MITEINANDER
ZUKUNFTSRELEVANT

SYSTEM EVALUATION OF OPTIMIZED DISTRICT HEATING NETWORKS

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Resilience of district heat supply

- Many **biomass-based district heating networks** in Austria (~2,500 with ø 1 MW) **require modernization**.
- Operators face increasing **pressure to improve efficiency, reduce costs** and optimize diversified heat supply.
- Facing global crises of fossil energy supply, the **operation of fossil** (backup, peak load) **boilers** increases economic pressure
- Resilient retrofit options call upon further **reduction of climate impacts and strengthening regional added value creation**
- Numerous retrofit options exist, but **early-stage decision-making is complex** and time consuming

Project BM Retrofit (2023-2026)

- Interdisciplinary team of **13 partners from Research, DH network operators and Technology suppliers**
- 3 Demonstrators with Good-Practice examples of
  - **Active flue gas condensation** with heat pump
  - **Simulation model** for network optimization
  - **Predictive control** for maximized efficiency
- **Open-access tool** for fast **techno-economic assessment** of options for biomass DH modernization https://bm-retrofit-tool.ait.ac.at/tool
- System evaluation based on **Global Warming Potential, Cumulated Energy Demand (LCA) and Economic Value Added**

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System evaluation

Life Cycle Assessment (LCA):

- **Comparative analyses of 'before-Retrofit' and 'after-Retrofit'** (retrofit measures implemented) for each demonstrator
- Assessment of **Global Warming Potential (GWP), Cumulated Energy Demand (CED)** (Method: EF3.1+CED, ecoinvent V3.11)
- **Functional Unit**: yearly heat demand [MWh/a] by DH consumers
- Net-zero direct CO_2-emissions from biomass combustion

Value Added Analysis:

- **Multi-regional input-output model GLOB-IO** (based on OECD IO-tables with 77 countries/regions & 45 economic sectors)
- Impact assessment of retrofit measures on **domestic and foreign value added and employment**
- Considers **direct and indirect induced economic effects**

3 Demonstrators

Saalfelden


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15,069 MWh/a
7,600 m network

Challenge
- Operation since 1997 requires modernization
- Additional heat demand for new DH customers

Retrofit
+ Active flue-gas condensation at BM-boiler with heat pump (750 kW_{th}, COP 5.5)
+ Heat storage 150 m^3
+ Optimized BM boiler operation by CO-Lambda-control

Kreuzstetten


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4,100 MWh/a
8,700 m network

Challenge
- Low heat demand in summer
- Inefficient partial load operation of BM boiler, high grid losses (60% in summer)

Retrofit
+ Optimization by heat storage (2x20 m^3) management
+ Predictive boiler control
+ Heat pump (300 kW_{th}, COP 2.5) for May – Sep

Wald i. Pinzgau


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3,069 MWh/a
3,000 m network

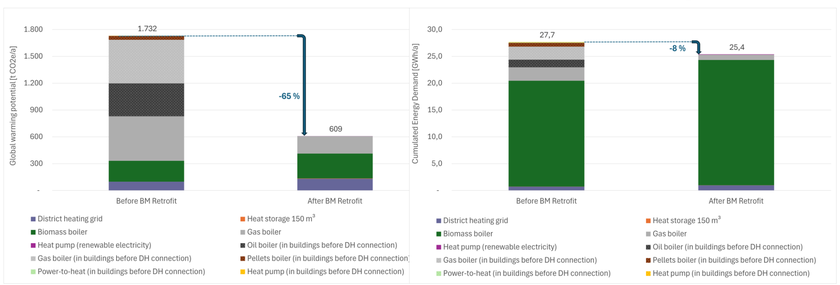
Challenge
- Low heat demand in summer
- Inefficient partial load operation of BM-boiler

Retrofit
+ Use of waste heat from near-by hydro-turbine with heat pump (250 kW_{th}, COP 2.6) and Power2Heat (250 kW_{th})
+ Heat storage 30 m^3

GWP and CED

Saalfelden

Benefit of Retrofit
+ Reduced operation of gas-boiler
+ Additional DH customers connected due to heat pump & phase-out of substituted fossil heating



