



Decarbonising Heat Supply in Low-Density Urban Settlements in the City of Vienna

Comparison between individual and collective heat supply solutions

Gerhard Hofer

16-Apr-2026



Current situation

45,000 / 600,000

residential units in single- and two-family house settlements still supplied by decentralised gas boilers in the City of Vienna

- Outside the district heating network - no thermal network solution in sight
- Individual heat pumps are the default - but is that the right answer?
- Low-density ≠ low complexity: spatial, economic and governance challenges stack up



Motivation

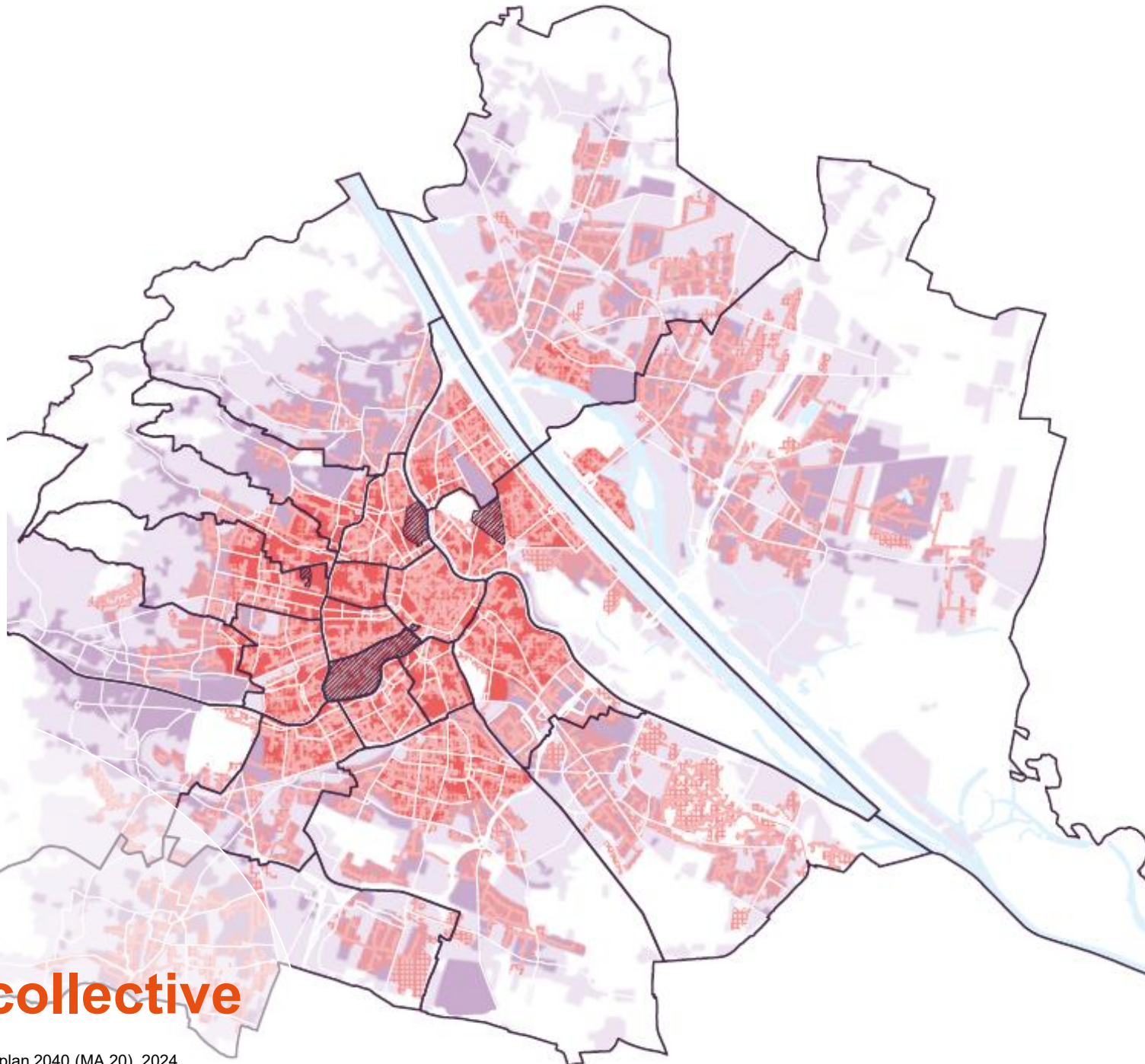
HEAT DEMAND ACCORDING TO THE VIENNA HEATING PLAN 2040



- Areas suitable for district heating
- Supplied with district heating
- Not supplied with district heating
- Local Collective Heating
- Local Individual Heating

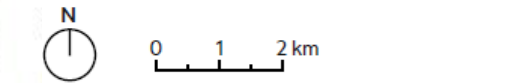
1/6
individual collective

Source: Stadt Wien, Wiener Wärmeplan 2040 (MA 20), 2024.



