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RHC Event

How to fully decarbonise the heating and cooling sector in Europe?

10 April 2024

Graz (Austria)

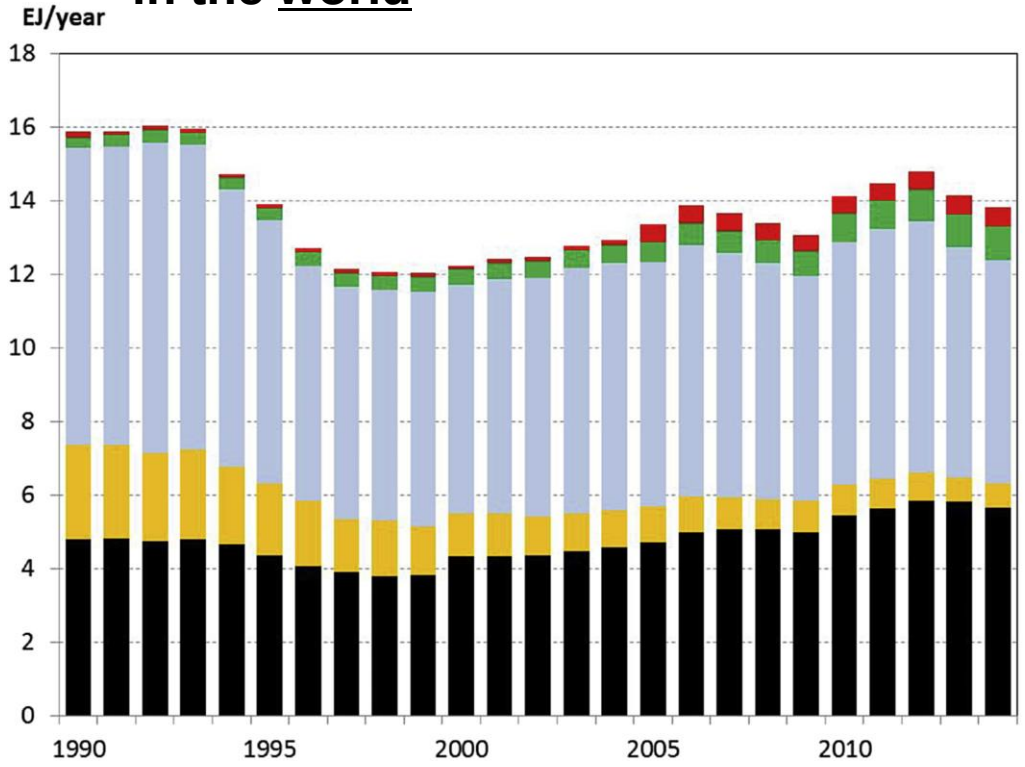
Dr.-Ing. Ralf-Roman Schmidt

Innovative Concepts for Heating and Cooling in Cities and districts

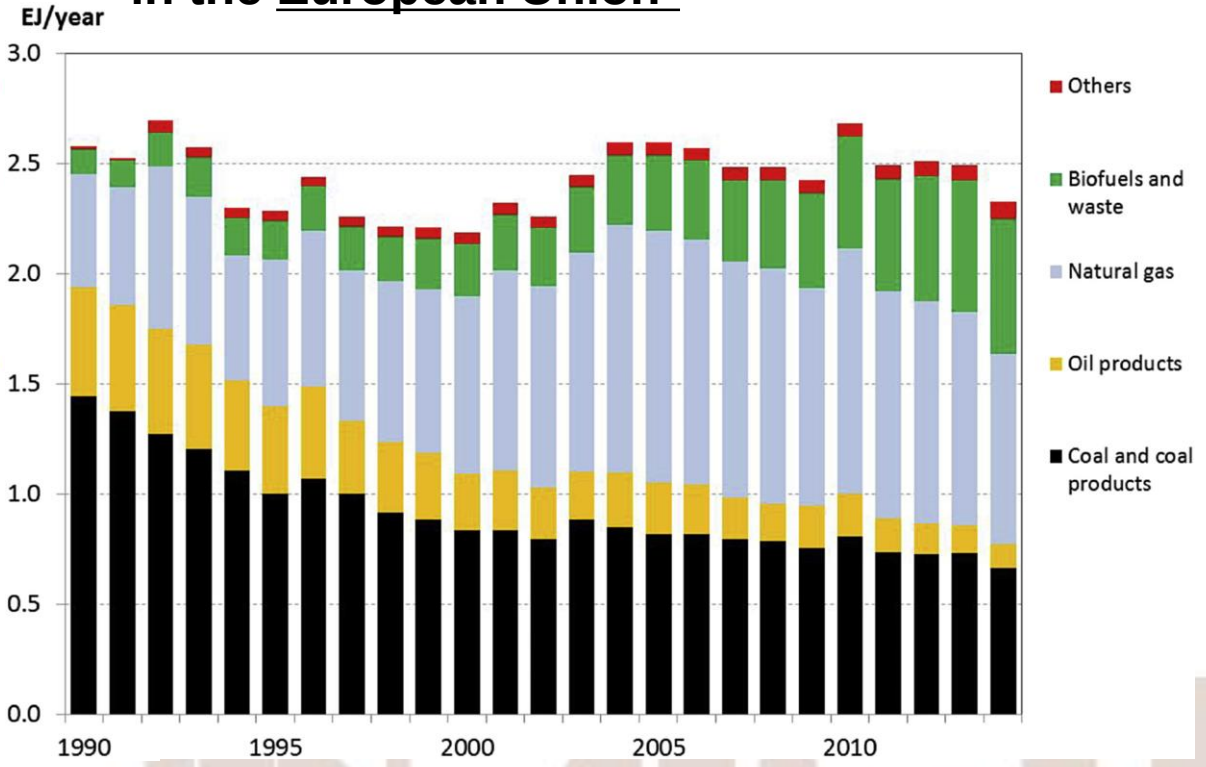
AIT AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY

Motivation

Heat supplied into all DH systems in the world*



Heat supplied into all DH systems in the European Union*



*according to original energy supply sources used

source: Sven Werner, International review of district heating and cooling, Energy, Volume 137, 2017 https://doi.org/10.1016/j.energy.2017.04.045

