

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



VORZEIGEREGION  
ENERGIE



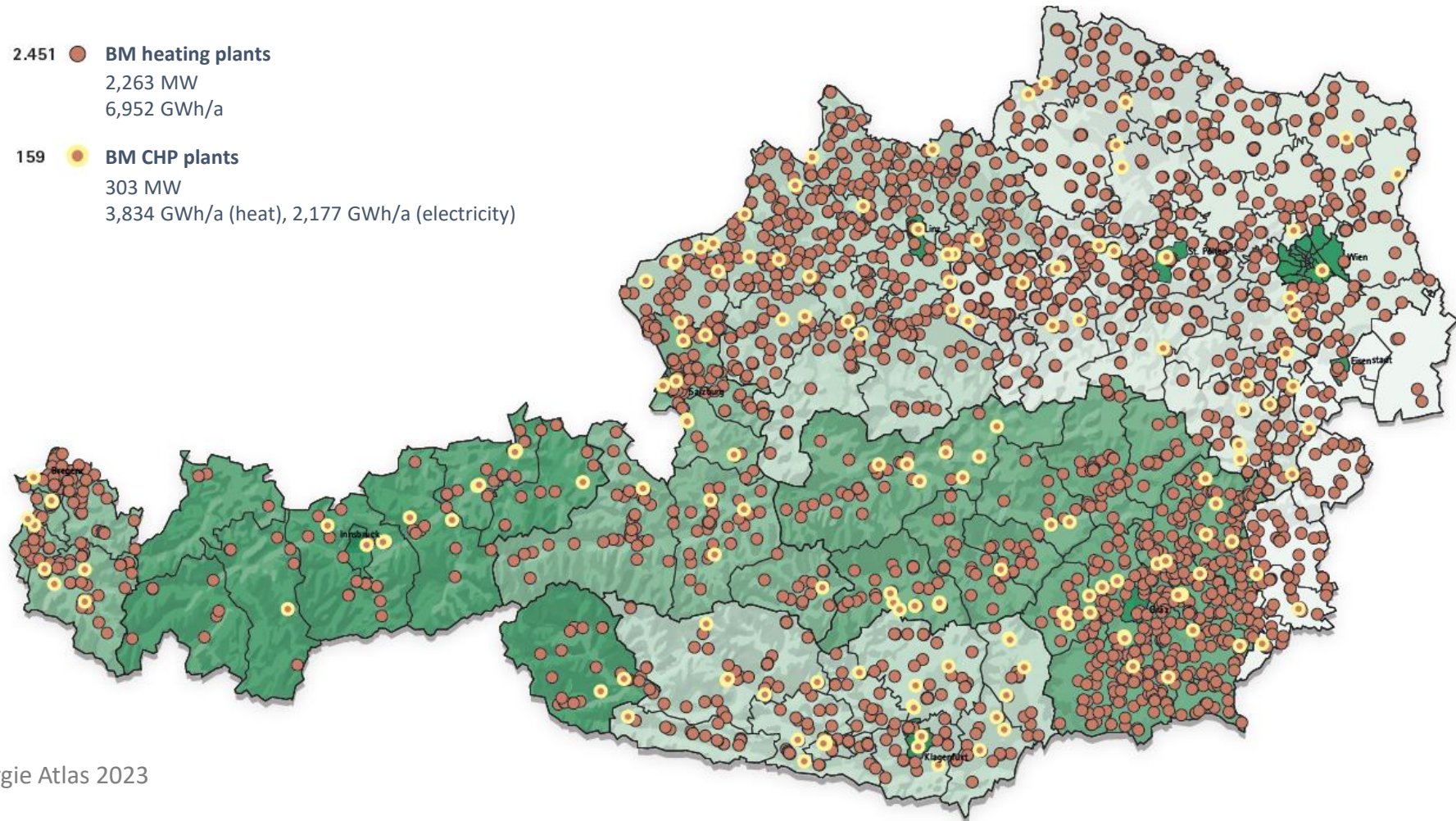
Stefan Retschitzegger

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TECHNOLOGIES (AEE INTEC)

