Urban Energy Innovations

Technology Report

Vienna,
August 2020

Dear Readers,

Vienna is one of the most successful metropolises in the field of sustainable innovations. In all, around 9,200 companies in Vienna are active in the field of urban and environmental technologies. Over 90,000 people generate an annual turnover of approx. 40 billion euros, i.e. 16 percent of the total turnover of Viennese companies.

According to various studies, Vienna scores particularly highly on innovative strength, comprehensive support for start-ups and a strong focus on sustainability. Vienna also holds top positions in several “Smart City” rankings. The key objective of Smart City Vienna is to provide optimal life quality, while at the same time ensuring the greatest possible conservation of resources by 2050. The Smart City Wien Framework Strategy[1] is implementing this objective through many innovative individual projects. As a location, Vienna also wins approval with its research and technology-friendly climate, its geographical and cultural proximity to the eastern growth markets, the high quality of its infrastructure and educational system and, last but not least, the highest quality of life worldwide.

In order to make optimal use of the potential at this location, the Vienna Business Agency acts as an information and cooperation platform for Viennese technology developers. It connects companies with development partners and key customers from business, science and city administration and supports Viennese companies with targeted subsidies and a wide range of consulting and support services.

The Vienna Business Agency supports you with targeted funding for smart business ideas and innovative solutions. Target groups are companies from the fields of energy and environment, mobility and construction, as well as social innovations and assistive technologies.

Your Vienna Business Agency team

1 www.wien.gv.at/stadtentwicklung/studien/pdf/b008551.pdf

EFRE Europäische Union Investitionen in Wachstum & Beschäftigung. Österreich.

vienna business agency

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1. The future belongs to smart cities

Urban habitats attract people. Compared to rural areas, conurbations offer more attractive economic opportunities and a multi-layered social environment. The demands, regarding the accomplishments of the urban space are tremendous. The history of urban development is therefore, among other things, a collection of multiple answers to the question of how to deal with the contradictions that inevitably arise from this complexity. Vienna is able to offer a strikingly large number of successful solutions.

Renewable resources, which are not available in sufficient quantities in the city, play a decisive role in the existence and development of urban structures. The large expanses of land needed to produce renewable resources are found in rural areas. The times when the Vienna Woods had to be protected so that they would not be cut down for firewood are now hopefully gone. Today, however, the land requirements for energy production are dramatically increasing with decarbonisation. Whereas, after the Second World War, it was only the areas of the hydroelectric power plants and biogenic energy sources that were used here, nowadays wind power also plays an important role. The expansion plans for photovoltaics can only be partially fulfilled through the land potential in conurbations. As an energy source, biomass is currently of greater importance for rural areas, but if "green gas" were to largely replace the present natural gas in the near future, biogas could make a significant contribution here. These examples show that a renewable urban energy system is always a partnership between town and countryside.

In times of change, the ability to respond to challenges plays a decisive role. Innovation – which, if necessary, requires a departure from what has been tried and tested – is the linchpin of a development that is expected to bring prosperity on a sustainable basis. This requires a political framework that is not only capable of dealing with areas of tension and conflicting goals, but also defines the rules of the game, the market design, in such a way that we can still achieve the goal of a decarbonised energy system in time. Cost allocation, i.e. the question of whether each market participant actually pays their "bill" for services consumed in the energy sector, plays a decisive role in the success of innovations. This "burden" must naturally include external costs, such as those caused by emissions.

The resulting resilience is transferred to the economy, as clear framework conditions open up a wide range of opportunities and provide planning security. The funding landscape is abundant, and innovation has long been a central criterion for the allocation of funding.

The Viennese economy has already seized many of these opportunities. Thanks to the Vienna Climate Protection Programme (KliP Vienna)[2], which has been in place for 20 years, the Vienna Energy Framework Strategy 2030 – the centrepiece of Vienna's energy policy, and the City Energy Efficiency Programme 2030 (SEP 2030)[3] – a large number of showcase projects have already been funded and implemented.

The future belongs to smart cities. Many examples in Vienna already show where the path is leading. The present technology report elucidates the key topics. Here, you will find projects that show how energy efficiency and renewable energy can be realised and thus contribute to a better quality of life in urban areas.

○ By the way, did you know?

A total of roughly 9,200 companies in Vienna work in the field of urban and environmental technologies. More than 90,000 people generate annual turnovers of around 40 billion euros, which corresponds to 16 percent of the total turnover of Viennese companies (according to Statistik Austria).

2 www.wien.gv.at/umwelt/klimaschutz/programm/

3 www.wien.gv.at/stadtentwicklung/energie/sep2030.html

2. Cities and the energy system of the future

Megacities are the focus of the big questions on how to meet the challenges of the future. Over 50 percent of the world's population already live in these metropolises. By 2050, it will probably be 70 percent. Cities are responsible for around three quarters of global CO_2 emissions. This also means that whether or not cities succeed in reducing greenhouse gases will be decisive in determining whether net zero emissions can be achieved globally by 2050 and whether global warming can be limited to 1.5 degrees Celsius. Even though the focus today is on greenhouse gases, it is also necessary to reduce the destructive effects in other areas to a level that allows our cultures to continue to survive.

As a result of the growing number of heat waves, more and more air conditioning systems are being installed in the cities. In Vienna, too, the same amount of energy is now used for heating as for cooling. District cooling is an example of an environmentally friendly alternative to conventional air conditioning systems.

Above all in developing and emerging countries such as China, India and many African states, there are numerous rapidly growing urban centres. It is not easy to abandon the path to development with fossil fuels pursued by the industrialised countries of North America and Europe.

Good examples of urban energy innovations are all the more important, as cities can take many necessary measures themselves. Even if support for climate strategies is lacking at the national level, efforts at the local level can still make a big difference – as, for example, the Global Covenant of Mayors shows.[4]

The window of time is narrow. Urban development plans for transport, infrastructure, energy supply and building management which are pursued today will still have an impact for decades to come. The long life cycle of these plans requires an approach that is geared to appropriately broad time horizons. These long life cycles have also had the effect that most cityscapes have developed organically and few of them were designed on the drawing board. The further development of the spaces, which are densely crowded in every respect, is therefore also setting trends for the long-term: the future is being decided in the big cities.

2.1. Cities as drivers of change

One characteristic feature of conurbations are the exacting requirements regarding the city structure that result from the fulfilment of the so-called "basic functions of existence". The focus here is to combine living, supply and disposal, work, recreation, education, community life as well as mobility to create a coexistence that is characterised by a high quality of life for all. However, this synthesis is not a definitively completed process. These functions, particularly the requirements and the associated protection goals, are constantly being reassessed and reweighted.

Taken separately, each function would shape the space according to its own needs, which would inevitably lead to one-sidedness. Until the 1970s, the spatial separation of functions was a declared objective, and the strong emphasis on individual motorised transport, in particular, had a major impact on cities. Today, cities all over the world are working to reclaim public space for different functions. At the same time, the new transport services are reducing the enormous amount of energy and resources required for mobility services.

4 wwww.globalcovenantofmayors.org

Vienna at night, © Vienna Business Agency / David Bohmann

2.2. Sectors are converging

Until recently, a clear separation characterised the supply of energy, in that the electricity, heat supply and mobility sectors were viewed largely independently of one another. Today, we speak of sector coupling and link systems that have hitherto been separate. Buildings thus take on supply and energy management functions by producing energy, storing energy and contributing to network stability through flexibility. Buildings also increasingly offer charging management for electric vehicles. Buildings are extremely important in a sustainable energy system. On the one hand, this is due to the fact that the building sector accounts for about one third of the energy demand, while on the other hand, buildings – together with their areas, masses and equipment – also have the prerequisites enabling change from being pure consumers to being active co-designers of the energy system.

In order to support this development, the EU Building Directive[5] provides for a new indicator whose aim is to show the extent to which a building is already prepared for a largely decarbonised renewable energy system. The "smart readiness indicator" is intended to assess certain features and characteristics of a building that are beneficial for intelligent operation in a sustainable energy system. This new quality of "grid usability" is to be shown on energy certificates in future.[6]

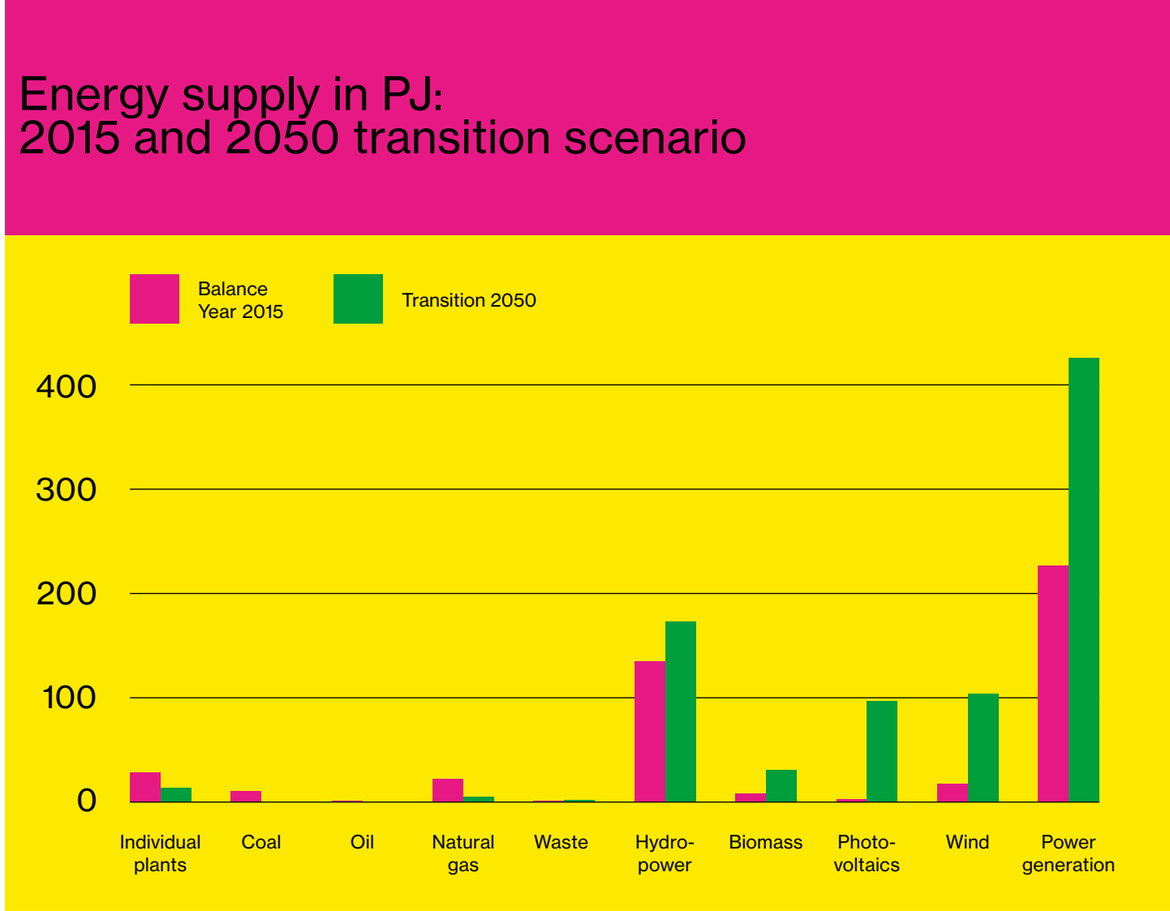
Energy communities will play a central role in future energy systems. In addition to the assessment of the building, the focus here is on its operation. EU directives create the legal framework for the establishment of energy communities; active customers who not only consume energy but can also produce, store and sell it themselves within their newly created energy community. Due to the anticipated higher revenues – for example, from the sale of photovoltaic-generated electricity – it's expected that energy communities will implement larger PV systems and thus drive the energy turnaround. The short distances between the different players enable synergies to a hitherto unrivalled extent.

A study by SolarPower Europe confirms that the European Union can achieve climate neutrality with a 100 percent renewable energy system even before 2050. The proportion of photovoltaics in power generation in Europe is expected to increase to over 60 percent by 2050. Energy storage, sector coupling and a high rate of electrification of the energy system are the cornerstones of a successful energy turnaround.

5
eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:32018L0844

6
www.17und4.at/projekte/oekologische-nachhaltigkeit/sri-austria

Possible change in energy supply in Austria, based on data from the 2050 transition scenario, sources: AEA 2017, STATISTIK AUSTRIA 2016a, Federal Environment Agency Austria



2.3. Smart operation

Precisely why "smart" operation on the consumer side is becoming so important is illustrated by the "transition scenario" of the Federal Environment Agency for Austria. For renewable energies to be able to cover demand at a reasonable cost, a drastic reduction in consumption is assumed here: reduction of the gross domestic consumption from approx. 1400 to 800 petajoules per year. Nevertheless, the energy volumes that would have to be provided by wind and PV are enormous.

The objective "Installation of PV systems and the goal of equipping one million roofs with photovoltaics" can be found in the 2019 programme of the Austrian government.[7]

The areas for PV which are already necessary for the 2030 climate goals and where they can be found have been surveyed in detail. The target production is 11 terawatt hours (39.6 PJ) in Austria (TWh). Approximately half of the area potentials were identified in built-up areas, and the rest in open spaces. In urban areas, open spaces are virtually unavailable; here, innovative PV integrated into buildings is particularly in demand – something which naturally also applies to traffic areas.[8]

The production of electricity from wind and PV also depends on the weather. In future, therefore, flexible customers who don't necessarily need a lot of electricity at the precise time when everyone else switches on their system will be in demand. This will be possible if, above all, the storage effect is actively used and the loads can thus be shifted by a few hours. New tariff models also offer cost advantages for flexible consumer behaviour; such models are in line with a European developmental approach and are constantly being expanded. Thus, all in all, buildings represent a huge potential for this type of management (demand side management) and the storage of energy in the form of heat.

7
www.bundeskanzleramt.gv.at/dam/jcr:7b9e6755-2115-440c-b2ec-cbf64a931aa8/RegProgramm-lang.pdf

8
oesterreichsenergie.at/positionen-standpunkte/studie-photovoltaik-ausbau-in-oesterreich.html

2.4. Change as fertile ground for innovation

Due to the global spread of this solution and the tremendous growth, much that we took for granted in the past must now be solved in a different way. It is a considerable challenge to preserve the qualities we have come to love and align the use of energy and material flows according to a comprehensive sustainability principle at the same time. Many systems must be gradually adapted without putting at risk the reliability of supply. However, this field of tension also provides the driving force for innovations at all levels. At the same time, the example of an urban residential building that is being renovated and converted to renewable energy while still in operation is a symbol of the change that is taking place throughout the urban fabric.

