stronger cooperation on energy and climate action in the eastern region (2016)

- **Alliances of cities:** Deepening of alliances with cities in Austria and other European metropolises to formulate and advocate positions and arguments that help to achieve the Smart City goals, e.g. safeguarding the principles of general public interest and provision of public services, ensuring that the relevant thematic priorities are incorporated in the EU funding programmes. City partnerships are also used as platforms for shared learning processes around key Smart City issues and experiences.

Smart Region

Metropolitan Region+, consisting of the city of Vienna at the core and the towns and municipalities in the surrounding hinterland, is a settlement area and economic region with a dense network of multiple interconnections. The boundaries between the provinces of Vienna, Lower Austria and Burgenland scarcely play a role in the everyday lives of local people in terms of where they live, work, shop or spend their leisure time.

The three provinces also face the same development trends and challenges: inward migration and sustained growth are not only a feature of Vienna, but also of the small and medium-sized centres of Metropolitan Region+. The impact of global climate change is increasingly making itself felt – albeit in various forms and to varying degrees – in the densely built-up urban districts as well as in the more rural areas; conservation of resources and the transition from fossil fuels to renewables are the order of the day in both types of settlement structure.

With regard to sustainable development, coordination and cooperation within Smart Metropolitan Region+ are thus growing in importance. This applies, for instance, to transport provision within the region, which significantly influences whether people choose eco-friendly forms of mobility for travel between home and work. Type of land use is an important climate factor in predominantly urban settlement structures; keeping so-called "fresh air corridors" free of development in the city and its hinterland can significantly reduce heating of the urban environment. The development of recreation areas throughout Metropolitan Region+ calls for joint landscape planning activities by the City of Vienna and its neighbouring local authorities, which have already been successfully initiated.

Likewise, the shift to renewable energy sources can only be effected through close collaboration between the provincial and local authorities. In future, Vienna will be able to cover a proportion of its renewables requirements from local sources (e.g. from geothermal energy and small-scale solar PV installations), yet at the same time it remains reliant on electricity from the large-scale wind farms and solar and biomass plants in Lower Austria and Burgenland. By the same token, urban centres like Vienna are major customers of the energy suppliers. The advantages are obvious: a climate-friendly energy supply, less dependence on imports from politically unstable countries, and the added value stays in the country.

Against this background, all opportunities are to be utilised in future to leverage the potentials of close cooperation and develop joint strategies and solutions for the Smart Metropolitan Region+.

Under the auspices of Planungsgemeinschaft Ost (PGO), the joint planning organisation of the three federal provinces of Vienna, Lower Austria and Burgenland, the "Platform for Energy and Climate Action (Smart Region)" was set up back in 2014 and agreed to step up cooperation on energy and climate action throughout the eastern region. In a joint policy paper published in 2016, the three provinces, taking account of and leveraging their different spatial conditions and requirements, commit to a common Smart Region based on inter-province collaboration that is to be deepened and expanded in future.

On this basis, Vienna aims to work with Lower Austria and Burgenland to develop the following aspects of this **common Smart Region:**

- combining sustainable spatial development with upgrading and expansion of the energy and mobility infrastructure; this entails:
  - compact, space-efficient development of settlements and buildings along eco-friendly transport routes
  - expediting the development of eco-friendly transport infrastructure and mobility options
  - energy-efficient development of settlements and buildings taking account of energy resources and supply infrastructure (e.g. utilisation/expansion of existing district heating grids, local sources of renewable energy, etc.)
  - expansion of renewable energy production and the associated supply infrastructure;

- coordination of measures for adapting to climate change;

- sustainable economic and business development that is more strongly geared to the principles of spatial and material efficiency, the circular economy and decarbonisation;

- maintaining/safeguarding a high level of supply security through coordinated expansion of renewable energy production and the associated grid infrastructure, simultaneously delivering an efficient energy supply system incorporating new smart technologies;

- a coordinated, effective working approach on the part of the relevant local authority departments and networks.

