



Transition Roadmap City of Winterthur



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Transition Roadmap of Winterthur

Introduction & Context

In 2013, the Winterthur City Council adopted the Municipal Energy Plan Winterthur (Energy Plan 2011).

In the meantime, Stadtwerk Winterthur (the utility) has implemented further district heating networks, continuously increased the connection density in the district heating area, which is supplied with waste heat from the waste incineration plant and announced the withdrawal of the gas supply from the district Gotzenwil by the end of 2026.

At the same time, the overarching climate targets at national, cantonal and municipal level were tightened to net zero CO₂ emissions - Winterthur committed itself to net zero emissions by 2040 in November 2021, while the population of Switzerland only recently voted in favour of climate neutrality by 2050 in a referendum.

Similarly, the revised Energy Law of the Canton of Zurich entered into force in September 2022 and implemented a wide-ranging prohibition of fossil-fuel boilers in buildings.

In view of the greatly changed framework conditions, the Energy Plan 2011 and the



roadmap had to be comprehensively revised and supplemented.

The new municipal energy plan was approved by the city parliament on October 31, 2022 and came into force in early 2023

In order to achieve the climate target of net zero tons of CO₂ by 2040, the heat supply of the city of Winterthur will be provided by renewable energies and waste heat.

It is a binding guideline plan that shows in which areas which energy sources are intended for heat supply.

”

Status Quo

Infrastructure

District Heating: In Winterthur, eight thermal grids are already being operated with a majority of renewable energy sources (three with waste heat from the incineration plant, five with wood).

Gas network: The residential area in Winterthur is largely connected to the gas pipeline network of Stadtwerk Winterthur.

Oil and wood heating: From the chimney sweepers, all gas, oil and wood combustion heatings are registered.

With these and more data, the City of Winterthur's Environmental and Health Protection Department (UGS) publishes an emissions register and a municipal environmental report every four years. This includes the elaboration of an energy balancing and greenhouse gas inventory.

Emissions by sector

The latest balance refers to the year 2020. According to this balance, the heating sector causes around 35% of the CO₂ emissions in Winterthur with 1.5 tonnes of CO₂ equivalents per person and year.

Energy source mix of the heating sector

Fossil fuels (heating oil and natural gas) account for 68% of the heating demand in Winterthur.

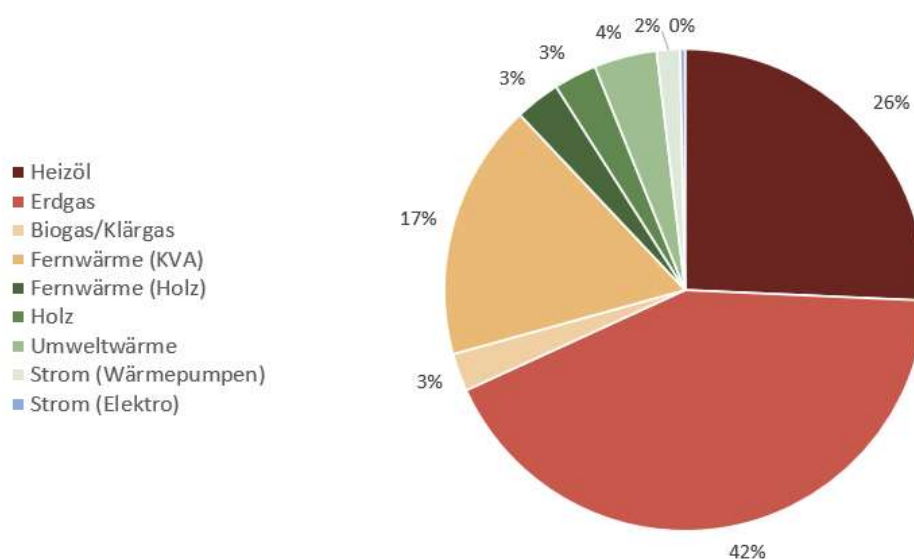


FIGURE 51: ENERGY SOURCE MIX HEATING 2020 (DATA SOURCE: EMISSION REGISTER CITY OF WINTERTHUR 2020)

Goals for 2040 & legal framework

The legal framework and specially the goals to achieve in Winterthur are diverse. The most important include:

2000-Watt Society

In 2012, the Winterthur electorate voted in favour of the 2000-watt society by a clear majority. The 2000-Watt Society is a concept which translates national (and higher) energy and climate goals onto the municipal level, in order to reduce greenhouse gas emissions and the scarcity of renewable energy resources. In 2020, the 2000-Watt society published a new guiding concept with adapted objectives. The following targets apply for the year 2050:

- ▶ Energy efficiency (2000 watts of continuous primary energy per person)
- ▶ Climate neutrality (zero energy-related greenhouse gas emissions)
- ▶ 100% renewable energy supply

Net zero CO₂ emissions by 2040

In the referendum of 28th November 2021, the electorate of the city of Winterthur voted in favour of the net zero target by the year 2040. This means that Winterthur aims to reduce greenhouse gas emissions to net zero tonnes of CO₂ equivalents per year and per capita by 2040 with an interim target of 1.0 tonnes by 2033.

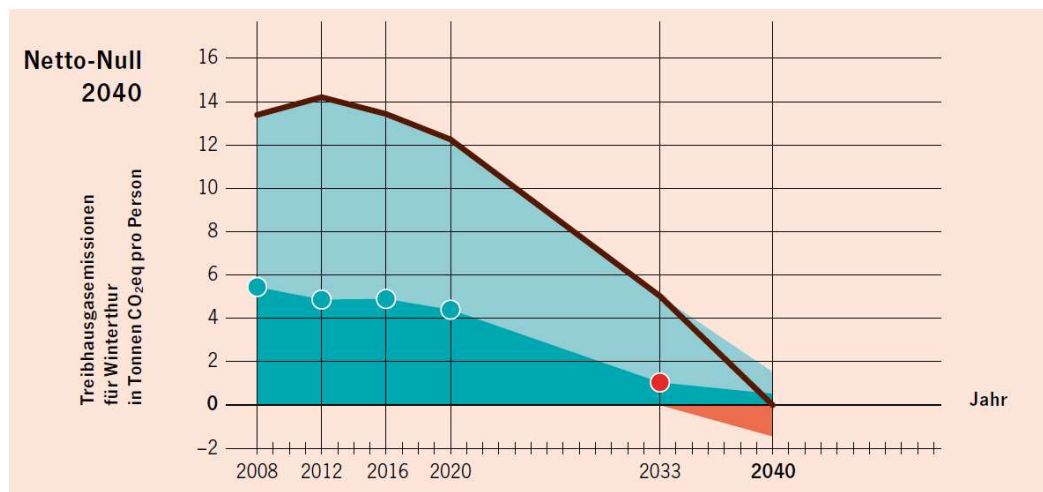


FIGURE 52: ACTUAL AND TARGETED GREENHOUSE GAS EMISSIONS FOR WINTERTHUR IN TONNES OF CO₂ EQUIVALENTS PER CAPITA AND YEAR FOR THE "NET ZERO BY 2040" SCENARIO (SOURCE: EMISSIONS REGISTER CITY OF WINTERTHUR 2020, ENVIRONMENTAL AND HEALTH PROTECTION WINTERTHUR; GREENHOUSE GAS FOOTPRINT, FOEN, SFSO).

Climate and Energy Charter

Furthermore, the Winterthur City Council signed the Climate and Energy Charter of Swiss Cities and Municipalities. Due to the urgent need for action, the city of Winterthur revised the existing energy concept and adopted a climate action plan with 54 climate protection measures.

Energiestadt Energy city (european energy award)

Winterthur has been an energy city since 1999 and was awarded the "European Energy Award Gold" for the fourth time in 2019. The city has thus been pursuing an active energy and climate policy since more than twenty years.

