Heat Pumps - the essential Technology for Carbon Footprint in District Heating Networks

Dipl.-Ing. ETH Karl Ochsner sen.

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How to meet climate targets?

COP21 in force since 04.11.2016

- No **Climate Control**

  without **decarbonizing Heat**

- No **Decarbonisation**

  without **Heat Pumps**

- No **Decarbonisation**

  without **Energy Efficiency**

- No **Smart Cities**

  without **Heat Pumps**

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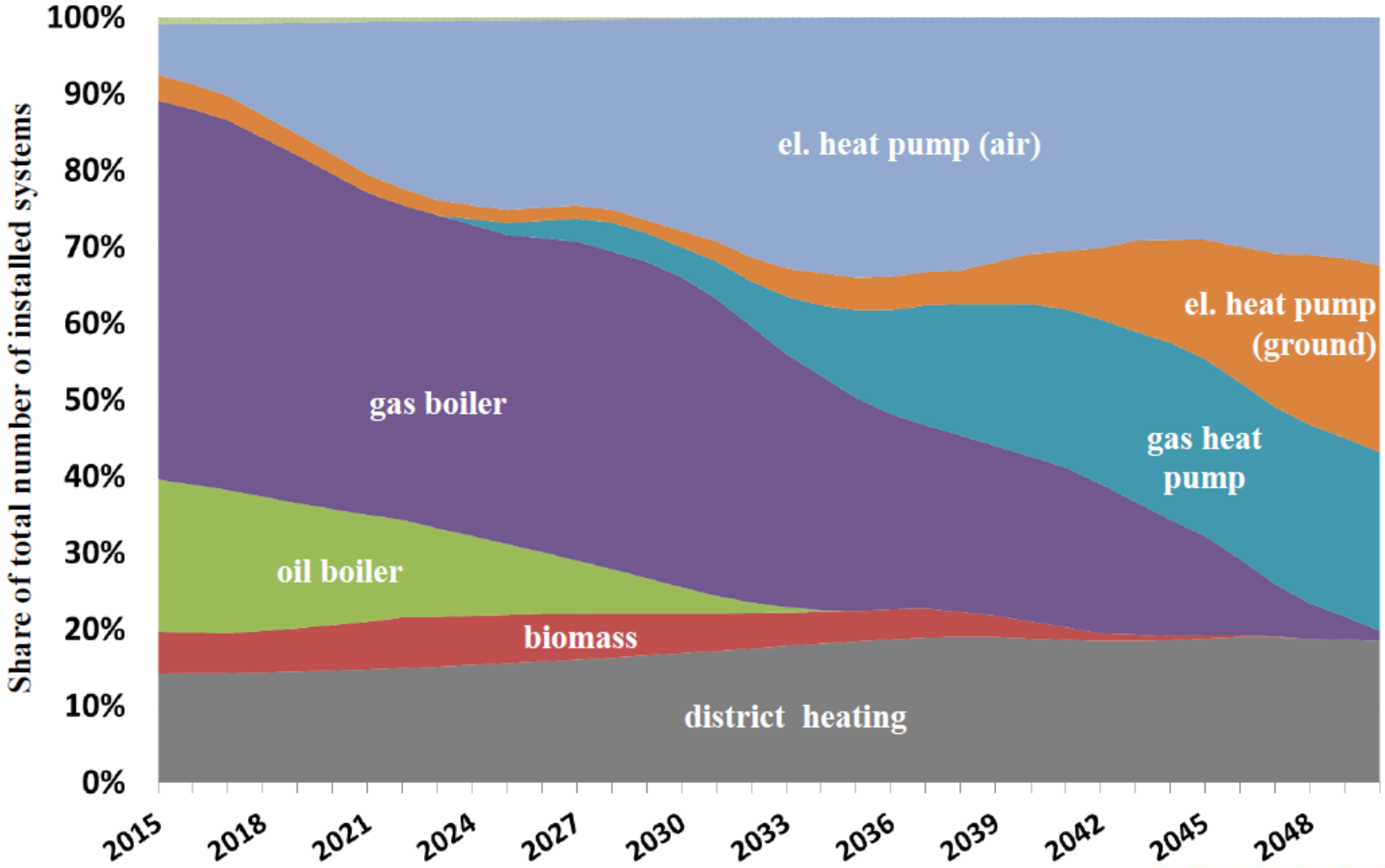
Energy policy

Heating technologies - 85-%-Scenario



(Source: Fraunhofer)

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Why Renewable Energy and Energy Efficiency?

Priorities in A

- **Safety of supply**
  - Dependence on Ukraine / Russia / Turkey / Middle East
  - Efficiency and replacing fossile reduces dependence
- **Cut energy costs**
  - Heat Pump most economical heat generation
  - Often outstanding ROI
  - Regard Profit over Lifetime (POL)
- **Sustainability (Goal 20-20-20) and by 2030, 2050**
  - Reduction of greenhouse gas CO_2 by Decarbonization
  - Energy Efficiency and Renewables
  - ***Carbon Foodprint***

(Source: bmwfw)