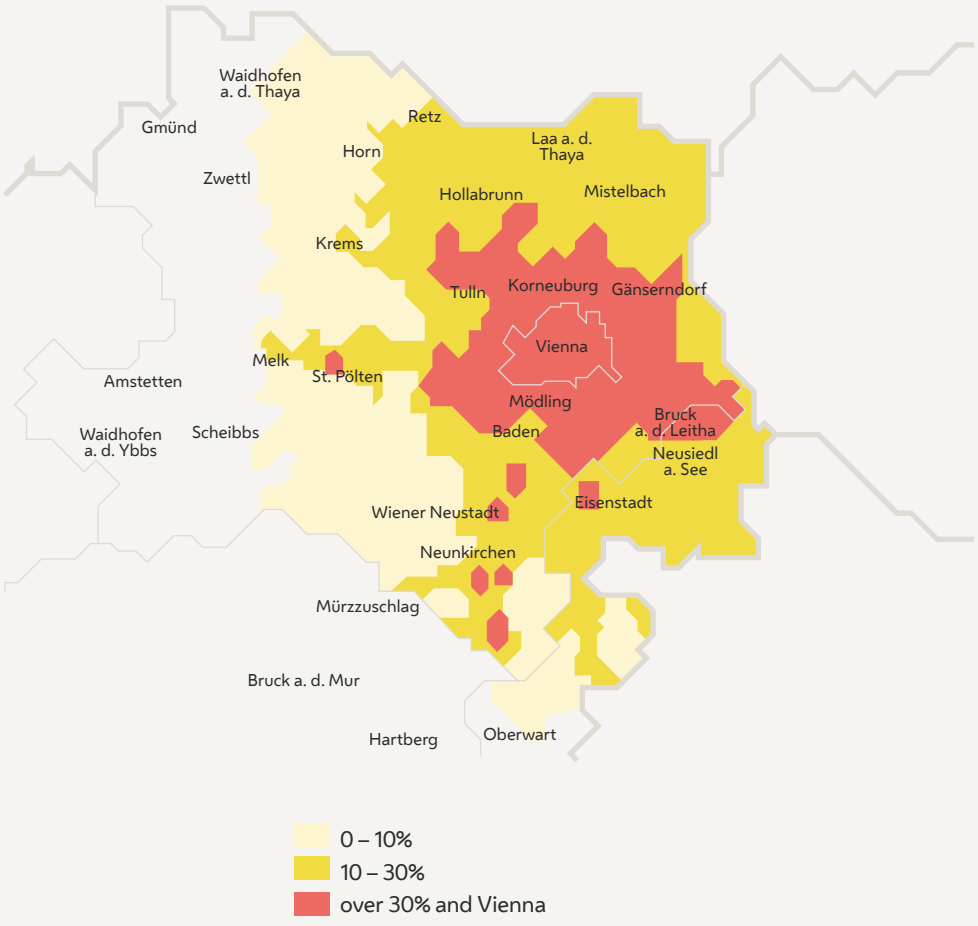
From Vienna's point of view, future spheres of action for Smart Metropolitan Region+ include, firstly, integrating this joint approach into the strategies and plans of the respective provinces;

- secondly, developing and implementing joint beacon projects, especially in the context of regional collaborations where emphasis is placed on working together across local authorities;

- consistent building of networks among stakeholders in the region, and

- drafting of a comprehensive spatial development strategy for the entire Smart Region.

Figure 22: Regional interlinkage: administrative boundaries are becoming less and less important in everyday life



Graphic based on Municipal Department MA 18 (Urban Development Plan Vienna 2025, 2014). Data: AIT/A1. Analysis of movements of users of the A1 mobile communications network in Austria (24–26 January 2012)

Degree of interlinkage: everyday journeys into Vienna from the surrounding region
Share of mobile phone users who spent the night (midnight to 6 a.m.) in one of Vienna's surrounding municipalities and visited Vienna (at least briefly) during the day.

Monitoring

Long-term strategies like the Smart City Wien Framework Strategy, in particular, require regular review to evaluate progress achieved in their implementation and assess action still required. Monitoring of this kind enables effective management of the strategy in order to ensure attainment of the goals.

Following adoption of the Strategy in 2014, the first monitoring process was carried out in spring 2017 and the results published in a detailed report. The findings provide the basis for the future design of the monitoring process.

The primary aim of the monitoring process is to verify at regular intervals whether the objectives of the Smart City Wien Framework Strategy are on track for attainment by the specified point in time, or indeed have already been attained. This evaluation is carried out on the basis of defined indicators, utilising the expertise of the participating staff of the City of Vienna and its associated institutions.