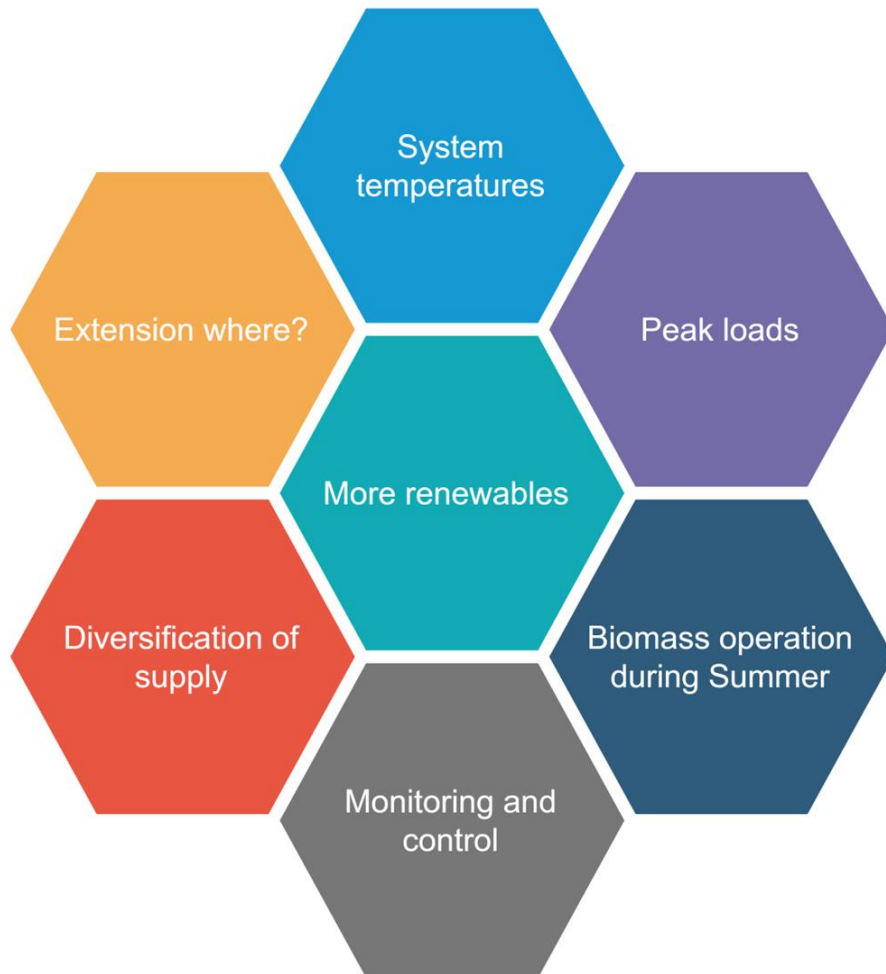
Feldgasse 19, 8200 Gleisdorf, Austria



# Background and motivation

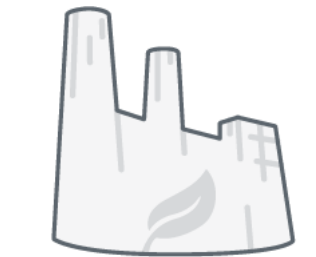


# Main challenges and future needs




- 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

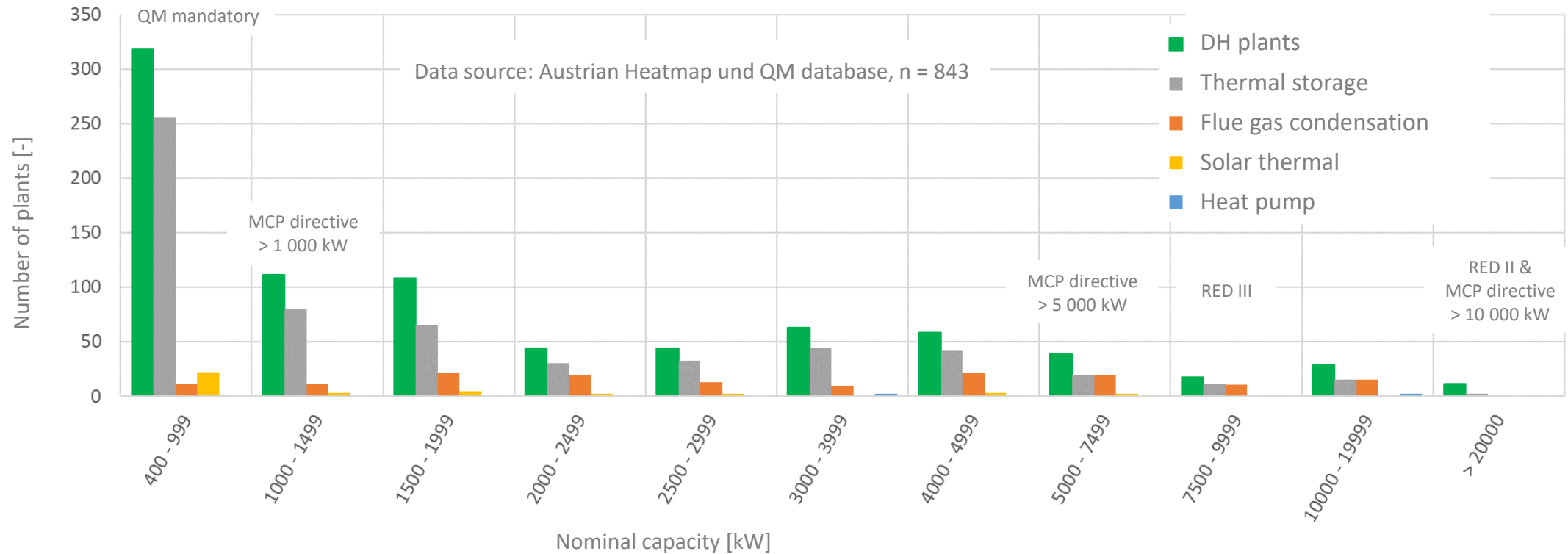
 Holistic system  
evaluation

 New business models  
and services



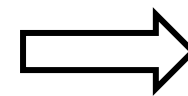
Climate-friendly  
district heating  
network

# 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 (~ 30m<sup>3</sup>) and storage management
  - Optimisation of large consumers
- Targeted results
  - Savings of approx. 10,000 l oil / 31 t of CO<sub>2</sub> (local)
  - Substitution of approx. 750 MWh biomass / 185 - 230 t of CO<sub>2</sub> (global)
  - Reduction in system temperatures: around 5°C
  - Increase in overall efficiency: around 5%



