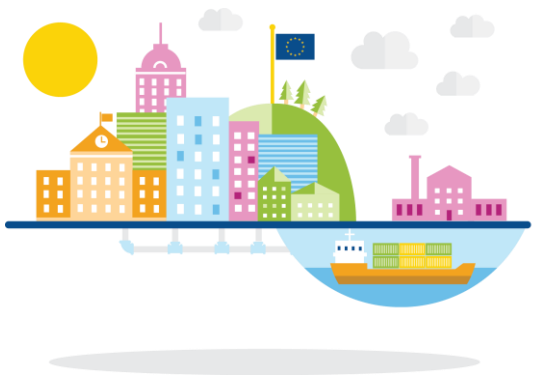
# Celsius Talk:

## "Heat-pumping the future of district energy"

**Thursday March 28, 2019**



ANNEX 47 | HEAT PUMPS IN DISTRICT HEATING AND COOLING SYSTEMS

AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY

# Barriers and Opportunities for Large-Scale Heat Pumps in District Heating and Cooling Networks

Roman Geyer (AIT)

CELSIUS Webinar | Thursday, 28th March 2019 | 10:30 – 11:30 CET

celsius

https://heatpumpingtechnologies.org/annex47/

# Content based on IEA HPT Annex 47

**Presentation overview**

- AIT in a nutshell
- Motivation for heat pump (HP) integration
- HPs in Europe
- Barriers / challenges
- Possible solutions and opportunities
- Success factors
- Recent developments
- Conclusions

bmvit

**1.370**
employees

Austria‘s largest
RTO

**8** Centers

Applied Research

System
Competence

Infrastructure Systems

Federation of
Austrian Industries

Next Generation
Solutions

**4** Subsidiary
Enterprises

LKR, NES, SL, Profactor 51%

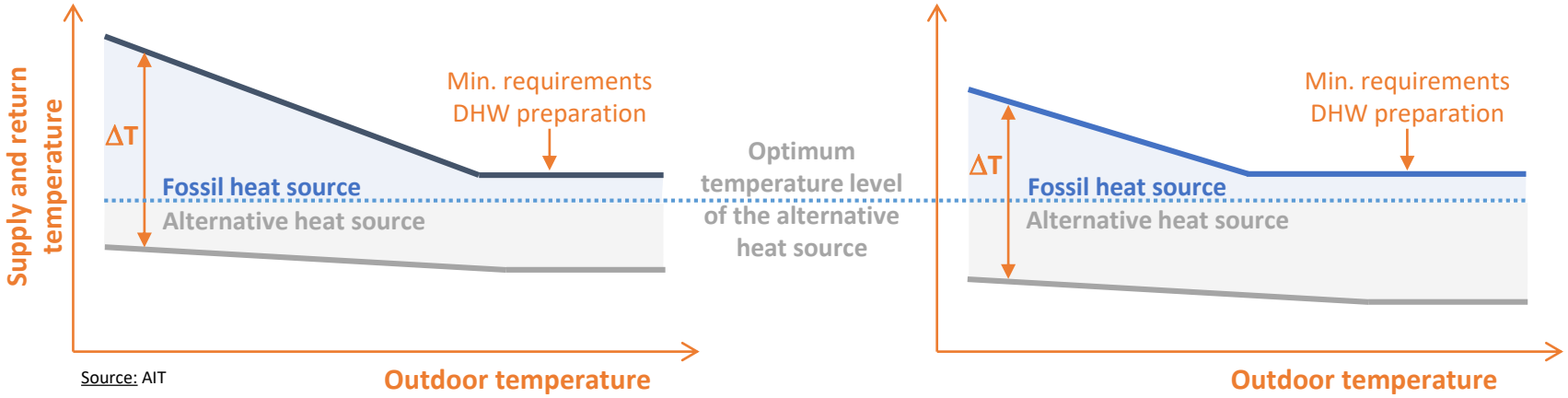
**162,9**
m EUR total revenue

**Tomorrow Today**

# Motivation for HP integration

The motivation to use HPs in DHC can be divided into the following areas:

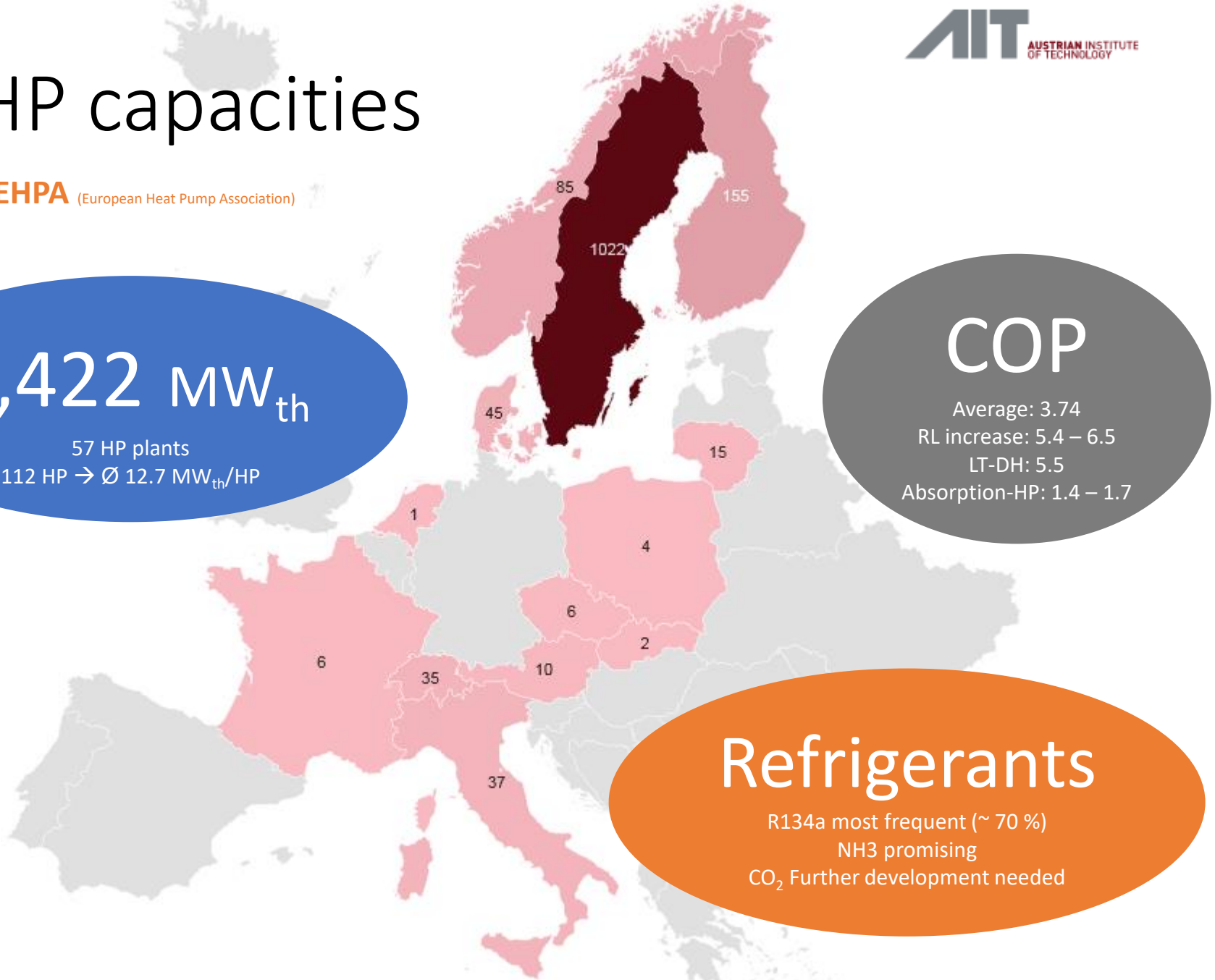
- **usage** / **capture** of low temperature alternative heat sources
- **enabler** for other alternative energy sources
- link to **electricity** grid (balance of energy domains)
- **reduction** of the network temperatures
- increasing transport **capacities** by using the return line as a source




