

BM Retrofit – Development and demonstration of holistic retrofitting concepts for biomass-based district heating networks



Developing High-Efficient Biomass-Based District Heating Systems for Renewable Heat Supply

3rd International Sustainable Energy Conference, 10 – 11 April 2024, Messecongress Graz Austria



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ENERGIE



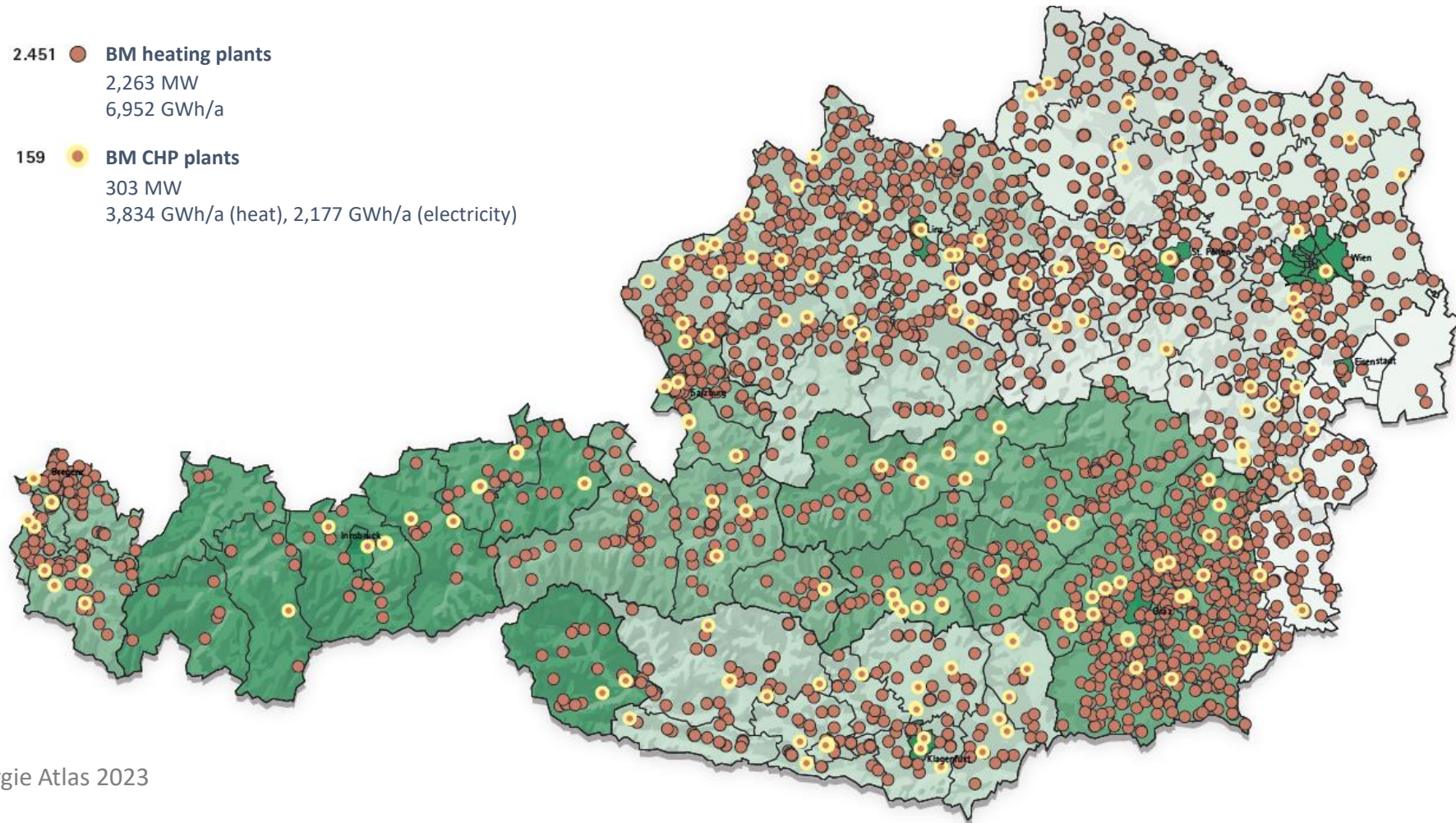
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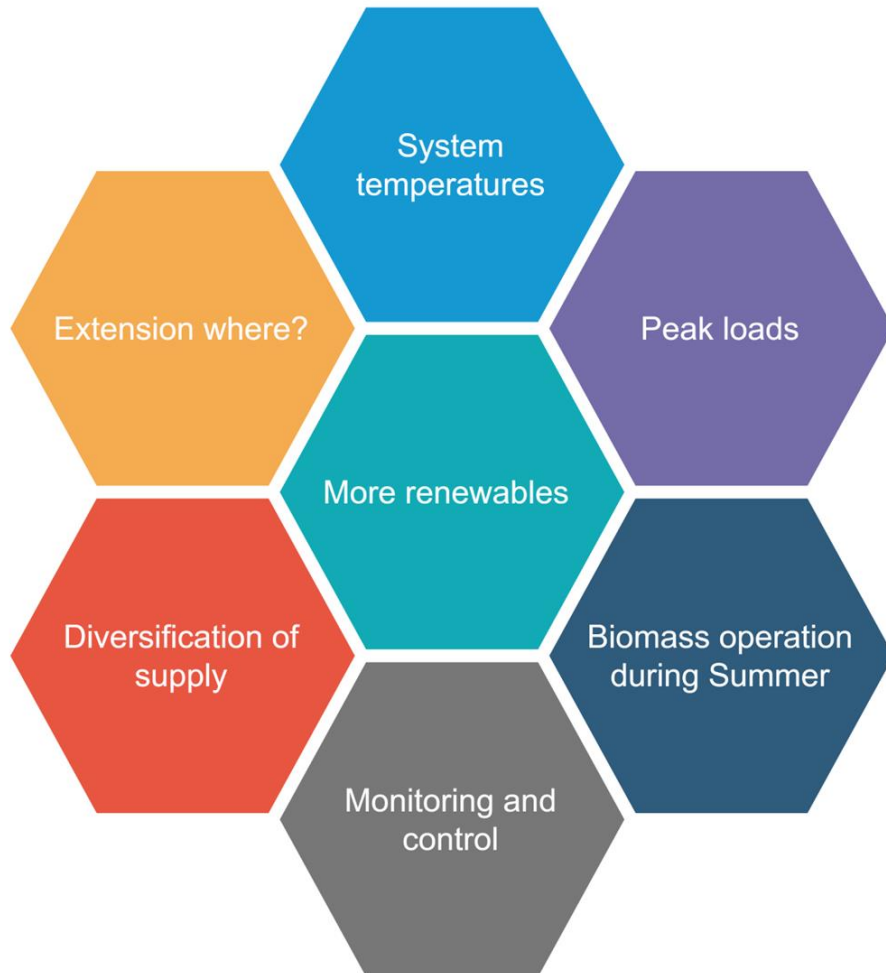
Feldgasse 19, 8200 Gleisdorf, Austria



