

APPLICATION OF HEAT PUMPS IN THE DISTRICT HEATING NETWORK OF VIENNA

Smart Energy Systems and 4th Generation District Heating
September 2017, Copenhagen

Bernd Windholz*, Michael Lauermann, Markus Köfinger (AIT)
Heinrich Ondra, Martin Höller (Wien Energie)

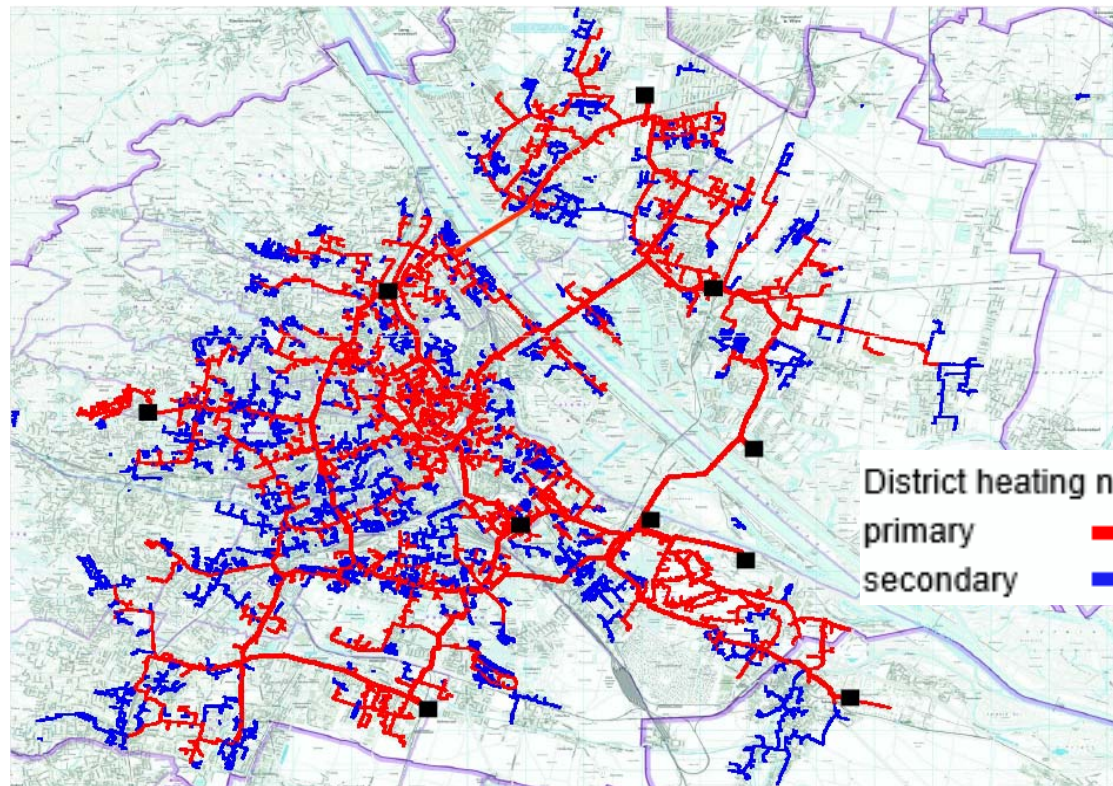
*Author



CONTENTS

- **Analysis of a pilot plant** with a decentralized heat pump in a substation
 - Introduction of DH network of Vienna
 - Description of the pilot plant
 - Monitoring results
 - Lessons learned
- Outlook
 - Simulation of a centralized heat pump with 3 variants of substations
 - Conception of heat pump systems
 - Contradictory goals thinkable
 - Application limits of different compressors and refrigerants
 - International reference plants