- District Heating Today Connection possible
- ▨ District Heating Today Connected areas
- District Heating Future Expansion planned
- ▨ "Pioniergebiete" Expansion in process
- Local Collective Heating Heating neighborhoods
- Local Individual Heating Heating individual buildings

- City boundary
- District boundary
- Water body
- Main streets
- Non-built-up area



Underlying data: City of Vienna – Energy planning (MA 20),
Wien Energie, Wiener Netze
Base map: City of Vienna – data.wien.gv.at

Vienna Heating Plan 2040

Status: May 2024

An aerial photograph of a residential neighborhood. The image shows a grid of streets with various types of buildings, including multi-story apartment blocks and smaller houses. A prominent feature is a large, rectangular green field in the center-left area. The text "Is this settlement better suited for individual or collective heat supply?" is overlaid in large white font across the top half of the image. The year "2024" is visible in the top left and top right corners of the map.

Is this settlement better suited for individual or collective heat supply?

or this neighbourhood?



An aerial photograph of a residential area. A road runs diagonally from the top left towards the bottom center. To the right of the road, there is a dense cluster of buildings, likely a residential development. The surrounding area is mostly green, indicating trees and grass. The text 'or this?' is overlaid in the top left corner.

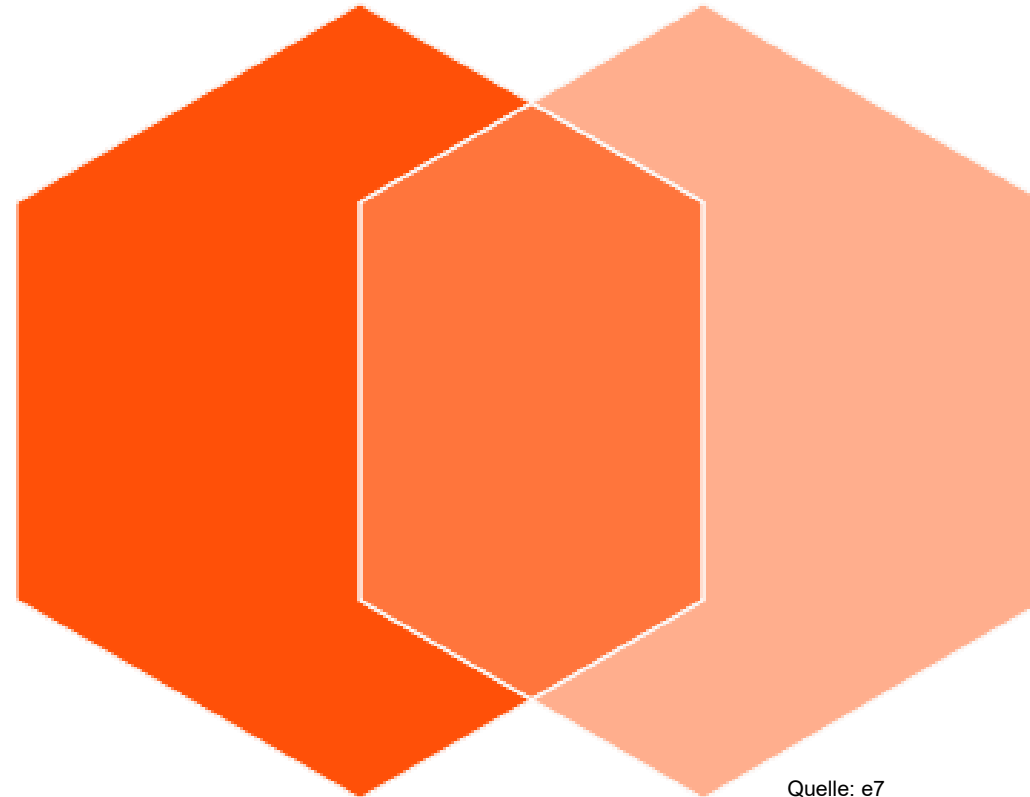
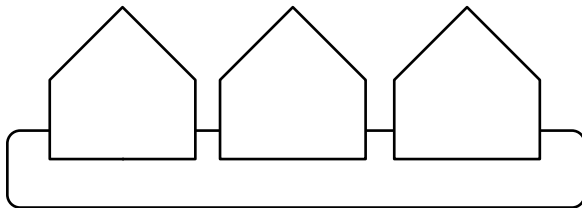
or this?

