Analysis of Austrian SDH plants constructed in the framework of a national funding programme

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Outline

1) Status quo of the Austrian district heating sector and future prospects for SDH

2) Introduction to the Austrian funding programme for large-scale solar thermal plants

3) Presentation of selected SDH plants constructed in the framework of the funding programme

Summary and outlook

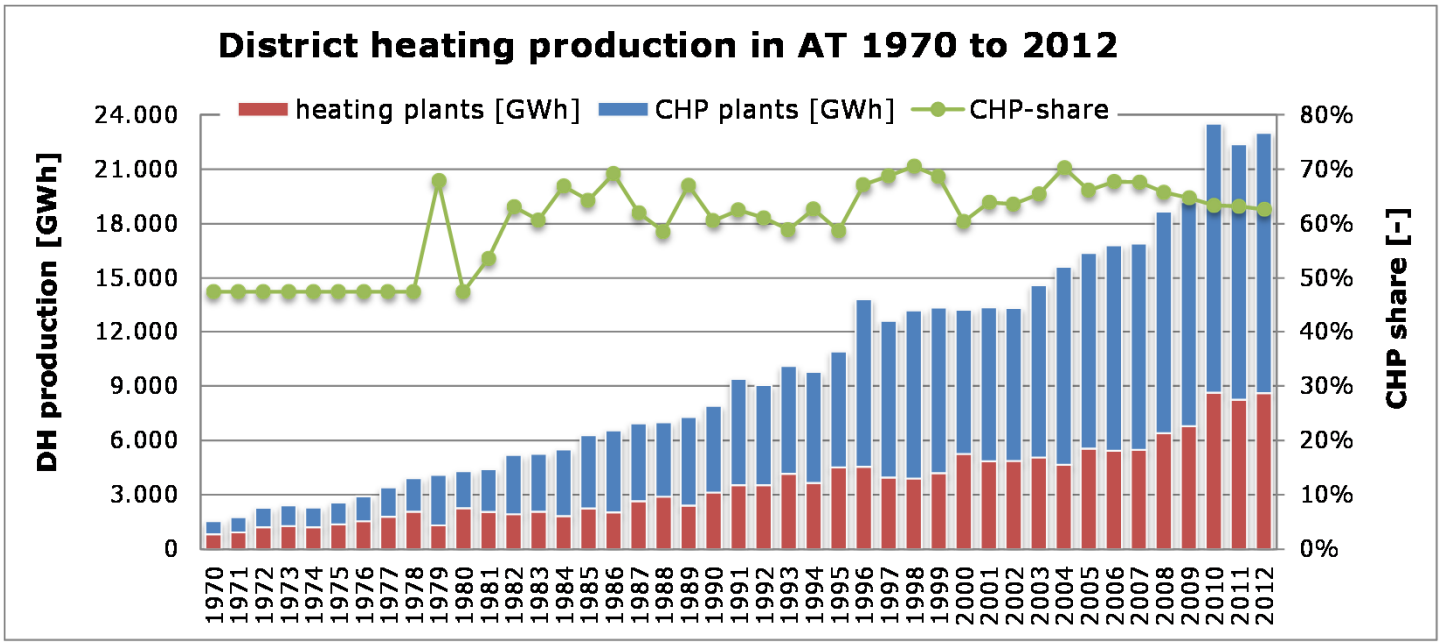
District heating in Austria

First DH in urban areas from 1950 (Wels, Klagenfurt, Salzburg), Graz (1963), Wien (1969), Linz (1970)

Market share on building thermal energy supply: 25%

DH production 2012: 23 TWh

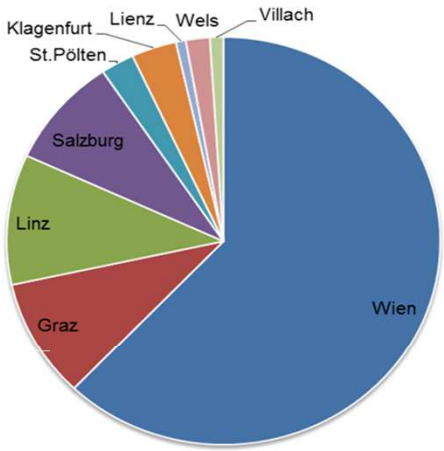
CHP share: 63% (especially high in dense urban areas)



