

Decentralized feed-in of solar heat into district heating networks – a technical analysis of realized plants

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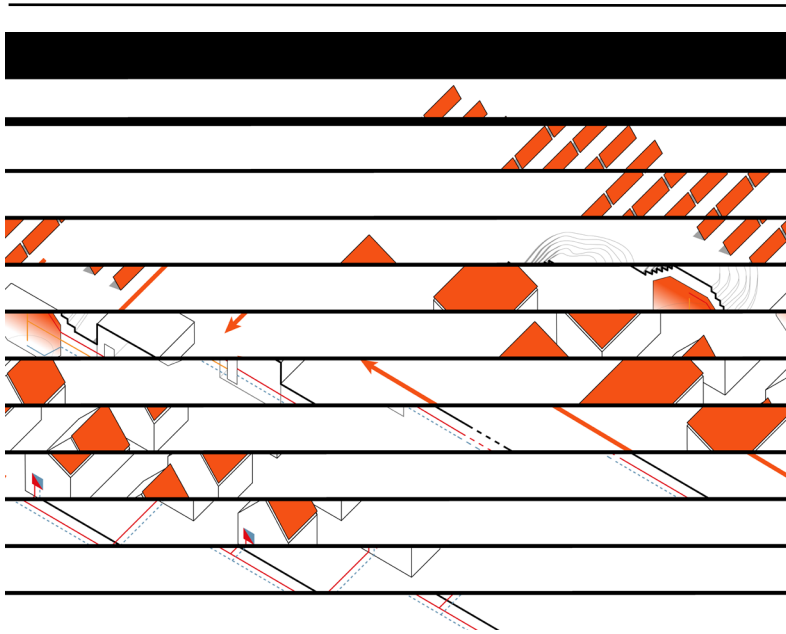
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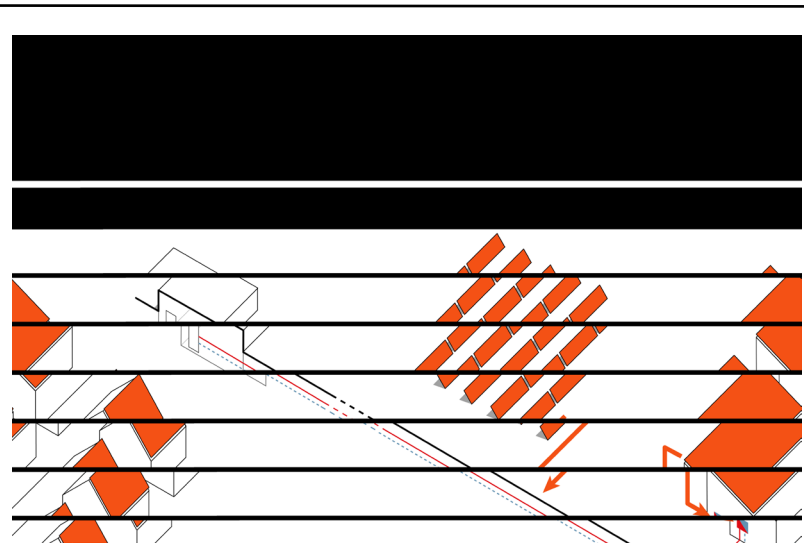