Source: AIT

# Installed HP capacities

**Survey EHPA** (European Heat Pump Association)




## 1,422 $MW_{th}$

57 HP plants
112 HP → Ø 12.7 $MW_{th}$/HP

## COP

Average: 3.74
RL increase: 5.4 – 6.5
LT-DH: 5.5
Absorption-HP: 1.4 – 1.7

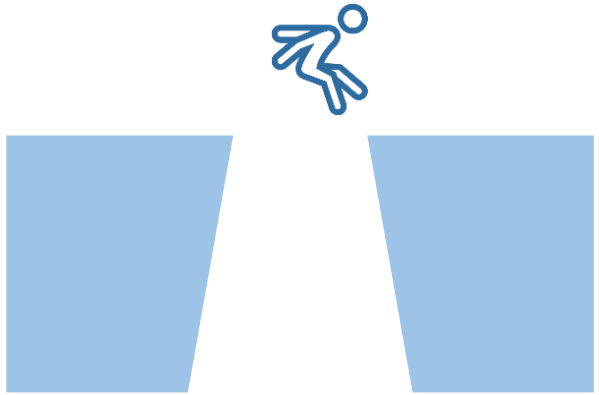
## Refrigerants

R134a most frequent (~ 70 %)
NH3 promising
$CO_2$ Further development needed

https://www.euroheat.org/wp-content/uploads/2016/04/160420_1600_1730_2nd-place_Andrei-David_presentation.pdf

# BARRIERS / CHALLENGES

Social-, economical- and technical barriers



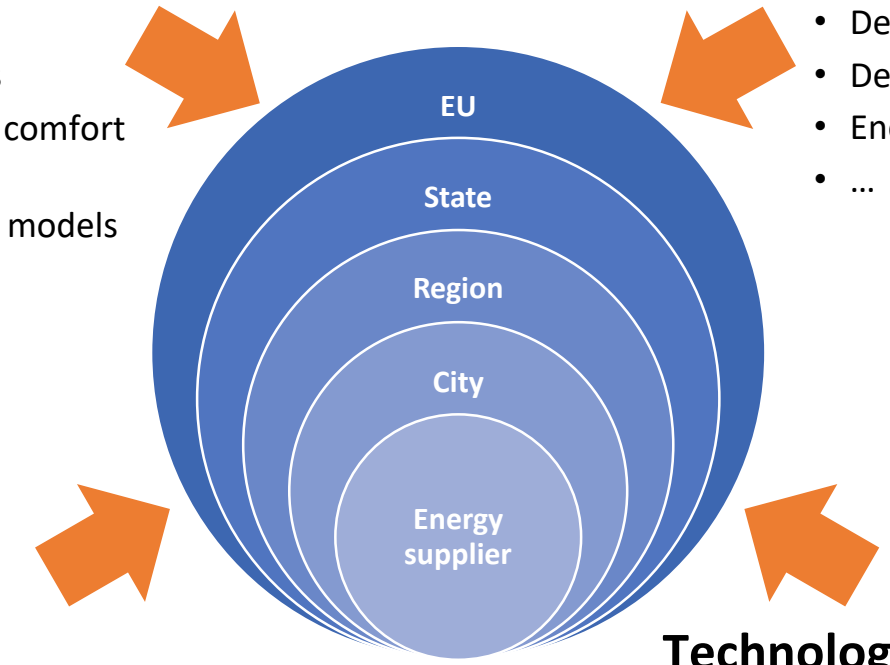
# Challenges

## Customers

- Prosumer
- Citizens' power stations
- Service orientation and comfort (cooling requirements)
- New business and tariff models
- Security supply
- …