Another basic prerequisite for the success of this change is the involvement of the economic sector in all renewal processes. Vienna's geopolitical position at the centre of the new Single Market, and the interdependencies that have emerged in the Vienna-Bratislava twin region, offer additional prospects far beyond the city limits. Thanks to the competencies that Vienna has acquired in the field of energy and environmental technologies over the past decades, the city can develop into a driver of change for the entire region.

2.5. Connecting systems

Reorientations and the accompanying processes of rethinking concepts are the most fertile ground for innovations. As the new term "sector coupling" shows, rethinking begins at the system boundaries, i.e. with how we structure our way of looking at things. Since energy can be described, very concisely, as the ability to create effects, it's also clear that the rethinking process and energy innovation affect practically all sectors.

A closed-loop economy is a system in which resource use and waste production, emissions and energy use are minimised by slowing down, reducing and closing energy and material cycles. The principle of closed cycles is implemented, for example, in the durable, maintenance-friendly design of products made from plant-based raw materials. Recycling management is the only way to reduce the demand for resources in a social system that is dependent on economic growth, in such a way that this demand can be met using renewable sources. The circular economy is therefore extremely closely linked to the renewable energy system.

In the city of Vienna there are about 4,500 kg of iron, 340 kg of aluminium, 200 kg of copper, 40 kg of zinc and 210 kg of lead per inhabitant. Today, a 100-square-metre apartment contains around 7,500 kilogrammes of metals.[9] Their production was energy-intensive: these treasures must be used in the future. Densely populated cities are huge "raw material repositories". "Urban mining" is a conceptual model for the systematic collection and recovery of (secondary) raw materials stored in buildings, infrastructure and products. However, this also includes research and the development of new techniques for the increasingly efficient recovery of raw materials and for their intelligent use in the future. When municipal waste management companies close material cycles by collecting and recycling waste separately, they too become part of the urban energy innovation.

Concrete, asphalt and glass make urban areas hotter. In these heat islands, areas of greenery provide relief and noticeably lower the perceived temperature as natural air conditioning systems. Greenery on buildings can also be an urban energy innovation; not only does it reduce energy demand, but can also be combined with technologies for generating renewable energies such as photovoltaics and, thanks to the cooling effect, can even increase the efficiency of such a system to a certain extent.

If one wants a sustainable energy system, then nutrition is also an issue. Worldwide, 22 percent of greenhouse gas emissions are attributable to nutrition – from production to the transport chain, to waste. In addition, 15 percent of emissions result from changes in land use – deforestation is used to increase the amount of land available for agriculture and food production (FAO 2015).[10]

For a variety of reasons, agriculture is currently finding its way back into our cities. Being able to produce one's own food, to shape urban space or make a business profit – all these can be motivations for "urban farming", although its contribution to the overall food supply is still small. However, concepts such as aquaponics, where fish farming in ponds is combined with the cultivation of crops in greenhouses, offer great potential. The Vienna Business Agency also offers its own technology report on the topic of "Urban Food".[11]

9
www.smartcity.wien.gv.at/site/urban-mining

10
www.fao.org/3/a-i4910e.pdf

11
Technology Report Food (PDF)

Courtyard of the Stadthalle Boutique Hotel, © Boutique Hotel Stadthalle

2.6. Planning and monitoring

The examples above already indicate that the energy system of the future will develop differently from the energy system of the fossil age. Coal, oil, gas (including uranium), with their high energy densities, are provided and managed by a few major players. In addition, they can be easily transported and thus used regardless of location. By contrast, renewable energies require a great deal of space and the appropriate type of use must be actively thought out for each project at each individual location, especially since electricity and heat can also be provided on site. This means that a much larger group of people will be involved in energy planning than in the past.

Accordingly, new planning instruments have been introduced at all levels. In the Energy Union, the framework for a European energy policy has been created, and with the Governance Regulation it was decided that a new type of planning and monitoring tool should be used. Each EU member state must submit an integrated national Energy and Climate Plan1 for the next decade (2021–2030). The Governance Regulation also contains clear rules that take effect if the overall measures taken by the countries are not sufficient and they fall short of the EU's 2030 targets (a so-called "gap-filler" mechanism). How energy planning currently works at the level of the City of Vienna is the subject of the next chapter of this report.

3. International commitments and their implementation in Vienna

Climate change has an immense influence on the development of cities. If global warming is not halted at between 1.5 and 2 degrees, there is a risk that so-called tipping points will be exceeded, so that dangerous developments will become irreversible, no matter how we react to them. Within 50 years, up to three billion people could be living in areas with an average temperature of over 29 degrees Celsius. That would be outside the “human ecological niche”: the range for which human beings are adapted and in which they have lived for at least 6,000 years.[13]

The EU is required to comply with the World Climate Treaty of Paris by achieving the following key objectives by 2030:

1. Reduction of greenhouse gas emissions by at least 40 percent (compared to 1990)
2. Increasing the proportion of energy from renewable sources to at least 32 percent
3. Increasing energy efficiency by at least 32.5 percent

What this means for Austria is:

1. The national emission reduction target for 2030 envisages a reduction in greenhouse gases (GHG) of at least 36 percent compared to 2005.
2. The proportion of renewable energies is to increase to 32 percent.
3. The increase in energy efficiency is defined by an improvement in primary energy intensity of 25–30 percent compared to 2015.

The aims of the Smart City Vienna Framework Strategy[14] show the course that should be pursued in Vienna:

1. Per capita reduction of greenhouse gas emissions in Vienna by 80 percent by 2050 (compared to 1990) Interim goal: Reduction of CO_2 emissions per capita in Vienna by 35 percent by 2030 (compared to 1990).
2. An increase in energy efficiency and a reduction of final energy consumption per capita in Vienna by 40 percent by 2050 (compared to 2005). The primary energy consumption per capita will thereby decrease from 3,000 watts to 2,000 watts.
3. In 2030, over 20 percent, and in 2050, 50 percent of Vienna’s gross final energy consumption will come from renewable sources.

The interim balance in the 2018 Energy Report of the City of Vienna[15]:

- Greenhouse gas emissions of -32.6 percent, reduced from 3.8 to 2.6 t of CO_2 equivalents per capita between 1990 and 2015
- Final energy consumption of -16.42 percent, reduced from 24,130 to 20,168 kWh per capita from 2005 to 2016
- Primary energy consumption of -16 percent, reduced from 3,090 to 2,900 W per capita (expressed as continuous output in relation to the concept of the 2000-watt society: multiplied by 8,760 annual hours, this shows the total amount of energy)
- Generation of renewable energy of +57.2 percent, from 2,244 to 3,528 GWh

It is remarkable that the measured values are in line with the relevant target path, which testifies to the practical suitability of Vienna’s planning, management and control tools and at the same time proves the performance capability of the business location. The relation of the target values to the per-capita figures can be explained in light of the city’s strong population growth.

One example is “OekoBusiness Wien”, the City of Vienna’s environmental service package, which supports companies in implementing environmentally relevant measures in their operations.[16] At the same time, it helps to reduce operating costs, initiate technological developments and make them market-ready, as well as to stimulate innovations that fit the description “smart” in every respect. This results in a win-win situation for all companies that see both future prospects and opportunities in this transformation process.

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www.pnas.org/content/early/2020/04/28/1910114117

14
www.smartcity.wien.gv.at/site/der-wiener-weg/rahmenstrategie

15
www.wien.gv.at/stadtentwicklung/energie/pdf/energiebericht2019-en.pdf

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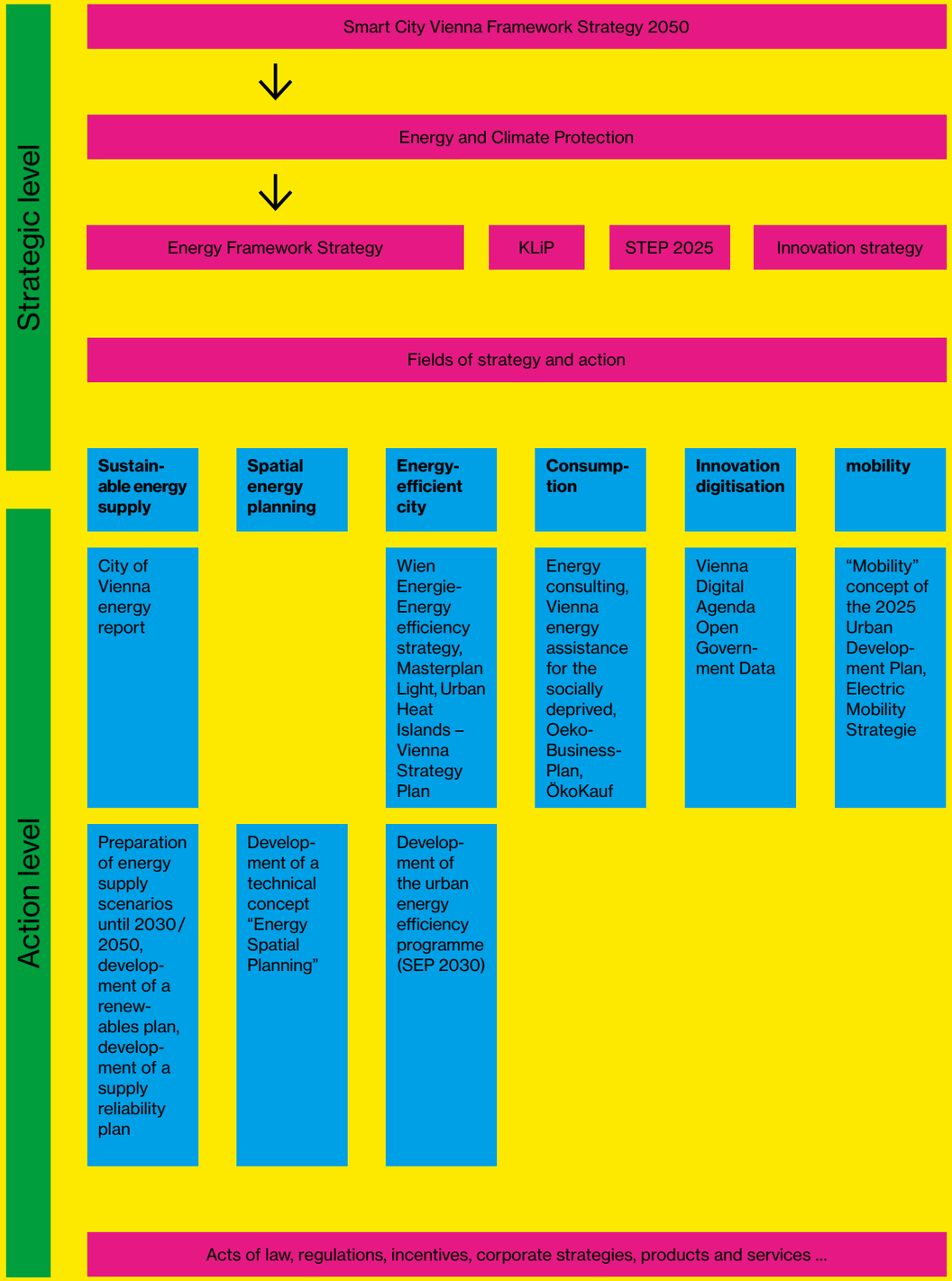
unternehmen.oekobusiness.wien.at/en/

Strategic placement of the Vienna Energy Framework Strategy 2030



Strategic placement of the Vienna Energy Framework Strategy 2030, source: www.wien.gv.at/stadtentwicklung/energie/pdf/energierahmenstrategie-2030.pdf

3.1. Sustainability is part of Vienna's history

The federal capital Vienna is Austria's only city with over a million inhabitants and differs from European "mega-cities" such as London or Paris, where more people live in the metropolitan region alone than in the whole of Austria. Since 2001, the number of inhabitants has increased by 340,000; according to forecasts, the two-million mark will be exceeded in 2027, and in 2035 the historical population peak of 1910 will be reached, with around 2,084 million.

The fact that the City of Vienna could not grow arbitrarily in all directions and that valuable natural landscapes have been preserved is due to the foresight of responsible local politicians, who recognised the irreversibility of some processes in time.

Today, Vienna is still benefiting greatly from the farsighted planning of periods of the past. High-quality residential buildings and other buildings dating from the Gründerzeit era are still highly valued, even after 150 years. It has been possible to integrate the former city railway into the subway network and the station buildings and bridges built by the city architect Otto Wagner are still lovingly maintained today. The water pipelines opened in 1873 and 1910 still supply Vienna with top-quality spring water from mountain regions. We owe the present impressive tree population in avenues and parks to forward-thinking people of the 19th century, as well as to the fact that the large natural spaces of the Prater, Lobau, Lainzer Tiergarten and Vienna Woods were placed under protection – which contributes significantly to Vienna's high quality of life today. Wien Energie Fernwärme (Vienna's energy and district heating provider) was founded in 1969 and plays a central role in the city's energy system. Today, Wien Energie supplies 380,000 apartments with district heating and operates one of the largest district heating networks in Europe, covering 1,200 km. In order to integrate renewable energy, including deep geothermal energy, into the heating sector, the importance of district heating will continue to grow.

3.2. Strengths for the future

"Vienna will be the innovation leader by 2030". This statement on the Smart City Vienna website reveals the aim of one of the focal points of the recently relaunched programme. There is no generally and universally valid definition for the term "Smart City". Even though similar approaches are being pursued, different priorities also exist, as every city is different. Vienna has always occupied top positions in different rankings based on comparative studies. One of its strengths is the open, extensive stakeholder dialogue, which has enabled the framework for action to cover as broad a range as possible.

> "The basis of the Smart City Vienna is a mixable, sensibly compact city with a densely-woven fabric of high-quality amenities. To achieve its far-reaching goals, Smart City Vienna focuses on the core areas of radical resource conservation, innovation (social and technological) and a high, socially balanced quality of life. This suddenly brings issues such as equal opportunities, participation, diversity and gender orientation to the fore."
>
> – as the Vienna Planning Director's interim assessment of the ongoing process.

For example, the international project "Smarter Together", launched in 2015, in which Vienna is represented with a large project area in the Simmering district, shows how participative methods ("Smarter Together") can be applied by the City of Vienna together with its residents and numerous companies to develop Smart City solutions:

> "The focus is on the fields of building refurbishment, energy, mobility and logistics as well as information and communication technology. This gives impetus for positive social dynamics and sustainable urban development. The aim is to create an innovative, liveable and environmentally friendly Simmering and Vienna of the future together with the local people."
>
> (Excerpt from the Mission Statement)[17]

The fact that gender planning and target group orientation are perceived internationally to be leading trends shows the exemplary effect that the Vienna model is already having. In addition, Vienna is very closely connected with those cities that follow a similar approach (e. g. Hamburg, Copenhagen, Amsterdam and Stockholm). Vienna was able to use this opportunity to successfully participate in various funding programmes which have enabled further targeted emphases and measures. In this way, Vienna has been able to strengthen its pioneering role as a Smart City topic leader and its collaboration with corresponding bodies in Brussels.