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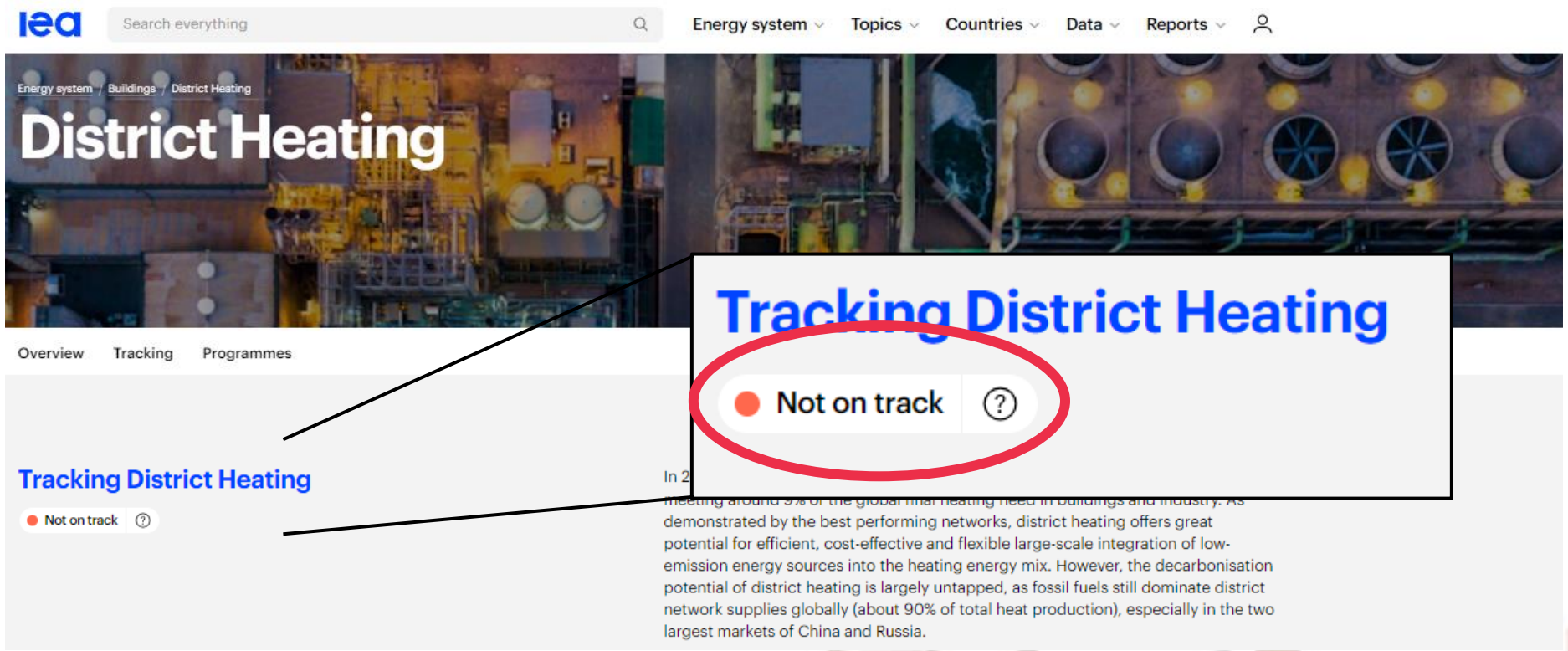
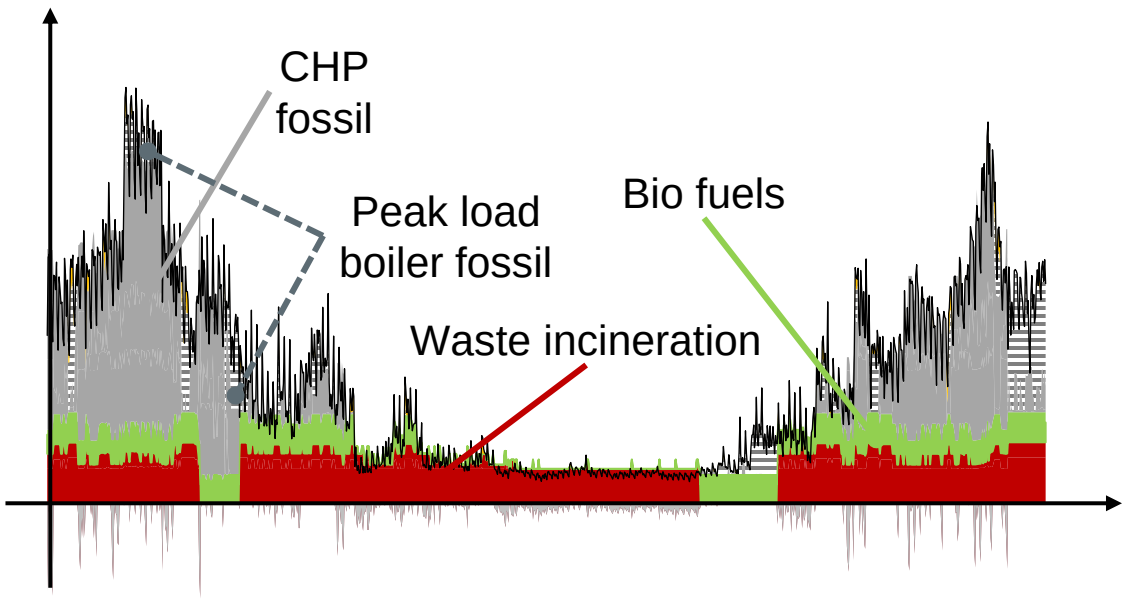
Motivation