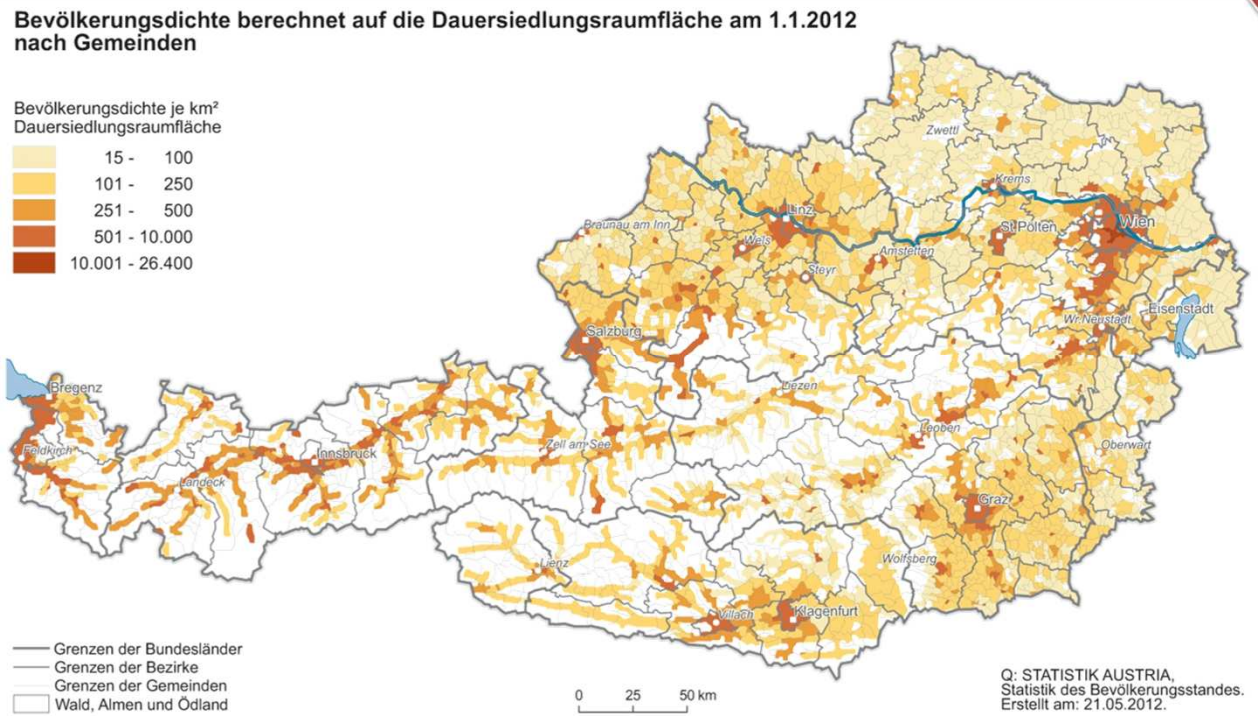
Data source: Statistik Austria 2013

District heating in Austria

~ 55% of the DH market in the 9 largest Austrian cities



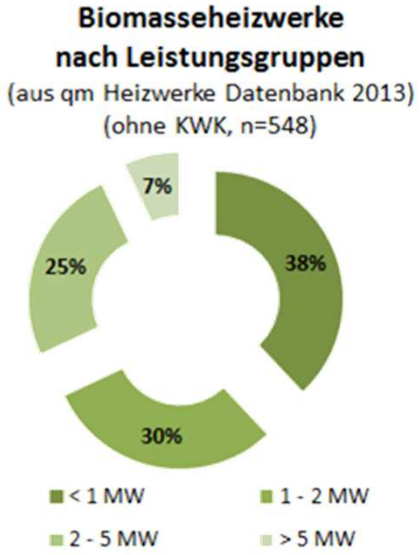
High share of N-gas CHP in urban district heating