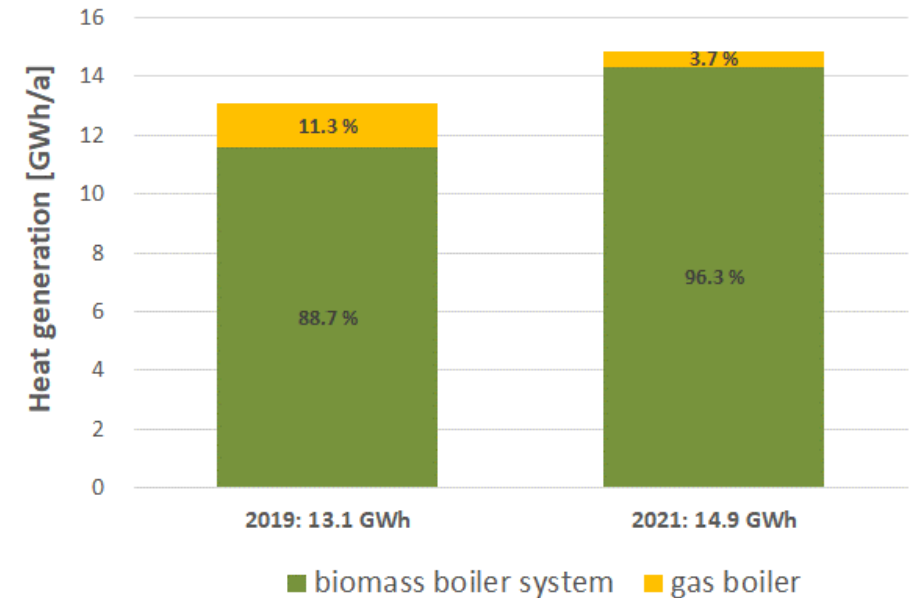
Source: Salzburg AG



# DH network Saalfelden

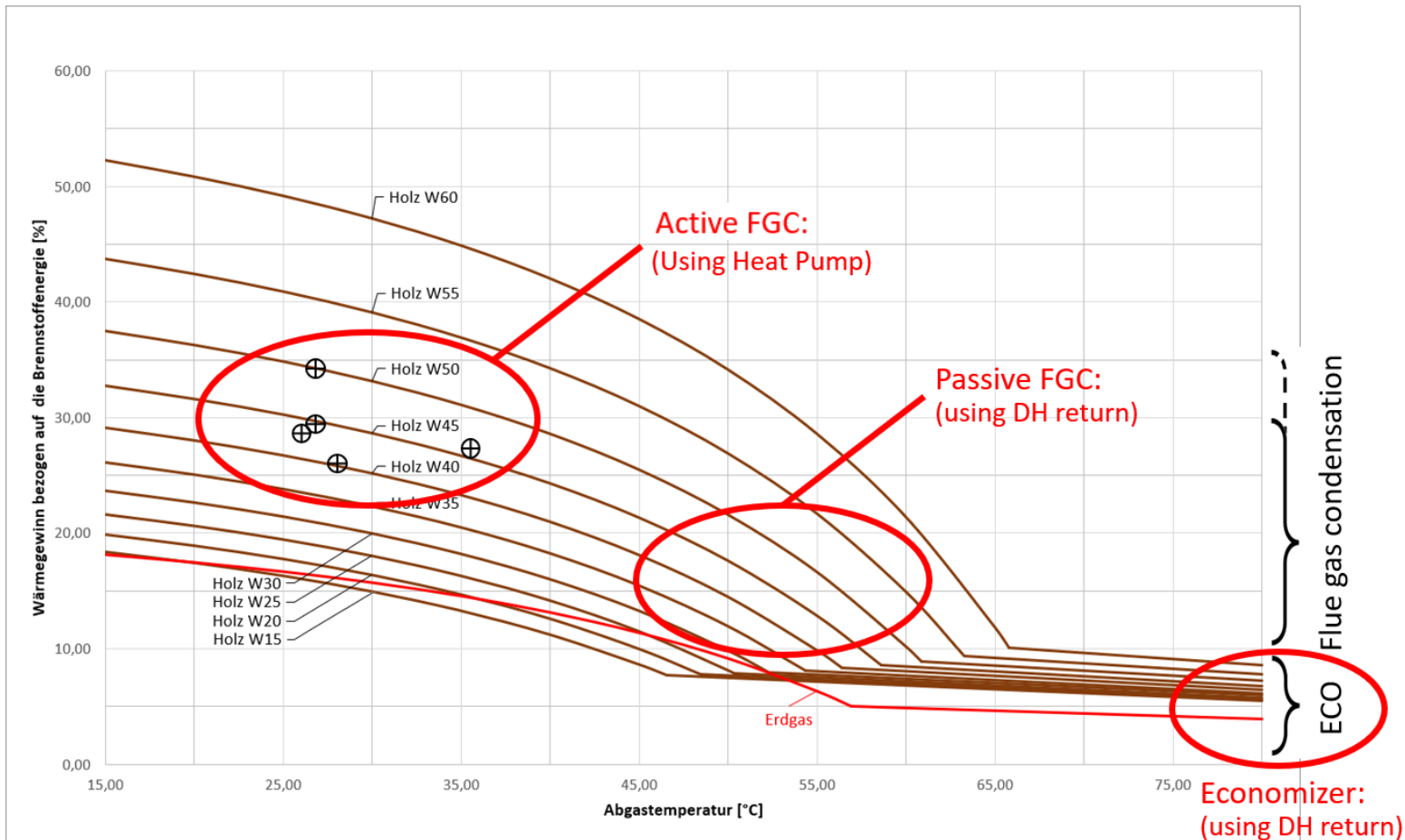
## Multiple efficiency improvement measures