**Which ownership structure and organisational
suitable for implementing community-based heat
supply?**

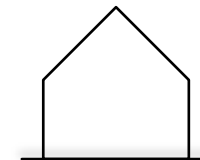
Research question

Test-Cases
at the interface between
both zones

**Local Collective
Heating**
Neighbourhood Heat Supply



**Local Individual
Heating**
Individual Building
Heat Supply



Quelle: e7

Assessment of the boundary
between neighbourhood-based and individual
heat supply

01

Spatial Analysis

- Heat demand density
- Floor area ratio
- Plot structure
- Network routing options

02

Technical Concepts

- Individual heat pumps
- Collective low-temperature networks
- Energy systems (Ambient temperature network)

03

Life-Cycle Costs

- Investment costs
- O&M and energy costs
- Replacement over system lifetime
- LCC calculation, LCOE

04

Governance Assessment

- Ownership structure
- Implementation models
- Transaction Costs

Overview of Test Cases

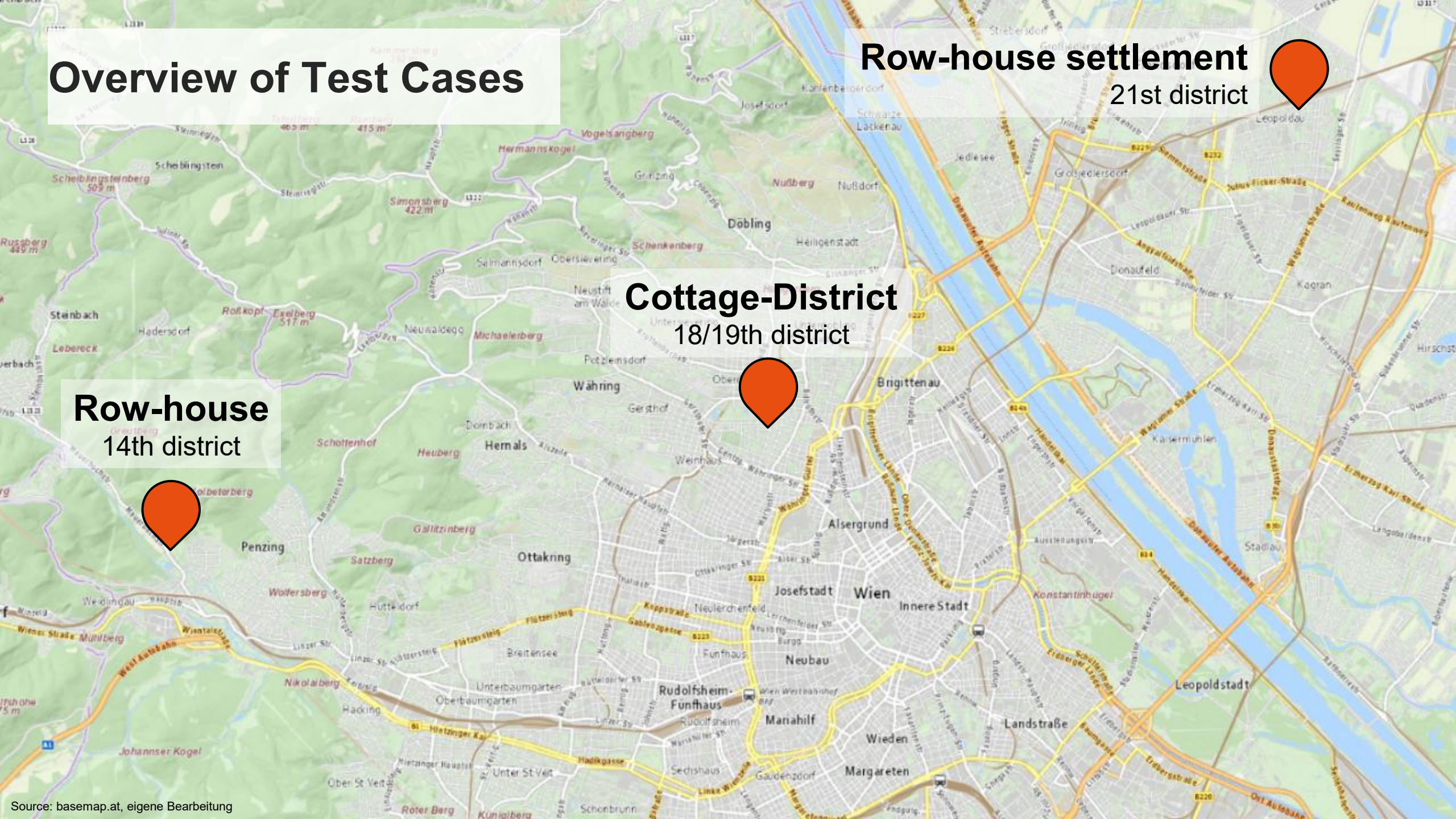
Row-house settlement
21st district



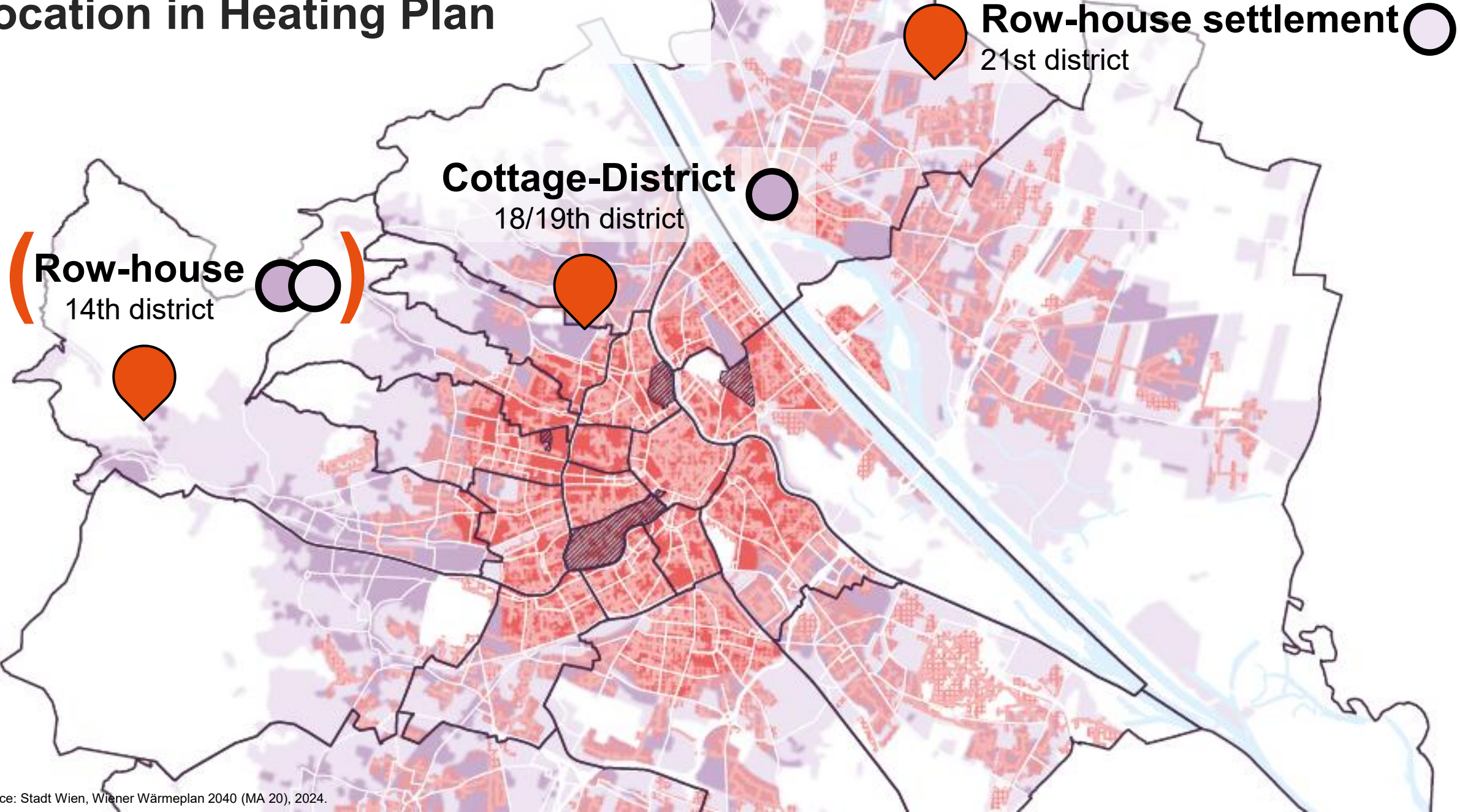
Cottage-District
18/19th district



Row-house
14th district



Location in Heating Plan



Source: Stadt Wien, Wiener Wärmeplan 2040 (MA 20), 2024.