The monitoring results provide Vienna's policy-makers and municipal administration with well-founded information as a basis for decision-making, assessing the need for immediate action and timely provision and coordination of the necessary resources. Management on the basis of the monitoring results thus plays a significant role in guaranteeing and optimising implementation of the Framework Strategy and making the process as efficient as possible. The monitoring process provides an overall picture of the various policy fields, enabling joint consideration and evaluation of the city's development. It also supports cooperation across departments and agencies.

Likewise, the clear, simply presented report on the monitoring results provides an important tool for telling people about the City of Vienna's activities and helps to create awareness of the Smart City goals among policy-makers and administrators, companies, research institutions and – last but not least – the Viennese public, mobilising all stakeholders to work together on their implementation.

In terms of methodology and content, the Smart City monitoring process is synchronised with other monitoring and evaluation processes carried out within the municipal administration, especially the reporting procedure for the UN Sustainable Development Goals.

The monitoring process for the Framework Strategy is based on methodology developed as part of a research project, which was piloted in 2017 and subsequently evaluated. The methodology comprises the following elements:

- Evaluation of attainment of objectives by means of indicators;
- Drafting of recommendations for action based on the evaluation of the objectives;
- Reporting to the political management level;
- Evaluation of the monitoring results and definition of appropriate management measures where required;
- Publishing of public information on the monitoring results.

Attainment of the objectives is evaluated by means of suitable indicators or sets of indicators, pre-defined for each objective of the Framework Strategy and approved by the City Council. In justified cases, indicators can be modified, replaced or added to. In the interests of efficient data collection, the city's numerous existing data sets are to be used where possible and the indicators aligned with those of sectoral strategies and programmes. The collection of required but not yet available data is assured where necessary. By these combined means, a solid corpus of data is put together for Smart City Wien.

All relevant departments and agencies of the municipal administration and its associated enterprises and organisations are involved in the monitoring process. In this way, joint reflection on the extent to which objectives have been attained and future action required creates a platform for dialogue across thematic and administrative remits. Clearly defined roles and remits – from higher-level responsibility through to operational coordination – ensure efficient and effective conduct of the process.

The monitoring process is carried out in this form at least once every five years. As far as technical capacity allows, core indicators that become available at regular intervals are digitally processed and published as soon as possible (e.g. via a Smart City Wien dashboard). The objectives and indicators are evaluated in multi-year cycles aligned with the time horizons of the Framework Strategy. Given that the background scenario will continue to change repeatedly in future, the results also serve as a starting point for any necessary revisions and/or updates of the Framework Strategy. In this context an assessment is to be made to see where objectives need to be sharpened.

Communication and awareness-raising

Vienna's municipal administration and policy-makers have designed a strong, broad-based communication strategy that aims to bring the concept of the Smart City to life, present the Smart City goals in a true-to-life style and stimulate public appetite for a smart future. This can only succeed through constant exchange and engagement with the Viennese population as well as with numerous experts and other partners.

Information and communication activities are conducted by the PR teams of the various municipal agencies and institutions, coordinated by the City of Vienna Press and Information Service and supported by the Smart City Agency where necessary.

These activities take the form of:

- **Showcase projects:** Raising the profile of innovative projects with immediate, readily communicable benefits for the city and its people. This is where the City of Vienna can lead by example with activities in its own sphere – from switching the municipal vehicle fleet to green fuel to designing public cultural venues, educational and healthcare facilities as flagship sustainable buildings.

- **Incentive schemes:** Creation of incentives for sustainable behaviours and lifestyles. For example, people can be "rewarded" for travelling by eco-friendly modes of transport (instead of by private car) or for buying green products, with tickets for City of Vienna cultural events or leisure facilities. This could be based on a transparent blockchain system using tokens as currency.

- **Testimonials:** Bringing personalities from all spheres of city life on board as ambassadors for the Smart City ethos.

- **Communication platforms:** Creation of physical and virtual platforms for an open public debate on visions, ideas and ways of implementing Smart City Wien.

- **Partnerships:** Establishing collaborative partnerships with various institutions and organisations, for instance in the education, media or cultural sectors, which act as multipliers for the Smart City ethos and open up spaces for dialogue on Smart City issues.

- **Showcasing Smart City Wien:** Stepping up marketing activities to increase the international visibility of Vienna's Smart City capability – as a shared urban agenda, a locational plus point and a strong brand in the international competition among cities.