- 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 m<sup>3</sup>)
  - 920 MWh gas substitution → 230 t CO<sub>2</sub>
  - 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”



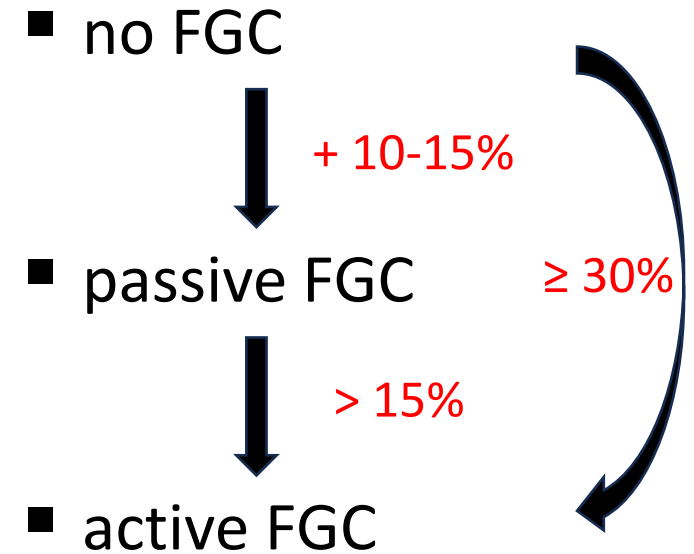
Source: Klimafonds / Krobath

# Active flue gas condensation



Randbedingungen: Rauchgas 160°C / Lambda 1,5 (= z.B. Rest O<sub>2</sub> feucht = 5,99% bei W45) / Heizwert Holz<sub>trocken</sub> = 18,78 MJ/kg / T<sub>umg</sub> = 10°C, 13% rel. Luftfeuchte, 1000 mbar

Source: Steps Ahead



# DH network Kreuzstetten

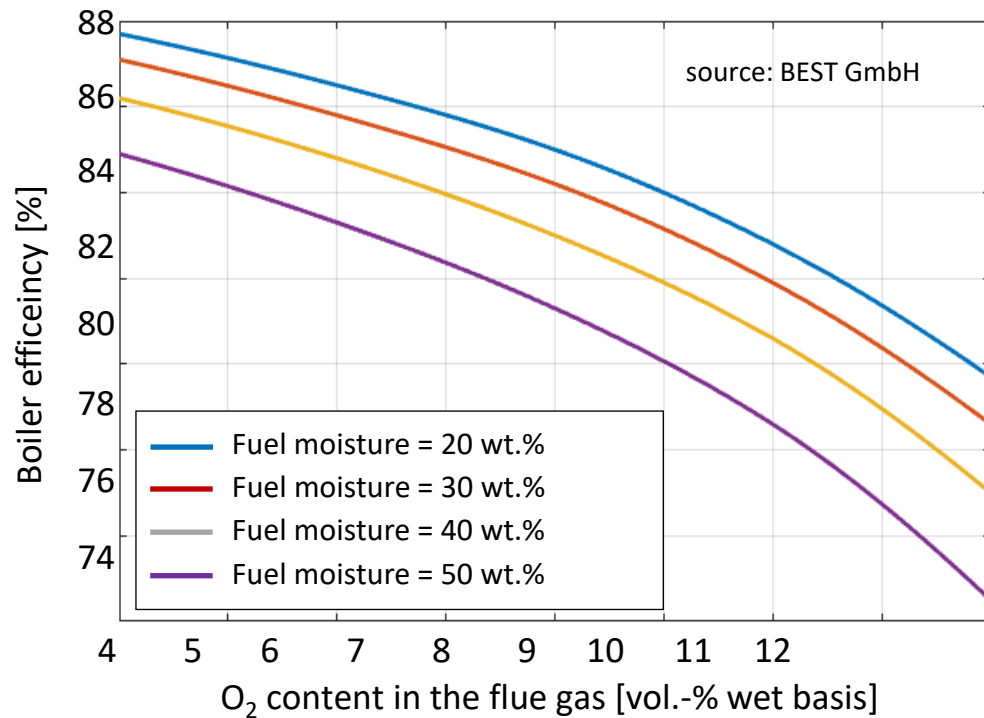
- Current situation
  - Heat demand: ~ 5,300 MWh/a
  - Heat generation: 2 x 1.0 MW<sub>th</sub> biomass boiler
  - Main Challenges: low summer load, too high system temperatures, options for flexible operation on sufficient
- Investigated innovations:
  - Advanced control (e.g. CO-Lambda optimisation) 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



