Decarbonisation of Vienna

Alexander Wallisch
We supply 2 million people with electricity, gas, heat and cooling.

1.25 billion Euro of investments until 2026

Leading Energy provider in Austria

Energy from 900,000 tons of waste

Excellent credit-rating confirmed (AA-)

largest photovoltaic provider in Austria

31 citizen power plants

District heating for 420,000 households

One new photovoltaic plant per week

2.167 employees

Our power stations stabilize the power grid – up to 240 times per year

every 400 meters one charging station

22.06.2022
Achieving zero emissions by 2040 in Vienna requires massive investment and a change in the regulatory framework

District heating is essential for achieving decarbonisation

- In 2040, 56% of heating demand will be covered by district heating
- Geothermal energy and large-scale heat pumps will generate 54% of district heating
- During the 2030s, green gases will be increasingly used to fuel CHP and heating plants

By 2040, the electricity import dependency of the city will increase significantly

- Electricity generation in Vienna will drop by 43% by 2040, with demand increasing by 63%
- A national concept for the security of supply is necessary due to the limited potential for renewable electricity generation in Vienna

Decarbonisation requires an adequate regulatory framework

It requires the implementation of incentives for:
- the use of green gases
- the use of carbon capture
- the realisation of building insulation
- the expansion of district heating
- the construction of charging points
- the expansion of renewable electricity

Carbon capture will enable CO₂ neutrality of waste incineration by 2040

- Carbon capture is the only alternative for reducing emissions from thermal waste incineration
- A CO₂ sink can be created via the sequestration of biogenic emissions

Significant investment is required by 2040

<table>
<thead>
<tr>
<th>Investment in the energy system of Vienna by 2040, excl. the electricity grid, for reaching climate neutrality</th>
<th>EUR\textsubscript{2021} bn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building insulation</td>
<td>10</td>
</tr>
<tr>
<td>Change of heating appliances</td>
<td>6</td>
</tr>
<tr>
<td>Expansion of district heating</td>
<td>2</td>
</tr>
<tr>
<td>PV expansion</td>
<td>1</td>
</tr>
<tr>
<td>Charging infrastructure for e-mobility</td>
<td>1</td>
</tr>
</tbody>
</table>

The transition to e-mobility will cause a strong increase in the demand for electricity in Vienna

- From below 100 GWh today to 2.7 TWh in 2040 – equivalent of a third of today’s end-use electricity demand in Vienna
- A broad roll-out of intelligent and coordinated charging infrastructure can reduce peak demand
Climate neutrality in 2040 will be achieved through the reduction and fundamental transformation of energy use in Vienna.

Final energy consumption in Vienna [GWh p.a.]
(values rounded to 50 GWh)

- Oil-based products (particularly in transport) will mainly be replaced by electricity.

- Natural gas (and heating oil) for space and water heating will be replaced by district heating and electricity (heat pumps).

- The use of district heating will be expanded.

- Vienna's electricity consumption will increase.

Note: Values for the scenario „Climate neutrality 2040“
Source: Compass Lexicon analysis based on Statistik Austria, 2020a (for 2019) and based on study assumptions (2040)
Vienna’s electricity consumption will increase by more than 4 TWh by 2040

Main growth drivers are:
- Transport
- Space and water heating
- District cooling
- Hydrogen production

In contrast to demand growth, Vienna’s electricity generation will decrease by more than 40% by 2040

„Climate neutrality 2040“:
Electricity consumption by application [GWh]
(Values rounded to 50 GWh, sums above the rounded values do not always correspond to the rounded sum values)

<table>
<thead>
<tr>
<th></th>
<th>2019</th>
<th>2030</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport (incl. public transport)</td>
<td>8,200</td>
<td>10,150</td>
<td>12,950</td>
</tr>
<tr>
<td>Cooling</td>
<td>450</td>
<td>1,850</td>
<td>3,150</td>
</tr>
<tr>
<td>Space and water heating (individual)</td>
<td>1,800</td>
<td>600</td>
<td>1,050</td>
</tr>
<tr>
<td>&quot;Other&quot; energy consumption</td>
<td>5,650</td>
<td>2,100</td>
<td>2,700</td>
</tr>
<tr>
<td>&quot;Other&quot; energy consumption</td>
<td>5,600</td>
<td>6,050</td>
<td></td>
</tr>
</tbody>
</table>
Demand for useable energy will decrease while natural gas is displaced

„Climate neutrality 2040“: Useable energy demand for heating

[Values rounded to 100 GWh, sums above the rounded values do not always correspond to the rounded sum values]

- Population growth leads to increased demand
- The renovation rate and climate effects more than offset population growth
- Accordingly, useable energy demand for heating decreases by 18% by 2040
- Even though the end energy demand will not decrease in the same way
- Natural gas is too valuable to be used in heating
- District heating and, where not applicable heat pumps (in low temperature networks or stand-alone) are the key
Climate neutrality in 2040 requires significant investment in Vienna – creating opportunities for Vienna as a business hub and for its labour market