Index of illustrations

In-depth sectoral strategies

A regularly updated list of detailed sectoral strategies and specialised programmes with relevance to the Smart City headline goals can be downloaded from the Smart City Wien website under the following link:
https://smartcity.wien.gv.at/site/en/appendix-smart-city-wien-framework-strategy/ – in German only

Indicators and data sources

A list of indicators used to evaluate attainment of the Smart City objectives can be downloaded from the Smart City Wien website under the following link:
https://smartcity.wien.gv.at/site/en/appendix-smart-city-wien-framework-strategy/ – in German only

References and further reading

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Glossary

Active & Assisted Living (AAL)
ICT-based solutions to enhance the autonomy of elderly people. The aim is to maintain and promote an independent lifestyle for people until well into their advanced years and improve the quality of help and support services and home-based care. The user-centred technologies and applications are designed to be integrated into the immediate home environment. The technology adapts to the needs of the user and not vice versa.

Adapting Infrastructure to Climate Change (InKA) programme
This programme will run from 2018-2025, implementing concrete measures to mitigate overheating in the summer months as provided for in the Urban Heat Islands Strategic Plan. The programme focuses on measures in the following areas: "Water in the city", "Sustainable urban space", "Green and open spaces", "Greening of buildings", "Measures in the existing urban fabric", "Air circulation and open spaces" and "Spatial planning and settlement structure".

Automated vehicles (also known as Autonomous vehicles, Driverless vehicles or Self-driving vehicles)
Vehicles, mobile robots and driverless transport systems that are largely autonomous in their operation. The level of automation varies, from the driver assistance systems that are already in widespread use today to partial, high and full automation. With increasing automation, the driver is successively relieved of driving tasks and delegates certain steering and control functions to the system.

Building Information Modeling (BIM)
An innovative digital modelling tool for planning, executing and managing a construction project across the project lifecycle. Prior to realisation the building is visualised as a virtual 3D model (the Building Information Model) integrating all information about every component of the building.

Carbon budget
Because greenhouse gases remain in the atmosphere for a very long time (several hundred years in the case of CO_2, for example), the key indicator is the cumulative build-up of carbon emissions in the atmosphere over time. This is illustrated by the concept of the carbon budget (also known as the CO_2 budget or emissions budget). The carbon budget is the amount of CO_2 emissions that human activities have emitted into the atmosphere since the start of the Industrial Revolution, or conversely the amount that humans can still emit while still having a likelihood of keeping global warming below 2°C; or preferably even below 1.5°C in accordance with the Paris Agreement on Climate Action.

Carbon neutral (or climate neutral)
Carbon-neutral or climate-neutral actions and processes cause no greenhouse gas (carbon) emissions, or the emissions they produce are fully compensated for and thus have no impact on the climate. The most consistent form of climate-neutral energy supply is the use of greenhouse gas-free energy sources such as sunlight, wind and hydropower.

Car-sharing
The average private motor vehicle actually stands unused – in most cases parked in the public space – for 23 hours a day. Several initiatives have sprung up in Austria over the past few years to promote more efficient use of cars and parking space, offering either commercial or privately organised car-sharing services. At present, car-sharing services are mainly clustered in cities; nationwide coverage with a range of different forms of car-sharing and appropriate vehicles will impact the future of mobility.

Clean Energy Package for All Europeans
The legislative package agreed by the EU comprises a series of key energy and climate policy regulations: a new version of the renewable energy directive, an amended version of the directive on energy efficiency, the revised energy performance in buildings directive, a regulation establishing a modern design for the EU electricity market, and a governance regulation for the energy union.

Climate Protection Programme (KliP Vienna)
The City Council adopted the first KliP Vienna back in 1999, to run until 2009. The sequel, KliP II, runs until 2020 and comprises 37 sets of measures with a total of 385 individual measures in the fields of energy production, energy use, mobility and urban structure, procurement, waste management, agriculture and forestry, nature conservation and public relations. The new climate protection programme currently under development (KliP III) will incorporate the climate goals set out in this Framework Strategy and specify measures to attain them.

CO_2
Carbon dioxide, the most important greenhouse gas, mainly results from the incineration of the fossil fuels coal, petroleum and natural gas. For the sake of simplicity and legibility, the term "CO_2" is used synonymously with "CO_2 equivalents" throughout the Smart City Wien Framework Strategy. The latter term takes account of the fact that other gases (nitrous oxide, methane, etc.) also have a greenhouse effect.