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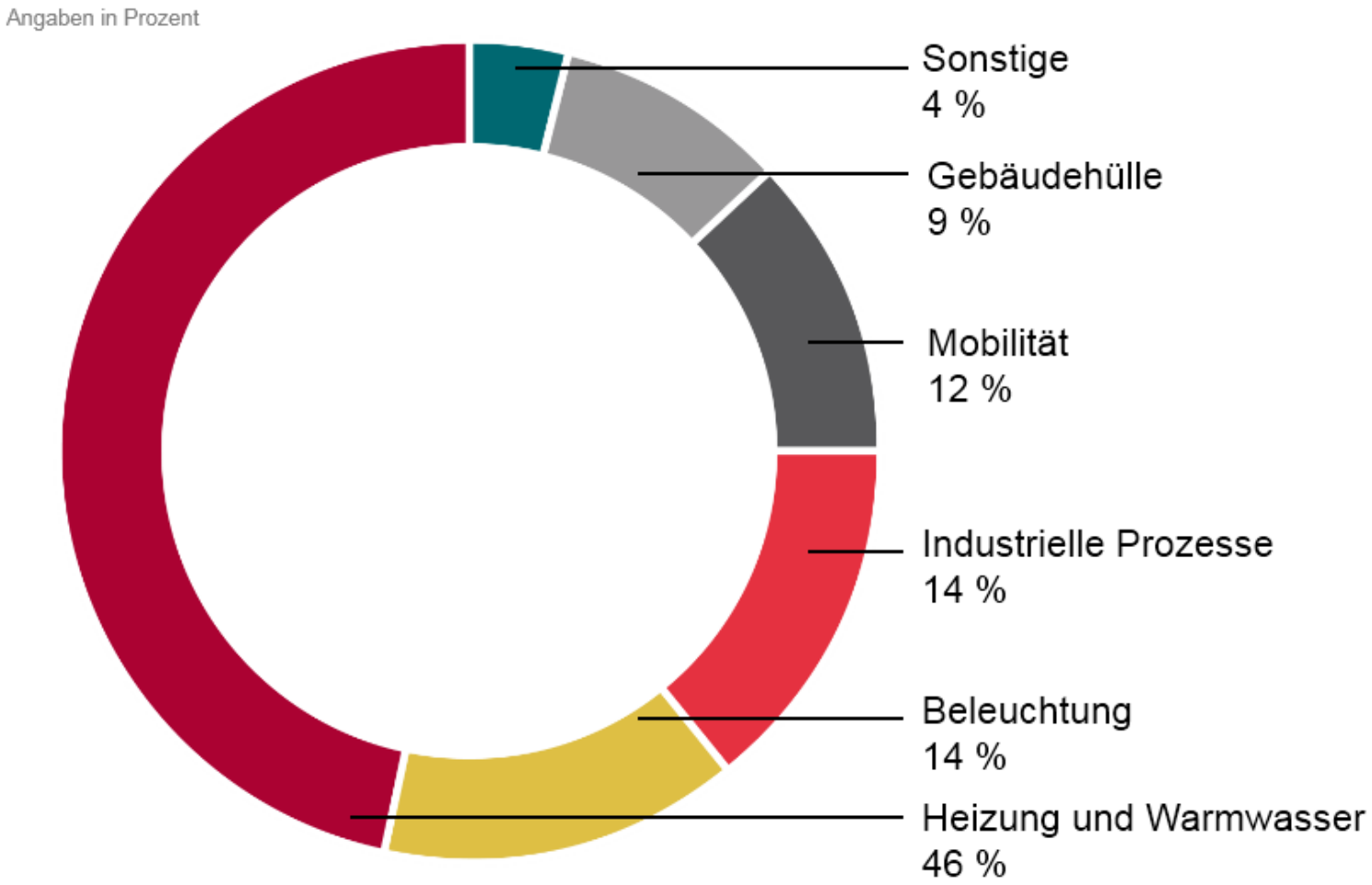
Space Heating - Potential



(Source: Oesterreichs Energie)

Anmerkung: Die Prozentgaben der Kategorien beziehen sich auf die gesamte Einsparung durch alle eingemeldeten Maßnahmen (individuelle und standardisierte Maßnahmen)
Quelle: Monitoringstelle

Smart Cities

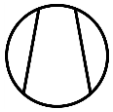
Heat source (Heat sink)

- Renewable ambient heat
  - Ground water
  - Earth tabs
  - Ambient air
- Waste heat

Unitary system **Heat storage** **Source**

network

cold



Heat Pump

Unitary system **Heat storage** **District**

heating

Heat distribution system **hot** **[district cooling]**

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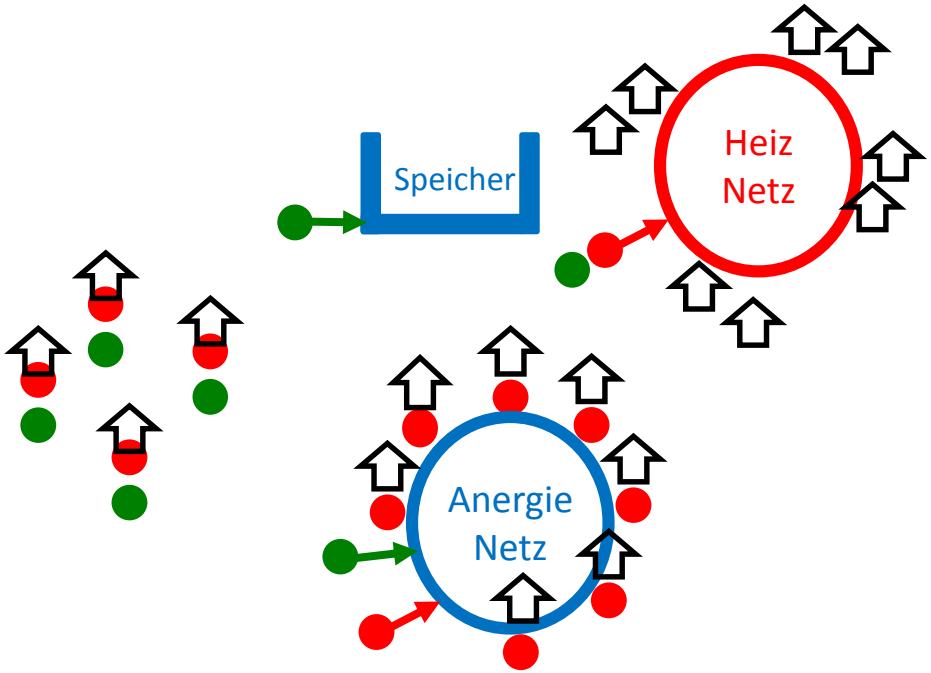
Smart Cities
Heat sources (Heat sinks)

» **Renewable ambient heat**

- Ground water
- Earth tabs
- Ambient air



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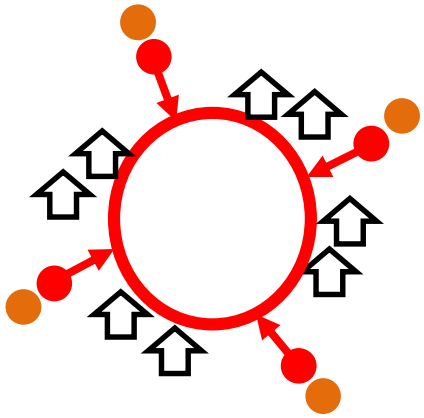
Smart Cities
Heat sources (Heat sinks)

» **Waste heat**

- Remote disponible - **remote feed-into heat networks**
- Heat source, e.g.
  - Sewage liners / Sewage treament (~ 15 ºC)
  - Chillers (Datacenter, Food industry) (~ 45 ºC)
  - Waste heat (power plants, chemical plants, industry (35 - 60 ºC)



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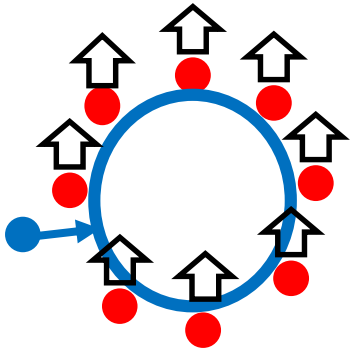
Smart Cities
Heat sources (Heat sinks)