Energy law (cantonal)

The cantonal energy law was revised and adapted to the current state of building technology and entered into force on 1 September 2022. It sets an important course for the reduction of CO₂ emissions in the provision of heat and the increase of energy efficiency. The most important changes are listed below:

- ▶ New buildings are to be built according to the state of the art. As little energy as possible should be used for heating, hot water, ventilation and air conditioning (§10a).
- ▶ New buildings should be equipped in such a way that part of the required electricity is generated by the building itself (§10c).
- ▶ New buildings are to be equipped with heating systems that do not cause any CO₂ emissions from fossil fuels on site (§11 para.1).
- ▶ When replacing the heating system in an existing building, only renewable energies (including biogas) may be used, provided that it is economically viable. If the costs for generating heat from renewable energies over the entire life cycle (investment, amortisation, operation and maintenance) are more than 5% higher than with a heating system using fossil fuels, the simplified requirement applies that at least a small proportion of 10% renewable energies must be used or the energy requirement of the building is reduced by 10%. This requirement can be met with a standardised renovation measure (e.g. window replacement) (§11 paras. 2 and 3).
- ▶ Existing stationary electric resistance heating systems for heating buildings and existing central electric water heaters are electricity guzzlers and must be replaced by 2035 (§10b para. 3).

Spatial development perspective Canton Zurich

The Spatial development perspective of the canton Zurich defines a priority list of energy sources for heating:

For heat supply, the existing heat sources are to be exhausted and heat networks are to be densified - taking into account economic efficiency as well as supply and operational safety. To this goal, supply areas are to be designated in communal or regional energy plans (H/C-Maps) according to the following priority:

1. **local high-grade waste heat:** In particular, waste heat from waste incineration plants and deep geothermal energy and industrial waste heat available in the long term, which can be directly distributed and used (without need of a heat pump).
2. **local low-value waste heat and environmental heat:** In particular, waste heat from wastewater treatment plants and heat from waters (lake, river, groundwater).
3. **thermal networks:** Densify existing district heating networks.

Outside of district heating networks, the decentralised use of locally unconnected environmental heat from geothermal energy and ambient air as well as the use of solar energy should be preferred for the heat supply; the decentralised use of wood energy should only be considered for the demand for high temperatures.

H/C-Map

Principles

The H/C-Map implements the goals of the city of Winterthur which are mentioned in chapter “Goals”. To remind: For the heating sector, an interim target of 300 kg CO₂-eq per year and person by 2033 is to be applied.

Reduction and transformation path for heating

Based on today's demand, the reduction and transformation path for heat shows how the heat supply is to be redesigned in the coming years (Figure 53).

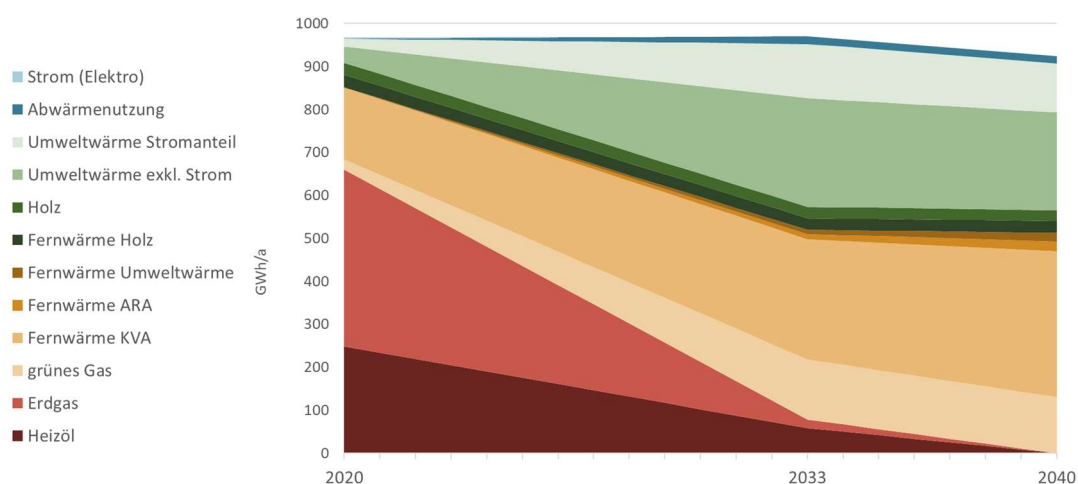


FIGURE 53: REDUCTION PATH FOR HEAT IN THE CITY OF WINTERTHUR (SOURCE: PLANAR 2021)

The target can be achieved by replacing fossil fuels with renewable energies and waste heat (transformation). The availability of renewable energy sources was taken into account. Equally important for the achievement of the target is the reduction of the total heat consumption. The reduction is possible through retrofitting and efficiency improvements. For the estimation of future demand, it has been assumed an annual renovation rate of 1.2%.