Decarbonisation pathway
Describes the processes involved in transitioning to a low-carbon – and ultimately zero-carbon – economy and includes carbon-saving measures by individuals, businesses and governments.

Deep geothermal energy
Utilisation of the natural heat found beneath the earth's surface at depths of between 400m and several thousand metres. Compared to near-surface geothermal energy the temperatures at these depths are far higher and can thus be used to generate electricity as well as for heating. The temperatures are also sufficiently high that the thermal energy can be used directly without the need for heat pumps.

Deep Learning and Machine Learning

- **Machine learning** is an application of artificial intelligence which develops algorithms that can learn and improve from "experience".
- **Deep learning** is an artificial intelligence function that is part of a broader family of machine learning methods based on artificial neural networks that imitate the workings of the human brain.

Digital building technology (also known as Smart building technology or Building automation)
Building technology refers to equipment used for the control and regulation of technical installations in buildings and the related planning. It ensures that buildings are supplied with heating, water and ventilation. The digitalisation and automation of this technology opens up new potentials with regard to energy efficiency, safety, security and comfort in the "smart home". Systems can be programmed to make energy-efficient decisions regarding lighting and heating, for example, while active & assisted living (AAL) systems allow elderly people to continue living an independent life in their own home for as long as they wish to.

Digital twin
Digital twins are virtual simulations of physical objects and systems. They model the properties and behaviour of these real-world objects and systems under specified conditions in real time and transmit data to the real world via sensors. The objects and systems modelled by the twin can be material or immaterial, such as products, services or processes. The latter may already exist in the physical world, or a digital twin can be created before they are physically built for planning and development purposes.

District heating and cooling
- District heating: In district heating systems, heat produced as a by-product of power generation and waste incineration is generally transported using a heated medium (usually water or steam) via a system of insulated underground pipes and supplied to consumers for domestic room heating and hot water and/or for industrial processes.

- District cooling: Since demand for district heating is lower in the warm months of the year, redundant waste heat is fed through large, environment-friendly absorption chillers or cooled using water from the Danube Canal ("free cooling") to produce district cooling capacity. Like district heating, district cooling is supplied to consumers via insulated pipes in a highly efficient closed-loop energy system.

Ecological footprint
A sustainability indicator that shows the amount of land needed to support an individual's lifestyle in terms of food, consumer goods, energy consumption, etc., and also the amount needed to absorb the resulting carbon emissions from the burning of fossil fuels. It also includes the land required to provide space for our infrastructure, including roads and built-up areas. The larger the footprint, the larger the burden on the environment.

E-government
In concrete terms, e-government is the use of information and communication technologies (ICT) by public administrations, in combination with organisational changes and new skills, in order to improve public services and democratic processes and facilitate the design and delivery of public policies.

European Climate Alliance
The European Climate Alliance brings together 1,700 member municipalities and districts covering 26 European countries as well as a variety of regional governments, NGOs and other organisations who are actively working to combat climate change. In terms of members, Climate Alliance is the largest European city network dedicated to climate action. In terms of tangible targets, each member must pass a resolution committing itself to cutting CO_2 emissions by 10% every 5 years.

European Union Emissions Trading System (EU ETS)
The EU-wide Emissions Trading System was established in 2005. An emission allowance must be surrendered for every tonne of CO_2 emitted. Since the total number of emission allowances is fixed across the EU and is annually reduced, the system guarantees emission reductions in the long run without imposing specific emission targets on individual market participants. The scarcity of allowances, combined with their tradability, has created a functioning market for emissions allowances. The "carbon price" determined by supply and demand is a yardstick that shows which carbon reduction measures are more economical than paying for allowances.

Final Energy Consumption
Final energy is the energy generated from the conversion of primary sources of energy, such as coal, lignite, crude oil, natural gas, hydropower or wind. In this process, the primary energy is converted into a form that consumers can use, e.g. electricity, heat or fuels.

Fresh air corridor
Zones that are kept undeveloped to provide inner-city districts with a circulating supply of fresh air. Development in these zones (buildings, embankments, woodland, etc.) is deliberately restricted so currents of fresh air can flow freely. Fresh air corridors are an important tool for regulating the microclimate in cities.

Gender budgeting
Gender budgeting is the finance policy tool of the gender mainstreaming strategy. It aims to incorporate a gender perspective at all levels of budgeting so that budget funds are allocated in accordance with social principles and in a way that promotes gender equality. It does not mean a separate budget for women, but an additional dimension of the traditional budgetary process.