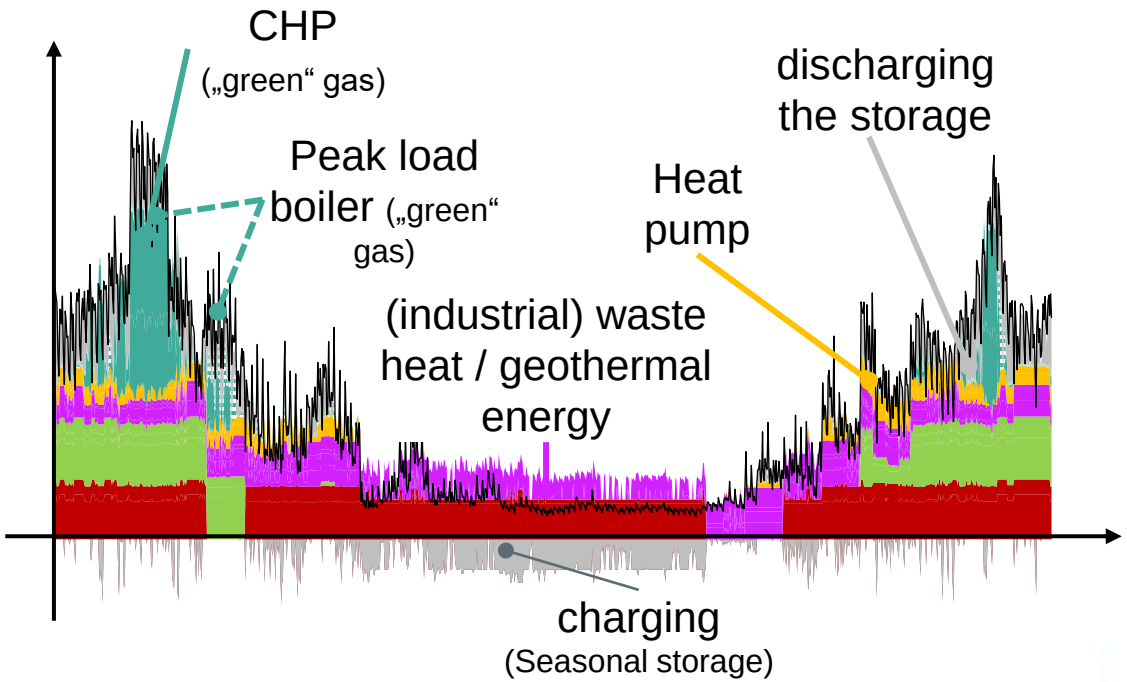


District heating supply today and tomorrow?