Background and motivation



Main challenges and future needs



- Reduced system temperatures – decrease losses
- Optimized operation of boilers and DH network
- Decreased local emissions
- Reduction of fossil energy share
- Efficient and sustainable heat generation

BM Retrofit in a nutshell



Existing
district heating
network

Modernization of heating
plant and network

Local heat source
integration

Sector coupling and
waste heat utilization

Digitalization solutions
and operation strategies

Storage and storage
management

Innovative methods and
planning tools

Actor integration and
innovation processes

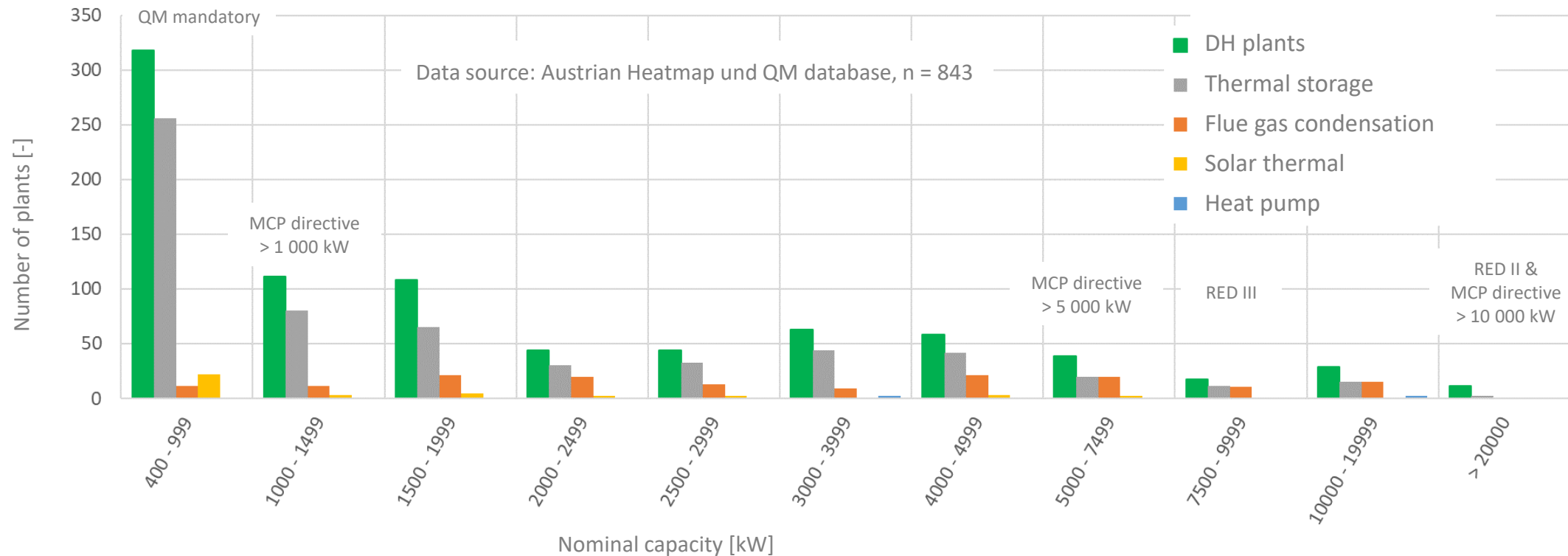
Holistic system
evaluation

New business models
and services



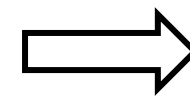
Climate-friendly
district heating
network

Components in DH plants



- Thermal storage: 71%
- Flue gas condensation: 18%

- Solar thermal: 5%
- Heat pump: 1%



**Significant potential
for modernisation**

DH network Wald im Pinzgau

Optimisation of summer operation

- Highlights and innovations
 - Waste heat utilisation (cooling circuit of the hydropower plant turbine cooling system) using a compression heat pump (250 kW)
 - Thermal storage tank ($\sim 30\text{m}^3$) and storage management
 - Optimisation of large consumers
- Targeted results
 - Savings of approx. 10,000 l oil / 31 t of CO_2 (local)
 - Substitution of approx. 750 MWh biomass / 185 - 230 t CO_2 (global)
 - Reduction in system temperatures: around 5°C
 - Increase in overall efficiency: around 5%