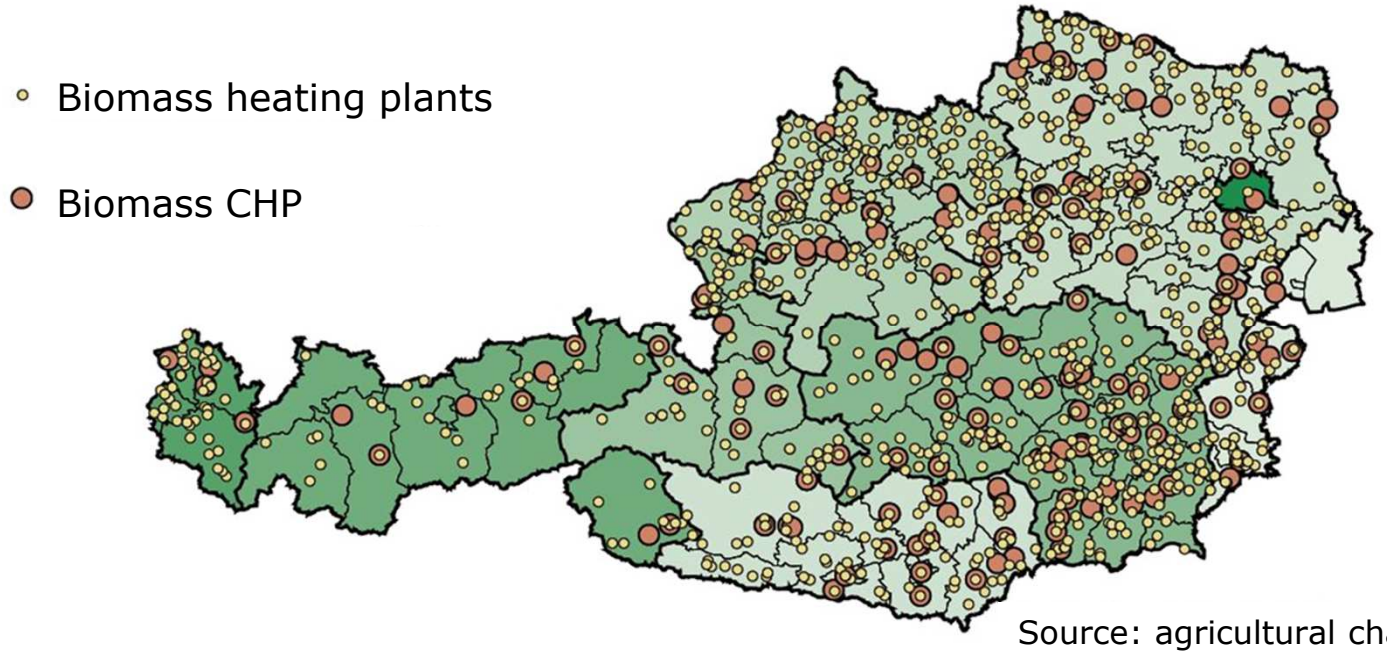


District heating in Austria

~ 45% of the DH market in small cities and municipalities, mainly based on biomass