Rowhouse settlement



Limited-profit housing developer



1210 Vienna



9 row house blocks
52 residential units
6,900 m² gross floor area



Year of construction: 1974/2006



Gas-based individual heating in each unit



Local heat supply – individual



Cottageviertel



Private owners



Cottagegasse, Felix-Mottl-Straße, Hasenauerstraße,
Weimarer Straße, 1190 Vienna



12 buildings
23 residential units
8,900 m² gross floor area



Year of construction: > 1872



Gas-based individual heating in each unit



Local heat supply – collective

Life cycle costs for one neighbourhood

Keine thermische Sanierung

V1•SW+LW

V3| Pr SW+LW

Netz Privatgrund

Mit thermischer Sanierung

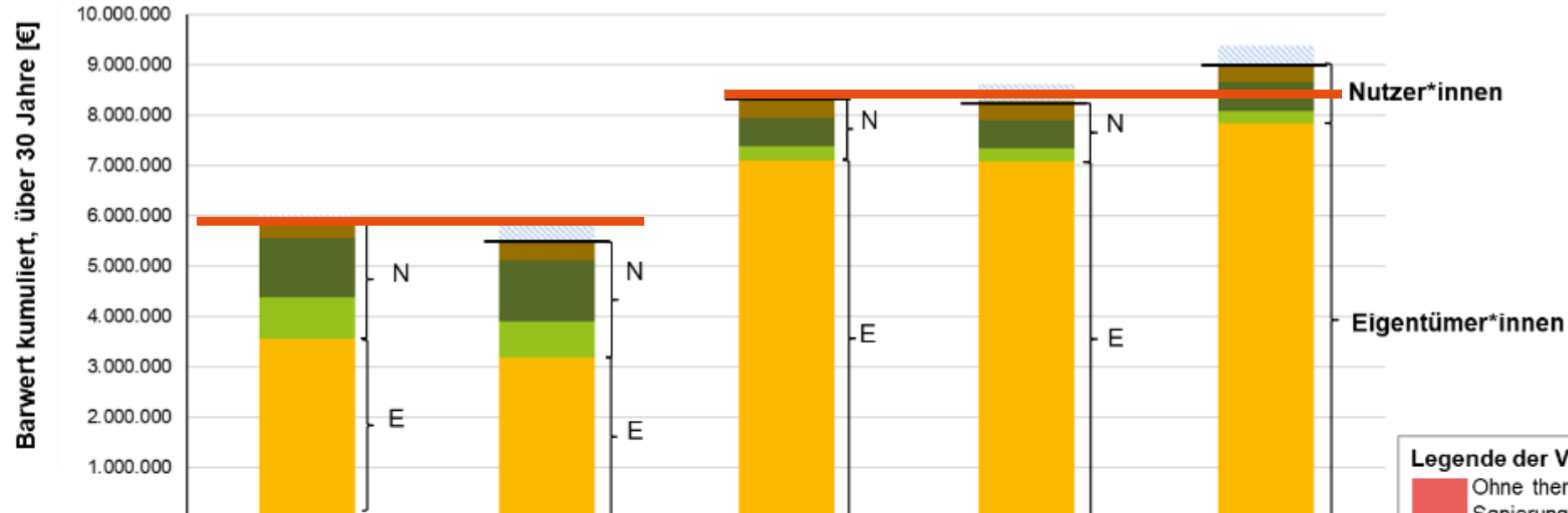
V2•SW+LWT

V4| Pr SW+LWT

V5|Öf SW+LWT

Netz Privatgrund

Netz öffentl. Grund



Summe	5.921.790	5.499.520	8.363.400	8.324.550	9.076.530
Barwert Förderungen	96.000	421.050	96.000	296.000	296.000
Barwert Haushaltsstrom	366.170	366.170	366.170	366.170	366.170
Barwert Energiekosten	1.173.730	1.230.850	571.170	577.450	577.450