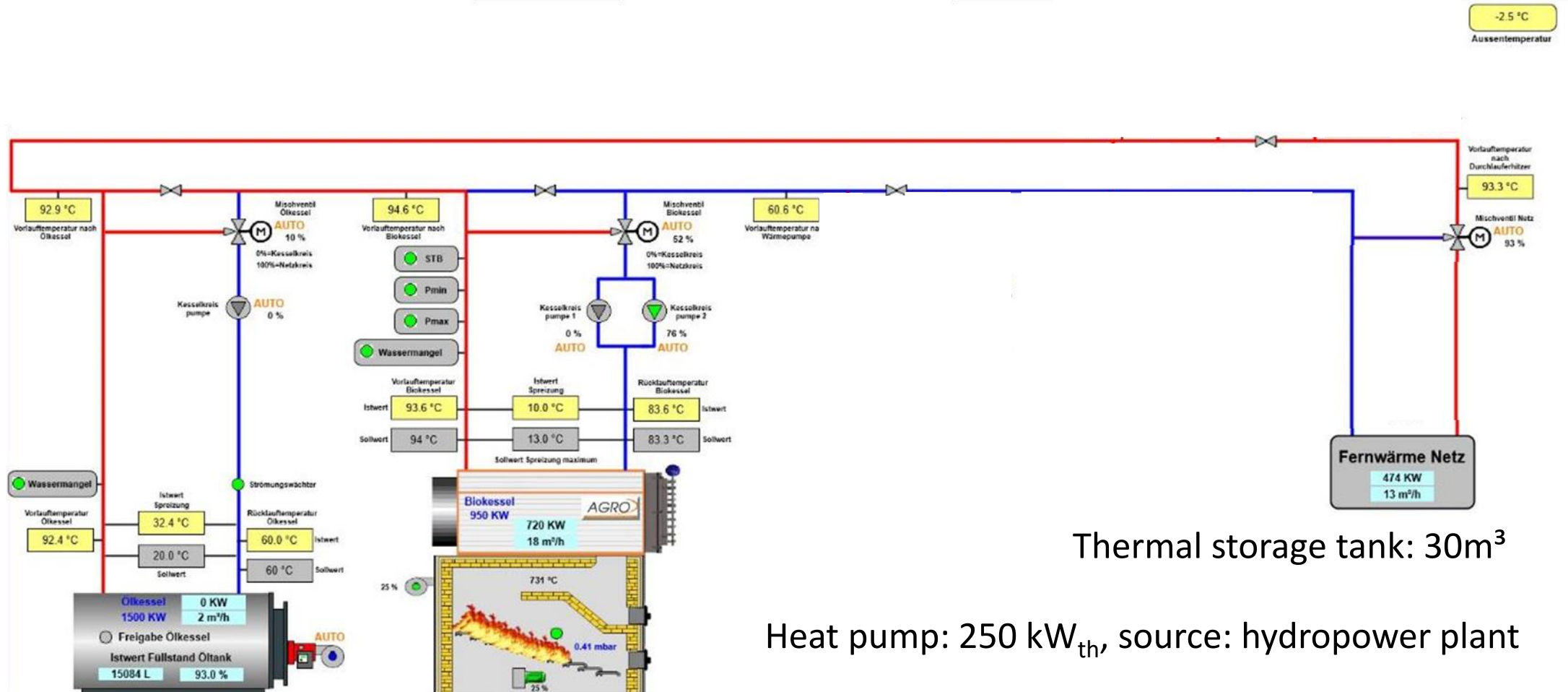


Source: Salzburg AG

DH network Wald im Pinzgau

Optimisation of summer operation

El heating for feed temperature: $250 \text{ kW}_{\text{th}}$



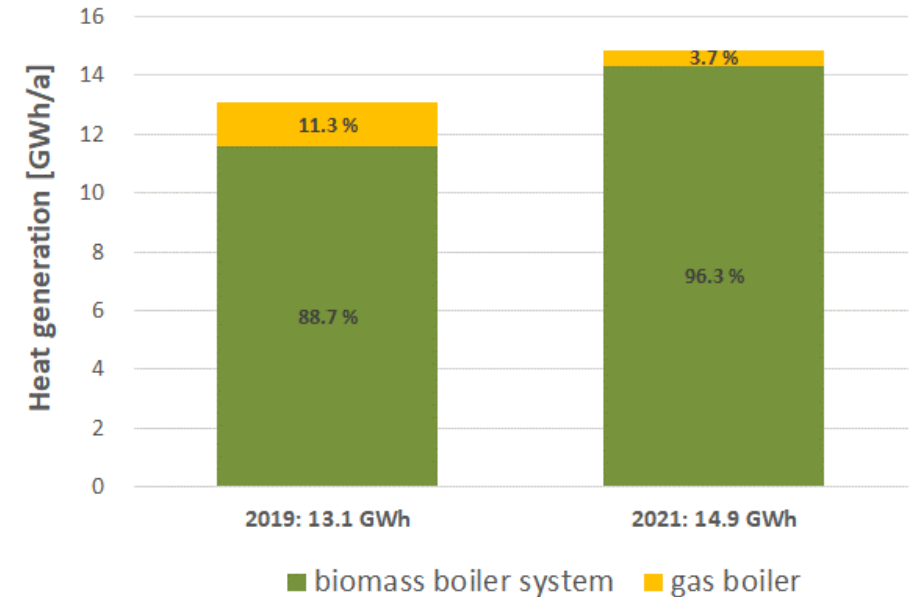
Thermal storage tank: 30m³

Heat pump: $250 \text{ kW}_{\text{th}}$, source: hydropower plant

DH network Saalfelden

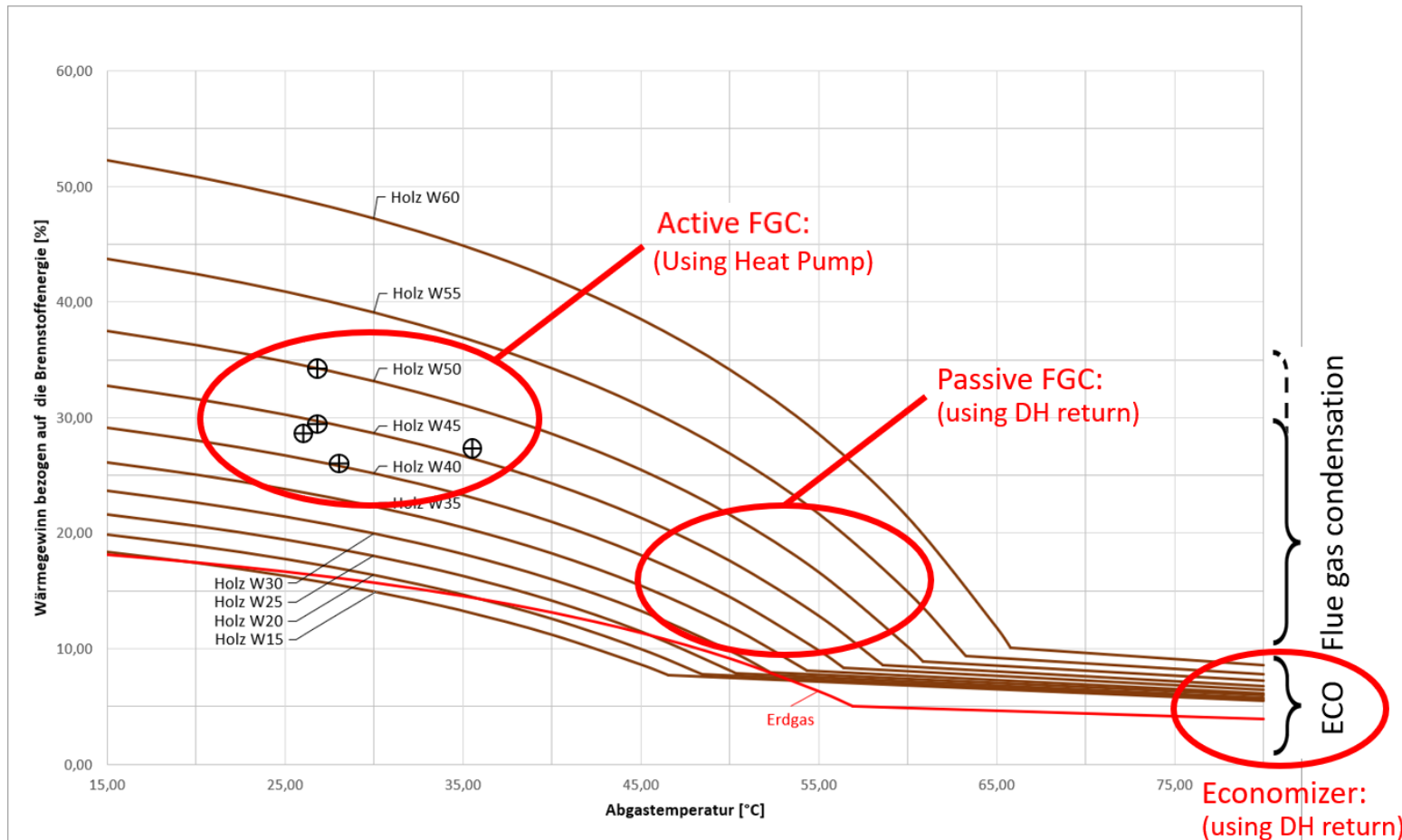
Multiple efficiency improvement measures

- Two-step retrofitting concept
 - Retrofitting measures (2020)
 - Heat pump integration (2023)
- Main retrofitting measures (2020)
 - Flue gas recirculation and flue gas cleaning (ESP)
 - Flue gas condensation (550 kW)
 - Thermal storage (150 m³)
 - 920 MWh gas substitution → 230 t CO₂
 - 2,700 MWh additional yield from boiler system
- Current retrofitting measures (2023)
 - Heat pump integration – active flue gas condensation
 - Innovative combustion control system “CO-Lambda control”