2024

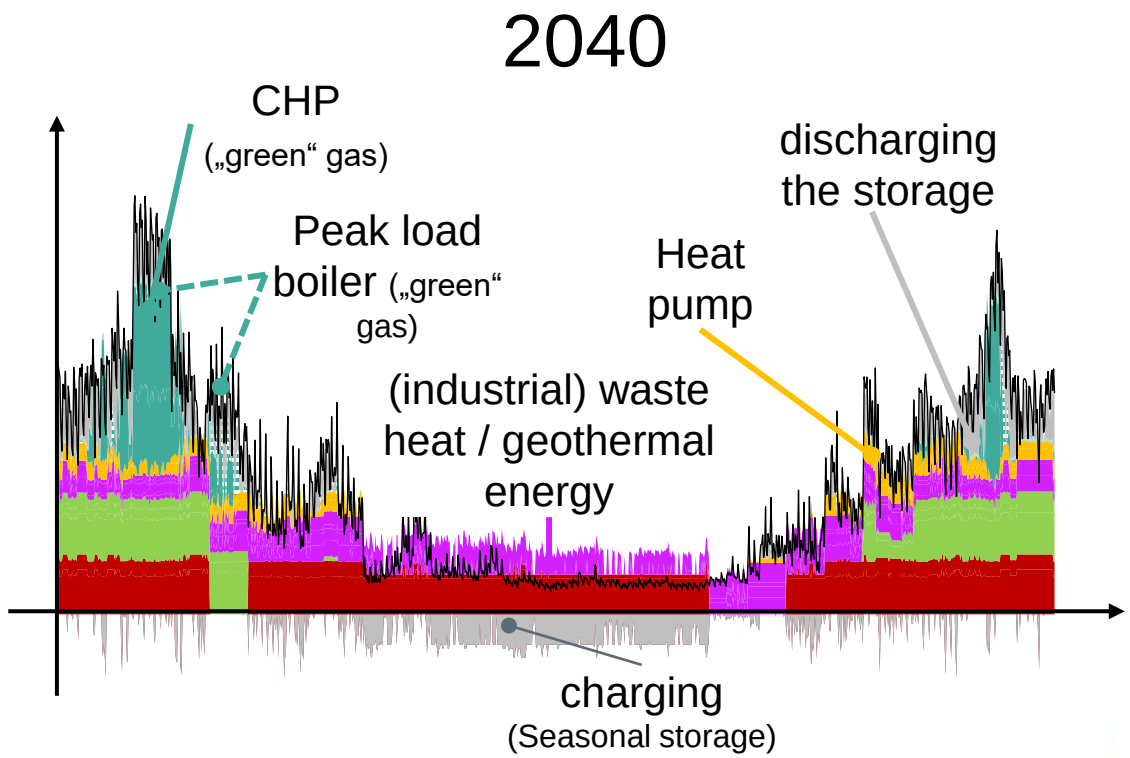


2040



Innovative Concepts

- infrastructure
- Peak load („green“ gas)
- CHP („green“ gas Gas)
- Seasonal heat storages
- (Industrial) waste heat
- Large scale heat pumps
- Geothermal energy
- biomass
- Waste incineration



Large scale heat pumps

trends

- Waste heat from sewage treatment plants
- Surface water and air as a source
- High temperature heat pumps
- Alternative working fluids
- Flexible operation

examples

Esbjerg (DK)

Värtan Stockholm (SE)

challenges

- Availability of heat sources and secured operation (winter)
- High network temperatures
- Future prices of electricity and available grid infrastructure
- Implementation (permissions, realization, operation)

Quellen:
https://www.man-es.com/discover/esbjerg-heat-pump
https://www.friotherm.com/wp-content/uploads/2017/11/vaertan_e008_uk.pdf

(Industrial) waste heat

trends

- Implementation of „new“ heat sources
  - Data centres
  - Electrolysis waste heat
  - Cooling processes
- Combination with large scale heat pumps

examples

AWS Data Center Dublin (IR)

Stockholm Data Park (SE)

challenges

- Surplus heat in summer
- Economic feasibility and business model
- Dependencies of external supplier

Quellen:
Stockholm Data Parks sets new standards for sustainable data centers

Seasonal thermal energy storage

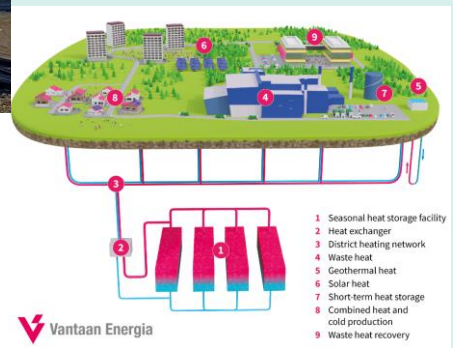
trends

- Geological structures and legacy infrastructures
- New materials
- Model bases operational optimization and design
- Combination of different storage units

examples

Vojens (DK)