Investment in the Viennese energy system to achieve climate neutrality by 2040 [EUR\textsubscript{2021} bn]

(in the sectors included in the study excl. electricity grid)

The majority of investments take place in the heating sector – this mainly encompasses building insulation, change of appliances and district heating expansion

<table>
<thead>
<tr>
<th>Sector</th>
<th>Investment [EUR\textsubscript{2021} bn]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating</td>
<td>18.6</td>
</tr>
<tr>
<td>Transport</td>
<td>1.3</td>
</tr>
<tr>
<td>Electricity</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Investment in transport is mainly based on the build-out of charging infrastructure for electric vehicles in Vienna

The expansion of PV capacity on Vienna’s buildings is responsible for most investment in the power sector

Notes: Values for the scenario „climate neutrality 2040“; results rounded to 100 mln EUR\textsubscript{2021}, values correspond to the non-discounted sum over the years 2022 to 2040
Heating: Investment in insulation of building stock, in the change of heating appliances and in district heating generation (geothermal energy plants, heat pumps, maintenance investment in waste incineration plans, carbon capture and half of the investment in a new CHP plant), as well as in the district heating grid
Transport: Investment in charging infrastructure for electric vehicles and hydrogen filling stations
Electricity: Investment in PV plants as well as the second half of the new CHP plant
Investment needs in the electricity grid were not separately analysed, nevertheless necessary grid charges were included.

Source: Compass Lexecon based on study assumptions
District heating is essential for achieving decarbonisation

„Climate neutrality 2040“: Generation of district heating [GWh]
(Values rounded to 50 GWh, sums above the rounded values do not always correspond to the rounded sum values)

- District heating generation will increase by 18% by 2040
- In 2040, 56% of heat demand will be covered by district heating
- Geothermal energy and large-scale heat pumps will generate 55% of district heating by 2040
District heating in Vienna

Decarbonisation through, and of, district heating is the key

- Production is, and will be, even more diversified

- Digitalisation and connecting all sources are fundamental to an efficient district heating

- Customer installations are important part of the decarbonisation strategy
Using renewable and waste heat

Wien Energie is actively searching alternative heat sources

- Industry, service sector
- Sewage
- Our own Plants
- Geothermal energy sources
Using heat from alternative sources

UNO City: Office building with datacenter

- Thermal capacity: ~4 MW (3 heat pumps)
- Heat source: recooling water of the cooling plant
- Heat sink: district heating network
- COP ≈ 3,9 (summer) - 4,9 (winter)
- Refrigerant: NH3 ammonia - R717
- Operation: 2021
Heat pumps in sewage treatment plant

110 MW and 880 GWh in the final stage. First Phase to be operational in 2023
Using deep geothermal energy sources

Definitions

**deep geothermal energy**

**Close to surface geothermal energy**
Using deep geothermal energy sources

GeoTief Wien: milestones

Potential study
Planning GeoTief

2015

starting GeoTief
Planning exploration

2016

2D seismic
Pilot-Seismic in eastern part of Vienna

2017

3D Seismic
seismic exploration in Vienna

2018/19

Evaluation
building geological 3D model

2020

Drilling tests
95° hot water under Vienna proven

2021
Using deep geothermal energy sources

...Target till 2030: 120 MWth

succesively buiding up and integration of deep thermal geothermal energy

➢ Decarbonisation of district heating
➢ Securing competitivness
Seasonal heats storage

Important cornerstone to decarbonisation!

Integration of heat storage is necessary to increase the usage of geothermal sources and waste heat

Needed especially for the use of heat from cooling

Helps to save green gas and other incinerated fuels
Project Scale-Up

Technical data

- Large-scale water tank built under the surface; maximum temperature 99°C
- Storage ca. 2000 MWh
- 40,000 m³ Volumen
- Length inside 40m
- Depth 25m
- Especially in combination with geothermal energy use
Wien Energie is taking action to achieve zero emissions by 2040

**Renewable electricity generation**
- Expand the portfolio of renewable electricity generation inside and outside Vienna.
- Provide IT solutions and services for energy communities

**Generation of heating and cooling**
- Offering sustainable, integrated and customised heating solutions, based on district heating and heat pumps
- Decarbonisation of district heating by tapping into geothermal energy and the expanding the use of large-scale heat pumps
- Expansion of highly efficient district cooling

**Circular economy and waste incineration plants**
- Identify the potential to recycle renewable assets and captured carbon within the scope of a circular economy

**Green gases**
- Build sustainable hydrogen production and associated filling infrastructure
- Ensure the technical requirements for the use of green gases in Wien Energie's power plants are met
Decarbonisation of Vienna