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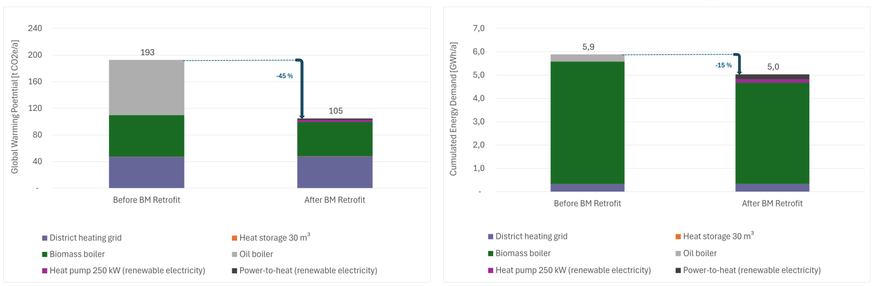
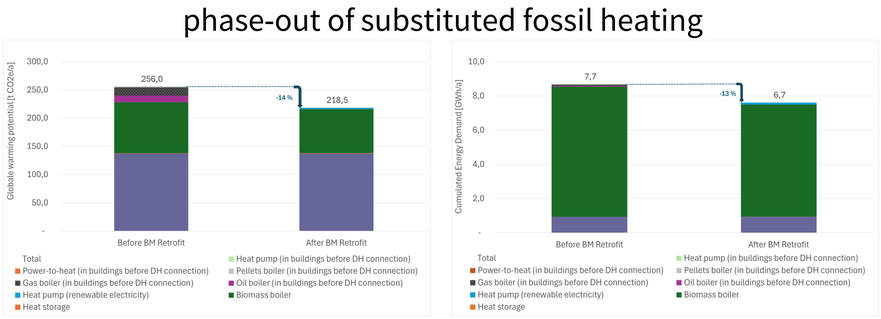
Benefit of Retrofit
+ No operation of BM-boiler May-Sep due to heat pump
+ Phase-out of oil-boiler due to heat storage



Kreuzstetten

Benefit of Retrofit
+ Optimization of BM boiler due to heat pump
+ Additional DH customers connected & phase-out of substituted fossil heating



Value added and employment

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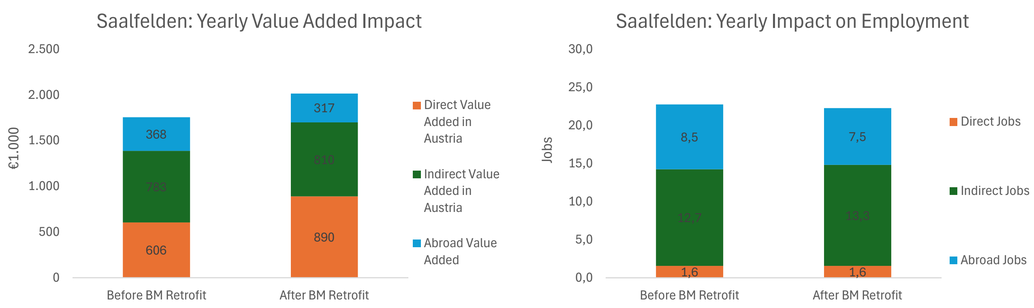
Benefit of Retrofit
+ 310.000 € additional value added in Austria per year



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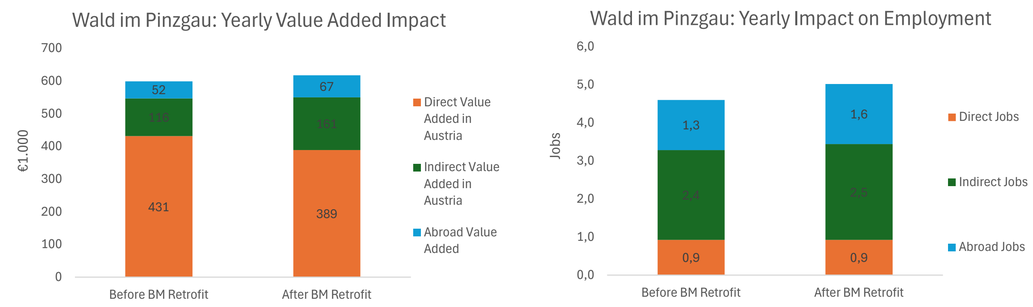
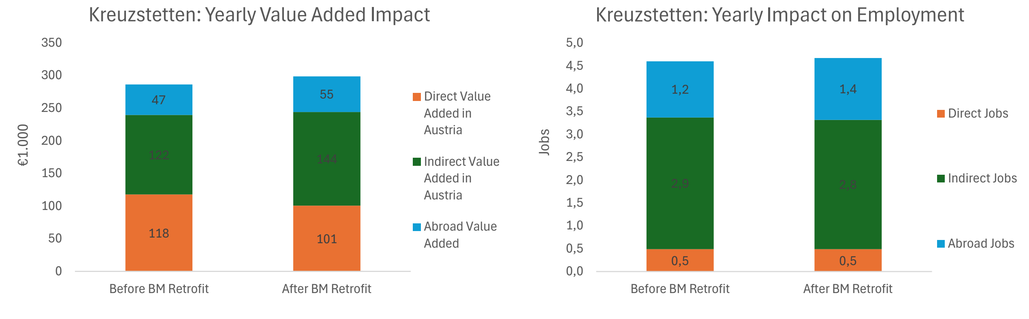
Benefit of Retrofit
+ 3.000 € additional value added in Austria per year



Kreuzstetten

Benefit of Retrofit
+ 4.000 € additional value added in Austria per year



The project BM Retrofit was funded by the Austrian Climate and Energy Fund within the research initiative "Green Energy Lab" as part of the Austrian innovation campaign "Flagship Region Energy".