PILOT PLANT – DISTRICT HEATING NETWORK VIENNA



Heat generation: 5 to 6 TWh/a

Primary net ≈ 560 km

Secondary net ≈ 630 km

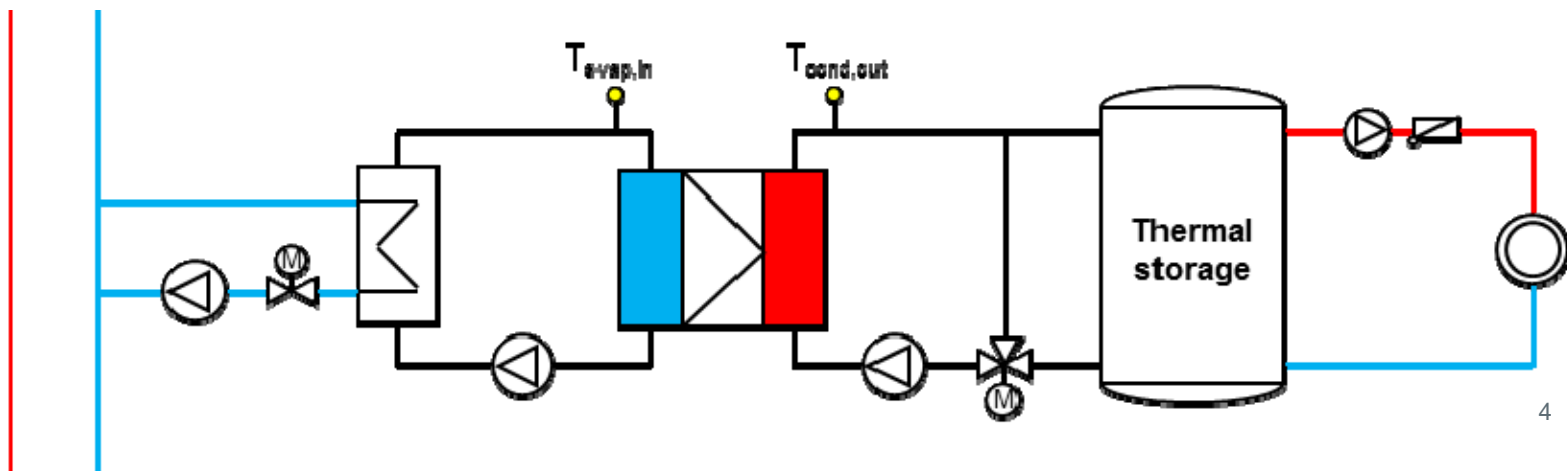
$T_{\text{sup prim.}}$ 80 – 150 °C

$T_{\text{sup sec.}}$ 63 – 90 °C