Fundamentals - location of integration from solar heat plants

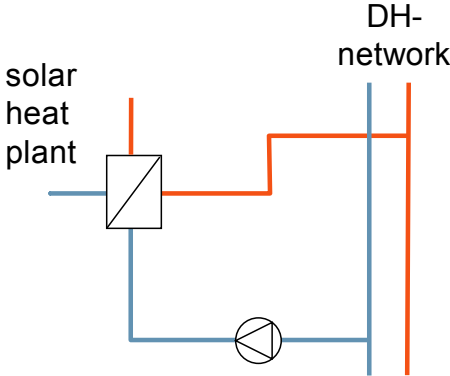
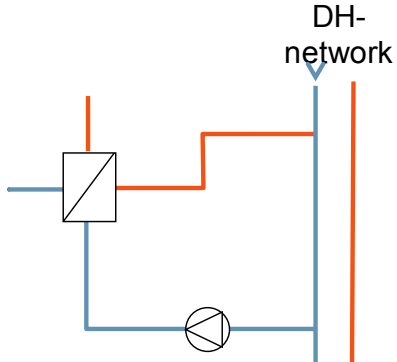
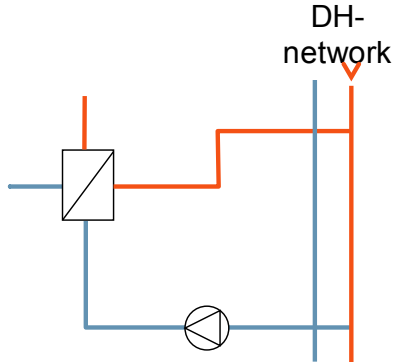
centralized integration
(schematic illustration)



decentralized integration
(schematic illustration)



Fundamentals – variants of decentralized feed-in

feed-in	RF/SF	RF/RF	SF/SF
schematic illustration			
temperature difference	high	low	low
pressure difference	high	low	low
solar system gain	medium	high	low

Overview of realized plants



Sweden

number of plants: 22

collector area: 42 – 1.128 m²

Denmark

number of plants : 4

collector area : 315 – 798 m²

Germany

number of plants : 3

collector area : 114 – 240 m²

Austria

number of plants : 4

collector area : 1.420 – 3.855 m²

general

specific solar system gains (aperture area): 300 – 450 kWh/(m²a)

Comparative analyses – feed-in variants and ownership structure

feed-in variants:

- RF/SF-feed-in: 30 plants
- RF/RF-feed-in: 2 plants
- SF/SF-feed-in: 0 plants

Comparative analyses – feed-in variants and ownership structure

feed-in variants:

- RF/SF-feed-in: 30 plants
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- SF/SF-feed-in: 0 plants

ownership structure:

no contractor			contractor
network operator	network operator	network operator	network operator
=	≠	=	≠
solar plant owner	solar plant owner	solar plant owner	solar plant owner
=	=	≠	≠
land owner	land owner	land owner	land owner

Comparative analyses – utilization concepts

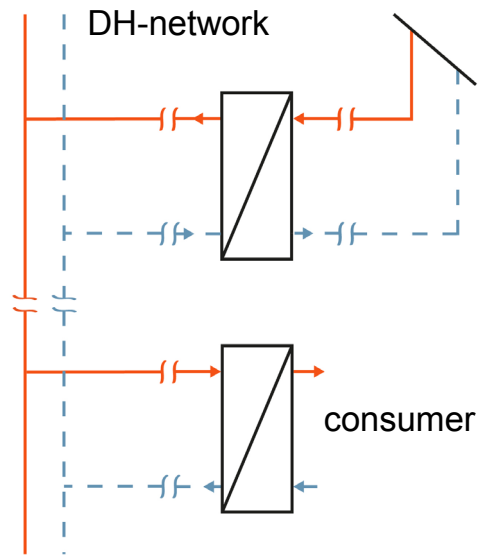
two utilization concepts:

- a) feed-in of complete solar heat gains; 29 plants
- b) feed-in of surplus solar heat gains; 2 plants

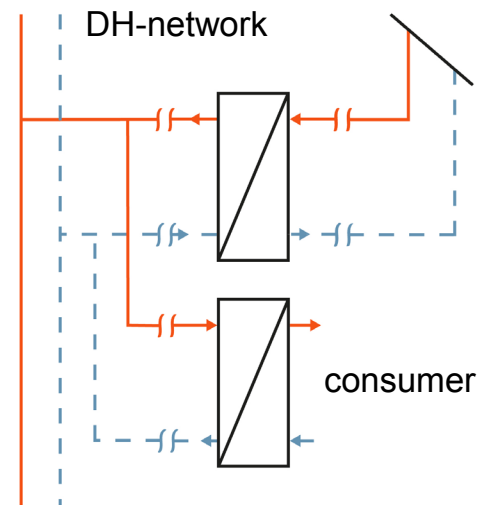
Comparative analyses – utilization concepts

two utilization concepts:

- a) feed-in of complete solar heat gains; 29 plants
- b) feed-in of surplus solar heat gains; 2 plants



- additional stub pipe necessary
- + stub pipe adjust to solar heat input



- possible limitation of the solar heat input due to existing stub pipe
- + no additional stub pipe necessary

Comparative analyses – system concept

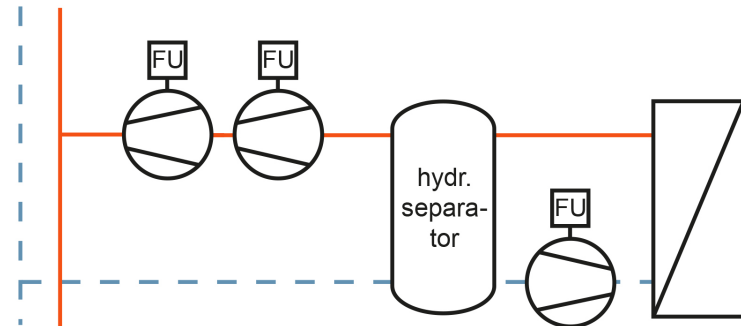
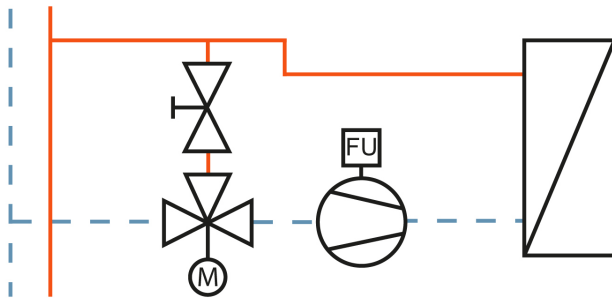
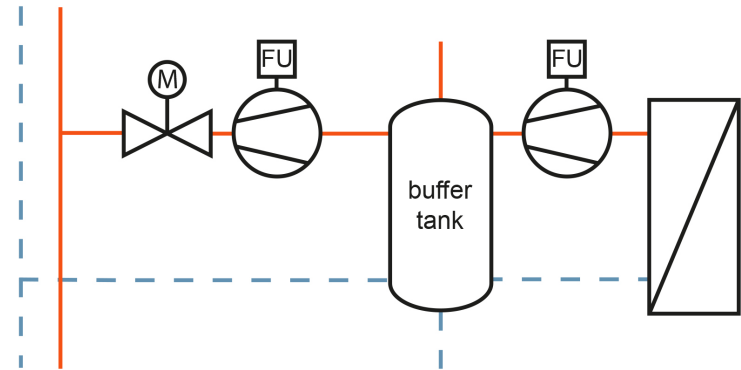
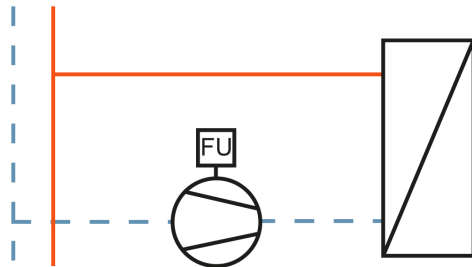
Difference of system concepts

- 9 different technical solutions for the hydraulic integration
- 2 ways to affect the control operation

Comparative analyses – system concept

Differenc of system concepts

- 9 different technical solutions for the hydraulic integration
- 2 ways to affect the control operation



FU: frequency converter; M: control valve

Conclusion

- in total 31 solar heat plants with decentralized integration into DH-networks analyzed
- more then half of the plants are located in Sweden
- predominance of RF/SF-feed-in **without** direct local use of solar gains
- wide range of different technical solutions for the hydraulic integration

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