17 www.smartertogether.at

The Alte Donau (Old Danube), © PID/MA45/Christian Fürthner

The online platform "Nachhaltig Wirtschaften" (Sustainable Economy) clearly shows the kind of ground-breaking innovations Vienna has to offer in the context of research and technology programmes. On the one hand, the results of the programme areas and project categories of the last 20 years are documented there, while on the other, the promising further development of future-oriented technology concepts is clearly evident, based on many ongoing projects. For example, the way from the low-energy to the plus-energy building, to the plus-energy district, which requires fine-tuned, cross-sectoral collaboration between the individual technological fields.[18]

3.3. Spatial energy planning

At the interfaces between classical and new planning levels, spatial energy planning has developed into a new, indispensable discipline. In Vienna, this is one of six strategic fields of action within the Smart City Vienna Framework Strategy and is given special emphasis.

The Digital Heat Atlas is becoming the central tool for spatial energy planning.[19] Its aim is to provide significant support for the key planning tools and processes in Vienna. Energy information (e. g. heat demand, pipeline infrastructure, energy potentials, etc.) is combined with a variety of building and climate data and is used to create informative planning and result maps in the Viennese GIS system.

The Energy Planning Department, Municipal Department 20 ("MA 20"), provides the basic data and also takes care of the accompanying development of applications. For example, with the help of the so-called "solar potential cadastre"[20], planning bases show which roof areas are suitable for photovoltaic and/or solar thermal energy, where geothermal potential is available, where waste heat utilisation is particularly effective, and where and with which capacity district heating or district cooling networks are available. For new districts and neighbourhoods, energy planning is now applied at an early stage of development, thus allowing innovative solutions to be implemented that make use of local resources or are only feasible in a larger network.

18 www.nachhaltigwirtschaften.at

19 www.waermeplanung.at/waermeatlas

20 www.wien.gv.at/stadtentwicklung/stadtvermessung/geodaten/solar

4. Urban energy innovations: selected showcase projects from Vienna

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This chapter presents innovative technologies, products and services that play an essential role in urban energy supply and have already been successfully implemented.

This overview makes no claim to completeness. However, its aim is to show how approaches to solutions often have an effect beyond the area directly affected – be it as a model, as a catalyst or as a milestone in a development. At the same time, it also aims to show how the collaboration between the city government, city administration and the business community enables transformative processes that also rely heavily on inclusion, in order to ensure sufficient room for social innovation.

4.1. Sustainable energy generation

Energy production, storage and consumption must be carefully coordinated to ensure a reliable and affordable supply. For spatial and logistical reasons, the use of biomass is limited in large cities, and there is usually insufficient space for large wind farms. With a capacity of 172 MW and an annual electricity generation of around one terawatt hour, the Freudenau run-of-river power plant is an exception among European cities.

Many areas in the city are suitable for energy production, but are still unused. Photovoltaics, solar thermal energy and also geothermal energy or deep geothermal energy can make a significant contribution in this regard. The Vienna solar potential cadastre and the geothermal potential cadastre[21] provide an impressive illustration of the reserves that can be drawn on here, and there is also the possibility of including suitable façade surfaces. This potential is nevertheless limited, which is why the exchange-based relations between the city and the surrounding region continue to be of special importance: Although renewable energy production in Vienna increased by 67.2 percent between 2005 and 2016[22], its proportion of the total volume of energy produced rose from 5.5 percent to 9.1 percent; including imports, the total proportion of renewable energy in Vienna was 16.8 percent in 2016.

Since a Smart City cannot be achieved to the desired extent without the involvement of its citizens, participation models – as described in the next example – are ideal for providing an additional incentive for the expansion of renewable energy generation: an attractive investment, "A savings book on the roof".

4.1.1. Joint PV plant in Lavaterstrasse – from consumer to prosumer

In 2018, Wien Energie built the first communal PV system on the roof of an apartment building in Lavaterstrasse in the Danube city. The 400 m² PV system can supply 48 households with solar power from their own roof. This plant generates 60,000 kWh of solar electricity per year. Surpluses are fed into the grid. With normal consumption, every household can thus obtain 30 percent of its annual power requirement from home-made solar power.

The citizen solar power plants[23] enable people to invest financially in photovoltaic systems. So far, more than 10,000 people have contributed over 35 million euros to 26 solar power plants. Together, all the solar power plants built by citizens in the greater Vienna area make up an area as large as 19 football fields. Since 2012, they have generated 40 GWh of electricity. This model is also scalable, with certain restrictions: in practice, all areas that can be used for solar power at a reasonable cost are suitable. However, technical parameters such as safety distances and roof windows must also be taken into account. Of the approximately 68,000 apartment buildings in Vienna, around 10 percent of these areas are suitable for the construction of communal power generation plants.

21 www.wien.gv.at/stadtentwicklung/energie/themenstadtplan/erdwaerme

22 www.wien.gv.at/stadtentwicklung/energie/pdf/energiebericht2018-en.pdf

23 www.wien.gv.at/stadtentwicklung/energie/beispiele/solarkraftwerke.html

Rooftop plant, © Solarimo_pixabay

Solar potential in Vienna[24]: With an existing stock of around 53 km² of roof surfaces, 64 percent of the roof surfaces are theoretically suitable for the use of solar thermal or photovoltaic energy. This corresponds to an area of approximately 34 km². Of these, 5 km² are "highly suitable" (annual global radiation of over 1,100 kWh/m²) and 29 km² are "well suited" (annual global radiation of 900 kWh/m² to 1,100 kWh/m²). The theoretical photovoltaic potential is 5,400 GWh/year. The theoretical solar thermal potential amounts to 28,200 GWh/year.

Even though sustainable energy generation requires the respective energy sources to be fully renewable, this does not mean that only energy sources that are directly available in nature can be used. As the next example shows, a waste product that occurs in large quantities can form the basis of sustainable energy production.

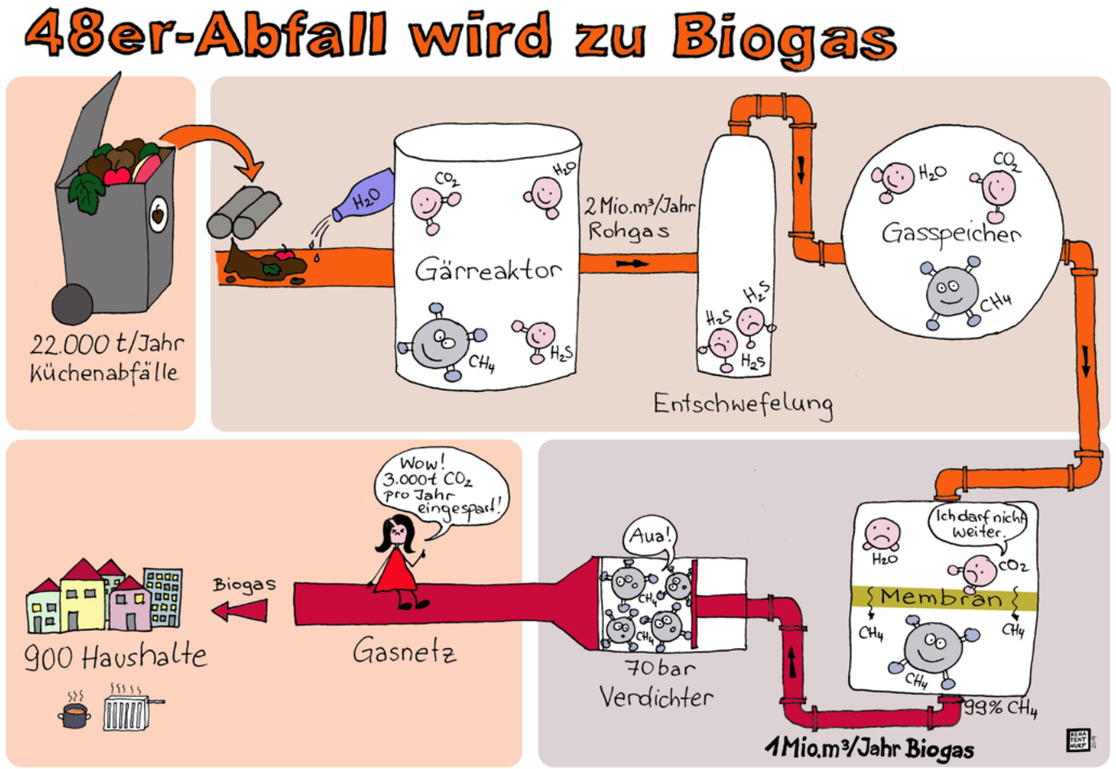
24 www.wien.gv.at/stadtentwicklung/stadtvermessung/geodaten/solar/wiener-solar-potenzial.html

4.1.2. Thermal sewage sludge utilisation – an international showcase for recycling management

A newly developed process developed by Wien Energie processes 140,000 tonnes of digested sewage sludge, a waste product of Vienna's main sewage treatment plants. This can be used to generate approx. 120 GWh of district heating.

In Simmeringer Haide, a drying process is used to create the right conditions for converting the digested sludge into environmentally friendly district heating, without the use of primary energy sources in the fluidised bed furnaces. With this unique process, this Viennese company is positioning itself as a technical pioneer in the sewage sludge disposal of the future.

In a multi-stage process, the organic portion of the sewage sludge is first reduced, producing methane gas, which is used for heat and electricity production. This enables the main sewage treatment plant to produce all the electricity that it needs itself. Afterwards, part of the sewage sludge is dewatered in mechanical centrifuges and mixed with the remainder again to achieve the calorific value necessary for combustion.



Biogas plant of the Municipal Departmenet MA 48, © Renate Mowlam

Simmering heat storage tank. © Wien Energie/Ian Ehm

In the next step, this mixture is burned at 850 °C in fluidised bed furnaces at the Simmeringer Haide power plant. The resulting 350 °C steam is used to provide electricity for the site and hot water for the Vienna district heating network.

Another noteworthy highlight is the phosphorus recovery from the remaining ash. The City of Vienna is thus closing the raw material cycles for the key raw material phosphorus, which is becoming increasingly scarce.[25]

4.1.3. Biogas from kitchen waste – innovative biomethane production

The biogas upgrading plant produces over one million cubic metres of CO_2-neutral biomethane annually from around 22,000 tonnes of biogenic kitchen waste. This is enough to supply 900 Viennese households, while saving over 3,000 tonnes of CO_2 annually. The biogas upgrading plant is the first in Vienna to upgrade biogas to biomethane. The biogas produced and desulphurised in the biogas plant serves as input material. In order to be able to feed it into the natural gas grid as biomethane, it is necessary to separate the carbon dioxide contained in the biogas, the remaining hydrogen sulphide, as well as perpenes and siloxanes, using a modern membrane separation process. This turns biogas with a methane content of up to 70 percent into almost pure biomethane with a methane content of up to 99 percent. The biomethane is then compressed to a feeding pressure of up to 70 bar and fed into the gas network.[26]

4.2. Energy Storage

Storage facilities are important components of an energy system from renewable sources. Sufficient wind, solar and water power are available, but their output fluctuates. Flexibility becomes economically attractive with flexible tariffs. The following example shows how heat storage systems higher than a 12-storey building are able to provide heating energy for thousands of households over a longer period of time.

25 smartcity.wien.gv.at/site/der-wiener-weg/smart-city-einfach-erklaert/energie-aus-klaerschlamm

26 www.wienenergie.at/ueber-uns/unternehmen/energie-klimaschutz/energieerzeugung/erdgas-und-biogas

4.2.1. District heating storage at the Simmering power plant – two “mega thermos flasks”

The two containers store district heat until it’s needed, regardless of the time of generation. This means that district heating plants can be used even less frequently, while cogeneration, waste incineration plants and renewable energy sources can be used still more effectively. This saves money and valuable raw materials, and reduces CO_2 emissions. The two high-pressure storage tanks – two huge, 45-m-high cylindrical steel tanks – have a combined storage volume of 11,000 m³, with a pressure of 10 bar at the bottom of the tank. The thermal storage capacity is 850 MWh, which is equivalent to the amount of heat required for 20,000 households per year.[27]

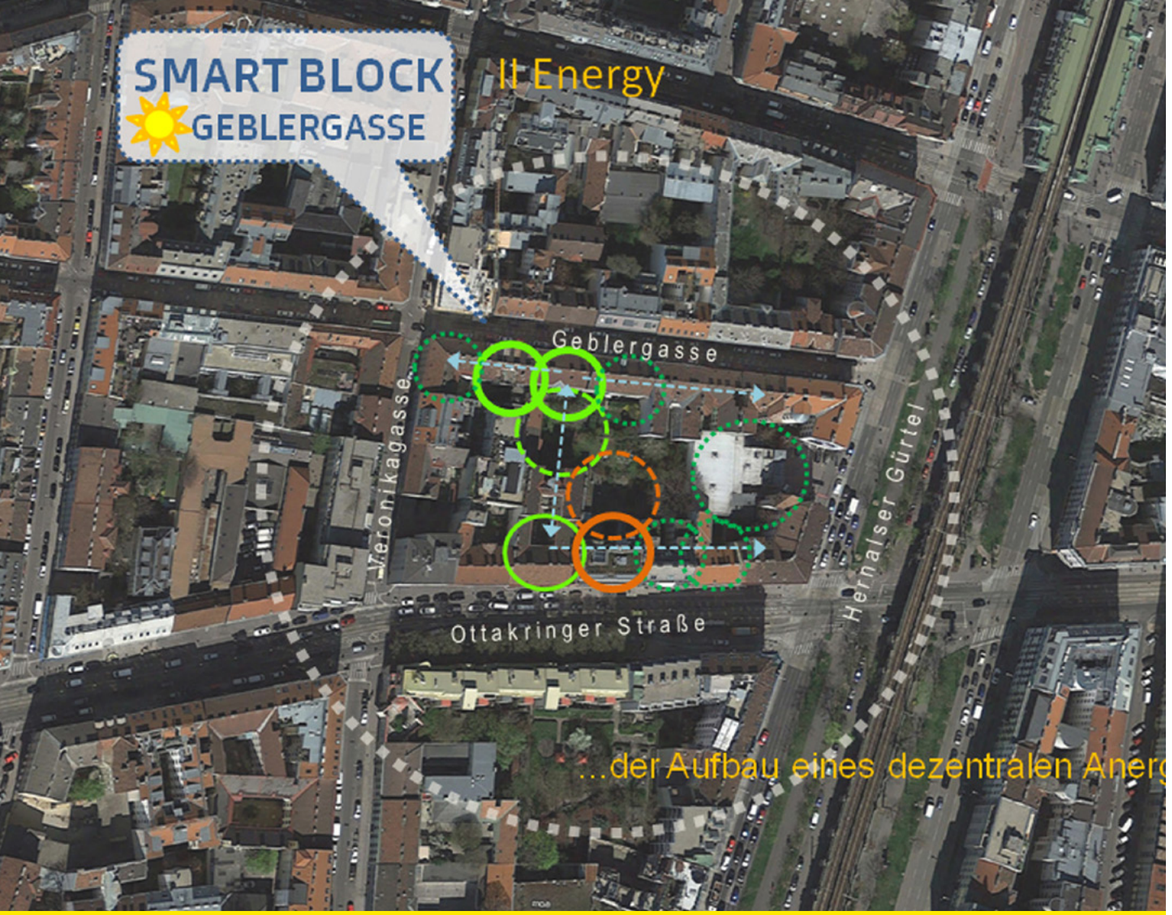
4.3. Power-to-X

Although the electricity, heat supply and transport sectors have hitherto been considered largely independently of each other, nowadays sector coupling is a much-discussed concept. There is a wide range of available technologies to connect these sectors: “power-to-X”[28], meaning electricity from renewable sources which is converted in the event of a surplus at certain times. “X” stands for gas or heat, for example. You cannot store electricity in concrete, water or soil, but you can store heat. In the event that there is only a low demand for electricity when large amounts of wind energy and photovoltaics are being fed into the grid, it’s possible to avoid being disconnected from the generation plants if the electricity is stored, e. g. for heat supply (“power to heat”). “Power to heat” is a good solution when, in times of surplus electricity, e. g. wind power plants would otherwise be switched off. Particularly if the conversion to heat with heat pumps is highly efficient (annual performance factors around 5 are possible). This measure is in the spirit of the flexibilisation of energy demand described above.