Vantaa (FIN)



challenges

- Space demand and construction
- Leakages, insulation, selection of materials, long term stability
- System integration
- Investment costs and long-term economic feasibility

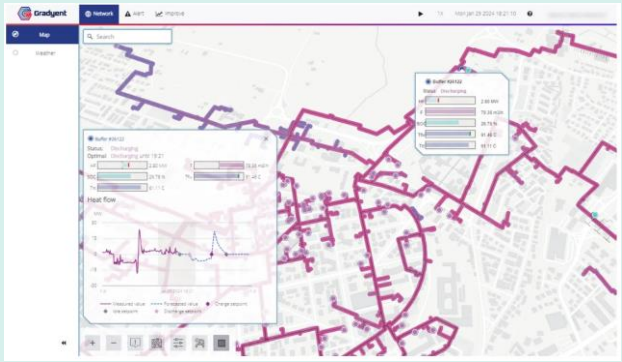
Quellen:
https://www.vantaanenergia.fi/en/the-planning-of-the-worlds-largest-seasonal-heat-storage-is-well-under-way/
Bombert et al - Installation of a thermal energy storage site in an abandoned mine in Picardy (France). Part 1: Selection criteria and equipment of the experimental site

infrastructure

trends

- Decreasing network temperatures,
- Customer involvement, motivational tariffs
- prosumer, bi-directional operat.
- Digitalization, smart controls and demand side management

examples



Digital twins of DH network, e.g. Gradyent in Vienna

challenges

- Different temperature levels from „new“ supply units
- Coordinated network transformation
- Hydraulic limitations for network expansions and new customers
- Complex system with many interdependencies

Quellen:
https://www.gradyent.ai/

And what about the areas outside the DH network?

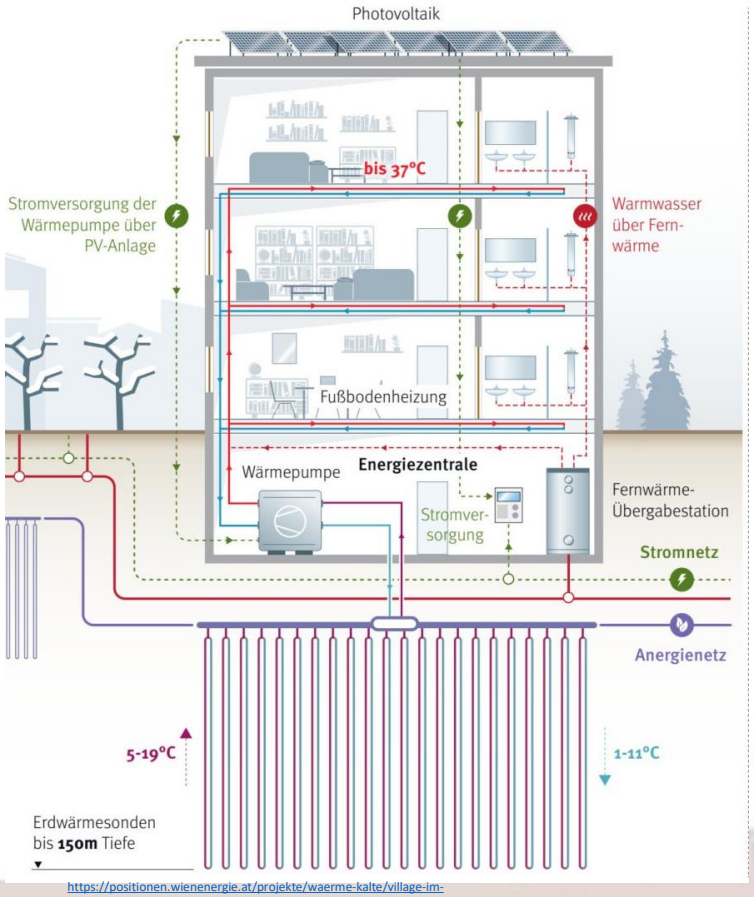
https://positionen.wienenergie.at/projekte/waerme-kalte/village-im-dritten/?utm_source=mailpoet&utm_medium=email&utm_campaign=energiepolitisches-update_21