As the city is still growing, the reduction is compensated through new buildings (which has to be built in compliance with the goals).

Greenhouse gas target path

The reduction of the heating demand and the transformation of the energy sources have a direct impact on the greenhouse gas emissions. Figure 54 shows the resulting target path of greenhouse gas emissions (t/a) in the heating sector of the city of Winterthur. For the year 2033, the target is met with 0.300 t/CO₂-eq per person. In 2040, a residual emission of 0.101 t/CO₂-eq per person and year remains.

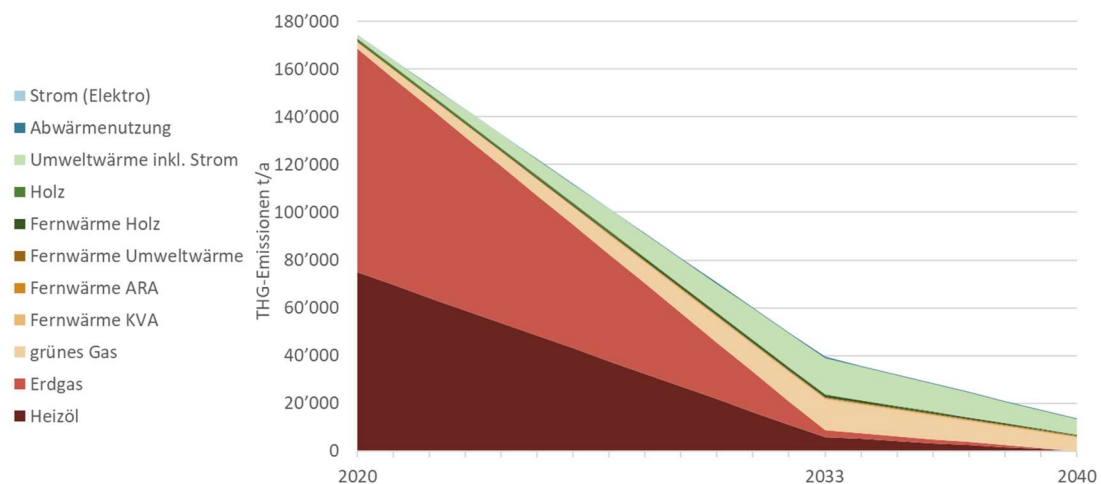


FIGURE 54: TARGET PATH OF CO₂ EMISSIONS IN THE HEATING SECTOR OF THE CITY OF WINTERTHUR (SOURCE: PLANAR 2021).

Despite the conversion to 100 % renewable energies and waste heat utilisation, compensation of the residual emissions through sinks and emission reduction certificates is required to achieve the net zero target. The handling of sinks and emission reduction certificates is discussed in the climate strategy of the city of Winterthur.

Fossil fuels

In order to achieve the communal goal of net zero by 2040, it is necessary to phase out fossil fuels. The requirements for fossil fuels in the cantonal energy law have become stricter.

Strategy for oil-fired heating systems

According to the new energy law of the Canton of Zurich, fossil fuel heating systems may no longer be replaced. The prioritisation in the H/C-Map must be followed when approving replacement heating systems.

Gas strategy

In order for the city of Winterthur to achieve its energy goals, it must switch to renewable gas in the long term. Current estimates of potential assume that 15-30% of current gas sales can be covered by renewable gases in Switzerland as a whole. This means that the gas grid and gas sales must be reduced to a maximum of 30% of the current level (as of Dec. 2021).

From 2040 onwards, gas will no longer be available for space heating, but only for processes in industrial and commercial zones and to cover peak capacity in district heating systems.

In order to give customers sufficient time to switch their heating systems, the shutdown of the gas supply will be announced at least 10 years in advance, if possible. Moreover, the expansion of the thermal grids will take time in the coming years, so a coordinated, staged withdrawal of gas and the offer of transitional solutions is necessary.