The following example illustrates this interaction between individual sectors of the energy industry. The Power-2-Heat plant in the Leopoldau district is an unconventional coupling of the electricity and heat sectors.

27 www.wienenergie.at/eportal3/ep/channelView.do/pageTypeId/67831/channelId/-49069

28 irena.org/-/media/Files/IRENA/Agency/Topics/Innovation-and-Technology/IRENA_Landscape_Solution_11.pdf?la=en&hash=2BE79AC597ED18A96E5415942E0B93232F82FD85



Aerial photograph: Vienna GIS, © zeininger architekten

4.3.1. Power-2-Heat Leopoldau – Vienna's largest water boiler

The Power-2-Heat system[29] is a kind of oversized kettle that converts excess electricity into environmentally friendly heat. The production of renewable energy, such as solar or wind power, is difficult to control and depends on the weather. So, in the event of oversupply, the Power-2-Heat system in the Leopoldau district is activated. The excess electricity from the grid is used to heat water in electrode boilers. Via a heat exchanger, the water, which has been heated to approx. 160 degrees Celsius, is fed into the district heating network and used directly in the surrounding households. The Power-2-Heat plant absorbs the surplus from up to ten wind turbines. In this way, heat can be provided for 20,000 households per year. With a number of 2-electrode boilers, the output per electrode boiler is 10 MW at a maximum pressure of 12 bar.

As the above examples show, extremely efficient solutions for storing energy are available. For some storage technologies, such as electrochemical or electrical storage[30], no practical applications on such a scale are currently available. One essential aspect of energy storage is the overall efficiency of all transformation and storage processes. A certain amount of loss must be accepted here – about 30 percent in the case of hydrogen, which however represents an important bridging technology and can play an important role in processes in the medium and high-temperature range.

The potential of thermal component activation should not be underestimated. Thermally activating existing storage masses is a particularly economical measure: with the current volume of new buildings, around 4 million square metres of concrete ceilings are produced each year. If ten million square metres of concrete ceilings were thermally activated over the next ten years, their storage capacity could be used to make a relevant contribution to balancing the fluctuations in electricity generation.

The successful practical implementation in Vienna can, for example, be found in the Mühlgrundgasse (MGG 22) housing project, which is described as a "game changer"[31], and also on the new campus of the Vienna University of Economics and Business Administration[32], where impressive results have been achieved through collaboration with one of Austria's largest plants for thermal groundwater use.

4.4. Buildings

The existing stock of old buildings in the cities is a particular challenge for the energy turnaround. Existing structures, little available open space, and often complex ownership structures and continuous habitability require solutions that have already been compared to open-heart surgery. This makes innovative solutions all the more attractive here!

4.4.1. SMART Block Geblergasse – an anergy network in the existing stock of buildings

An anergy network is a piping system between several buildings in which water flows at temperatures of between five and 25 degrees C. This allows, for example, waste heat from various sources to be absorbed and brought to a higher temperature level using a heat pump. Larger systems have, for example, already been in operation for some time in Switzerland – especially in newly built settlements.

In the course of the thermal renovation of old apartment buildings, an energy network was installed in Vienna in the 17th district.[33] Solar heat gained through collectors is stored in the ground at a depth of up to 150 m in summer, fed back into the grid during the heating period and used for heating and hot water via heat pumps. As an additional benefit, in summer the ground is used for a gentle and almost free cooling of the apartments via the underfloor heating systems. Thanks to the seasonal heat storage and the anergy network, the heat pumps can heat in winter with an exceptionally favourable annual performance factor of 6. The heating costs for the new system approximately correspond to the cost of a natural gas heating system.[34]

29 www.wienenergie.at/eportal3/ep/channelView.do/pageTypeId/67831/channelId/-4400144

30 www.energieforschung.at/projekte/speicher

31 nachhaltigwirtschaften.at/de/sdz/artikel/die-bauteilaktivierung-als-baustein-fuer-die-stadt-der-zukunft.php

32 literatur.zement.at/themen/40-thermische-bauteilaktivierung-tba/3738-campus-wu-wien

33 www.rfm-architektur.at/projekte/uploads/1539537129Endbericht%20Smart%20Block%20II%20Energy.pdf

34 www.oegut.at

The next example illustrates the effect that energy efficiency measures can have on an individual building. Here, a construction and building services relic from the 1970s with an abysmal energy balance has been successfully transformed into the world's first plus-energy office tower.

4.4.2. University of Technology tower block at Getreidemarkt square: Austria's largest plus-energy office building

Even though no technologies of above-average complexity have been used for the building, this extreme reduction in energy consumption has been achieved through the meticulous analysis and optimisation of over 9,300 individual components. The project is characterised by its replicability, which has made it a unique showpiece worldwide.

The former Chemistry block at the Vienna University of Technology[35] has 11 floors with a net floor space of 13,500 m² where about 800 employees and students work and study.

The basis is an enhanced passive house shell, supplemented by highly energy-efficient building technology. This includes thermal component activation in the form of activated screed for heating and cooling, a ventilation system with minimal pressure losses (with no heating and cooling registers), core ventilation for automated night ventilation and cooling energy savings, and much more.

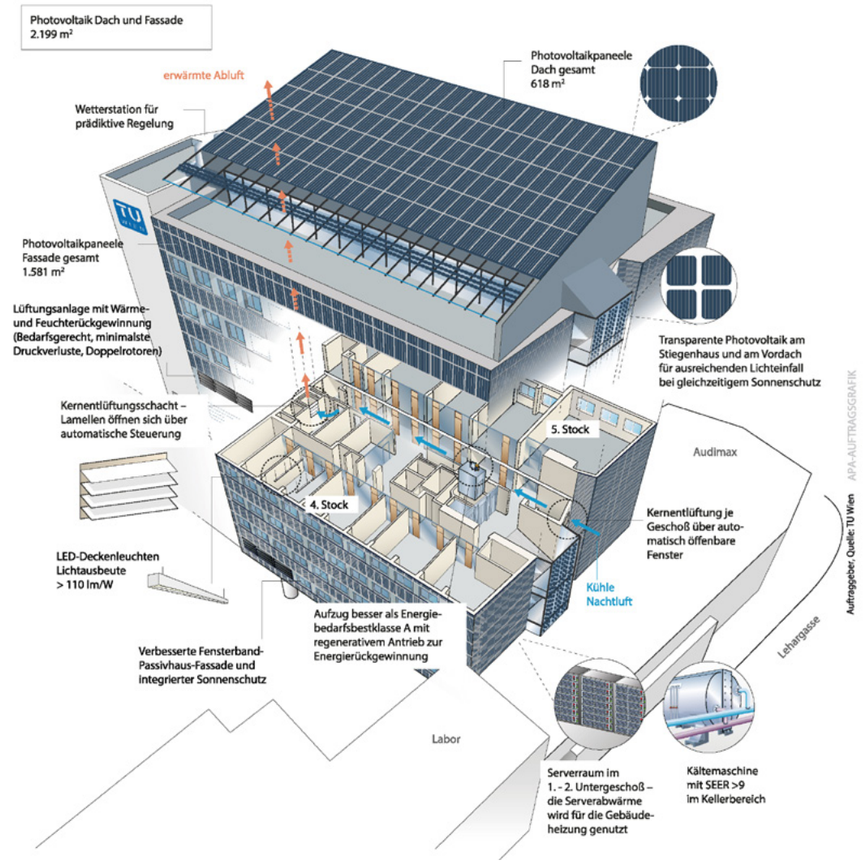
The key areas for energy generation are the façade with the largest building-integrated photovoltaic system in Austria to date (230.6 kWp), the PV roof system with 97.8 kWp and the waste heat recovery from the server room for component activation, through which a large part of the heating energy requirement can be covered. Even the energy recovery from the operation of the lifts contributes towards achieving the Plus-Energy Standard. The quality offered by this building is also evident from the 983 points achieved in the TQB building certificate of the Austrian Sustainable Building Council (ASBC).[36]

The increasingly strict rules for thermal insulation, primary energy consumption and GHG emissions applicable to new buildings have led to the development and gradual perfection of a wide range of technological solutions for the building sector. The next example illustrates the importance of the low-energy and passive house and its typological evolution in large-scale urban housing.

35
www.energy-innovation-austria.at/issue/eia-2016-05-de

36
www.tuwien.at/tu-wien/campus/tu-univercity/standorte/getreidemarkt

Energy-plus office tower block at Vienna University of Technology



4.4.3. Passive house standard in a large-scale residential building: Eurogate building site 4+5

Within the framework of the Eurogate project, a total of 238 apartments and 4 business premises have been built on the Aspanggründe plots 4 and 5[37], in Vienna's 3rd district, based on four buildings. The building complex has been designed according to the passive house standard. Each staircase contains 28 or 26 apartments on a total of 7 residential floors. At the entrance level, there is a common room for all residents. The ventilation of all apartments in all building structures is carried out by means of controlled ventilation with heat recovery, implemented with central ventilation units.

In order to provide as many apartments as possible with the amenity of double-sided lighting and ventilation, almost exclusively apartment types that extend through the entire width of the building (the housing units are positioned transversely to the longitudinal axis) are offered, and long corridors and central corridors without natural light have been avoided. In most cases, the open-air spaces belonging to the apartments are designed in the form of loggias, thus providing a view in several directions, as well as a distant view. Also worthy of mention is the maximisation of the solar radiation reflection through appropriate colour selection. The heating requirement (HWB) in the four building volumes is between 13 and 15 kWh/m² energy reference area, in accordance with PHPP. The building complex achieved 930 of 1,000 klimaaktiv points and was awarded klimaaktiv GOLD.

Further highlights are: the layout of green flat roofs and a focus on façade greening, the integration of residential green open spaces (balconies, loggias, etc.), a minimum degree of sealing and extensive infiltration of rainwater on site. Rainwater management also includes rainwater retention and storage of part of the precipitation, as well as the use of these water quantities for on-site irrigation.

Waste heat recovery on a larger scale and the Vienna district heating network allow for synergy effects involving a special category of urban energy innovations and show a further facet of sector coupling. The focus here is on a networked overview of the electricity, heat and cooling supply, transport and industry sectors.

37
www.oegnb.net/upload/file/OEGNB_Broschuere_2019_FINAL_web.pdf
p. 55

4.4.4. Manner wafer production plant: waste heat from the baking process heats 600 apartments

The recycling of industrial waste heat is an essential part of a clean heat supply. It was thus possible to commence full operation in autumn 2016, after the completed modernisation of the Manner production line. As the popular confectionery products come off the production line, a second process for district heating[38] runs in the background. It uses the hot exhaust air from the wafer oven which is generated during the baking process. This is collected in pipes and led to the roof by a ventilator. A heat exchanger converts the hot exhaust air into hot water.

The waste heat from the baking process is fed directly into the local district heating network over a length of 3.5 kilometres, and used for heating and hot water. For this purpose, district heating pipes, a heat exchanger and connections to the supply systems of Wien Energie have been installed on the Manner factory premises.

The thermal output is 1 megawatt, and the annual energy input around 5,600 MWh. This means that 600 households in the immediate vicinity of the wafer production sites in Hernals and Ottakring districts can benefit from the waste heat. Manner also converts the excess waste heat from the production process into cold and uses this for cooling purposes. The use of renewable energy sources for the process heat additionally enhances the value of the district heat produced.

The next example shows the scalability of the technology used here. There is a wide range of applications for heat pumps. In urban areas, one can find some very worthwhile applications on a large scale. For example, for the purpose of supplying the waste heat from a power station to a district heating network with a high leverage effect.

4.4.5. Simmering large-scale heat pump – a new dimension

The Simmering power plant site has the largest and most powerful heavy-duty heat pump in Central Europe[39] with a thermal output of 27.2 to 40 megawatts. The technology installed in this highly complex plant enables heat to be generated from very low temperatures. Starting at a temperature level of 6 degrees Celsius, a temperature level of 95 degrees Celsius can be reached with the help of the heat pump. The previously unusable waste heat in the cooling water of the combined heat and power plant in Vienna Simmering is thus fed into the district heating network.

Because even the temperature of the main district heating pipes in Vienna (on average, 100 to 150 °C) is still rather low, an intelligent distribution system ensures that the water can be used optimally in the district heating network and is used where the required temperatures correspond to those generated by the heat pump.

This enables the provision of a secure and environmentally friendly heat supply for 25,000 Viennese households. At the same time, 40,000 tons of CO_2 can be saved per year.

38
www.fernwaerme.at/aktuell/178

39
www.blog.wienenergie.at/2019/03/06/staerkste-grosswaermepumpe-mitteleuropas-pumpt-in-wien

Manner-Fabrik, © 17&4 Organisationsberatung GmbH, M. Mayr-Ebert

4.5. Smart urban energy systems

Even though the label “smart” is usually associated with the use of digital technologies, this does not imply an exclusive context. The holistic approach of the Smart City Vienna Framework Strategy already makes it very clear that it is much more important to consider and be aware of all essential aspects in order to fulfil the claim of being “smart”.