Barwert Betriebskosten	810.160	717.740	272.210	241.320	241.320
Barwert Invest	3.571.730	3.184.760	7.153.850	7.139.610	7.891.590

Legende der Varianten

- Ohne thermischer Sanierung
- Mit thermischer Sanierung
- Individuelle Lösung
- gemeinsame Lösung

Quellen:

SW ... Sole/Wasser
LW ... Luft/Wasser
LWT ... Luftwärmetauscher

Annahmen:

- Kalkulationszinssatz: 3,5%/a
- Laufzeit: 30 Jahre

Preissteigerungen:

- Investitionen: 2,5 %/a
- Betriebskosten: 2,0 %/a
- Strom: 2,5 %/a

Energietarif:

- Strom: 0,20 EUR/kWh netto
- Strom: 0,24 EUR/kWh brutto

Ohne Restwertbetrachtung

Indicators for assessment

Specific Heat Demand

168 - 451 MWh/ha·a within or near the 400+ benchmark range

Floor area ratio (FAR)

0.27–0.31 — well below the 1.0+ benchmark → structural challenge

Linear Heat Demand (LHD)

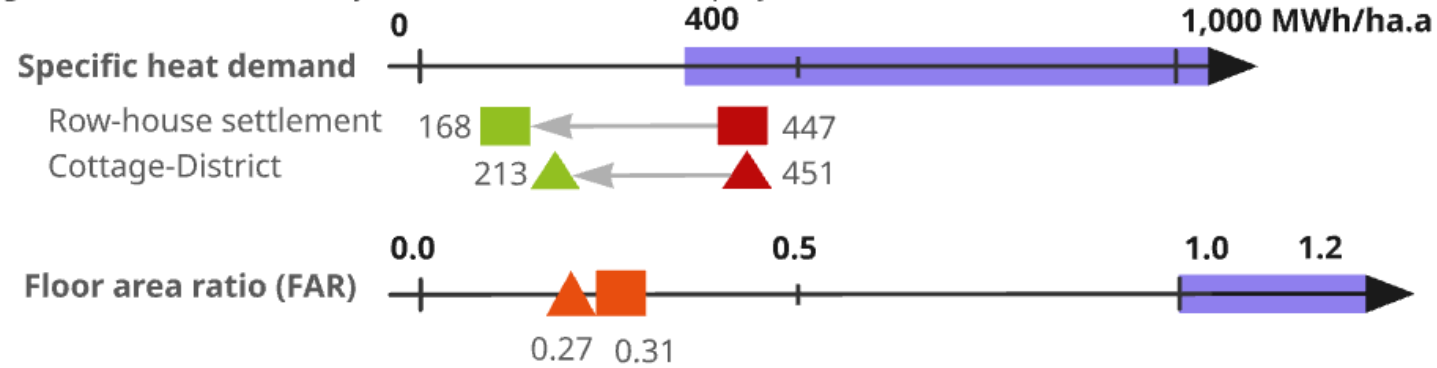
Head demand per network length → higher dispersion = disproportionate infrastructure cost

TinA indicators

Network length per area and per unit → higher dispersion = disproportionate infrastructure cost

