Decentralised solar heat supply in DH networks
Theoretical and practical aspects

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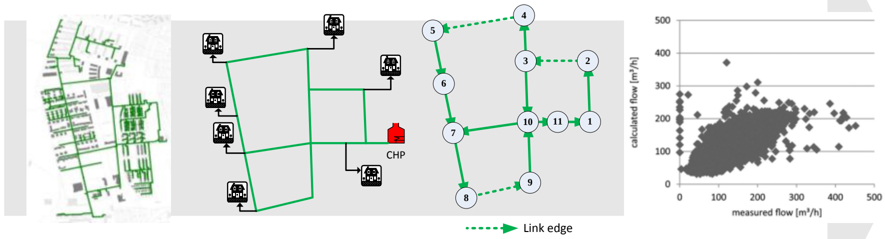
The DH tool *spHeat*

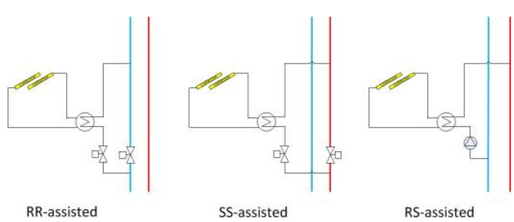
- Reduced topology
- Hydraulic calculation (conservation of energy & mass)
- Thermal calculation (temperature propagation)
- Data export



The DH tool *spHeat*

Three feed-in strategies

- RR-assisted for return temperature increase
- SS-assisted for feed temperature increase
- RS-assisted as conventional heat source

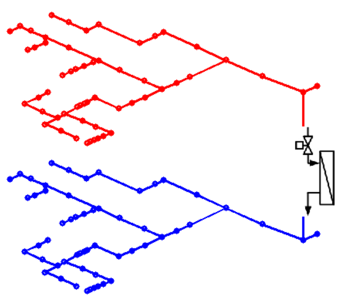


G. Bucar et al.
Grazer Energieagentur, 78/2006

	RR-assisted	SS-assisted	RS-assisted
solar fraction %	0,32	0,2	0,26
solar gain kWh/m²a	421	248	342
savings €/a	3567	3084	2950

The DH tool ***spHeat -Update***

- Non-reduced topology
- Merging feed and return sub-networks
- Consumer model (hydraulic & thermal)



$$\Delta p = k_v \dot{V}^{nv} + k_x \dot{V}^{nx}$$

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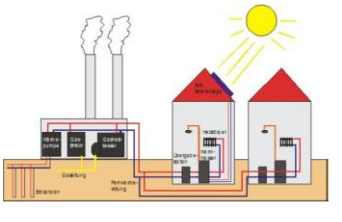
The case study

- Located in Sonnenberg, Germany
- CHP plant with 230/110 $\mathrm{kW}_{\mathrm{th/el}}$
- Heat pump with geothermal field (200kW)
- Currently 24 stations
- Operating temperature 70-40°C



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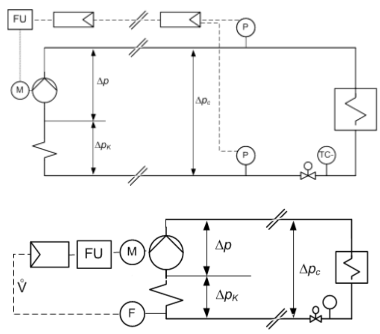
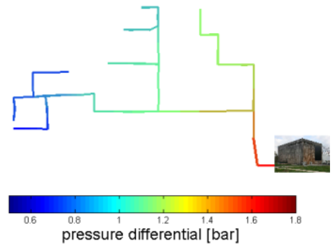
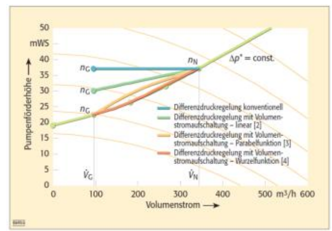
The hydraulic analysis I

State of the art

- Δp driven control
- Flow rate driven control





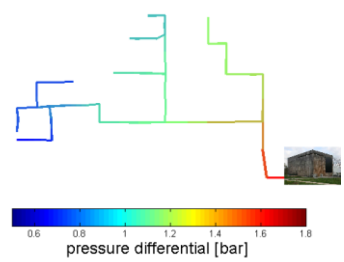


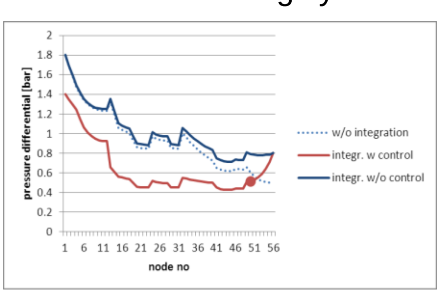
Geck C. & Kunst B.
Optimierter Netzbetrieb mit drehzahlveränderlichen Pumpen