## Society & Politics

- Demographic developments
- Decarbonization / COP21
- Energy efficiency act
- …




## Market

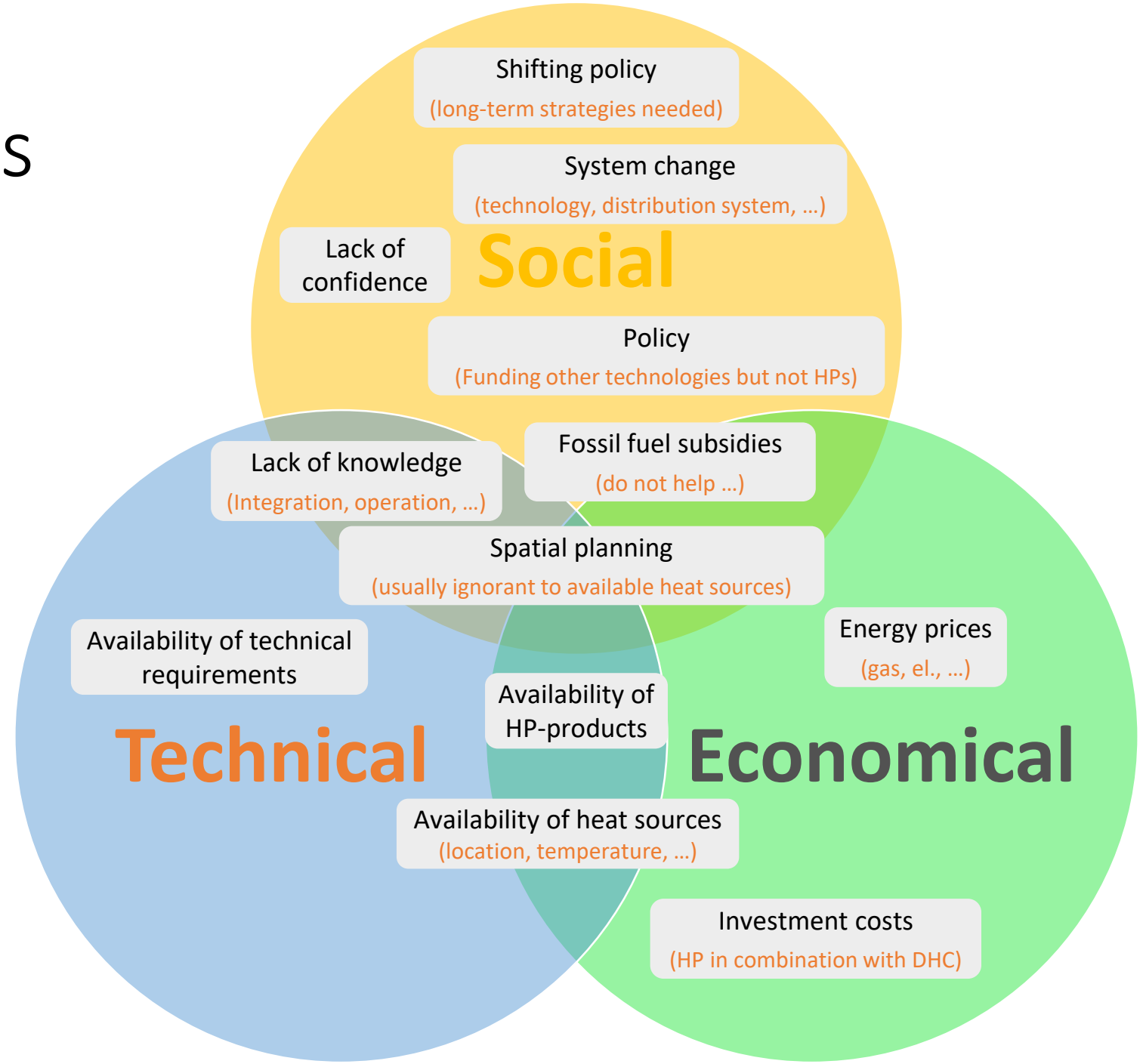
- High volatility, pooling of flexibilities/ balancing energy markets
- Copper plate or electric fences? (e.g. electricity price zone DE/AT)
- Energy price developments (oil, gas, …)
- …

## Technology & Innovation

- Digitization & Smart Home
- Energy efficiency & storage
- Electric mobility
- …