» **Anergetic Heat source network**

- Ideal because of low temperature losses
- Remote Heat Pumps



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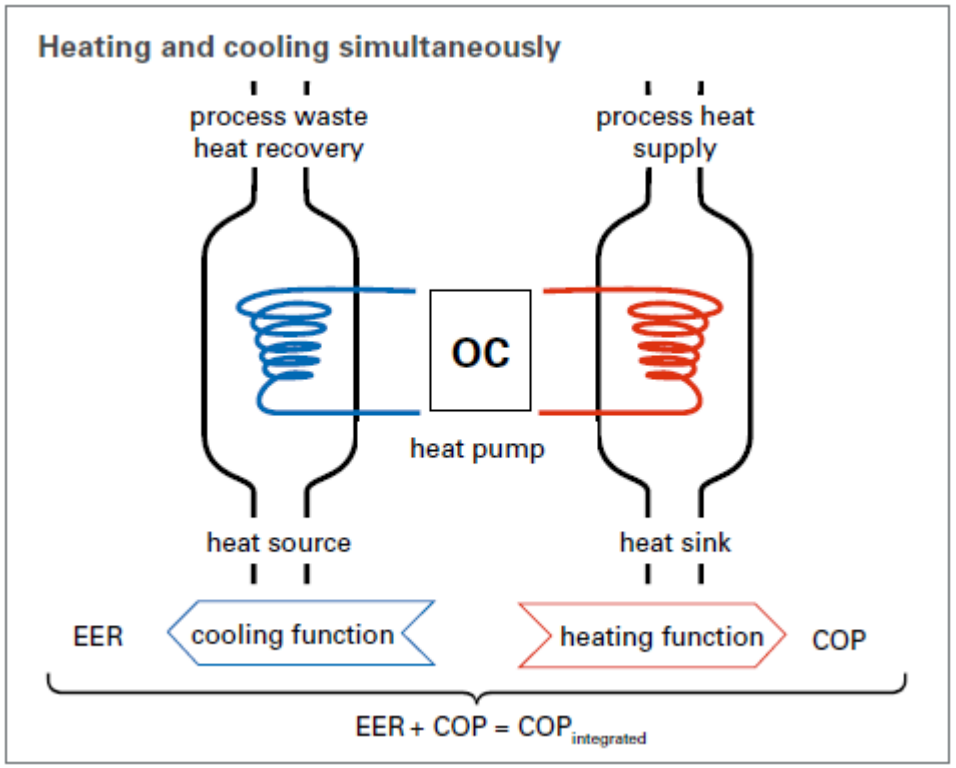
Energy Concepts

» Heating & Cooling simultaneously

- Unbeatable efficiency of Hea
- $COP_H + COP_C = COP_\Sigma$

- **Heat transfer**
- **Heat recycling**
- **Use of thermal waste**

- See garbage separation



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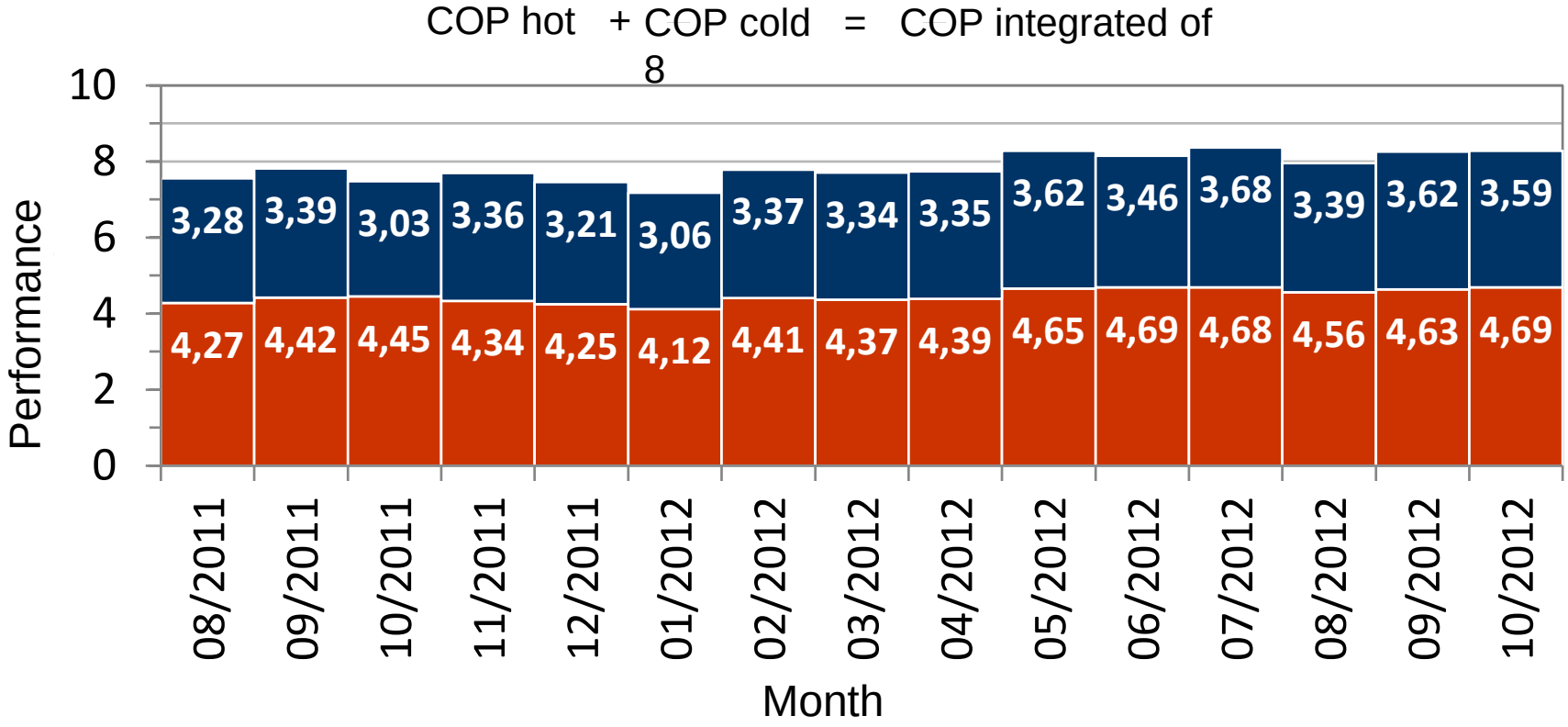
Simultaneous Heating and Cooling