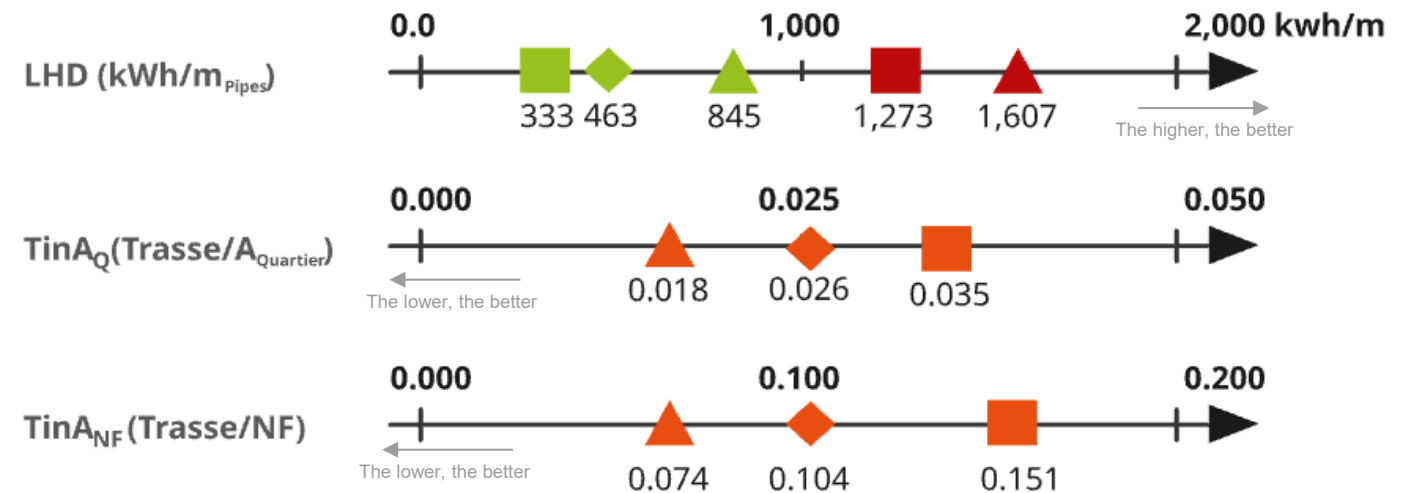
Heat Plan indicators

the higher the value, the more favourable the economic performance

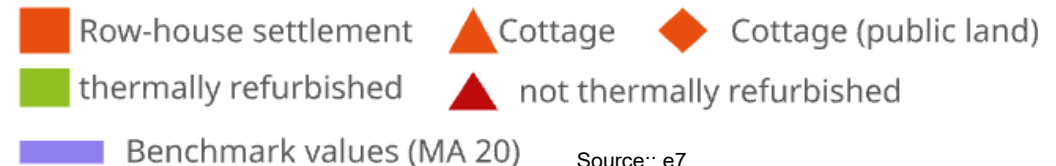


Additional indicators

the lower the value, the more favourable the economic performance



LEGEND



Cottage-District

FAVOURABLE

- + **High heat density:** Sufficient demand for energy networks.
- + **Low TinA factor:** High floor area compared to short network lengths on private property.

CHALLENGING

- **Fragmented ownership:** Multiple owners per building (WEG).
- **Complex routing:** Difficult to lay pipes in private gardens (trees, pools, existing structures).
- **High transaction costs:** Coordination and legal barriers dominate.

Row-house Settlement

FAVOURABLE

- + **Single ownership:** One non-profit developer controls the entire site.
- + **Low transaction costs:** Centralized decision-making drastically reduces coordination effort.

CHALLENGING

- **Low heat density:** Drops even further after thermal refurbishment.
- **High TinA factor:** Low floor area per building compared to long network lengths required.

Conclusions

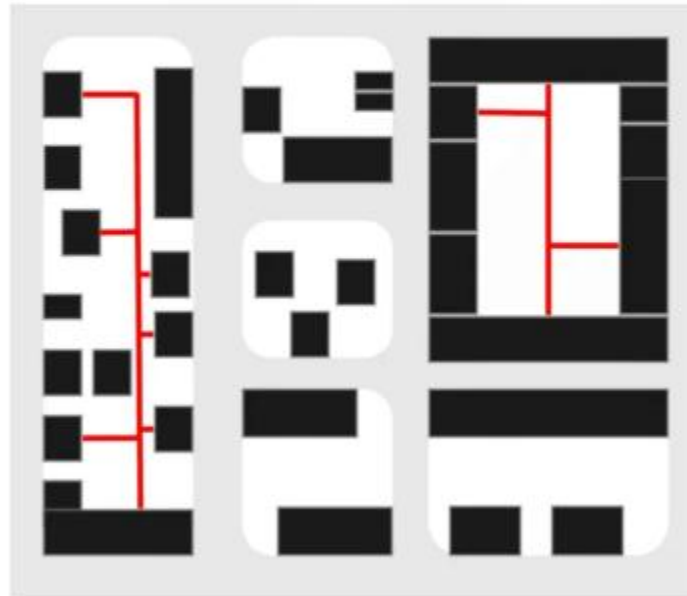
- 1** **The Vienna Heat Plan distinction between individual and collective solutions is plausible:** community-based solutions can also work at lower heat demand densities
- 2** **The organisational structure of the settlement is decisive:** if a community-based structure already exists, implementation is significantly easier – low transaction costs necessary
- 3** **Low transaction costs are critical for implementation:** especially regarding coordination, decision-making, and organisation
- 4** **Connection rates are a key success factor:** community-based solutions require high participation; otherwise, economic viability declines
- 5** **Timing is critical:** successful implementation requires aligning with replacement cycles, when many buildings are ready to switch and few have already invested in individual renewable systems