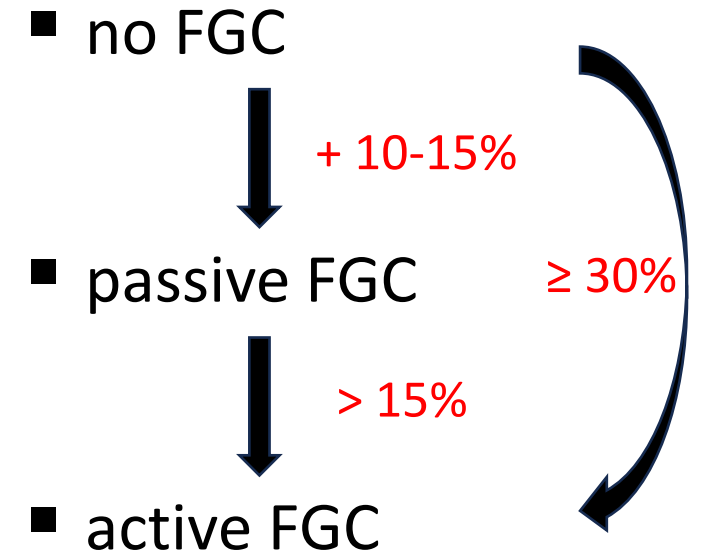
Source: Klimafonds / Krobath

Active flue gas condensation



Randbedingungen: Rauchgas 160°C / Lambda 1,5 (= z.B. Rest O₂ feucht = 5,99% bei W45) / Heizwert