Gender mainstreaming
Gender mainstreaming is a gender equality strategy. Differences in social status and structural inequalities between women and men are to be identified, analysed and the causes eliminated. Essentially, gender mainstreaming is a way of ensuring that decision-making on policy measures, priorities and projects takes due account of women's and men's different interests, needs and lifestyles from the outset.

Gender pay gap
The gender pay gap is the percentage difference between the average earnings of men and women.

Governance
These days, traditional forms of government are no longer sufficient to ensure effective use of the volume and variety of information or the creativity available in society. For this reason, administrations are opening up and initiating collaborative action with other social groups, e.g. citizens, the business community and other local or regional authorities, alongside the traditional hierarchical forms of government.

Grätzl
"Grätzl" is a Viennese dialect word for an urban neighbourhood that usually comprises a few blocks and is considered the smallest urban "unit". Such neighbourhoods are defined in terms of their differences from adjoining areas or a special, unique atmosphere; there are no official delimitations or territorial boundaries.

Grey energy
Grey energy refers to the (considerable) amounts of energy consumed (and the respective "grey" CO_2 emissions produced) over the entire life-cycle of a product (incl. raw material extraction, transport, storage, disposal).

Gross Regional Product
Regional equivalent of Gross Domestic Product (GDP). It is usually presented in nominal terms (using the market prices of the respective year) and is used to analyse regional economic development as well as making comparisons with other federal provinces. To calculate the gross regional product, the national subsidies and taxes on products are allocated to the individual federal provinces in keeping with their shares in regional gross value creation, resulting in the GRP.

Heat pump
Heat pumps take heat energy from water, the ground or the air, bring it to a usable temperature and transfer it into heating or hot water plumbing systems. The more efficient a heat pump is, the less electricity is required for its operation and recovery of the desired heat energy. The ambient heat captured by heat pumps comes from renewable regional resources and causes zero local greenhouse gas emissions.

Indicator structure of the Framework Strategy
Indicators are parameters based on measurable proxy values to describe subject matter that is otherwise hard to grasp. To facilitate the evaluation and documentation of the Smart City objectives, an indicator structure was designed to provide a structured overview of the individual objectives and their indicators. Indicator sets were elaborated for those objectives that cannot be mapped with a single indicator. These sets comprise one or more indicators to be used for evaluating the respective objective.

Intermodality and multimodality
- **Intermodality:** Refers to the combination of multiple modes of transport in a seamless travel chain, e.g. travelling to the rail or underground station by bike.
- **Multimodality:** Refers to the routine use of different modes of transport for different journeys over a specific period, which usually varies between a week and a month (multimodal lifestyle). A multimodal interchange in the public transport network offers alternative options for intermodal travel chains.

Internet of Things
Internet of Things (IoT) is a generic term for a network of infrastructures, devices and/or other objects that can interact with one another by exchanging data. These smart networks can be used, for example, to save energy, conserve resources, and for smart control of infrastructure systems.

Light pollution
Refers to the brightening of the night sky by artificial light sources, which can have a negative impact on flora and fauna as well as on people's health. Light pollution can come from various sources: street lighting, floodlighting of public buildings and landmarks, illuminated commercial signs and advertising, and light from homes.

Living labs
Living labs embody a research concept, often collocated in a user-centred, territorial context (e.g. a city or region), that examines the integration of research and innovative processes within the scope of a public-private partnership.

Material passport
A digital tool that provides information about the material composition of buildings and the quality and quantity of the materials they contain. This has multiple uses and benefits: as a planning and optimisation tool to support efficient use of materials in the construction and later disassembly of buildings, to document details of the materials for later recycling and recovery at the end of the building's useful life, and as a basis for the creation of a material inventory at municipal level (cf. urban mining). New digital planning tools such as Building Information Mode(l)ling (BIM) can be used to create a digital material passport and manage the data over the entire life-cycle of a building.

Memorandum of Understanding (between the City of Vienna and the Federal Ministry for Transport, Innovation and Technology (BMVIT))
Vienna's former mayor Michael Häupl and Minister for Infrastructure Doris Bures signed a Memorandum of Understanding (MOU) between Vienna and the Federal Republic of Austria to advance the Smart City cause. The aim was to set up a joint steering group to initiate future projects and cooperations and obtain funding at the European level.