Buildings in urban networks can take on new tasks as energy producers, flexible users and energy storage systems for the future decarbonised energy system. Economic interests regarding the innovative equipment of buildings also play a role. Energy is being increasingly generated and stored decentrally, in many small units. Smart grids are energy networks in which modern information technologies ensure communication between network components, energy producers, storage facilities and consumers, as well as energy management.

The EU’s Clean Energy Package[40] enables private individuals to actively participate in the energy market themselves, within the framework of so-called “Energy Communities”. They can form communities and jointly produce, distribute, consume, store and trade electricity and heat.

The next example shows what more smart grids can achieve:

40
ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en

4.5.1. VIERTEL ZWEI – Austria's first energy community

In the urban development area VIERTEL ZWEI[41], an office and residential locality in Vienna's Leopoldstadt district, a new generation of innovative mobility, energy and residential concepts has been implemented. Among other things, the residents generate their own electricity with a PV system and trade it with each other using block chain technology. This innovation project thus led to the establishment of Austria's first Energy Community.

Background: As part of the interactive pilot project "Urban Pioneers Community", Wien Energie invited residents of the VIERTEL ZWEI to work together to develop new products and services in the fields of energy, mobility and smart living that would precisely meet their needs. The community was thus able to contribute its own ideas.

The residents can trade their self-generated solar electricity from the PV system on the roof with each other and thus share the electricity according to their needs. Electricity not used by the residents themselves can be sold to other participants in the community. Surplus electricity can also be sold at the electricity exchange. The basis for all these solar power trading transactions is block chain technology. All components in the system, PV system, electricity meter, charging points for e-mobility and storage are equipped with a special chip and thus integrated into the block chain.

Buildings play a central role in the transformation of our energy system[42] and the achievement of climate targets. A further step towards an intelligent urban network, where a decarbonised energy system depends heavily on the optimal coordination of partially volatile electricity production, decentralised production structures, storage capacities and flexible consumers, is to be able to reliably assess the suitability of buildings with regard to this scenario.

4.6. Cooling

In an increasingly warmer world, cooling energy is becoming a central issue: both the number of hot days (daily maximum temperature of at least 30 °C) and summer days (daily maximum temperature of at least 25 °C) recorded an increase of approx. 33 percent in Vienna between 1990 and 2016 (from 15 to 20 or from 64 to 85 days, respectively!). This means that there is a significantly increased demand for cooling energy! Besides construction measures for preventing overheating in buildings in summer, such as external sun shading, etc., two extremely innovative approaches present themselves:

41
positionen.wienenergie.at/beitraege/viertel-zwei

42
www.klimaaktiv-elearning.at/Lernplattform/common/pages/c01_gesamtbild_energiewende.html

Viertel Zwei, © 17&4 Organisationsberatung GmbH, Johannes Fechner

4.6.1. District cooling – the smart cooling solution for hot phases

Compared to conventional air conditioning systems, district cooling[43] requires four to ten times less primary energy, less space and no additional recoolers on the roof – which often conflict with the protection of historical monuments. Above all, there's no negative impact on the microclimate.

District heat is generated all year round for heat supply and hot water preparation. The same energy sources – waste incineration, waste heat from industry or CHP systems – also supply the drive energy for the so-called "absorption chillers".

As in the case of district heating, the buildings are supplied both centrally and decentrally, in which case a central cooling plant is installed on the consumer's premises. Insulated pipes transport the water, now cooled to 6 °C, to the consumers. The return temperature is about 16 °C.

Currently a 12-km-long district cooling network with 16 district cooling plants is being operated in Vienna. The total capacity is 130 MW. This corresponds to over 2,500,000 m² of air-conditioned floor space. The further expansion is currently at the planning stage or, in part, already under construction. District cooling saves about 50 percent CO_2 compared to conventional air conditioning systems.

4.6.2. 50 green houses as pilot projects for the Urban Heat Island strategy plan

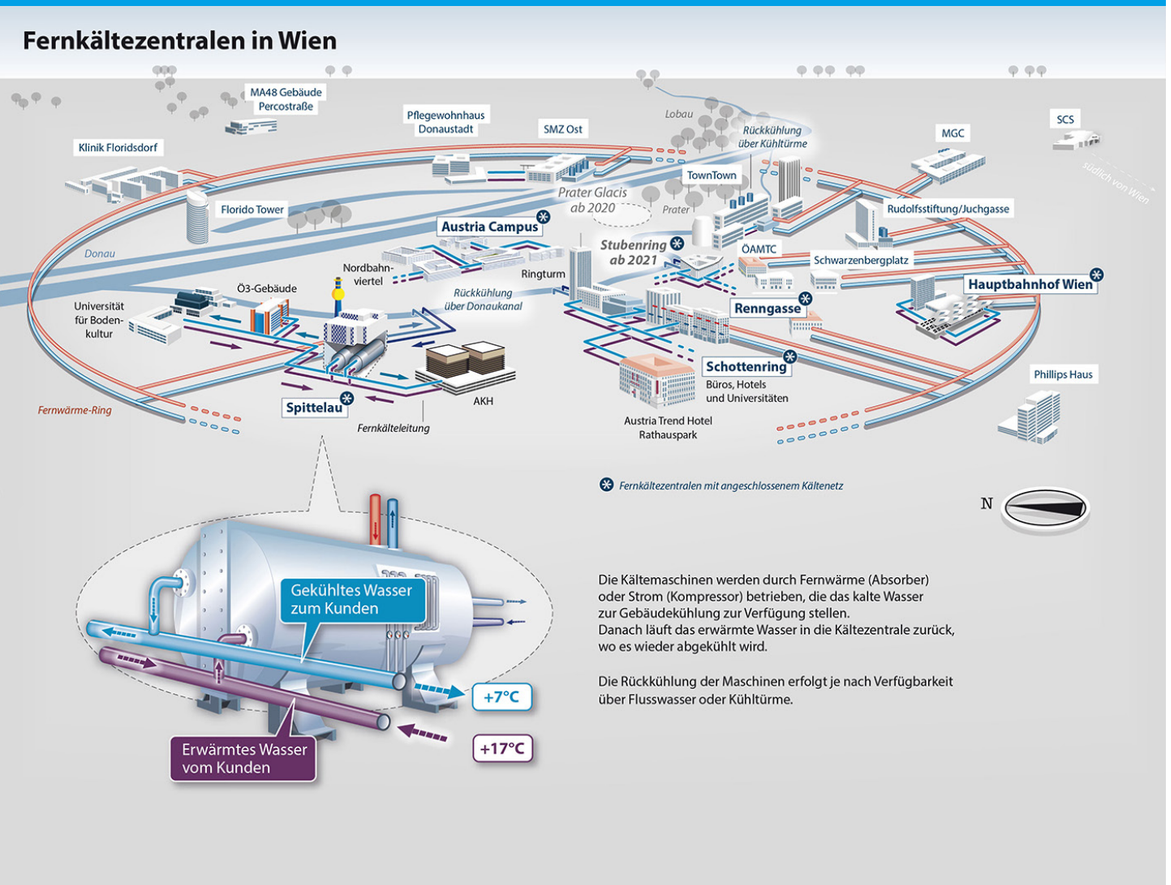
According to climate forecasts, in future Vienna can expect up to 100 days of heat, with temperatures above 30 °C in individual years. The cooling degree number – the equivalent of the heating degree day number – will almost certainly increase to a multiple of the values that are common today. The intelligent solution on offer is based on an avoidance strategy: greenery on buildings reduces the perceived temperature in hot weather by up to 13 °C and thus counteracts "urban heat islands".

The Vienna Urban Heat Island Strategic Plan (UHI STRAT)[44] was developed under the leadership of the Vienna Municipal Department for Environmental Protection (MA 22), together with scientific experts and numerous departments of the City of Vienna, and describes in detail different possibilities for cooling down the urban heat islands. It contains precise information on the effectiveness of the individual measures regarding the climate in the city and in the neighbourhood. In addition, the strategic plan provides information on the advantages and possible constraints in the implementation of measures, as well as the expected costs of construction and maintenance.

The 50 Green Houses[45] project marks the beginning: since there has been no widely applicable, inexpensive, all-in-one solution for the implementation of green façades in existing buildings up to now, the approval procedure was first considerably simplified and the green façade module BeRTA was developed – a simple, inexpensive, widely implementable plant trough solution with climbing aids and a maintenance concept, especially designed for existing buildings. The pilot project will be implemented on 50 existing buildings in the target area of Innerfavoriten.

4.7. Mobility

We need to change our way of thinking. This is particularly true of the mobility sector, which in many respects represents one of the biggest problems in urban areas. A sustainable transport system must treat scarce public space in a highly efficient way. The Smart City Vienna Framework Strategy describes the desired scenario in the chapter "Mobility and Transport Vienna 2050". The aim is a fair distribution of public space in order to meet the expectations of urban space, as well as a new diversity of means and types of transport. Mobility is becoming increasingly virtual. Accelerated by the Corona crisis, professional communication is becoming more and more digital, including the control of production facilities. Many people therefore work and live in the same place. Alternative drive systems can be part of the solution. By the end of 2020, a total of 1,000 e-charging points will be available in Vienna, with a maximum distance between 2 charging points of 500 metres. Over the next 10 years, the proportion of electrically powered vehicles is to increase to 15 percent. In terms of charging stations, Vienna ranks among the top 10 in a comparison of 75 European cities. The Business Agency offers a special booklet "Urban Mobility" on the subject of mobility.[46]



District cooling in Vienna, source: Wien Energie

43 www.wienenergie.at/ueber-uns/unternehmen/energie-klimaschutz/energieerzeugung/fernkaelte

44 www.wien.gv.at/umweltschutz/raum/uhi-strategieplan.html

45 smartcity.wien.gv.at/site/50-gruene-haeuser

46 viennabusinessagency.at/fileadmin/user_upload/Technologie/Factsheets_T-Reports/19_12_Urban_Mobility_Tech_Report_Screen_final.pdf

5. Epilogue

30

This brochure was compiled in the first months of the Corona pandemic, the economic effects of which are not yet foreseeable. While many companies invest less in research & development and postpone innovation activities in times of crisis, it has also been observed that, during past recessions, some companies have invested in innovation precisely because there was a time of crisis. According to studies, these innovative companies proved to be more resilient during the crisis and lost significantly fewer employees than companies without innovation.

A field of action in which innovative solutions are in great demand on the one hand, and in which a large market potential with a high domestic added value still remains untapped on the other, is the thermo-energetic upgrade of existing buildings. Suitable framework conditions for stimulating renovation are currently being worked on at both the federal and the municipal level.

6. Services of the Vienna Business Agency

31

The objective of the Vienna Business Agency is the continuous development of international competitiveness by supporting both Vienna-based companies and their innovative strengths, and the sustainable modernization of the city as a business location. To achieve this, the Agency provides free consultations to all entrepreneurs in Vienna on the topics of business creation, business location or expansion, business support and financing. Furthermore, networking contacts in the Viennese economy are also made available.

The Vienna Business Agency supports and helps businesses complete their research and development projects with both individual consulting and monetary funding. Depending on requirements, they will receive information about sponsorships, financing opportunities, possible development partners, research service providers, or research infrastructure, according to their needs.

The Vienna Business Agency sees itself as a network of the Viennese Green Tech & Social Tech industry and supports businesses with consultations, as well with distribution and networking among themselves. Events and workshops on topics from the sustainability sector are held regularly.

Additionally, the Vienna Business Agency helps with company relocations or internationalization services. Assistance is provided to business founders and young entrepreneurs in the start-up area. Free workshops and training sessions on topics of everyday business are offered as well as small, affordable office spaces.

Founders Labs[47] support aspiring entrepreneurs and founders with a two-month, part-time program to help them get started.

All funding programs of the Vienna Business Agency can be found here: viennabusinessagency.at/funding/programs

47 wirtschaftsagentur.at/gruenden-und-wachsen/founders-lab-future-technologies/

7. Companies from Vienna

In the alphabetical list[48] on the following pages, we present an overview of selected companies from Vienna that offer services in the sustainable construction sector.

Companies in the Field of Urban Energy Innovations

COMPANY	DESCRIPTION	WEBSITE
17&4 ORGANISATIONS-BERATUNG GMBH	Independent private consulting and research company for sustainable development, founded in 1992; organisational consulting for project development and sustainable processes, professional development; main topics: Climate protection and energy system transformation, resource and material efficiency in sustainable construction, cycling infrastructure, local agenda.	www.17und4.at
1STLEVELSOLAR GMBH	1stLevelSolar offers sophisticated photovoltaic solutions in all sizes for private households as well as companies of all sizes, and relies on competent support, up-to-date products and reasonable prices. With SunDrops, 1stLevelSolar GmbH developed a mobile solar power plant with a variety of functions: among other things, a power generator with battery storage, a pumping system for agriculture and a drinking water treatment system with a capacity of 1000 litres/hour.	www.sundrops.at
AB&CD INNOVATIONS GMBH	ab&cd innovations is dedicated to the challenge of developing processes for the recovery of chemicals and recyclables from industrial residues and by-products as well as biomass. ab&cd innovations works closely with biodiesel producers, the chemical industry and other industrial companies to process the generated waste and by-products into high quality chemicals.	www.abandcd.com
AC-RÄDLER UMWELT-TECHNIK GMBH	AC-Rädler is the producer of the RTC cleaning device for tube bundle exchangers, for pipe-saving complete removal of hard coverings and of total blockages. The main focus of the company's activities is the distribution of machines and processes for energy and resource savings in industry and the thermal economy, which improve economic efficiency and protect the environment.	www.ac-raedler.at

48
This list makes no claim to completeness.

COMPANY	DESCRIPTION	WEBSITE
AEE – ARBEITSGEMEINSCHAFT ERNEUERBARE ENERGIE NÖ–WIEN	As a specialist in solar energy with over 25 years of experience in the field of renewable energy, AEE NÖ-Wien offers a wide range of services. Originally founded as a non-profit and independent association, the AEE NOW team successfully develops strategies for the use and implementation of renewable energy. Scientific expertise combined with many years of implementation experience are the prerequisites for high-quality and cost-effective solutions for private households, commercial enterprises, housing cooperatives and municipalities.	www.aee-now.at
AIT – AUSTRIAN INSTITUTE OF TECHNOLOGY	The AIT Austrian Institute of Technology is Austria's argest non-university research institution and is considered a specialist in the central infrastructure issues of the future. Around 1,300 employees conduct research throughout Austria – especially at its main facilities in Vienna Tech Gate, Vienna TECHbase, Seibersdorf, Neustadt, Tulln, Ranshofen and Graz. The energy-relevant focus areas include complex energy systems, battery technologies, photovoltaics, smart and resilient cities and smart grids.	www.ait.ac.at
AKARYON GMBH	Founded in Styria and since 2000 also based in Vienna, the company offers not only concept, implementation and marketing on the web, but in particular web applications in the context of sustainability and support with funding applications.	www.akaryon.com
ALCHEMIA NOVA	alchemia-nova is a research institute based in Vienna.Its mission is exploring new areas by creating circular systems. alchemia novas leitmotif includes research, development and education as well as productisation, selling & consulting of circular economy and nature-based solutions.	www.alchemia-nova.net
ALLPLAN GMBH	ALLPLAN GmbH was founded in Vienna in 1967 and has since developed from a planning office for heating, ventilation and air-conditioning technology to an international consulting company in the fields of technical building equipment, as well as energy and environmental management. The company is now active worldwide in the energy and environment sector.	allplan.at
ALTERDYNE ENERGY GMBH	Alterdyne supports the selection of promising projects in the field of renewable energy. Alterdyne identifies market opportunities for clients, reduces project risks and ensures transparency in the global market.	alterdyne.energy