1,400 biomass heating plants and CHP's >400kW$_{th}$





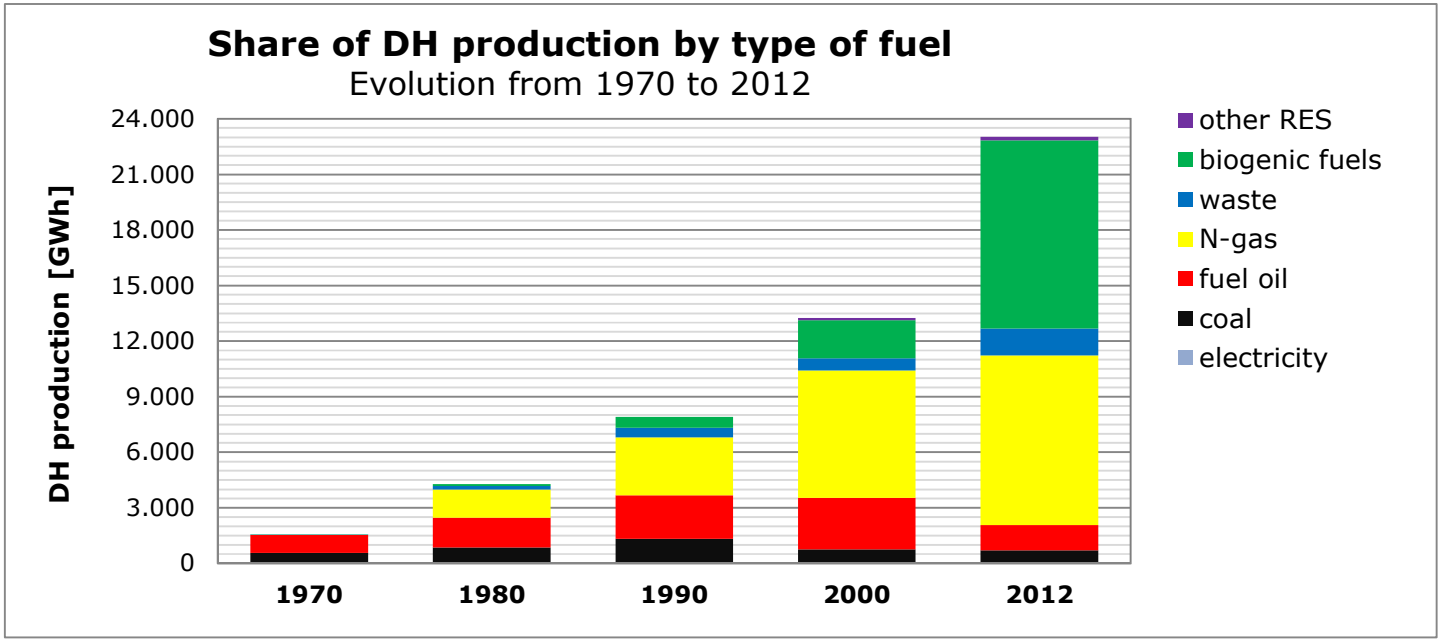
Source: agricultural chamber of Lower Austria

District heating in Austria

Dynamic development regarding fuels used for DH (oil/coal → natural gas → biomass and other RES)

DH production 2012: 45% from RES (mainly biomass)