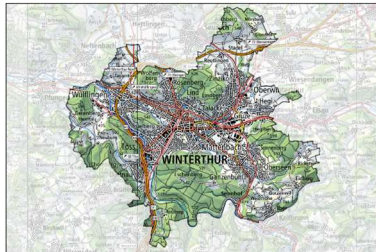
H/C-Map

Stadt Winterthur



Kommunaler Energieplan 2022

Massstab: 1:20'000



Bildquelle: www.jacobsplan.ch

PLANAR

Projekt: WWS 24
Datum: 14.06.2022
Format: A4 (210 x 297 mm)
Erstellt / geprüft: G. Schmid / G. Schmid
Grundlagen: Geodaten Stadt Winterthur
Datei: WWS24_P01_Energieplankarte.aprx

Genehmigungsinhalt

Verbundgebiete

Erdschliessung

- P** bestehendes thermisches Netz
- V** vorgesehene thermisches Netz

Gasversorgung

Die Gasversorgung bleibt langfristig für Prozessenergie und Spitzendeckung in Verbundgebieten sowie Winterstromproduktion erhalten.
Die reine Baumwärmeversorgung ist nicht mehr vorgesehen, das Gasnetz wird etappiert stillgelegt.
Die Stilllegungspunkte ergeben sich aus Übergangsfristen für Anschlüsse an Energieverbunde oder individuelle Lösungen.

Stilllegungszeitpunkte:

- Bis Ende 2030: P2
- Bis Ende 2033: alle P-Gebiete und alle E-Gebiete
- Bis Ende 2040: alle V-Gebiete
- Keine Stilllegung: ausgewiesene Industriezonen, Spitzendeckungen Wärmeverbunde

Informationsinhalt

Eignungsgebiete

Wärmequellen

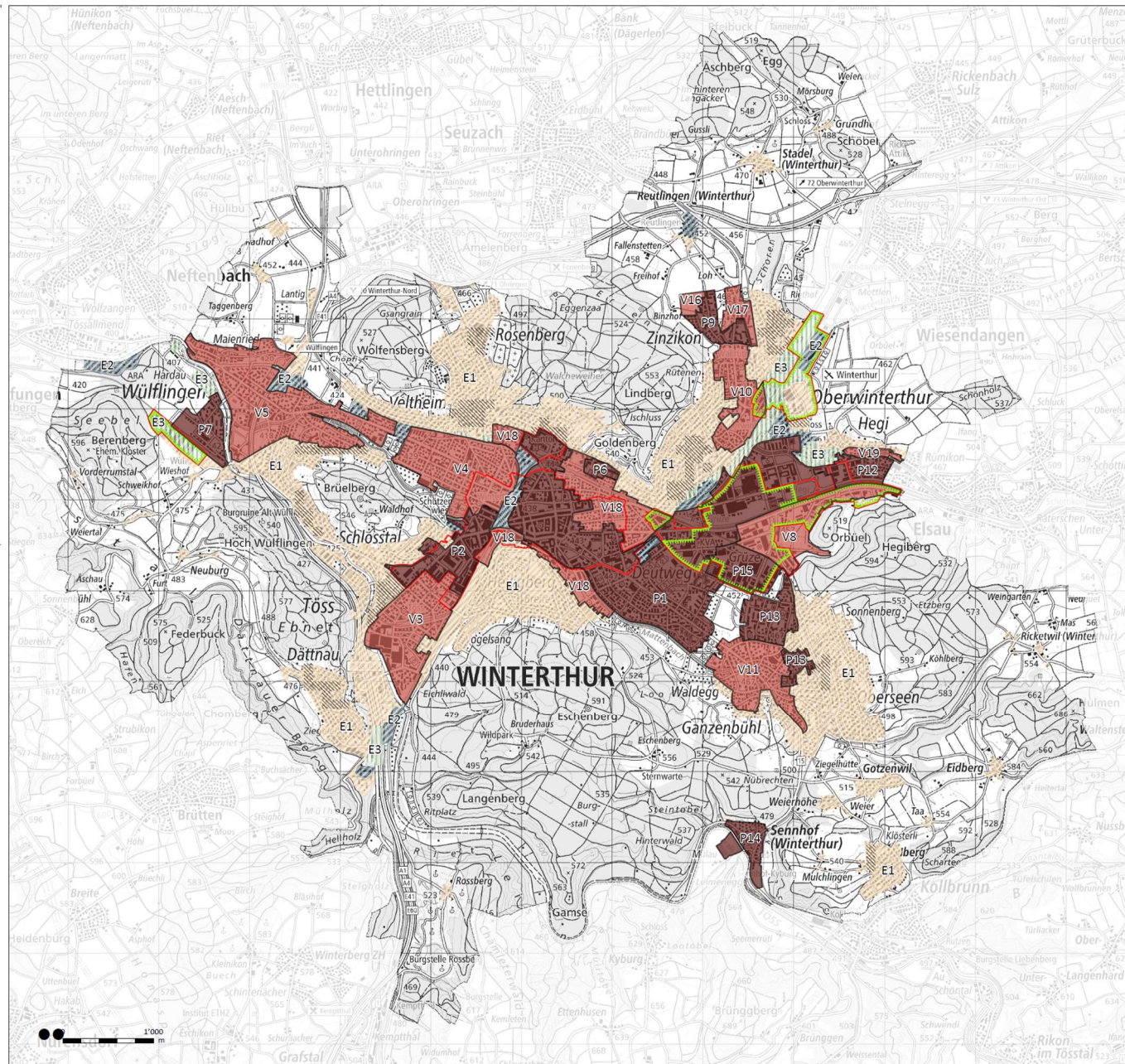
- E1** Erdwärme
- E2** Grundwasser
- E3** Umgebungsluft (Luft-Wasser-Wärmepumpe)