Unbeatable efficiency

Efficiency of Heat Pumps



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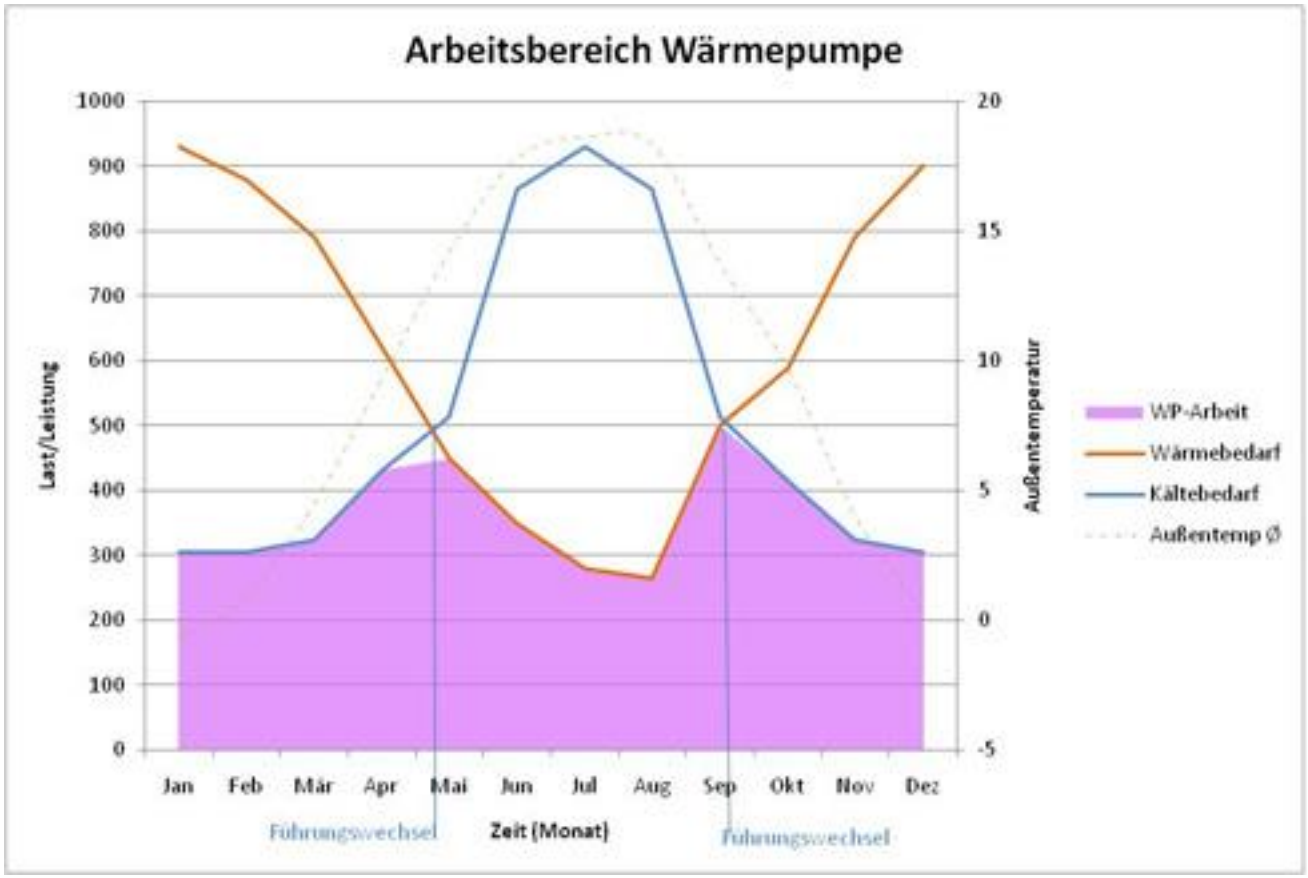
Heat Source & Heat Sink

Capacity varies over the year



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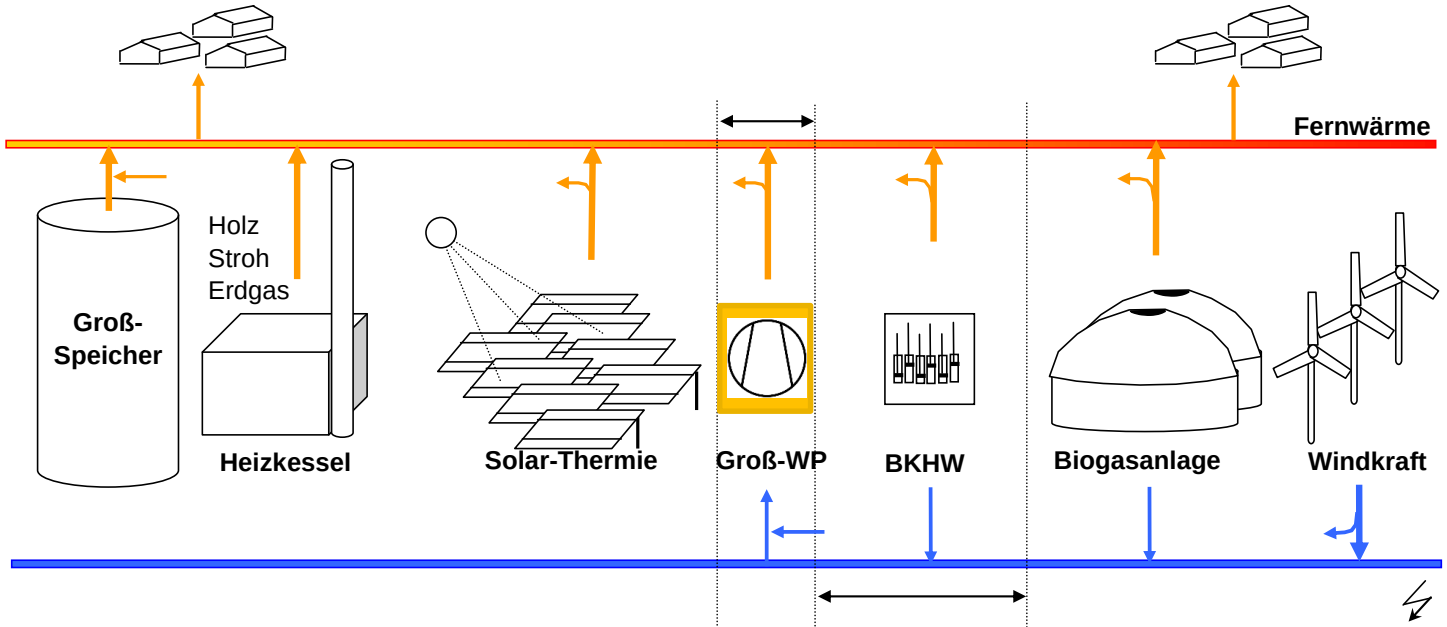
Power to Heat