CHP share in RES DH production: around 50%



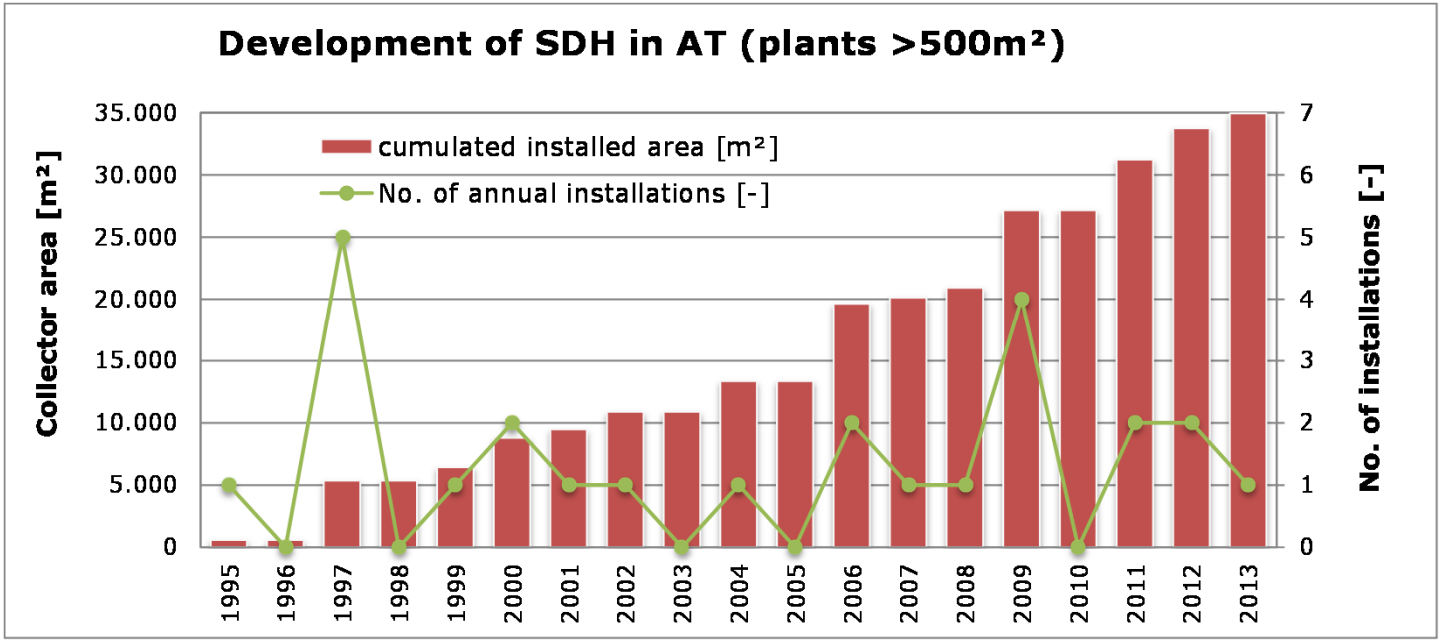
Data source: Statistik Austria 2013

Solar District heating in Austria

2013: 25 SDH plants >500m² (35,000m² / 24.5 MWth)

Three major categories:

- solar assisted biomass heating networks (first plants in the 1990's)
- distributed SDH plants connected to urban DH networks (from 2002)
- solar assisted local heating grids (micro-grids) in urban environments



Data source: Jan-Olof Dalenbäck / Chalmers University of Technology, 2013 and own survey

District heating in Austria

Future prospects / challenges for SDH in Austria

Changes in consumer load profiles due to increasing thermal building quality and climate change

- Without a densification of the supply area the ratio of heat output to network length in MWh/km (heat occupancy) decreases continuously
- Proportion of the energy demand for domestic hot water supply in the total thermal energy demand is increasing
- Without technological adaptations distribution losses in heating networks increase relative to the amount of heat sold

Increasing interaction between the electricity and heat sectors

- Market mechanisms (liberalized electricity market) will increasingly influence the (economic) operation of electricity and combined heat and power generation technologies
- Further transformation of the energy system to fluctuating renewable energy sources will demand for new “flexibilities” within the system
- Measures for load shifting, storage, energy conversion (P2H, P2G) and ICT ("smart grids") will become increasingly important

Austrian funding programme

Funding programme for commercial ST applications of between 100 and 2.000m², covering 5 categories:

1) Solar process heat
2) **Solar district heating**
3) Solar combi systems with >20% solar fraction
4) Solar cooling applications
5) *Since 2013: new category "special developments"*

Funding amounts for up to 50% of the extra costs caused by a ST system compared to a reference oil based system