Eignungsgebiete werden mit Einzelanlagen oder Kleinverbunden versorgt.

Die Solarstromerzeugung soll in allen Versorgungsgebieten genutzt werden. Die Solarwärme sollte in Verbundgebieten nur in Absprache mit der Energiehelferlei eingesetzt werden.

Zusätzliche Hinweise

- Geeignete Gebiete für Kleinwärmeverbunde
- Industriezonen (Prozessgas verfügbar)
- Gebiete mit potentiell hohem Kältebedarf



Pathways

The H/C-Map sets the direction for the future heating and cooling supply of the city of Winterthur. In order to achieve the formulated goals, the city's heating and cooling supply must be redesigned according to the energy plan map. The necessary implementation steps are noted in the measure sheets.

The H/C-Map focuses on three different areas which are: "existing thermal network" (P), "planned thermal network" (V) and "areas for individual supply" (E). The designated settlement areas show the desired target state in each case.

Development of the energy source mix

In order to achieve the climate targets, at least 85% of the district heating systems should be based on renewable energies by 2033 and 100% on renewable energies by 2040. Before 2033, the heat in thermal grids must come at least 70% from renewable energies. In concrete terms, this means:

- By 2033, at least 70% renewable
- From 2034 at least 85% renewable
- Between 2034 and 2040 between 85 - 100% renewable energy
- From 2040, 100% renewable (peak coverage fossil-free)

Coupling of thermal networks (District heating systems)

The further development of thermal networks, their coupling and construction of not yet existing district heating systems was the subject of an engineering study. This study considered the following areas as shown in Figure 55 (P1, P2, V3, V4, V11, P13, P15, V18):