→ Identification and assessment of chances and risks

# Barriers

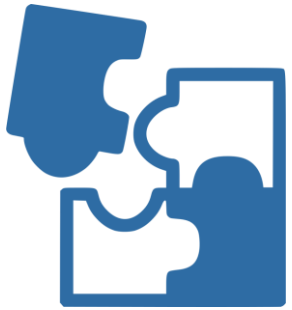

Shifting policy
(long-term strategies needed)
System change
(technology, distribution system, …)
Lack of confidence
Social
Policy
(Funding other technologies but not HPs)
Lack of knowledge
(Integration, operation, …)
Fossil fuel subsidies
(do not help …)
Spatial planning
(usually ignorant to available heat sources)
Availability of technical requirements
Energy prices
(gas, el., …)
Availability of HP-products
Technical
Economical
Availability of heat sources
(location, temperature, …)
Investment costs
(HP in combination with DHC)

# POSSIBLE SOLUTIONS AND OPPORTUNITIES

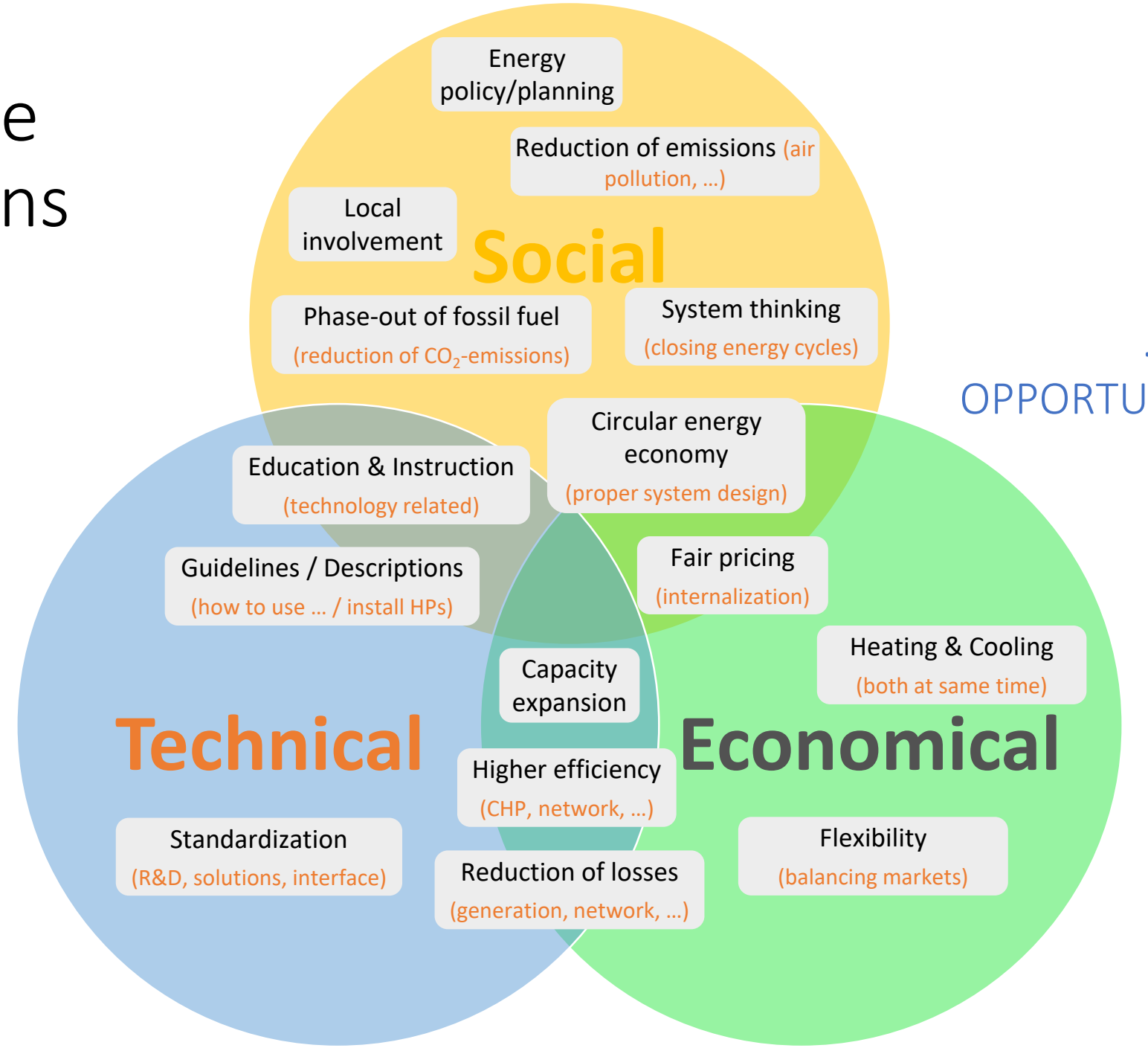
Holistic heat supply strategies

Sector coupling/ hybrid energy systems

Business models



# Possible solutions



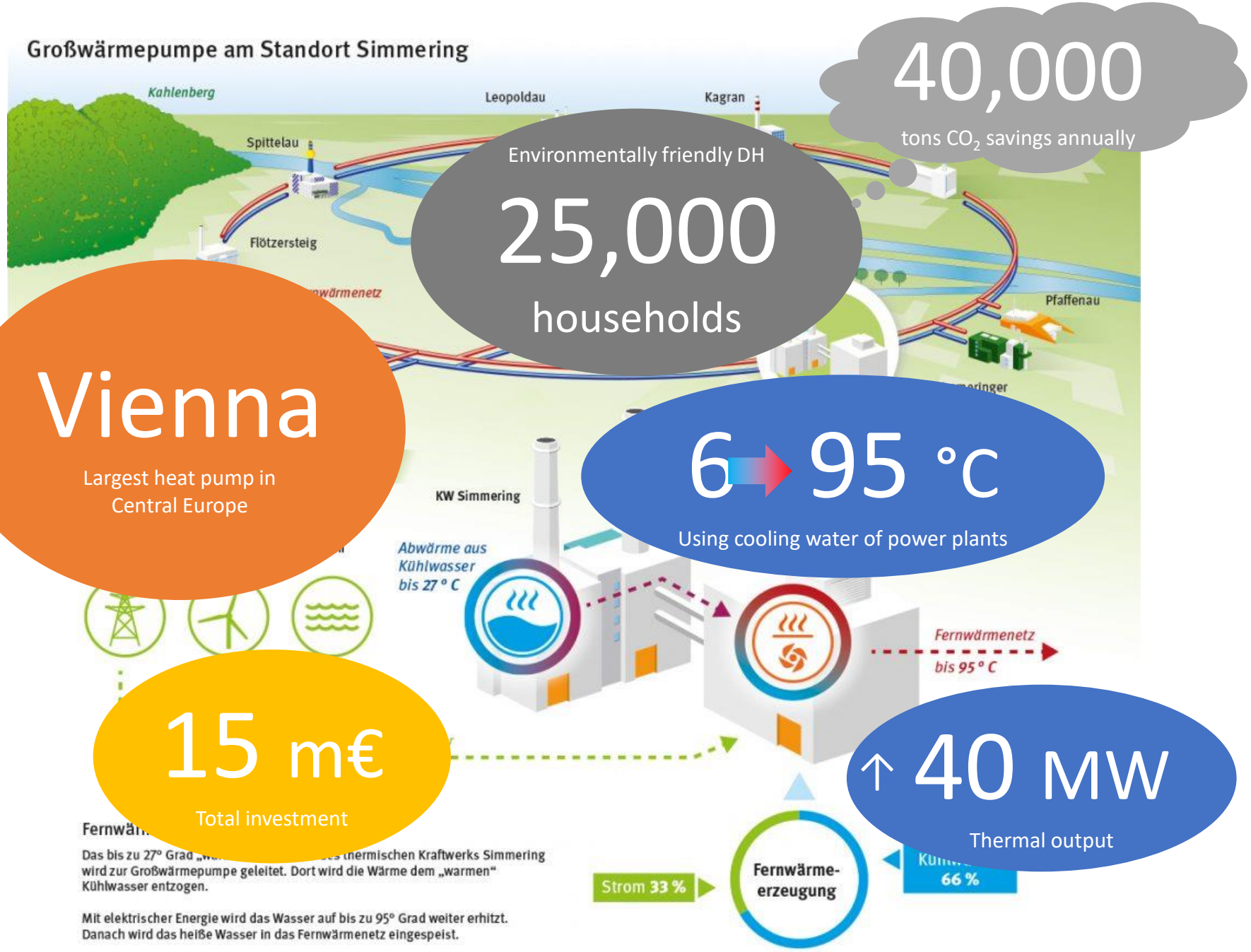

… AND OPPORTUNITIES

# SUCCESS FACTORS

# What do we need?


- Strong partners
  - companies, institutes, start-ups, etc.
- Projects
  - demo, best practice, experiences, motivation
- Learning by doing
  - requires pioneers who are willing to "pay its dues“
- Energy spatial planning
  - localizing waste heat, avoiding double infrastructure