Cutting electric grid peaks

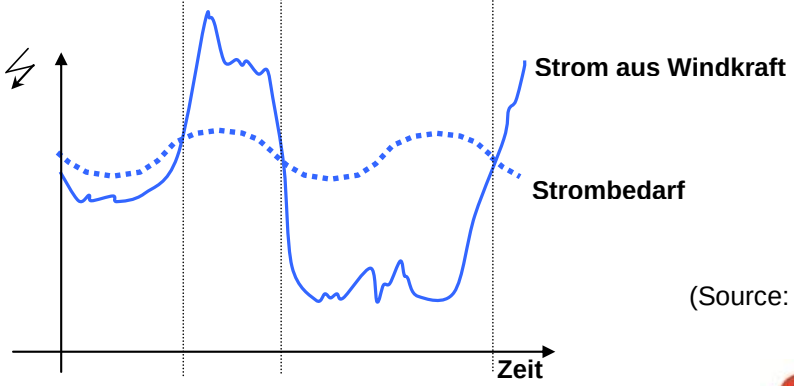


No pilot project, everyday practice in Denmark

Further options:

- Waste heat
- Geothermal energy

> POWER to HEAT



(Source: Bremer Energie Institut)

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High Temperature Heat Pumps

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References Industrial Heat Pumps

Residents Straubing (GER)

Commissioning:	October 2010
Heat source:	Wastewater
Heat pump type:	1 x ISWS150ER2 (+ OSWP 56)
Compressor type:	Screw, R134a
Source temperature:	12 - 4 ºC
Standard flow temperature:	45 ºC for FBH storage
Heating capacity:	200 KW (+ 55 KW)

102 residential units in 11 buildings are supplied over the local heating network and the TWW. As energy source is uses sewage, which heat is sent over an external heat exchanger to the heat pump.

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References Industrial Heat Pumps

Stadtwerke Amstetten (Lower Austria)

Area map: heat exchanger (red), heat source pipeline (red),
Installation location: heat pump in the workshop , heated objects (orange framed)

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References Industrial Heat Pumps

Plansee Reutte (A)

Commissioning:	2013
Heat source:	Waste heat sinter process
Heat pump type:	IWHS 400 ER3
Compressor type:	High-temperature screw compressor, ÖKO 1
Source temperature:	ca. 45° C
Supply temperature:	ca. 90° C
Heating capacity:	380 kW
Cooling capacity:	287 kW
COP:	4

» Process waste heat recovery for company district heating system

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References Industrial Heat Pumps

District Heating Mänttä (FIN)

Commissioning:	2017
Heat source:	Return line of district heating system
Heat pump type:	IWWDS 120 ER3
Compressor type:	Screw, ÖKO 1
Heat source temperature:	45 - 55 ºC
Supply temperature:	120 ºC
Heating capacity:	158 kW
COP Heating:	2,0

» **Application**: Hot water production for a local district heating network

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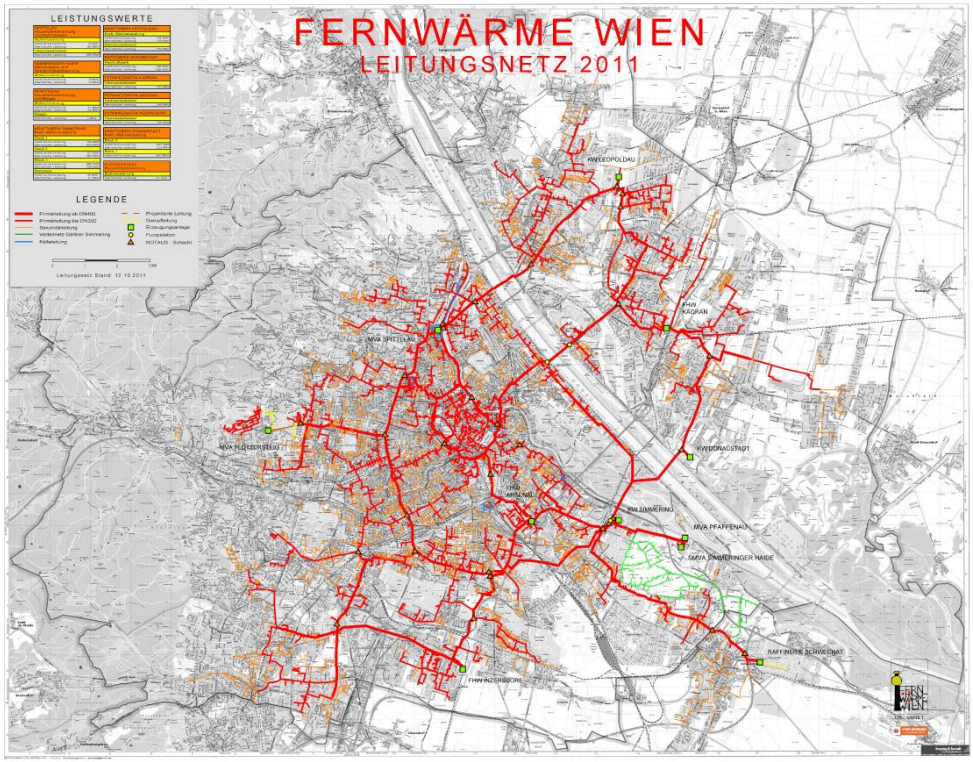
References Industrial Heat Pumps

Vienna District Heating (AT)

» District Boost:

By using the high-temperature heat pump the capacity of the Vienna district heating system can be boosted, without increasing the capacity of the heating plant respectively of the boiler.