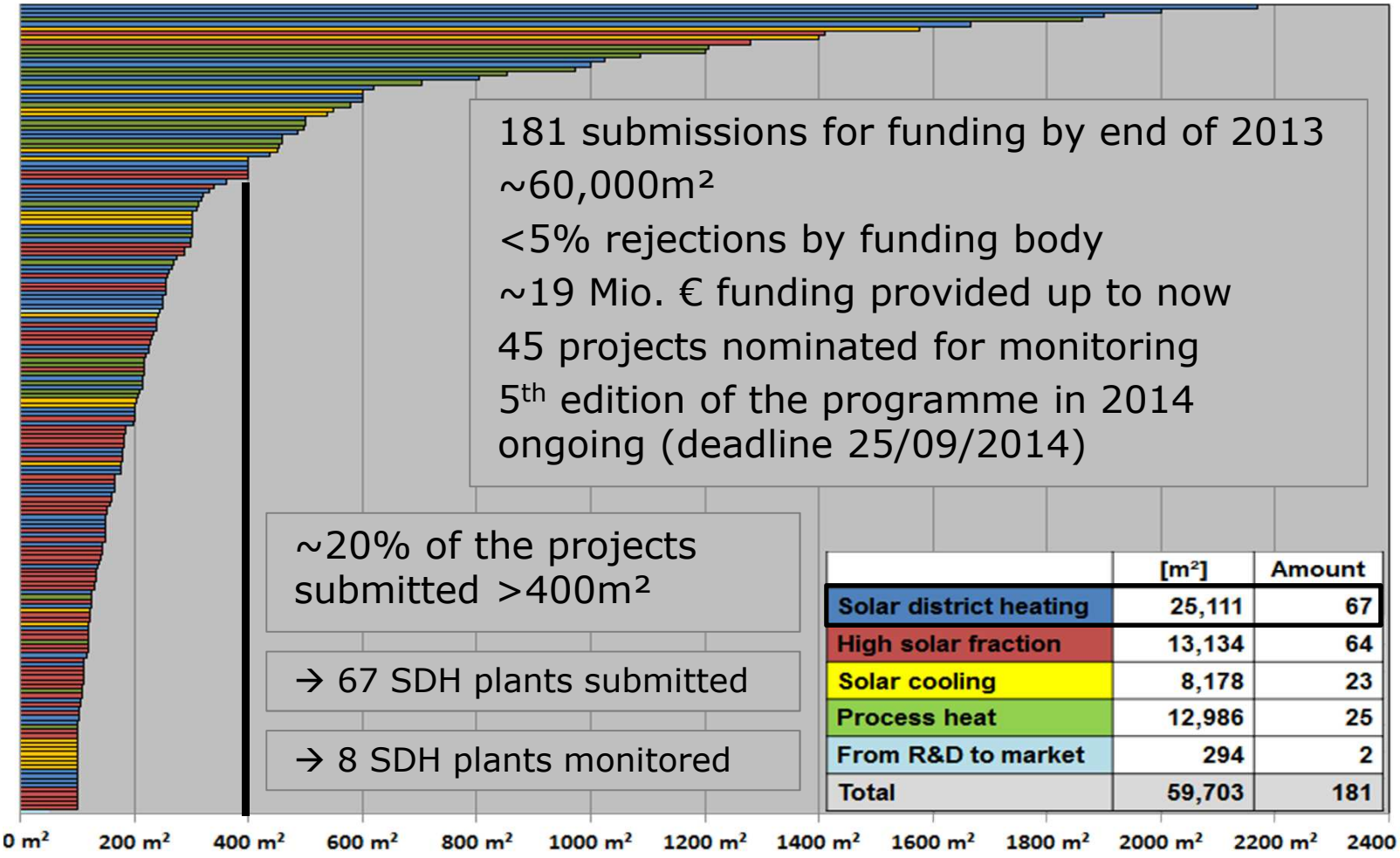
Applicants have to take advantage from a scientific project support by AEE INTEC (project lead), AIT or ASIC

→ Mandatory scientific consultancy beforehand for all applicants

→ 12 months monitoring of selected projects with high market relevance (replicability) and/or high level of innovation

Austrian funding programme

Achievements 2010 – 2013 (4 years)