COMPANY	DESCRIPTION	WEBSITE
ARCHITEKTURBÜRO REINBERG ZT GMBH	The office has existed since 1980 as an independent planning office, since 1985 as a civil engineering office and since 2006 as Ziviltechniker GmbH. The architectural office focuses on ecological passive houses and plus-energy buildings. The team has experience in almost all building areas. More than 100 projects have so far been realised, all of which have a high ecological standard.	www.reinberg.net
ARGE ARCHITEKTEN HIESMAYER, GALLISTER UND KRATOCHWIL	General planning for the Plus-Energy office tower of the TU Vienna. Content development of the project with over 20 planning participants and specialists. Detailed design drawings checked for feasibility on site and improved so that the top-notch theoretical approaches from the model could be approximately reproduced in reality.	www.ae30.at
ASPERN SMART CITY RESEARCH GMBH& CO KG (ASCR)	The Research Association was founded in 2013 by Siemens, Wien Energie, Wiener Netze and the City of Vienna (Vienna Business Agency and Vienna 3420). It develops technical solutions for the energy future – in real life in the newly built Lakeside Town of Aspern. Among other things, the focus is on forward-looking building automation and the use of the energy flexibility of buildings, also on the energy market – all this with the involvement of "smart users".	www.ascr.at
ATELIER AMBROZY	The studio works for both institutional and private clients. Modern energy-optimised architecture is the main focus. The range of services includes planning and renovation as well as, increasingly, corporate consulting before and during construction, private construction consulting as well as lecturing and teaching activities.	www.ambrozy.at
AWATTAR GMBH	aWATTar entered the Austrian market as an electricity supplier in May 2015. The company is primarily active in energy supply (sales to end customers), with an exclusive focus on electricity and the development of software applications that bring special benefits to its customers. aWATTar is the first and, so far, the only electricity provider with an hourly variable tariff for end customers.	www.awattar.com

COMPANY	DESCRIPTION	WEBSITE
BAI BAUTRÄGER AUSTRIA IMMOBILIEN GMBH	As one of the largest property developers in Austria, BAI develops, constructs and manages properties in Austria and at selected locations abroad. Through the efficient and sustainable use of resources, BAI supports the further development of cities at all levels and turns visions of the future into tangible projects. First-class locations as well as customer-oriented utilisation concepts are of prime importance.	www.bai.at
BASE.ENERGY	base.energy allows people to generate electricity on their balconies, at events or for small businesses. SolCube is a compact solar generator which works completely without any noise or pollution. SolCube powers electrical appliances anywhere off the the public grid.	www.base.energy.at
BAUXUND FORSCHUNG UND BERATUNG GMBH	A technical office for technical chemistry specialising in environmental and health issues in the construction sector. The fields of activity of bauXund are the different aspects of sustainable construction in large-scale building construction. Over the last 15 years, bauXund has successfully implemented “chemicals and product management” in more than 800 construction projects in large-scale building construction throughout Austria and has shown that it is, for example, possible to drastically reduce the use of organic solvents / VOCs and thus to reduce indoor air pollution accordingly.	www.bauxund.at
BEA INSTITUT FÜR BIOENERGIE GMBH	BEA offers testing equipment and services for the bioenergy sector, chemo-physical laboratory tests for quality assurance and product development for solid biofuels, consulting and planning services as well as training for companies involved in the production and use of energy from solid biomass, particularly manufacturers of wood pellets, machinery and plant manufacturers, fuel traders and energy service providers.	www.bioenergy.co.at
BEST BIOENERGY AND SUSTAINABLE TECHNOLOGIES GMBH – STANDORT WIEN	BEST – Bioenergy and Sustainable Technologies GmbH is a K1 Competence Centre in the Austrian COMET programme and closes the gap between academic research and industrial technology development by undertaking industry-driven applied research and development in the fields of bioenergy, the sustainable bio-based economy, and future-proof energy systems.	www.best-research.eu
BIOSURE WASTE AND ENERGY GMBH	Consulting and construction engineering in environment, energy and waste management.	www.biosure.eu

COMPANY	DESCRIPTION	WEBSITE
BLUEPRINT ENERGY SOLUTIONS	Austrian ThinkTank for smart energy transition.	www.blueprintenergy.at
BUNDESVERBAND AUSTRIA SOLAR	The association Austria Solar includes all reputable Austrian suppliers of thermal solar systems. Overall, the association represents the interests of over 220 companies in the solar sector, an industry with almost 3,500 employees.	www.solarwaerme.at
BUNDESVERBAND PHOTOVOLTAIK AUSTRIA	The association Photovoltaik Austria is an industry-wide, non-partisan interest group that focuses on improving the framework conditions for photovoltaics in Austria.	www.pvaustria.at
BUNDESVERBAND SONNENSCHUTZ-TECHNIK ÖSTERREICH	This association provides detailed knowledge about sun protection technology at a business-neutral level on the topics of shading, glare protection and use of daylight.	www.bvst.at
CLIMATE-KIC ÖSTERREICH	Climate KiC supports European research, development and/or innovation projects. Austrian stakeholders have the opportunity to participate in these projects.	www.climate-kic-dach.org
COLLECTIVE ENERGY GMBH	Crowdfunding for an energy transition – Support the construction of photovoltaic plants and profit from it!	www.collective-energy.at
DACHGOLD E.U.	With the initiative TausendundeinDach, Dachgold advises companies that want to invest in photovoltaics or solar thermal energy and takes care of the planning, construction and marketing of solar systems for companies.	www.dachgold.at
DACHVERBAND ENERGIE-KLIMA	Working group in the Austrian Federal Economic Chamber with a focus on renewable energies, climate protection and energy efficiency. It coordinates and represents the common interests of the industry involved in the technology and use of environmental energy and the relevant trades and retailers, in order to proactively use and improve market opportunities within Austria and internationally.	www.energieklima.at

COMPANY	DESCRIPTION	WEBSITE
DECA – DIENSTLEISTER ENERGIEFFIZIENZ & CONTRACTING AUSTRIA	Exploiting the development potential of services and the market: DECA is the independent platform for companies that want to promote the further development of high-quality energy efficiency services on the Austrian market. This involves not only technical, but also economic, ecological and social aspects. One united voice for energy efficiency: DECA enables members to take a joint approach to energy efficiency issues, with the aim of sensitising and informing decision-makers and customers of high-quality energy efficiency services and thus developing the market for these.	www.deca.at
E7 ENERGY INNOVATION & ENGINEERING	Research institute and engineering office for energy and environmental technology for energy efficiency, renewable energy and climate protection. An interdisciplinary team from the fields of technology, economics and ecology, which seeks the challenge of energy innovation to accelerate the energy turnaround. A special asset of e7 energy innovation & engineering is the company's independence from interest groups, federal and state governments.	www.e-sieben.at
E-CONTROL	Energie-Control Austria for the regulation of the electricity and gas industries is a public institution and the regulatory authority responsible for the electricity and gas industries in Austria.	www.e-control.at
ECOTECH E.U.	Ecotech develops and produces electric charging stations for the public sector, charging stations (wall box) with energy and load management for homes, as well as customised charging systems for shopping centres and municipalities. In September 2019 Ecotech e.U. merged with GreenInfra GmbH and now shares its expertise and numerous customers with GreenInfra GmbH.	www.chargepoint.at
EFRIENDS	The green electricity provider enables the direct exchange and trade of privately generated solar electricity and compensates with hydroelectric power if the volume of electricity is not sufficient. The hardware module and the efriends app enable private households and other small providers to offer and purchase electricity via the marketplace.	www.efriends.at

COMPANY	DESCRIPTION	WEBSITE
ENERGIEBERATUNGS-STELLEN	At the energy counselling centres in Vienna you can find out everything about energy-efficient building and living, about energy-saving household appliances and about energy-conscious user behaviour: Wien Energie-Welt Spittelau, "die umweltberatung", EB-Plus – ARGE Energieberatung & Umweltbildung, AEE NÖ-Wien, Association for Consumer Information, OekoBusiness Wien – business consulting	www.gaswaerme.at
ERNEUERBARE ENERGIE ÖSTERREICH (RENEWABLE ENERGY AUSTRIA)	The umbrella organisation Renewable Energy Austria (EEÖ) is the association of the most important players in all sectors in the field of sustainable energy. The main goal of EEÖ is to switch the energy supply in Austria to renewable energy sources and to create long-terme framework conditions for the expansion of renewable energy sources.	www.erneuerbare-energie.at
ESG PLUS GMBH	ESG Plus GmbH stands for innovative sustainability consulting and offers more than 30 years of experience in the field of sustainability with private, scientific and NGO background. ESG Plus, together with financial partners, develops concrete and meaningful solutions for a sustainable financial market and makes these solutions available to a broad audience.	www.esgplus.com
ESW GEBÄUDETECHNIK GMBH	ESW is a Viennese company with a long tradition in the fields of heat engineering, heating, air conditioning, ventilation and sanitary engineering, a partner for all requirements in building services engineering. Decades of experience in a very broad range of areas of expertise enable us to plan, implement and maintain optimum solutions for buildings and to be available as a long-term partner. Sustainable planning and responsible execution ensure quality for many years to come.	www.esw.at
ETHUS GBMH	ETHUS is a start-up in the field of energy efficiency. In 2015, the company developed the first mobile app for trading in energy efficiency measures and successfully placed it on the market. Since 2016, the company has also been working together with companies from the energy sector to implement innovative concepts and solutions for the digitisation of the energy industry, for example how the integration of decentralised generation plants and smart home systems can be made attractive and tangible for the user.	www.ethus.at

COMPANY	DESCRIPTION	WEBSITE
FACHVERBAND DER GAS- UND WÄRME-VERSORGUNGSUNTER-NEHMUNGEN	The Association of Gas- and District Heating Supply Companies (FGW) is the independent statutory body that represents the interests of the Austrian gas and heat industry within the framework of the Austrian Federal Economic Chamber (WKÖ). FGW operates www.initiative-gas.at, an information site about gas, as a partner of renewable energies.	www.gaswaerme.at
FEEI – FACHVERBAND DER ELEKTRO- UND ELEKTRONIKINDUSTRIE UND OESTERREICHS ENERGIE	The professional association represents the interests of the Austrian electrical and electronics industry, comprising around 300 companies in Austria, helps to create the necessary framework conditions and supports companies in dealing with technological, legal and strategic issues.	www.feei.at
FH TECHNIKUM WIEN INSTITUT FÜR ERNEUER-BARE ENERGIE	The Institute for Renewable Energy implements research and consulting projects in the future-oriented field of renewable energies. The international positioning and connection to global research and development trends is ensured by active participation in various research groups of the International Energy Agency and the EU technology platforms.	www.technikum-wien.at/ueber-uns/institute/institut-fuer-erneuerbare-energie
GBV GEMEINNÜTZIGE BAUTRÄGER VEREINIGUNG	The umbrella organisation of the non-profit housing industry functions both as a cooperative auditing association and as a lobby. As a lobby group, the association is responsible for legislative initiatives, the evaluation of draft laws, participation in committees and working groups, public relations work, training and further education, as well as information and advice for member companies. The statutory audit association carries out an extensive audit mandate. This is active consumer protection, as offered exclusively by the non-profit housing construction sector.	www.gbv.at
GRADIENT – PROCESS TECHNOLOGY GMBH	Thanks to many years' experience, Gradient process technology GmbH has considerable expertise as a technological and economic consultant and planner in broad areas of the process industry (innovative process technologies, food and biotechnology and the energy industry).	www.gradient.at

COMPANY	DESCRIPTION	WEBSITE
GRAT – GRUPPE ANGEPASSTE TECHNO-LOGIE (TU WIEN)	The Angepasste Technologie Group (Adapted Technology Group, GrAT) is a research centre at Vienna University of Technology. In national and international research and demonstration projects the subjects of Adapted Technology, Sustainable Development and Life Cycle Approach are further developed and taught. The overarching concept is a common awareness of the responsibility for a socially and environmentally compatible handling of technology and its consequences. In research and demonstration projects, GrAT works out and develops innovations in the fields of renewable raw materials, product-service systems, sustainable construction, resource and energy efficiency in buildings, and technology design and dissemination. The aim is to adapt technologies to human needs and resources and not vice versa.	www.grat.at
GREEN4CITIES GMBH	Green4Cities is an international Center of Excellence for Green Infrastructure in urban areas. Green4Cities develop and realize concepts, ideas and solutions for your green vision in the area of technical research and development as well as network and installation projects. They create tailormade signposts to guide cities toward a life quality and resilience to climate change in all relevant areas.	www.green4cities.com
GREEN ENERGY LAB – FORSCHUNGSINITIATIVE	A project within the framework of the FTI initiative "Energy Showcase Region", funded by the Climate and Energy Fund. Over 200 partners from research, industry and the public sector are developing customer and demand-oriented, scalable solutions together with the four provincial energy suppliers Wien Energie, EVN, Energie Burgenland and Energie Steiermark – from prototype to marketability.	www.greenenergylab.at
GRÜNSTATTGRAU FORSCHUNGS- UND INNOVATIONS GMBH	The competence centre for green building promotes innovation and implementation for the green, smart city of the future. GRÜNSTATTGRAU is an interface between network partners from public authorities, industry and research. In the long term, quality assurance is promoted and new awareness of the range of services offered by green buildings in the context of climate change and energy is created.	www.gruenstattgrau.at
GTÖ – GEOTHERMIE ÖSTERREICH	A platform for the promotion of geothermal energy for heating, cooling and the production of electrical energy, and umbrella organisation of geothermal operators in Austria.	www.geothermie-oesterreich.at