Holz_{trocken} = 18,78 MJ/kg / T_{umg} = 10°C, 13% rel. Luftfeuchte, 1000 mbar

Source: Steps Ahead



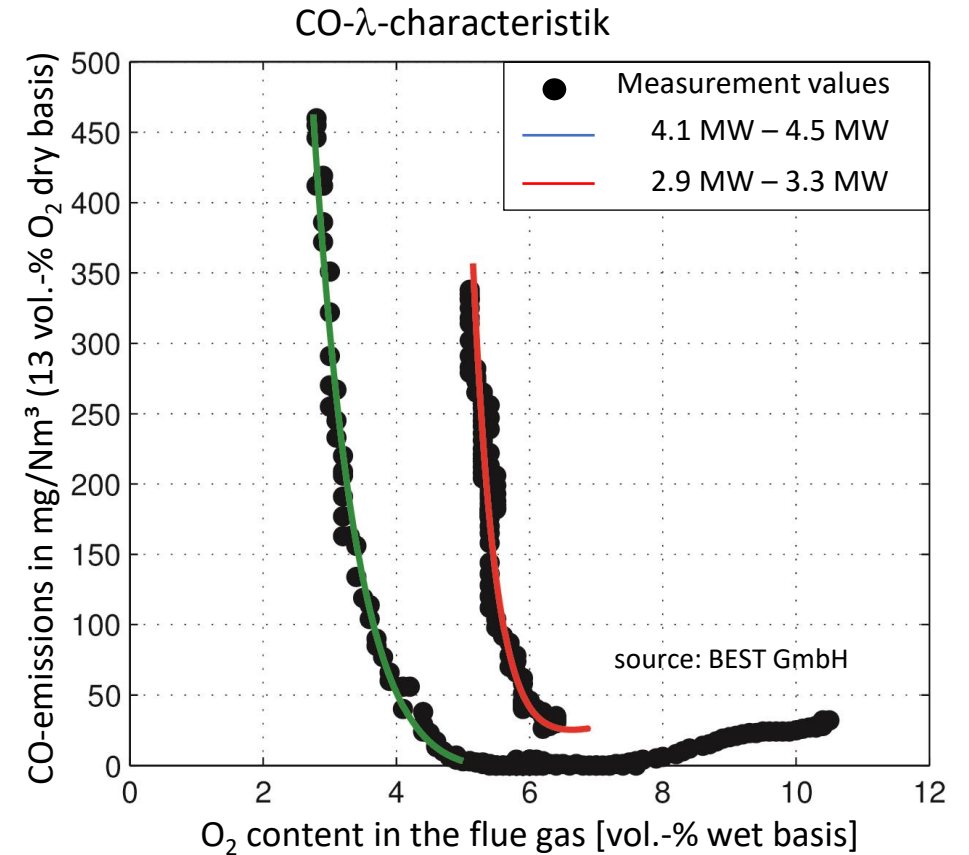
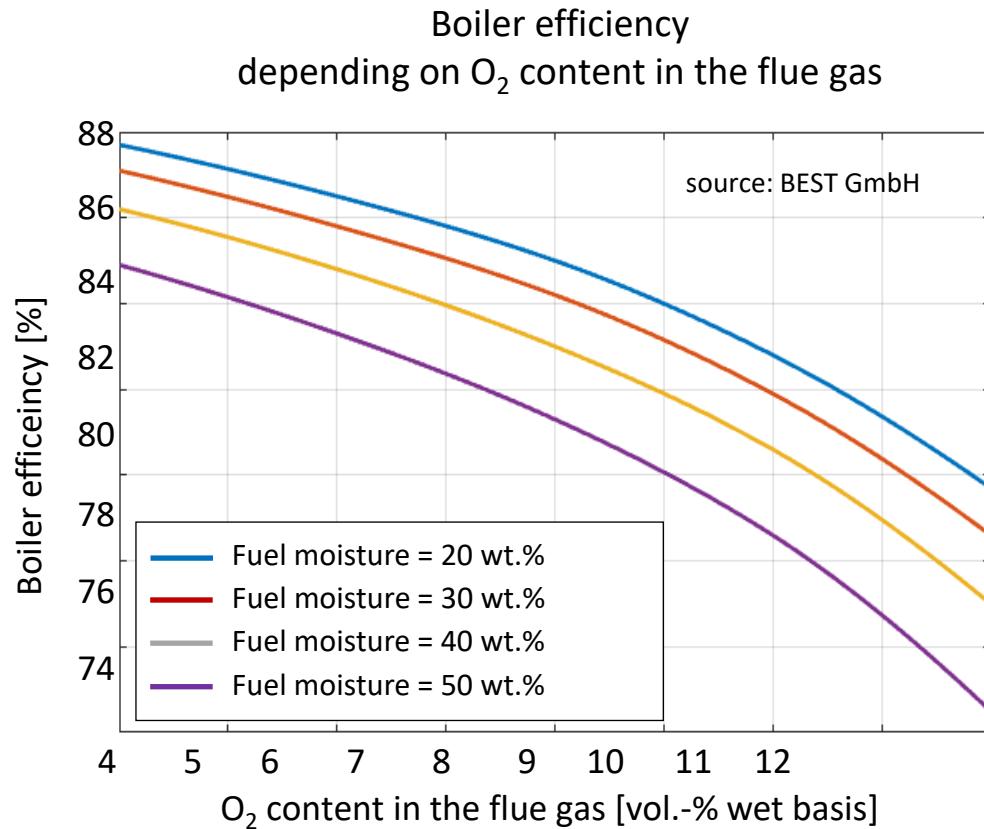
DH network Kreuzstetten