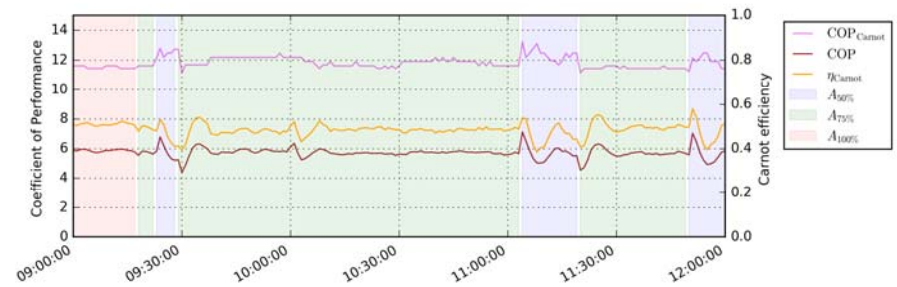
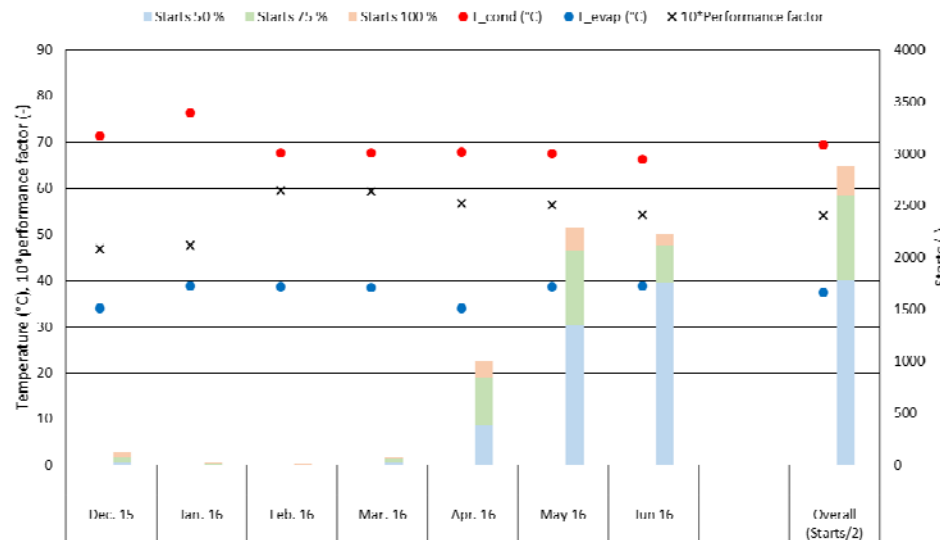
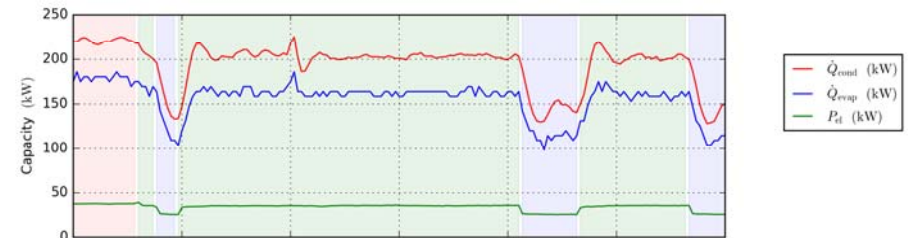
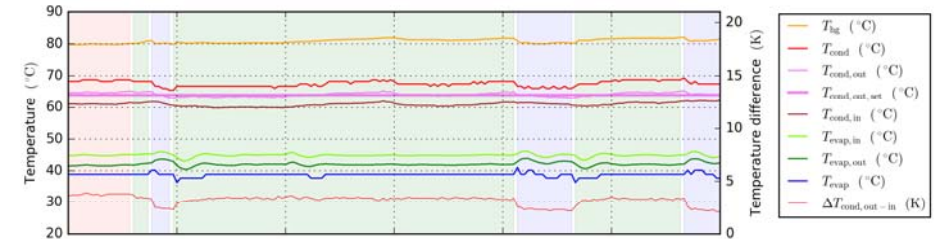
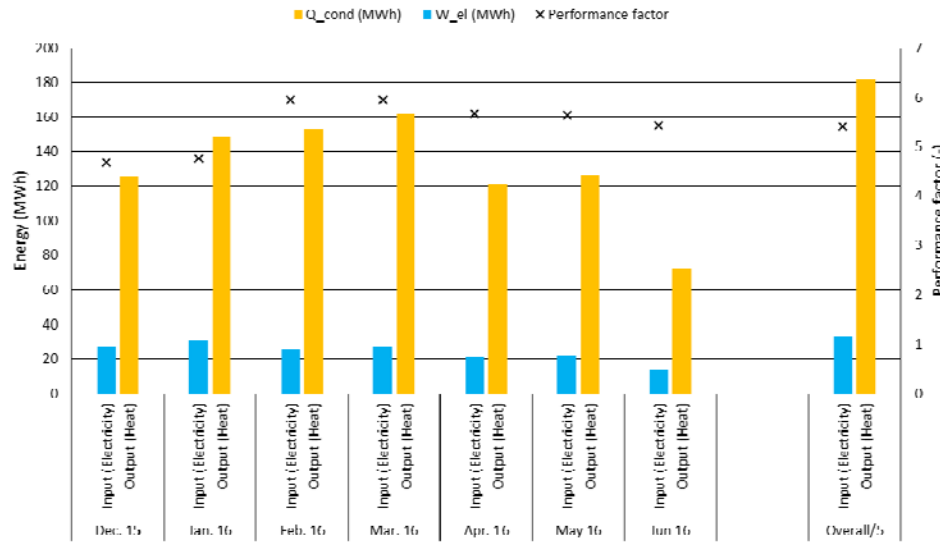
T_{ret} ≈ 60 °C