COMPANY	DESCRIPTION	WEBSITE
HAKOM EDV-DIENSTLEISTUNGS GES.M.B.H	HAKOM is the market leader in individual segments of energy data management (EDM) in Austria and a successful player in Germany and the emerging markets. Since 1991, the Viennese company has been developing innovative and productive software for the liberalised energy industry. It successfully supports its customers in essential business processes with time series management systems and forecasting solutions.	www.hakom.at
HAS.TO.BE GMBH	be.ENERGISED is the cloud-based management and billing solution from has.to.be gmbh when it comes to charging infrastructure for electric vehicles. Over 5,000 charging points are already in operation using this system. be.ENERGISED stands for the simple, interoperable operation of charging stations. By integrating mobile direct payment and roaming functionalities, the system does not exclude any electric vehicle users.	www.beenergised.com
HELIOZ GMBH	The company Helioz GmbH, which has been awarded numerous prizes, has developed a solar-powered UV measuring device (WADI) that illustrates the process of solar water disinfection in a PET bottle. It shows the time at which the water disinfected by UV rays from the sun is drinkable. Solar water disinfection (SODIS) is a natural process in which the UV radiation of the sun deactivates pathogens in the water, thus making contaminated water drinkable again.	www.helioz.org
HYDROGRID GMBH	The start-up Hydrogrid offers a Software as a Service (SaaS) solution for hydroelectric power plants and generates more revenue by making optimal use of them. Fully automated, production is optimised in real time.	www.hydrogrid.eu
IBA WIEN NEUES SOZIALES WOHNEN	IBA Vienna regards itself as a process and platform with a broad-based involvement of the key players – in addition to planning and implementation, building developers and financing, research and teaching, as well as policy-makers and administrators, those key players are, above all, the people of Vienna.	www.iba-wien.at

COMPANY	DESCRIPTION	WEBSITE
IBO – ÖSTERREICHISCHES INSTITUT FÜR BAUBIOLOGIE UND -ÖKOLOGIE (VEREIN) UND IBO – ÖSTERREICHISCHES INSTITUT FÜR BAUEN UND ÖKOLOGIE GMBH	IBO is an independent scientific association that researches the interactions between human beings, buildings and the environment. Its central task is to develop and promote the principles of ecological architecture. Special fields: material ecology, building evaluation, building physics, measurements, research. IBO GmbH is the service company of the IBO association founded in 1980; baubook GmbH is operated by the Energy Institute Vorarlberg and IBO GmbH.	www.ibo.at
IG ARCHITEKTUR	IG Architektur is an Austrian-wide architects' interest group. It is a trendsetting platform for the discussion of questions concerning architecture and architectural policy. IG Architektur has over 300 members, many of whom participate in the activities of the association.	www.ig-architektur.at
IMPACT HUB VIENNA	At Impact Hub Vienna, our mission is to connect, enable, and inspire businesses that innovate with heart, balancing social responsibility with profitability to build a world that works for all.	www.vienna.impacthub.net
INERCOMP GBMH	Inercomp is an independent service company with a focus on wholesale energy trading and energy management.	www.inercomp.com
INNOVATIVE GEBÄUDE ÖSTERREICH	The platform innovative gebäude© is an independent interest group for the propagation of progressive and sustainable building standards in Austria. Its members are companies from various sectors of the construction industry that have set themselves the goal of realising innovative, sustainable buildings of the highest quality.	www.innovativegebaeude.at
INSTITUTE OF BUILDING RESEARCH & INNOVATION ZT-GMBH	This independent, private research institution is run as ZT-GmbH and managed by a state-authorised, sworn civil engineer in the field of architecture. It offers a broad, interdisciplinary spectrum and works on behalf of the Federal Chancellery, ministries, state authorities, research institutions, international organisations and the industry.	www.building-research.at
JIRA ZT & SV GMBH	JIRA ZT & SV GmbH is a civil engineer & expert office for civil engineering, building physics, acoustics & noise protection. The team specialises in building physics planning and the supervision of small to large-scale projects. Managing Director DI Jira is also a certified thermographer (Level 3) and registered energy auditor.	www.jira.at

COMPANY	DESCRIPTION	WEBSITE
CHAMBER OF ARCHITECTS AND ENGINEERING CONSULTANTS FOR VIENNA, LOWER AUSTRIA AND BURGENLAND	The statutory chamber has the task of representing the professional, economic and social interests of architects and engineering consultants. In doing so, the zt: akademie gmbh, with its headquarters in Vienna, fulfils the statutory mandate for further education in accordance with the Chamber of Civil Engineers Act.	www.wien.arching.at
KLEINKRAFT OG	kleinkraft helps to benefit from the energy transition. Kleinkraft offers technical advice, submission and processing of grants, analysis, feasibility studies and implementation.	www.kleinkraft.co.at
CLIMATE AND ENERGY FUND	The Climate and Energy Fund of the Republic of Austria regards itself as an impulse generator and innovative force for climate-relevant and sustainable energy and mobility technologies. It supports ideas, concepts and projects in the fields of research and development, market penetration and awareness raising.	www.klimafonds.gv.at
KLIMAAKTIV	klimaaktiv is the climate protection initiative of the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW). With the development and provision of quality standards such as the klimaaktiv building standards, and with advice, information and a large network of partners, klimaaktiv supplements the existing climate protection subsidies and regulations. The focus is on construction & renovation, energy saving, renewable energy and mobility.	www.klimaaktiv.at
KNOTH AUTOMATION GMBH	KNOTH specialises in the environmentally friendly cleaning of components in machining processes, such as engine, steering and transmission components. Knoth systems consume less energy due to their high temperature stability; the energy saving compared to traditional systems is between 25 percent and 60 percent.	www.knoth.net
KOMOBILE W7	This engineering office for transport and the transport industry covers the entire field of traffic and mobility planning – ranging from municipal and regional traffic concepts, traffic modelling and micro-simulation to the design, moderation and management of processes.	www.komobile.at
KOMPOST & BIOGAS VERBAND ÖSTERREICH	The umbrella organisation for five provincial organisations representing over 500 plants from the compost and biogas sector throughout Austria. Represents decentralised composting as a contribution to the circular economy.	www.kompost-biogas.info

COMPANY	DESCRIPTION	WEBSITE
VEREIN KLEINWASSER-KRAFT ÖSTERREICH	This non-profit association with about 1000 members for increasing the share of renewable energy from small hydropower (plants with a bottleneck capacity of up to 10 MW) is committed to the ecologically compatible expansion of small hydropower.	www.kleinwasserkraft.at
KRONEIS GMBH MESSTECHNIK FÜR DIE UMWELT-METEOROLOGIE	Kroneis GmbH has been a manufacturer of meteorological measuring instruments, mechanical precision instruments and aircraft board instruments since 1883. In addition to precision apparatus engineering, the emerging modern electronics were soon being used to develop sensors and measuring systems. The company's wind measurement technology is also used in the wind power industry, among others.	www.kroneis.at
LLYNX ELECTRONIC GMBH	llynx sees itself as a competent and reliable partner for the planning, development and production of your electronics, lighting control and sensor technology. The llynx product range includes operating, control and regulation equipment for light and lighting purposes as well as sensor technology.	www.llynx.at
LUKAS LANG BUILDING TECHNOLOGIES GMBH	Lukas Lang Building Technologies has developed a construction method by which buildings can be individually planned and constructed from industrially prefabricated components. Constructed buildings can be extended, changed or dismantled at any time without any reduction in their value. An efficient construction method for single and multi-family homes, housing estates, kindergartens, hotels, office buildings, staff accommodation, market halls and event buildings and much more. The first 100% industrial production of building components enables the most economical construction costs and maximum quality assurance in the production and construction process.	www.lukaslang.com
METGIS GMBH	MetGIS combines exact weather models and terrain data to produce ultra-precise forecasts. Its customer segments include the energy industry, which depends on accurate forecasts to calculate energy production, network capacities and electricity price trends.	www.metgis.at

COMPANY	DESCRIPTION	WEBSITE
MYWARM GMBH	myWarm Gmbh is an innovative developer of energy efficiency solutions for holistic, metrologically controlled and directly verifiable optimisation. The myWarm® | pure-efficiency solution is the first milestone in a development roadmap which aims to achieve usage-dependent, self-optimising operation, including integrated consumption monitoring for every room.	www.mywarm.at
NEXT KRAFTWERKE AT GMBH	The supply of electricity, particularly the trading and marketing of electricity from renewable energies and the provision of grid reserve capacities. As a subsidiary of Next Kraftwerke in Austria, the virtual power plant networks electricity producers such as wind, solar and hydropower plants, commercial and industrial electricity consumers as well as electricity storage facilities.	www.next-kraftwerke.at
NEXT:URBAN TECHNOLOGIES GMBH	next:urban develops passenger information systems, including the "urban station", a stationary e-paper display for public transport stations/stops. In addition to planning and providing the technical components, another focus is on the IT systems that provide the information.	www.nexturban.at
NONCONFORM ZT GMBH	nonconform is first and foremost an architectural office that sees its task primarily in promoting the sustainable development and revitalisation of buildings, public spaces and infrastructures. With the nonconform ideenwerkstatt and the nonconform stadthaus, they are leaving the beaten track in the interests of sustainable action, and revitalising spaces and squares with participatory planning, creating open-use urban buildings.	www.nonconform.at
OFI – ÖSTERREICHISCHES FORSCHUNGSINSTITUT FÜR CHEMIE UND TECHNIK	A specialist in quality testing and assurance, testing, inspections, certifications, research projects and expert opinions in the field of material applications and structural renewal. Also offers training and further education.	www.ofi.at
ÖGLA – AUSTRIAN SOCIETY FOR LANDSCAPE ARCHITECTURE	About 40 of the offices in Austria are represented by the Austrian Society for Landscape Architecture and Planning (ÖGLA) within the framework of office membership. The fields of activity of landscape architecture include the planning of outdoor facilities for private and public buildings, roof gardens, façade greening, sports, play and leisure facilities.	www.oegla.at

COMPANY	DESCRIPTION	WEBSITE
ÖGNB – AUSTRIAN SUSTAINABLE BUILDING COUNCIL (ASBC)	The ASBC regards itself as an umbrella organisation in the sense of sustainable building. The TQB evaluation tool for residential and service buildings was developed as an open standard and is freely available.	www.oegnb.net
ÖGUT	The Austrian Society for Environment and Technology is a competence centre and platform for sustainable development. With its professional range of services, ÖGUT links about 110 organisations and institutions from the fields of business, administration, science and the environment.	www.oegut.at
ÖKOBUSINESS WIEN	The Environmental Service Programme of the City of Vienna – environmental protection supports companies in Vienna in implementing and adopting sustainable measures. Within the framework of the OekoBusiness Check, potential energy savings are identified and tailor-made implementation concepts are then created.	www.unternehmen.oekobusiness.wien.at
OEKOSTROM GMBH	A producer and supplier of electricity from renewable energy sources, the company offers production, distribution, planning and energy services, and creates models for efficient energy production, use and saving.	www.oekostrom.at
OPEN-ENERGY AG	open-energy AG combines New Economy information systems for the energy industry with decentralised energy generation, energy supply and plant service. open-energy constructs and operates plants such as photovoltaic, solar thermal, heating and cooling systems, heat pumps, CHPs, as well as district heating house and transfer stations of maximum efficiency.	www.open-energy.at
OURPOWER ENERGIEGENOSSENSCHAFT SCE MBH	The development and operation of an online marketplace for renewable energy; members invest money and commitment in an innovative community project which stands for 100% green electricity, 100% regional value creation and direct market access.	www.ourpower.coop
AUSTRIAN ENERGY AGENCY	The Austrian Energy Agency is a competence centre for energy and advises decision-makers in politics, business and administration on a scientific basis.	www.energyagency.at
ÖSTERREICHISCHE FORSCHUNGSFÖRDERUNGSGESELLSCHAFT (FFG)	The Austrian Research Promotion Agency is the national funding institution for business-related research and development in Austria.	www.ffg.at/content/das-nationale-angebot-f-r-die-energie-und-umweltforschung

COMPANY	DESCRIPTION	WEBSITE
AUSTRIAN BIOMASS ASSOCIATION	The Austrian Biomass Association represents the interests of stakeholders whose raw materials come from agriculture, forestry and the timber industry as well as from municipal, commercial and industrial biogenic waste, the sector of energetic biomass use from raw material production to private consumers.	www.biomasseverband.at
ÖSTERREICHS ENERGIE	Österreichs Energie is the lobby of the Austrian electricity industry. It represents the jointly elaborated industry interests vis-à-vis policy-makers, the administration and the public.	www.innovation.oesterreichs-energie.at
POS ARCHITEKTEN ZT GMBH	The company's competences and focus lie in the field of planning and realising holistically sustainable building concepts. Through intensive research activities, POS Architects have developed a high level of expertise in planning sustainable buildings and can always access the latest findings in the field of applied building research.	www.pos-architecture.com
PROHOLZ AUSTRIA WORKING COMMUNITY OF THE AUSTRIAN WOOD INDUSTRY	proHolz Austria is the marketing institution of the Austrian forestry and wood industry. The aim is to communicate the ecological, economic and constructional advantages of wood as a material and building material and to encourage its increased use. One of the services offered is a catalogue of wood and wood-based materials, building materials, components and component joints for timber construction that have been tested and/or approved in terms of building physics and ecology: dataholz.eu	www.proholz.at
PULSWERK GMBH	pulswerk was founded in 2012 by the Austrian Institute of Ecology. The Institute of Ecology conducts research for the sustainable development of our society. pulswerk advises companies and politicians on the planning and implementation of sustainable solutions.	www.pulswerk.at
RAUM & KOMMUNIKATION GMBH	An interdisciplinary planning office with a focus on innovative residential construction projects, urban development planning and new urban mobility solutions. Research and political consulting, planning at the municipal and neighbourhood level, process support and process control, as well as implementation in model building projects.	www.raum-komm.at