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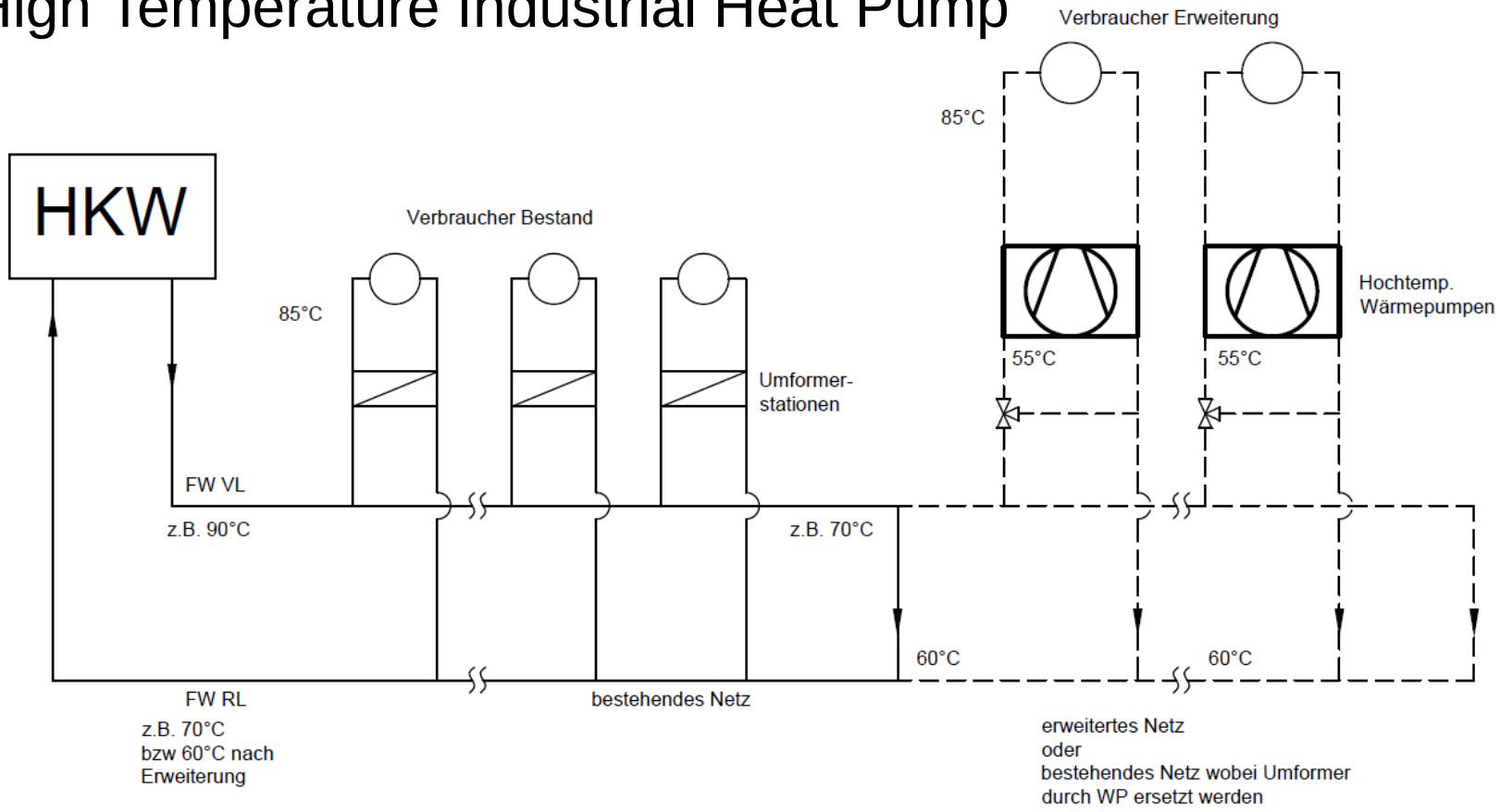
Extension of District Heating Grid

» High Temperature Industrial Heat Pump



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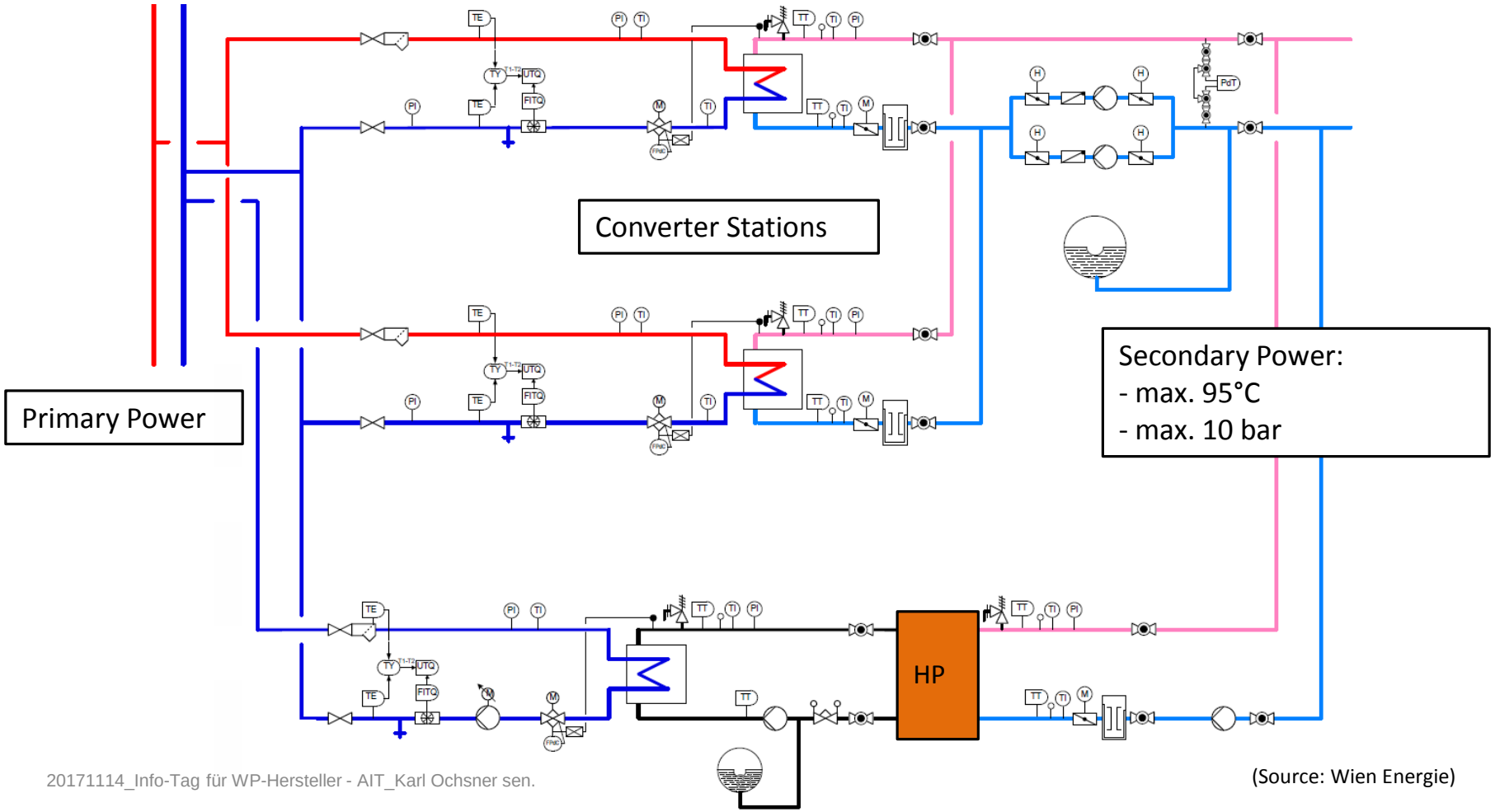
Extension of District Heating Grid