- Standardized solutions
  - R&D, degression of costs, economy of scale
- Price signals
  - to the use of fossil fuel, reduce the burden from tax and levy on clean energy

# RECENT DEVELOPMENTS




40,000
tons $CO_2$ savings annually

Environmentally friendly DH
25,000
households

Vienna
Largest heat pump in Central Europe

6 → 95 °C
Using cooling water of power plants

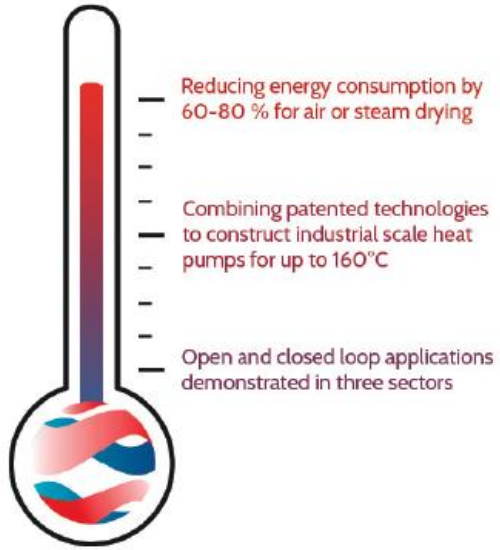
15 m€
Total investment

↑ 40 MW
Thermal output

https://blog.wienenergie.at/2019/03/06/staerkste-grosswaermepumpe-mitteleuropas-pumpt-in-wien/

# High temperature heat pump (HT-HP)

- Project DryFiciency (12 partners)
- Horizon2020 Innovation project for Utilization in Industrial Drying Processes
- Drying: 12 - 25% of industrial energy consumption
  - Goal: up to 80% energy saving
- Demonstration of two HT-HP up to 160 °C
  - Agrana
  - Wienerberger
- Project Coordinator: Veronika Wilk
  Austrian Institute of Technology GmbH)




at

Leading supplier of sugar in CE

World´s largest producer of bricks.

(AIT


http://dry-f.eu/
https://www.ehpa.org/fileadmin/red/03._Media/03.02_Studies_and_reports/Large_heat_pumps_in_Europe_MDN_II_final4_small.pdf

# conclusions

- **Heat pumps** can make a significant **contribution** to the **decarbonization** of the heat supply (simultaneous decarbonization of the electricity supply)
- HPs are "**enablers**" for other alternative energy sources (geothermal, solar thermal, waste heat, etc.)
- HP **potential** depends on **economic** and **political framework** (but also on DH grid type, generation mix and other local conditions)
- **New business models** and **application** possibilities are required / support HP integration (e.g. sector coupling, energy markets, pooling, heating & cooling, etc.)
- Looking ahead:

  **Positive** signs for **heat pumps** in **DHC networks** (remarkable developments in recent years; e.g. Austria)

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# Thank you!

Roman Geyer

28th March 2019

Federal Ministry
Republic of Austria
Transport, Innovation
and Technology

IEA RESEARCH COOPERATION

FFG
Promoting Innovation.

IEA HPT

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http://heatpumpingtechnologies.org/annex47/

# Thank you!

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**Supported by**

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