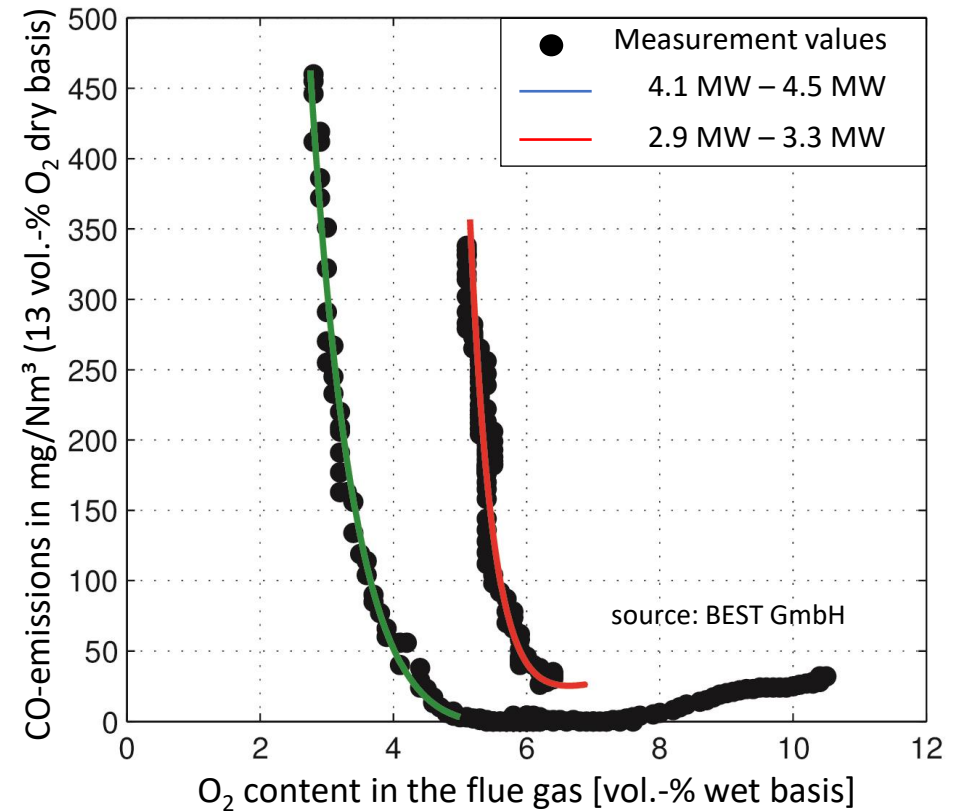
Source: AEE INTEC

# CO – Lambda optimisation

Boiler efficiency  
depending on O<sub>2</sub> content in the flue gas



CO-λ-characteristik



CO-λ optimisation provides an optimum setpoint for the existing O<sub>2</sub> 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](https://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>