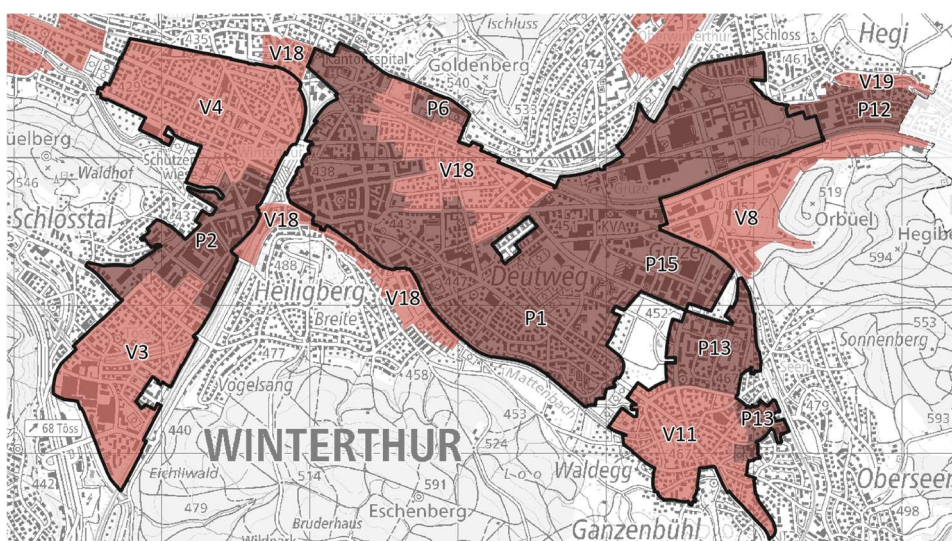


FIGURE 55 : PERIMETER OF THE MASTER PLAN (P1 - V19) AND OF THE STUDY "WÄRMEVERBÜNDE UND NETZE" (BLACK BORDER).

The study is to examine the extent to which the P1 distribution network can be enlarged by coupling it with the neighbouring networks in order to supply the neighbouring networks with heat from the incineration plant in summer. In the winter months, the neighbouring thermal

networks are to be supplied by using the local heat potential from "own" heating centres. The incineration plant thus continues to form the core of Winterthur's heat supply.

Conversion phase

In order to be able to accelerate the network expansion, further main pipes are to be laid from the Sulzer-Stadtmitte area (P2) in the direction of Töss-Eichliacker (V3) and Neuwiesen (V4). In the first period, the heat will be provided from the incineration plant heating centre. Additional temporary fossil-fuelled peak capacity boilers will be necessary for this.

The energy source mix can be optimised and the peak coverages reduced, as soon as the individual neighbouring thermal grids have their own heating centres.

The temporary deterioration of the energy source mix is accepted in favour of a rapid grid expansion and earlier climate neutrality. It can also be assumed that, despite everything, there is a positive overall benefit if the replacement of purely fossil-fuelled decentralised heating systems necessitates greater fossil-fuel peak capacity in the P1, because more waste heat and renewable energies can be used overall.

Individual supply

In Areas with individual supply (E), the strategy is given through the energy law of the Canton Zurich, as fossil heating must be replaced by a renewable solution (see also Chapter Goals – Energy law).

Roadmap

Measures to be implemented

To reach the goals and to implement the H/C-Map, there are several measures foreseen. For each area shown on the map there exists an own sheet on which the measure is explained. Furthermore, the responsibility is fixed, and a timetable shows the next steps to be taken and by when (see also Appendix).

Additional there are six supporting measures defined. Five from them are shown in the following paragraphs. The sixth is to order a new study about the deep geothermal potential in Winterthur.

1) Engineering Study

The engineering study to couple the thermal networks is already in progress. The aim is to maintain a flexible infrastructure that can be used optimally. Details on the coupling have been explained in the previous chapter.

2) Organisation and resource building

In order to achieve the objectives of the city of Winterthur and to implement the H/C-Map, a lot more thermal network pipes and connections will have to be built in the next few years than in previous years.

The central implementation organisation of the H/C-Map is the utility “Stadtwerk Winterthur”. In order for the implementation to succeed, Stadtwerk Winterthur needs the support of the City of Winterthur, in particular of the building department, but also of other municipal offices. They all need sufficient resources (human and financial).

Structural/organisational

In order to make this rapid expansion possible, a number of framework conditions need to be created:

For this, three working groups will be established:

Working group on acceleration measures for heating networks

(Head: City Councillor, involvement of Head of Stadtwerk Winterthur, Head of environmental and health department, Head of Civil Engineering, Energy Department).
Start: September 2021

Tasks:

- ▶ Identify and remove structural/organisational obstacles.
- ▶ Increase the speed of administrative processes in the administration, either by simplifying processes or increasing resources.
- ▶ Optimise interdepartmental construction coordination and cooperation.