Integration of Heat Pump parallel to Converter Stations



(Source: Wien Energie)

References Industrial Heat Pumps

Vienna District Heating (AT)

Commissioning:	2014
Heat source:	Return line of district heating system
Heat pump type:	IWHS 240 ER3
Compressor type:	High-temperature screw compressor, ÖKO1
Source temperature:	35 - 55 ºC
Supply temperature:	70 - 85 ºC
Heating capacity:	255 kW (W45/W75)
Cooling capacity:	207 kW
COP:	5,3

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Application: District Heating System

» Benefit

- **Additional District heat** using return flow as source
  - **No costs for the heat source** systems
  - Required temperature lift with heat pump relatively low → high annual COP
  - Increases transport capacity of the line
    (District Heating Booster)
  - Temperature reduction of the return flow increases the efficiency of the CHP plant

- District heating from ambient heat and waste heat
  - Contribution to a stable power grid (POWER to HEAT)
  - Existing system as heat storage available

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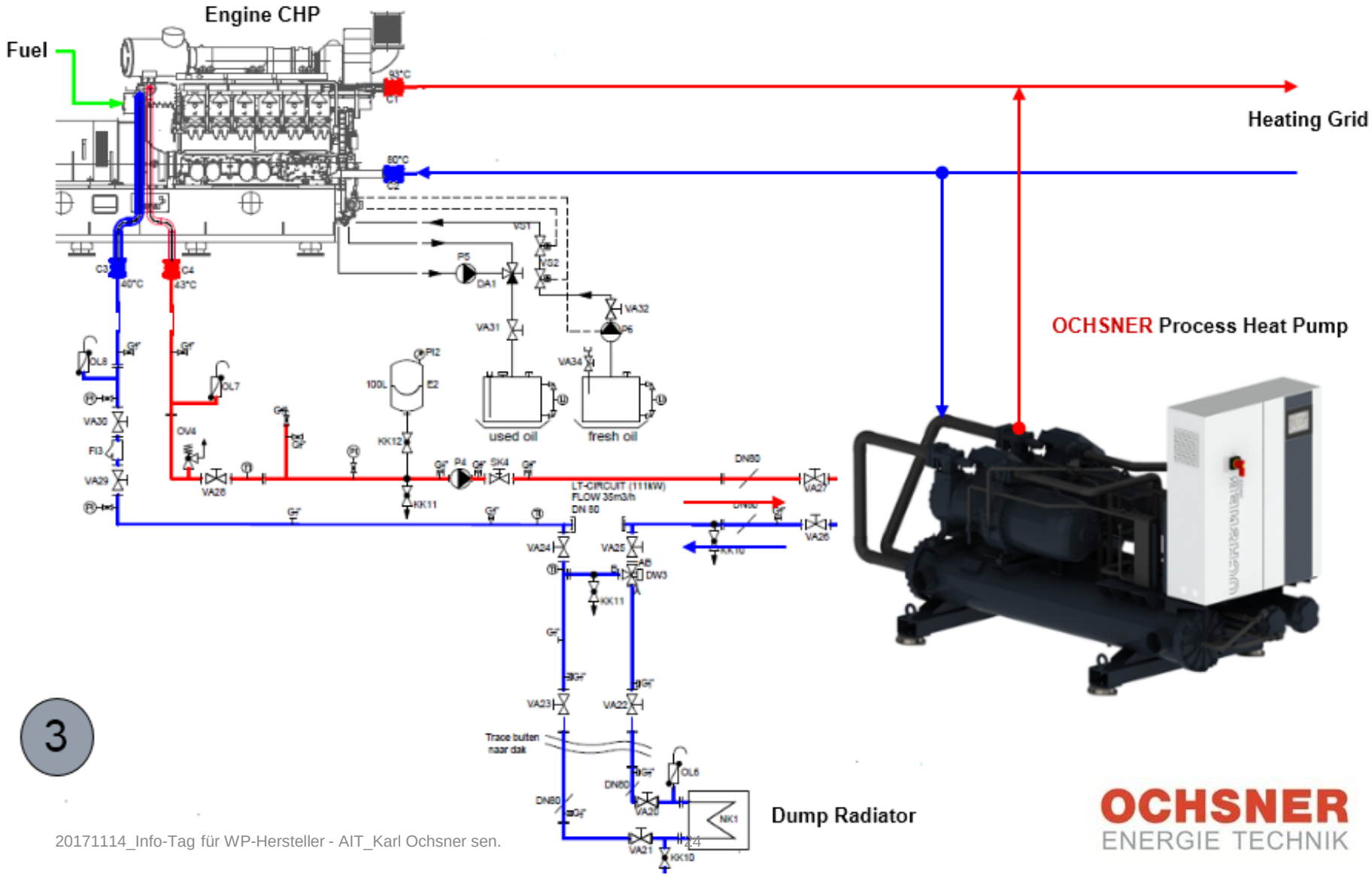
Application: Cogeneration Units