COMPANY	DESCRIPTION	WEBSITE
RIDDLE&CODE GMBH	The Blockchain technology company helps companies and individuals meet the challenges of our digital society, such as machine identity, product origin, online fraud, identity theft and special issues such as cyber insurance, cyber risk assessment and token investment systems. RIDDLE & CODE combines the security of smart cards with the potential of Bitcoin technology and the Internet of Things.	www.riddleandcode.com
SAVE ENERGY AUSTRIA	Specialises in effective energy efficiency measures that achieve high energy savings. Energy suppliers can order energy efficiency measures in the desired quantity from Save Energy Austria and can also directly purchase measures already implemented (Energy Efficiency Act). Subsidiaries of propellets Austria and the Austrian Biomass Association.	www.saveenergy-austria.at
SCHÖBERL & PÖLL GMBH	Building physics office with a focus on research and further development of the most energy efficient buildings, such as passive houses, zero-energy houses, plus-energy buildings and energy self-sufficient buildings. The office has supervised the most passive house projects worldwide, specializes in multi-storey passive house construction and promotes the development and dissemination of PlusEnergy buildings.	www.schoeberlpoell.at
SIROCCO LUFT- UND UMWELTTECHNIK GMBH	SIROCCO Luft und Umwelttechnik GmbH has been a leader in the field of industrial ventilation technology for over 100 years. The traditional core area is the production of industrial fans and heat exchangers	www.sirocco.at
SMART GRIDS AUSTRIA	The Smart Grids Austria technology platform connects key players from the energy sector, industry and research and creates the framework for coordinated cooperation to shape the framework conditions for R&D and the implementation of innovative technologies for the future energy system. The supporting organisations are the FEEI – Association of the Electrical and Electronics Industry and Oesterreichs Energie.	www.smartgrids.at
SMART INSPECTION GMBH	Efficient inspection through drone technology. The service includes on-site inspection and automated error analysis using artificial intelligence. Asset Inspection for structures and buildings: district heating inspection, indoor inspection for industrial plants, buildings, production halls and power plants, photovoltaic inspection and wind power plant inspection.	www.smartinspection.eu

COMPANY	DESCRIPTION	WEBSITE
SMATRICS	SMATRICS, a joint venture of OMV, Siemens and Verbund, has positioned itself as a full-service provider of electric mobility services. According to the information provided, it set up the first nationwide high-speed charging network in Austria, with around 450 charging points within a radius of approx. 60 km and charging capacities of up to 350 kW.	www.smatrics.com
SOLABOLIC GMBH	SOLABOLIC is developing the next generation of parabolic trough collectors, which have the potential to significantly increase the economic efficiency of solar thermal power generation. Its unique, patented design ensures the necessary optical precision in windy conditions and eliminates the inefficiency of large collectors. At the same time, it also reduces material usage, production costs, maintenance costs and delivery costs.	www.solabolic.com
SPIRIT DESIGN – INNOVATION AND BRAND GMBH	The strategic design company includes a team that specialises in the areas of innovation and brand, and develops sustainable solutions for future challenges. Spirit Design advises customers from the mobility, telecom/IT, energy, industry and consumer sectors on their future viability and offers a comprehensive range of services. Since 2008, Spirit Design has been conducting its own research in the field of sustainable mobility, focusing on topics such as alternative drives, electromobility, intermodality and consistent usability design.	www.spiritdesign.com
SPUMIX DÄMMSTOFFE GBMH	In scientific cooperation with the Vienna University of Technology, Spumix develops completely new insulation materials based on microporous foam ceramics. The innovative production process results in extremely low raw densities and, at the same time, high strength. The fibre- and organic-free products have an excellent thermal insulation effect.	www.spumix.com
FUNDING BY THE CITY OF VIENNA – MUNICIPAL DEPARTMENTS MA 25 AND MA 50	The Municipal Departments for Technical and Financial Assessment in Matters of Housing Construction and Promotion, Specialised Urban Renewal (MA 25) and for Housing Subsidies and the Arbitration Board for Legal Housing Matters (MA 50) handle energy-relevant subsidies in housing construction.	www.wien.gv.at/wohnen/wohnbautechnik/foerdern www.um-haeuser-besser.at
CITY OF VIENNA EXECUTIVE OFFICE FOR THE CO-ORDINATION OF CLIMATE PROTECTION MEASURES	The Municipal Chief Executive Office (MD) Office for the Coordination of Climate Protection Measures coordinates activities in the areas of the climate protection plan, awareness raising, climate change adaptation and climate research.	www.wien.gv.at/umwelt/klimaschutz

COMPANY	DESCRIPTION	WEBSITE
CITY OF VIENNA MUNICIPAL DEPARTMENT ENERGY PLANNING (MA 20)	The tasks of MA 20 Energy Planning include the coordination and further development of energy-relevant concepts and energy strategies as part of comprehensive urban strategies, such as the Smart City Framework Strategy and the Climate Protection Programme. Its areas of responsibility also cover the coordination and further development of spatial energy planning in accordance with the Urban Development Plan 2025, monitoring the achievement of the objectives of the existing energy industry concepts and recommending relevant measures.	www.wien.gv.at/stadtentwicklung/energie
CITY OF VIENNA MUNICIPAL DEPARTMENT 22 – ENVIRONMENTAL PROTECTION	Innovative projects can also make a contribution to the preservation of biodiversity: For rare species and habitats, there is a legal obligation to take conservation measures. In the Vienna urban area, certain interventions in nature are prohibited or require a permit, depending on the protection category of the area.	www.wien.gv.at/umweltschutz/naturschutz/biotop
CITY OF VIENNA MUNICIPAL CHIEF EXECUTIVE OFFICE (MD) – BUILDINGS AND TECHNOLOGY DEPARTMENT (CITY PLANNING DEPARTMENT)	The Viennese City Planning Department is tasked with securing the technical and spatial basis for a city in which more than 2 million people will live in the future. In doing so, it constitutes the bridge between business, policymakers and administration. The City Planning Department is part of the Municipal Chief Executive Office (Magistratsdiektion).	www.wien.gv.at/kontakte/md-bd
SWIMSOL GMBH	Swimsol GmbH offers the planning and installation of photovoltaic systems on roofs. These activities primarily serve to build competence and awareness in the markets where floating solar systems are to be offered. The target areas are tropical islands and coastal cities where diesel generators are used to generate electricity and where the electricity production costs exceed € 0.20 per kWh.	www.swimsol.com
TATWORT NACHHALTIGE PROJEKTE GMBH	Communication and participation expertise and project management with content expertise in the fields of renewable energies, environment, water, climate protection, sustainable consumption and the efficient use of resources. The company solves complex interdisciplinary problems innovatively and across all sectors, in consortia with experts from business, science and administration.	www.tatwort.at
TBW RESEARCH GESMBH	tbw research bundles R&D activities in areas such as mobility, energy, construction and water management, thus professionalising the handling of research and funding projects.	www.tbwresearch.org

COMPANY	DESCRIPTION	WEBSITE
TEAMGMI INGENIEURBÜRO GMBH	teamgmi has been working as a team of engineers in planning in the field of energy optimisation of buildings for 20 years. teamgmi has supervised numerous projects in Liechtenstein, Switzerland, Germany and Austria and is involved in various applied building research projects.	www.wien.teamgmi.com
TECHNOLOGIEPLATTFORM PHOTOVOLTAIK AUSTRIA (TECHNOLOGY PLATFORM PHOTOVOLTAICS AUSTRIA)	The association “Technologieplattform Photovoltaik Austria” (TPPV) was founded in May 2012 as a joint initiative of Austrian manufacturing companies in the field of photovoltaics and relevant Austrian research institutions. Innovation and research for the Austrian photovoltaics industry are to be optimised in order to achieve a greater share of Austrian added value in the global photovoltaics market.	www.tppv.at
VIENNA UNIVERSITY OF TECHNOLOGY ENERGY ECONOMICS GROUP (EEG)	The Energy Economics Group (EEG) at the Vienna University of Technology researches and teaches in the fields of energy markets, climate change, renewable energy, energy modelling and sustainable systems.	www.eeg.tuwien.ac.at
VIENNA UNIVERSITY OF TECHNOLOGY RESEARCH FOCUS ENERGY & ENVIRONMENT	With more than 30,000 students and around 4,800 employees, the Vienna University of Technology is Austria’s largest research and educational institution in the scientific and technical field. In order to promote interdisciplinary cooperation, the Research Centre “Energy and Environment” was established, which links the existing in-house research initiatives.	www.energiewelten.tuwien.ac.at
TWINGZ DEVELOPMENT GMBH	twingz predictive analytics solutions provide value in the insurance industry, real estate, facility management, SMEs, energy providers & grid operators. Our products are grouped in two tracks: twingz Safety / Damage Prevention and twingz Energy Management.	www.twingz.com
UBIMET GMBH	The main area of expertise of UBIMET is in the field of meteorology, particularly in the development and creation of temporally and spatially high-resolution weather forecasts, severe weather warnings and models as well as the preparation of data and forecasts tailored to the customer’s needs. UBIMET manages the Thunderstorm Control Center (www.uwz.at), where the concept of weather warnings at the level of the natural environment was successfully implemented for the first time.	www.ubimet.com

COMPANY	DESCRIPTION	WEBSITE
UMWELTBERATUNG WIEN (ENVIRONMENTAL CONSULTING)	Since 1988, DIE UMWELTBERATUNG has been informing and advising private households and businesses and has been working on environmental protection projects. Our clients and project partners benefit from this expertise.	www.umweltberatung.at
UNIVERSITY OF NATURAL RESOURCES AND LIFE SCIENCES, VIENNA (BOKU) ZENTRUM FÜR GLOBALEN WANDEL & NACHHALTIGKEIT	The Centre for Global Change and Sustainability promotes networking, exchange and cooperation in the fields of climate, global change and sustainability.The aim is to promote institutional sustainability at the University of Natural Resources and Life Sciences and to act as a point of contact to promote and support sustainable projects, initiatives and people know-how, expertise, contacts, visibility and foresight.	www.boku.ac.at/en/wissenschaftliche-initiativen/zentrum-fuer-globalen-wandel-nachhaltigkeit
URBAN INNOVATION VIENNA	Urban Innovation Vienna (UIV) is a company of Wien Holding and supports the City of Vienna in the area of Smart City Vienna and the topics Energy, ICT and Urban Future. UIV was born of TINA Vienna and Europaforum in 2017.	www.urbaninnovation.at
URBAN INNOVATION VIENNA – ENERGY CENTER	As part of Urban Innovation Vienna, the Energy Center Urban is an independent competence centre which supports the City of Vienna and its companies in achieving their ambitious energy and climate protection goals. At the same time, the Energy Center fulfils the function of a regional energy agency, such as exist in other cities and countries in Austria and Europe.	www.urbaninnovation.at/de/Energy-Center
VERTICAL FARM INSTITUTE	Vertical Farming enables the year-round, sustainable cultivation of food on the smallest possible area by means of vertical cultivation methods and by using natural energy resources. The vertical farm institute is researching and planning the future of food together with regional and international partners.	www.verticalfarminstitute.org
WIEN 3420 AG	The central contact for the Urban Lakeside Town (Seestadt). Wien 3420 aspern Development AG is developing a city where over 20,000 people will live and thousands of people will work by 2028. Together with its partners, the development company coordinates urban development and the expansion of the infrastructure in the Urban Lakeside Town. The multidisciplinary team contributes a wide range of experience and is a sparring partner for investors, developers and companies.	www.aspern-seestadt.at/ueber_uns/wien_3420_ag

COMPANY	DESCRIPTION	WEBSITE
WIEN ENERGIE GMBH	Wien Energie GmbH is an energy company that is part of Wiener Stadtwerke. Wien Energie is the largest energy supplier in Austria. Wien Energie is active in the supply of electricity, natural gas and heat to around 2 million customers, 230,000 commercial and industrial facilities and 4,500 agricultural businesses in the greater Vienna area.	www.wienenergie.at
WIENER NETZE	Wiener Netze is Austria's largest combined network operator. The network extends over 30,000 kilometres: it includes an electricity, gas and district heating network as well as a telecommunications network.	www.wienernetze.at
WIENER UMWELT	The aim of the Environmental Ombudsman (WUA) is to protect the interests of environmental conservation on behalf of the people of Vienna and thus contribute to improving the environmental situation in Vienna. The Ombudsman's main focus is on nature conservation and urban ecology. It provides information and proposals for solutions regarding tree protection, light pollution and bird collisions with glass surfaces, i.e. protection goals that can be important in the course of innovative projects.	www.wua-wien.at
WIENER WOHNBAU-FORSCHUNG (VIENNA HOUSING RESEARCH PROGRAMME)	The research programme of the Housing, Residential Construction and Urban Renewal Executive Group of the City of Vienna supports current developments in the field of housing, residential construction and urban renewal. Accordingly, since 2011 research projects within four defined focal points have been commissioned: affordable housing; technical, ecological and social qualities and standards in new construction; technical, ecological and social qualities and standards in rehabilitation; social mixing, integration and participation.	www.wohnbauforschung.at
WIENER WOHNEN	The enterprise Stadt Wien – Wiener Wohnen administers, renovates and manages Vienna's municipal housing estates. This includes around 220,000 municipal apartments (of which around 1,400 are service apartments for janitors and 7,500 apartments under third-party management), 5,129 restaurants and more than 47,000 garage and parking spaces. This makes Wiener Wohnen the largest municipal property management company in Europe.	www.wienerwohnen.at

COMPANY	DESCRIPTION	WEBSITE
HOUSING ASSOCIATION FOR PRIVATE-SECTOR EMPLOYEES NON-PROFIT LIMITED LIABILITY COMPANY	WBV-GPA has an administrative portfolio of over 14,000 administrative units – including approx. 8,500 apartments in Vienna, Lower Austria and Styria. With its corporate philosophy of 'people, standards, milestones', it realises projects that display the attributes "social, cost-effective and innovative". This means that the company very often plays a pioneering role and paves the way for many innovations in residential construction.	www.wbv-gpa.at
WOHNFONDS WIEN	The wohnfonds_wien is a non-profit organisation and acts as a coordinating body between developers, house owners and municipal departments (especially funding agencies). The highest decision-making body is the board of trustees of wohnfonds_wien, in which various interest groups and the City of Vienna are represented. wohnfonds_wien was founded in 1984 after a decision by the Vienna City Council and was named the "Vienna Land Provision and Urban Renewal Fund" (Wiener Bodenbereitstellungs- und Stadterneuerungsfonds).	www.wohnfonds.wien.at
XYLEM TECHNOLOGIES	XYLEM Technologies offers companies, consultants as well as cities and communities innovative solutions for energy and risk management. The software solutions include ECOCITIES, which supports operators of building complexes – such as companies, municipalities, cities, property management companies – in deciding how budgets can be used most efficiently to align the real estate portfolio with specific political, economic and ecological objectives (e. g.: reduction of costs and CO_2).	www.xylem-technologies.com
ZAMG – CENTRAL INSTITUTE FOR METEOROLOGY AND GEODYNAMICS	Founded in 1851, ZAMG is Austria's national meteorological and geophysical service. The quality of the state-of-the-art products and services offered is achieved through findings from research and development programmes, combined with the continuous development of methods.	www.zamg.ac.at
ZEININGER ARCHITEKTEN (ARCHITECTS)	Since 1990, the studio has been working in the field of construction planning and interior design as architects or general planners, conducting architectural and urban development studies as well as providing construction and urbanistic consulting services in the pre-construction phase. The focus of interest of the theoretical and practical work is the adaptation, transformation and "continuing construction" on all scales, from furniture to buildings, public spaces, engineering structures and urban planning topics.	www.zeininger.at

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