- Current situation
 - Heat demand: ~ 5,300 MWh/a
 - Heat generation: 2 x 1.0 MW_{th} biomass boiler
 - Main Challenges: low summer load, too high system temperatures, options for flexible operation on sufficient
- Investigated innovations:
 - Advanced control (e.g. CO-Lambda optimisation) for biomass boiler
 - Network expansion and densification in combination with spatial energy planning
 - Control and operation of the entire heating network, especially in summer
 - Control and operation of a large consumer (drying plant for agricultural products)
 - Integration potential of heat pump systems



Source: AEE INTEC

CO – Lambda optimisation



CO- λ optimisation provides an optimum setpoint for the existing O₂ control system

Take-home messages

- Development and implementation of retrofitting measures and continuous adaption is a vital and long-lasting process
- Technical solutions for retrofitting are available on the market
- Use all options for improving DH systems
 - Holistic retrofitting of the existing system
 - Integration of locally available energy sources
 - Extension/densification of network
 - Synergies to other infrastructures or ongoing developments
- Actor and stakeholder integration and communication is vital → otherwise no appropriate retrofitting is possible

QM Fachtagung

Beitrag der Wärmenetze zur Energiewende

“Contribution of heating networks to the energy transition”

Framework conditions for heating networks and renewable heat supply

- municipal heat planning
- funding opportunities

Technical issues

- renovation and longevity of heating networks
- transitional solutions for heat supply in network expansion

19.06.2024, WYNDHAM GRAND Conference Centre, Salzburg

klimaaktiv.at/erneuerbare/effiziente_heizwerke/fachtagung2024.html



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Thank you for your attention!

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Project information:

<https://greenenergylab.at/en/projects/bm-retrofit>