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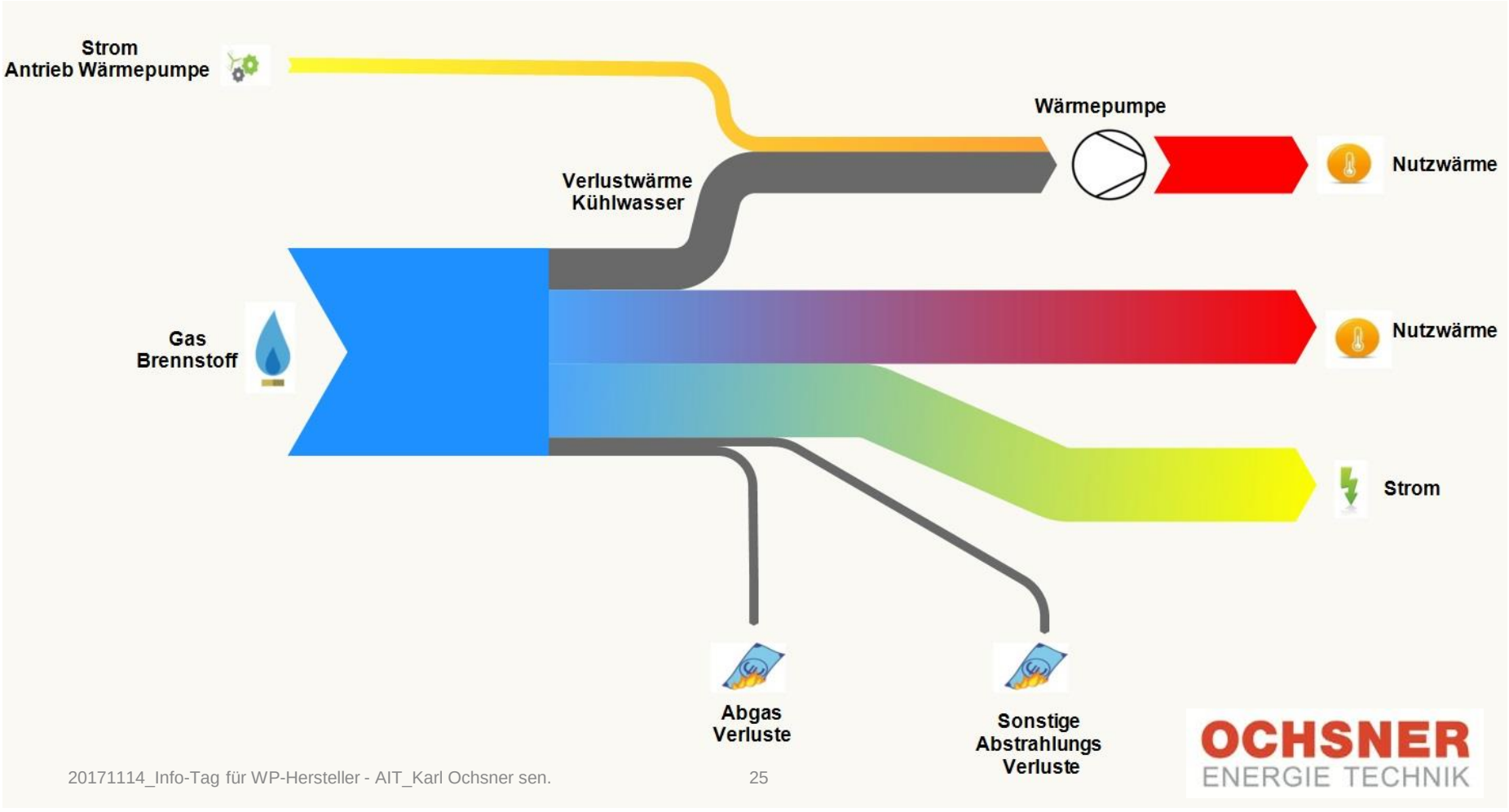
Application: Cogeneration Units

Energy flow diagram



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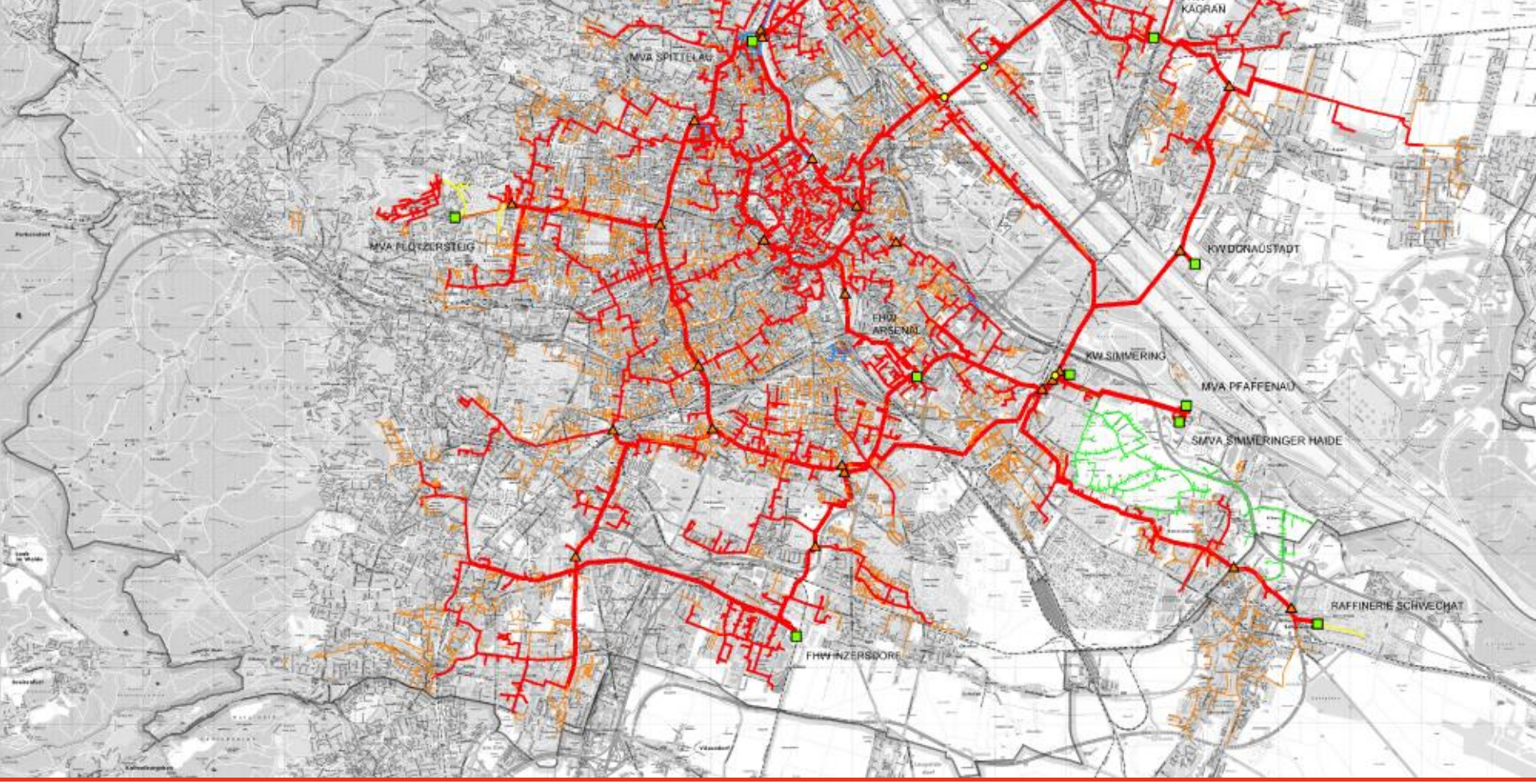

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