https://www.proholz.at/fileadmin/proholz/media/bauholz/2020/003_Modul1_JZeininger.pdf
https://www.tsb-energie.de/fileadmin/Redakteure/Veranstaltungen/Energiewende_und_Klimaschutz/2021/Referentenbeitraege/Johannes_Zeininger_-_Zeininger_Architekten.pdf

“5th generation” heating and cooling networks

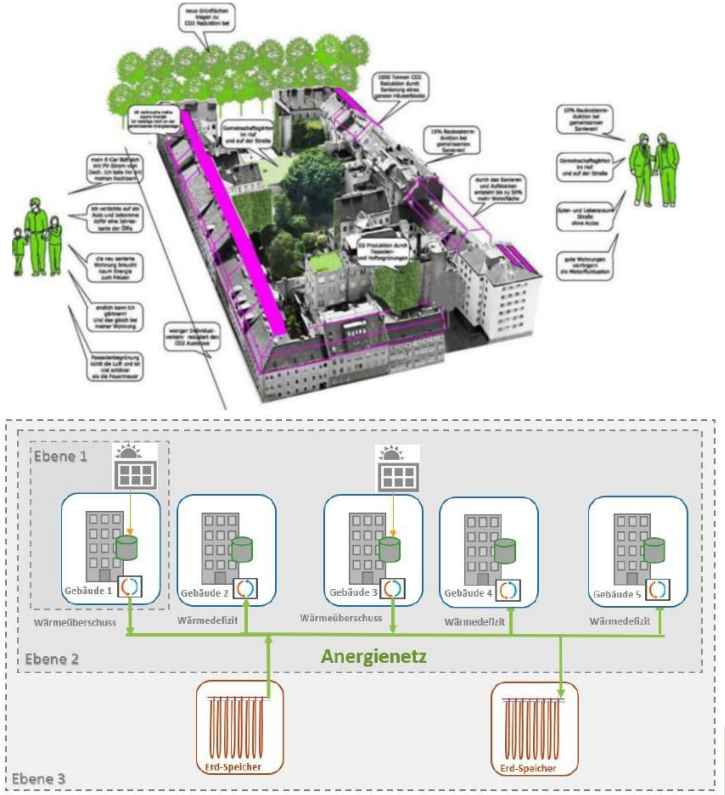
- operate around ambient temperatures,
- together with consumer-side heat pumps.
- waste heat from data centers / cooling processes can be directly utilized.

"Village im Dritten", Vienna



https://positionen.wienenergie.at/projekte/waerme-kalte/village-im-dritten/?utm_source=mailpoet&utm_medium=email&utm_campaign=energiepolitisches-update_21