Working group on master plan for heating networks

(Head: Stadtwerk Winterthur, including the head of environmental and health department and the Energy Department as well as the Civil Engineering Office)

Start: December 2021

Tasks:

- ▶ Preparation of the master plan, which aims to implement the energy plan (cf. M1).
- ▶ Rough network structure (main pipes / temperature level)
- ▶ Concept for heat generation
- ▶ Locations for heating centres
- ▶ Timetable

Working group for monitoring the implementation of the energy plan

(Head: Energy Office, involvement of Stadtwerk Winterthur, Head of environmental and health department).

Start: January 2022

Tasks:

- ▶ Annual monitoring of progress in implementing the Energy Plan (cf. M5)
- ▶ if necessary: Definition of corrective measures

Result: A yearly short report in KUE

Resources

Stadtwerk Winterthur and the other administrative departments - in particular the Civil Engineering Office - determine the human and financial resources required to implement the H/C-Map. If changes in the organisational structure are necessary for an optimal implementation of the H/C-Map, these must be taken into account accordingly.

Subsequently, the corresponding resources are to be approved by the city council as well as by the city parliament and the people. It is likely that one or more referendums will be required. This can take place at the earliest after the master plan has been presented.

3) Information, Energy Counselling und Subsidy Schemes

Information to customers and land owners should be internally coordinated and consistent.

When the energy plan comes into force, the property owners are to be informed on an area-specific basis about the gas supply and the planned expansion of thermal grids.

Periodic, targeted information campaigns should support the transition and increase the rate of energy-related renovations.

Development of a "building-specific" energy cadastre plan in geographic information system (GIS), also as a tool for public relations work.

4) Controlling

Controlling is carried out by means of an implementation control and an impact control.

In the implementation control, the progress of the different projects is checked with the help of the measure sheets (See Annex). It should be carried out at least once a year by the Implementation Control Working Group.

The impact monitoring records the extent to which the measures already implemented have an impact on the greenhouse gas emissions caused by the heating sector on the city's territory (the grey energy of the piping and central building is included in the calculation via the greenhouse gas emission factors).

The controls are carried out periodically (survey annually or every two years). For this purpose, a selection of suitable indicators is to be made: For a simple annual review of the progress of the work, never-threshold indicators are suitable, such as number of oil and gas heating systems, newly constructed km of heat pipe, number of new connections to thermal networks etc.

For a more in-depth review (every two or four years), indicators that are collected as part of the preparation of the energy and climate balance (or emissions register) of the environmental and health department are suitable. Up to now, this has been done every four years.

5) Transitional solution

Many buildings are still heated with oil and gas today. Oil and gas heating systems must be replaced by climate-neutral heating systems at the end of their life. When a heating system is due to be replaced, many property owners are therefore faced with the question of an alternative solution. A central role is played by the planned thermal networks that will be built or further expanded in the coming years.

Without a network solution, they decide for an individual solution. If there are too many individual solutions, the district heating can't be operated economically. Until the corresponding connections are available everywhere, building owners have to be offered a temporary transitional solution by the energy service provider and the Energy Office.

Appendix:

Example of measure sheet

Nr. Titel			
Last Trackings	11.01.2022, PLANAR		
Status of implementation	Proceeds according to plan	remarks:	
Objective			
Current energy source			
Temporary solution			
Energy sources to be taken in account	<input checked="" type="checkbox"/> waste heat incineration plant <input type="checkbox"/> waste heat sewage water treatment plant <input checked="" type="checkbox"/> waste heat from Industry or Cooling <input checked="" type="checkbox"/> Thermal groundwater utilisation <input type="checkbox"/> Geothermal energy (possibly also as seasonal storage) <input type="checkbox"/> Heat utilisation River Töss <input type="checkbox"/> Firing systems with wood and waste heat from CHP with biomass <input type="checkbox"/> thermal solar energy <input type="checkbox"/> Ambient air		
Cessation of gas supply	<input type="checkbox"/> no grid available <input type="checkbox"/> End of 2030 <input type="checkbox"/> End of 2033 <input checked="" type="checkbox"/> End of 2040		
Initial situation			
Description of measures			
Project responsibility			
Procedure	Steps	Lead (Involved)	Deadline
Interfaces, Conflicting goals			
Risks, Challenges			
Documents			
Enforcement Journal	To be continued...		





DECARB CITY PIPES

2050



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