Metropolitan Region+
Metropolitan Region+ is part of Austria's Eastern Region and comprises the federal capital Vienna with its 23 municipal districts, plus 205 local authorities in Lower Austria and 63 in Burgenland. Metropolitan Region+ is often referred to as Greater Vienna, Vienna Metropolitan Area, or as the Vienna conurbation or urban agglomeration. It is Austria's strongest economic region, with good infrastructure and excellent transport links, and is one of the most dynamic urban regions in Europe.

Microclimate
The urban microclimate is the climate of the city, or a small area of it, that has a direct impact on local people. The urban microclimate is influenced by a number of factors including solar radiation, air circulation (wind) and the design of building facades.

Mobility-as-a-service (MaaS)
Refers to the increasing availability of mobility solutions that are consumed as a service. Usually this entails choosing from

a wide range of mobility options (e.g. with regard to mode of transport or vehicle size). MaaS is expected to generate benefits in terms of efficiency (e.g. fewer privately owned motor vehicles with low intensity of use), convenience (e.g. central provider takes care of vehicle maintenance and functioning) and also sustainability (e.g. more considered mobility decisions due to availability of alternative options and greater cost transparency). The fast-growing trend towards service-based mobility is most pronounced in urban centres.

Mobility platform
Internet-based platforms allow transport providers to be accessed at any time. From basic travel information and booking through to end-to-end organisation of an entire travel chain, a wide range of digital formats are opening up new avenues in passenger transport to make the whole process easier and more convenient. Apps give customers user-friendly mobile access to mobility platforms via smartphone or tablet.

Nearly-zero-energy building standard
Nearly-zero-energy buildings are characterised by very low energy requirements, with a considerable share of these requirements to be covered by renewable energy sources, either on site or close by. This standard can be met either through stricter specifications for the building shell (very low heating requirements) or through increased use of renewable energy sources. The European nearly-zero-energy building standard is being introduced step by step for all new buildings in Vienna, as it applies to all new public buildings since 2018 and to all buildings from 2020.

Netzwerk Natur – Vienna's species and habitat protection programme
The programme is provided for by law in the Vienna Nature Conservation Act to protect, care for and support rare animal and plant species and near-natural habitats throughout the city for the benefit of plants, animals and people. Netzwerk Natur also carries out ongoing monitoring and mapping of rare species and habitats as a basis for further measures and the programme's accompanying PR and outreach activities.

OekoBusiness Wien
OekoBusiness Wien is the City of Vienna's environmental services package for businesses in the Austrian capital. Established in 1998 by Municipal Department 22 – Environmental Protection, OekoBusiness Wien helps companies launch eco-friendly initiatives in their day-to-day operations.

Ökokauf Wien
Launched in 1998, Ökokauf Wien is the City of Vienna's programme for sustainable public procurement. The programme aims to place a stronger focus on environmental considerations in the procurement of goods, products and services across the entire municipal administration.

Open government data
Open government data are data collected by the public administration – including e.g. geodata, traffic data, environmental, budget and statistical data – and made available to the public in machine-readable form to allow automatic data processing. Open standards for interfaces and software allow greater transparency, participation and collaboration. Alongside the technical interfaces, the administration is also required to provide a legal framework. No personal data are published.

Organic Cities Network Europe
Vienna is a founding member of the Organic Cities Network Europe, which was launched in early 2018. This network of several European cities and municipalities is committed to supplying urban populations with organic produce and promoting organic farming in urban and suburban areas.

Paris Agreement on Climate Action
The Paris Agreement, signed in 2015, is an agreement between 195 member states of the United Nations Framework Convention on Climate Change (UNFCCC) which sets out a global action plan to avoid climate change as a follow-up to the Kyoto Protocol. Its goal is to keep human-induced global warming to well below 2°C above pre-industrial levels, striving for 1.5°C if possible, and to reduce global greenhouse gas emissions to zero by the middle of the 21st century.

Renewables
This term defines energy sources that are constantly renewed or replenished and hence are permanently available. Renewables include sunlight, wind, hydropower, biomass, geothermal heat and waste. Renewables are carbon neutral. Even with renewable energy sources, however, sustainable use is only assured if the consumption rate does not exceed the renewal rate.

Secondary raw materials
Secondary raw materials are raw materials that are recovered from recycled waste. They serve as raw materials for new products, but differ from primary raw materials in that they are not extracted from natural resources but processed from recycled waste and fed back into the economic cycle for a second time or multiple times. The use of secondary raw materials conserves natural resources and contributes to sustainable development.