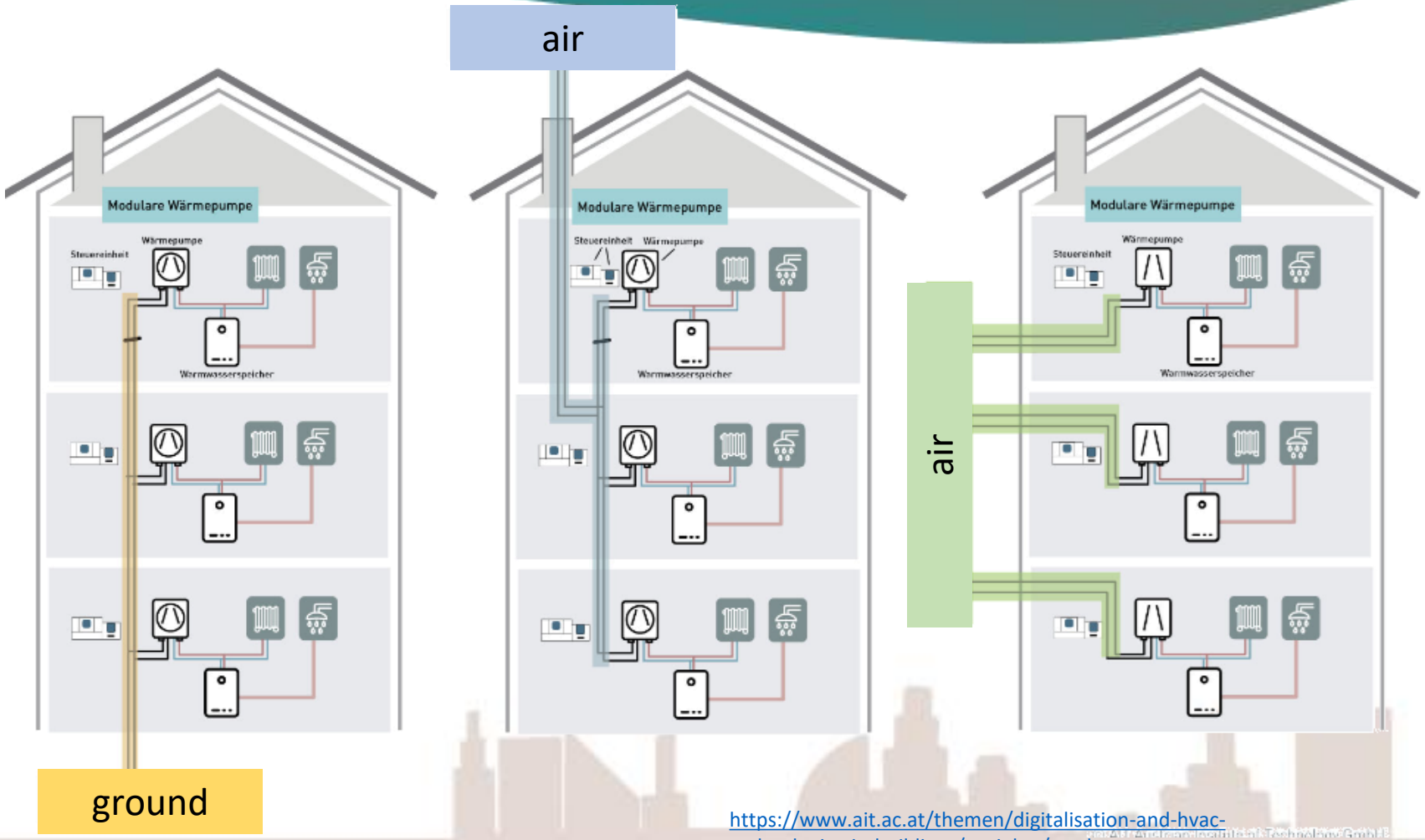
"Smart Block Geblergasse", Vienna



https://www.proholz.at/fileadmin/proholz/media/bauholz/2020/003_Modul1_JZeininger.pdf
https://www.tsb-energie.de/fileadmin/Redakteure/Veranstaltungen/Energiewende_und_Klimaschutz/2021/Referentenbeitraege/Johannes_Zeininger_-_Zeininger_Architekten.pdf

modular heat pumps as gas boiler replacement in large-volume residential buildings.

- The piping can be routed through the now unused chimney.
- waste heat generated during cooling is used to heat water in the summer.



https://www.ait.ac.at/themen/digitalisation-and-hvac-technologies-in-buildings/projekte/gasthermenersatz

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Thank you!

This session is organised by

Renewable Heating & Cooling

European Technology and Innovation Platform

www.rhc-platform.org

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