PILOT PLANT – SIMPLIFIED SCHEME AND HP CONTROLS

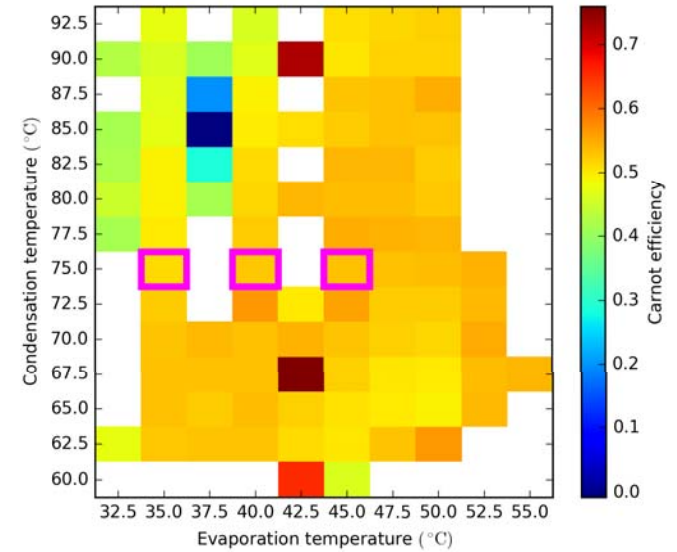
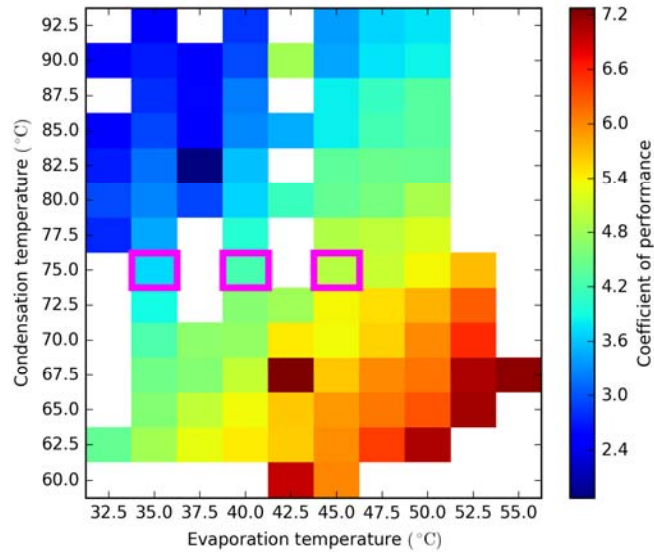
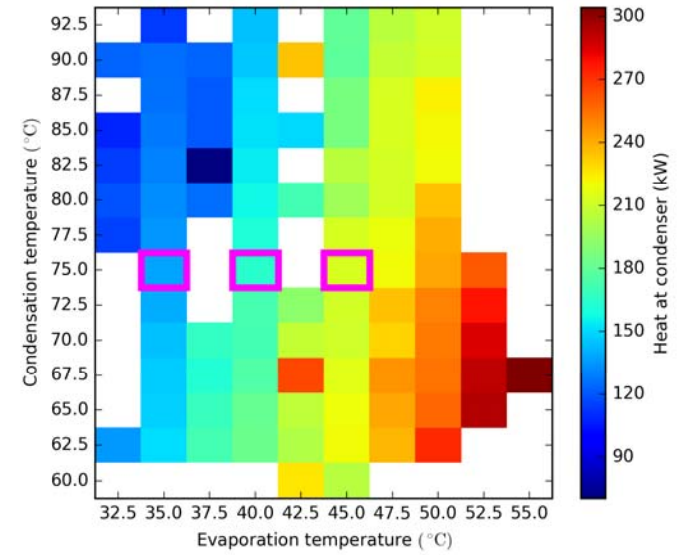
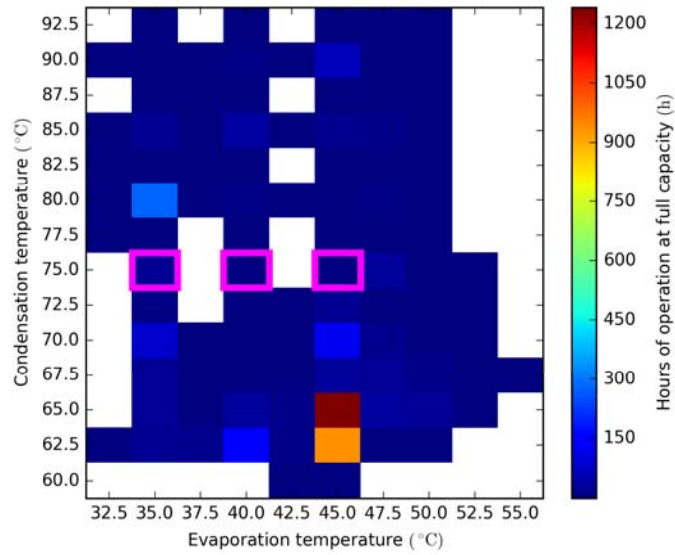
- At condenser:
 - Control variable: Outlet temperature of condenser
 - Constant flow rate and a temperature rise of about 4 K → Mixing valve required
 - If the return temperature from storage is too high, mixing cannot avoid exceeding the set temperature → Capacity slide with hysteresis (100, 75 and 50 %)
- At evaporator:
 - Constant flow rate and controlled inlet temperature of evaporator



PILOT PLANT – BALANCES, COURSES OF TIME



PILOT PLANT – PERFORMANCE DATA



PILOT PLANT – SUMMARY & LESSONS LEARNED

- **Dimensioning**
 - Capacity and efficiency vary within operating range
 - choose most important operating points well
 - consider most unfavorable operating points
- **Hydraulics and general concept is good**
 - Thermal storage allows for
 - long operating times at full load and thereby high efficiency
 - potentially cheaper HP due to lower peak capacity
- **Further optimization possible**
 - To control faster and more accurate
 - adapt control parameters of mixing valve
 - To avoid starts (transient operation) and partial load
 - adapt storage management and hysteresis of capacity slide

THANK YOU!

Bernd Windholz

Center for Energy | Sustainable Thermal Energy Systems

+43(0) 50550 6385

bernd.windholz@ait.ac.at