Next step?

Low-temperature network as district infrastructure

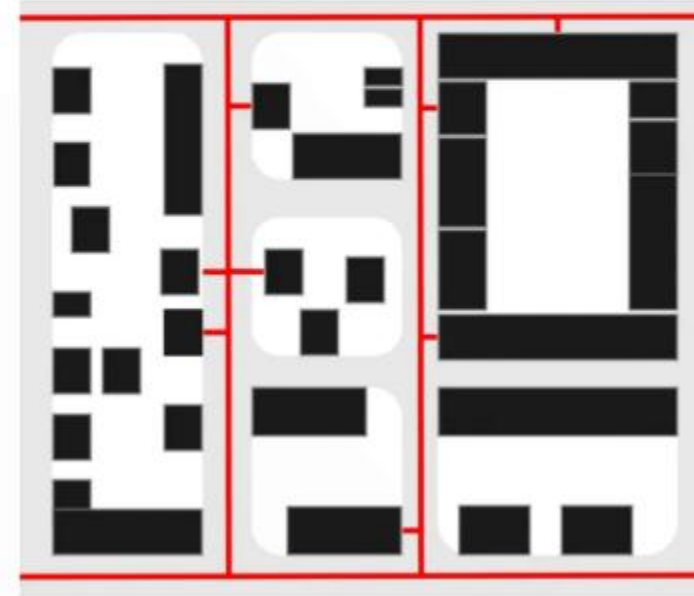
BOTTOM UP

Individual implementation of thermal networks within building blocks, without occupying public land.



TOP DOWN

Zonal, area-wide implementation of thermal networks on public land (typically within public streets).



LEGEND ■ building ■ Public street — Low temperature network Source: e7

Bottom-Up

Incremental · Private land · Lower upfront coordination · Higher long-term fragmentation

Top-Down

Zonal · Public streets · Municipal coordination · Scalable · District-heating logic

References

- **Study for the City of Vienna:**
Hofer, G., Jicha, J., Leutgöb, K., Leutgöb, R., Maier, S., Peischl, A., Preisler, A., & Schlager, K., (2025), Decarbonisation of heat supply in single-family-house-like settlement structures in Vienna. Study commissioned by Urban Innovation Vienna on behalf of the City of Vienna (MA 20 – Energy Planning). e7 energy innovation & engineering, Vienna.
 - Link: <https://www.digital.wienbibliothek.at/wbrup/download/pdf/5710293>
- **ISEC Paper:** Hofer et al. (2026), Decarbonisation of Heat Supply in Single-Family-Dominated Settlements in Vienna. ISEC 2026

This paper has been funded by *Austrian Funding Promotion Agency* under the Driving Urban Transitions Partnership, which has been co-funded by the European Commission.

Dekarbonisierung von einfamilienhaus- ähnlichen Siedlungsstrukturen

Studie der e7 GmbH im Auftrag der Abteilung
Energieplanung der Stadt Wien

Veröffentlichung im Sinne des § 4 IFG



Stadt
Wien | Energieplanung



Shaping the energy future together.

We look forward to collaborating on innovative research and implementation projects.

Gerhard Hofer

e7 energy innovation & engineering

 Hasengasse 12/2, A-1100 Wien

 www.e-sieben.at

 +43 1 907 80 26 - 55

 gerhard.hofer@e-sieben.at

 e7 energy innovation & engineering