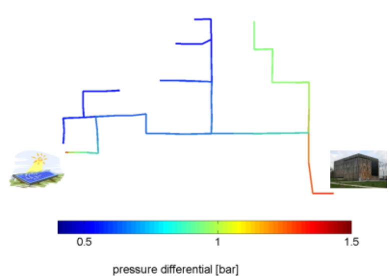
The hydraulic analysis II

Δp driven control

- Critical if integration point close to node with lowest pressure
- Risk of too low supply pressure
- Control variable highly undamped



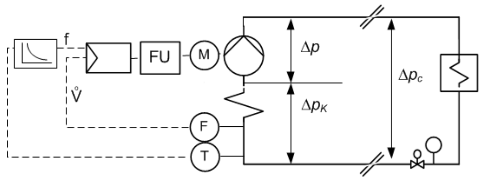


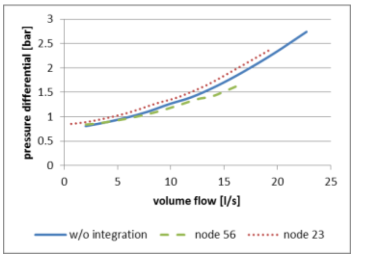


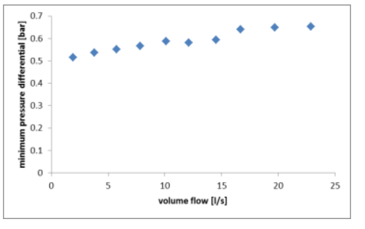
The hydraulic analysis III

Flow rate driven control

- Supply characteristic curve slightly changes depending on:
  - Integration point
  - Feed-in flow rate
- Non optimised operation
- ➢ Feed-forward of return temperature







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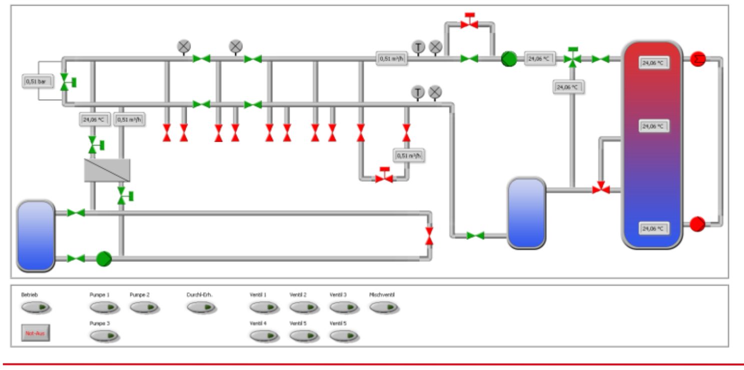
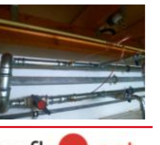
The test bench

- 10-15 kW stations
- *hp* up to 30m
- T up to 100°C





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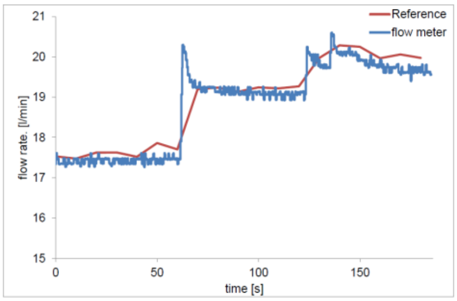
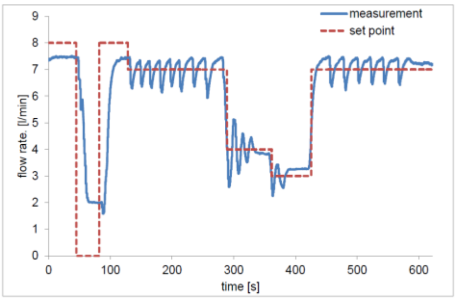
Test bench commissioning

- Test of components
- First non-tuned controllers





Conclusions

- Extended model to understand network behaviour
- Merging feed- with return lines is necessary

- Pressure differential driven control is difficult to realise
- Volume flow driven control is not optimal
- Running work on combined flow & return-T driven control

- New test bench for decentralised integration layouts
- Focus on control issues
- First commisioning steps done
- Station design is running