Sensitive urban renewal
The primary focus of "sensitive urban renewal", a successful Viennese model which was introduced nearly 40 years ago, has always been on affordable housing based on subsidy schemes, social sustainability and a comprehensive strategy of renewal in the "core city". The resulting positive trends in the architectural, social and economic development of Vienna's urban renewal zones are clearly evident, especially within the perimeter of the Gürtel ringroad. Targeted refurbishment and new-build projects upgrade and rejuvenate local neighbourhoods. The teams of experts at the respective Local Area Renewal Offices (Gebietsbetreuung Stadterneuerung, GB*) serve as the hub for all renewal processes, but also for all questions relating to housing, the local environment and good community relations within neighbourhoods. To date, 320.000 dwellings have been renovated and refurbished under the programme.

Services of General (Economic) Interest (SGI/SGEI)
Prudent and reliable provision of public goods and services that entail a special responsibility for the community at large. These comprise e.g. energy, water, waste and sewage disposal, education, culture, medical services or public transport. They are characterised by a guarantee of equal,

universal access, security and continuity of provision and – where the state is the provider – by democratic scrutiny and public accountability. In Austria, the definition of services of general economic interest and how they are delivered typically involves a high degree of municipal autonomy

Sharing economy
The sharing economy is often seen as a route to greater social responsibility and conservation of resources. The term refers to projects such as community gardens, private car and food-sharing initiatives or the City Bikes bike hire scheme. Commercial sharing schemes are now also gaining ground alongside private and non-profit initiatives, with online platforms frequently acting as the interface between provider and customers.

Spatial energy planning
Combines the disciplines of spatial planning and energy planning to ensure a stable, efficient and environmentally sustainable energy supply. Its role is to integrate energy considerations into planning processes such as land use designation and secure the energy supply for new urban developments of the future, as well as for the existing city. To this end, the spatial structure of the power generation and distribution system needs to be aligned with the location and requirements of energy users. Spatial energy planning likewise ensures that urban planning factors are taken into account during the development and planning of energy infrastructure projects.

Start-up ecosystem
A start-up ecosystem consists of all individuals and stakeholders involved in a company start-up, interacting as a system. The ecosystem is composed of a large number of people and organisations – from venture capital donors, incubators and business angels to large corporations, IT providers and research institutions – all with a direct or indirect influence on the various development stages of the start-up.

Sustainable Development Goals (SDGs)
In September 2015 the General Assembly of the United Nations adopted the 2030 Agenda for Sustainable Development, comprising 17 universally applicable Sustainable Development Goals (SDGs) and 169 targets, which all 193 member states are committed to implementing by 2030

Upcycling
Upcycling is the process of transforming waste products or (apparently) useless materials into brand new products. As opposed to downcycling, this form of recycling turns waste into a material or product of higher quality. This recycling and reuse of existing materials reduces consumption of natural resources.

Urban farming (also known as City farming or Urban agriculture)
Generic term for different types of primary food production in urban conurbations and their immediate hinterland for consumption within that same region. It comprises the growing of vegetables, fruit, flowers and herbs, the products of which are chiefly used within the city, and beside urban forms of market gardening also includes animal husbandry in predominantly urban areas.

Urban heat island effect
Urban settlement structures differ significantly from the surrounding rural areas in many respects, including climatic factors such as precipitation, wind conditions and temperature – one consequence of this are so-called urban heat islands. Urban heat islands are mainly caused by surface development in cities that absorbs heat as well as removing the natural layer of vegetation and moisture-retaining soil. The temperature differential between city and hinterland can be as much as 12°C, placing a significant health burden on city-dwellers.

Urban Heat Islands Strategic Plan
The Strategic Plan gives detailed descriptions of various possibilities for cooling of urban heat islands. It contains precise information regarding the effect of individual measures on the climate in the city and the urban neighbourhood, and also provides details of benefits and possible obstacles associated with implementation of the various measures and the likely installation and maintenance costs.

Urban mining
Densely built-up urban areas are vast "repositories" or "banks" of raw materials. Urban mining is a concept for the systematic inventorisation and reclamation of the (secondary) raw materials in buildings, infrastructure and products that would otherwise go to waste. It also includes research and development of new technologies for increasingly efficient recovery of these raw materials and smart new uses for them.

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Education

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