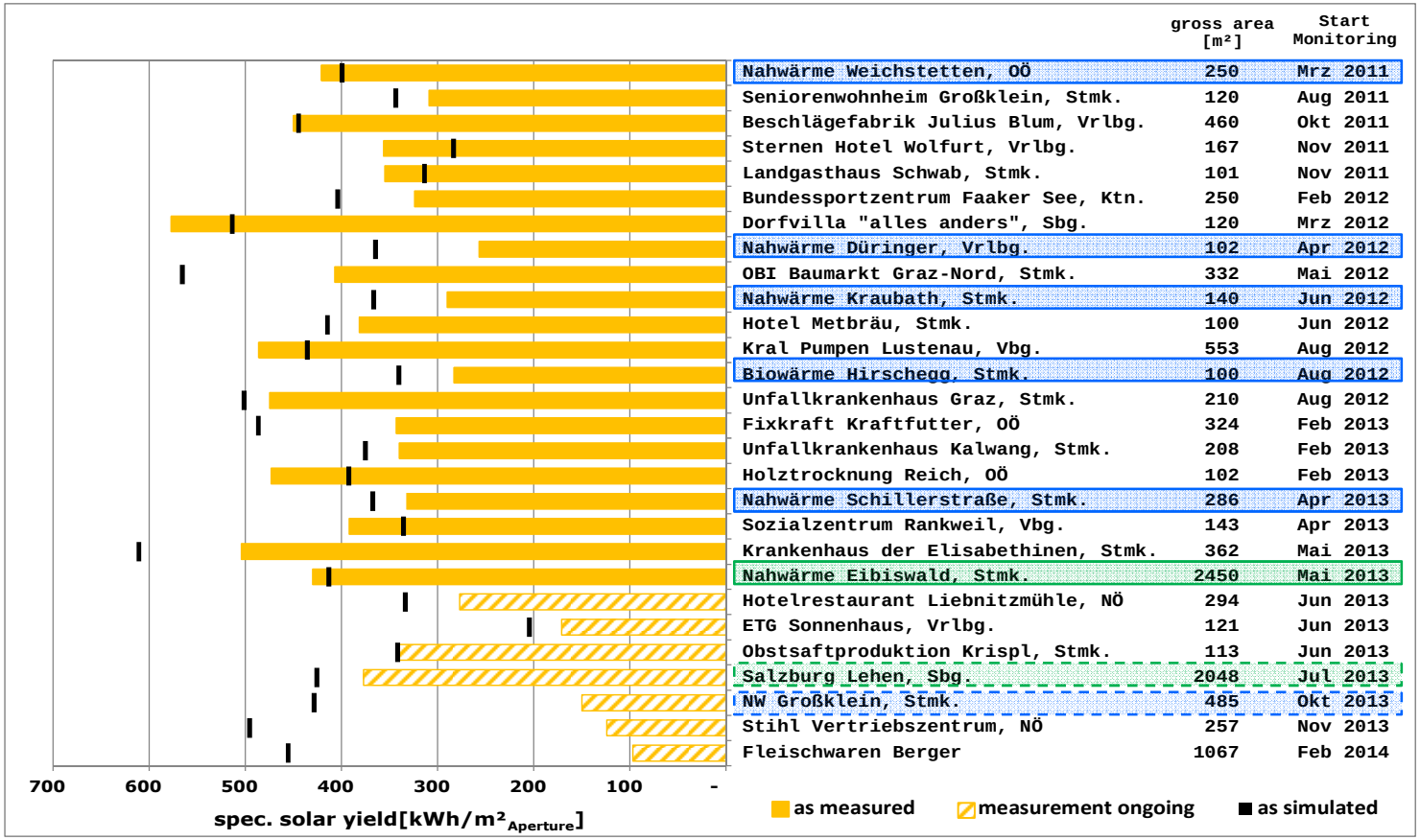
	[m²]	Amount
Solar district heating	25,111	67
High solar fraction	13,134	64
Solar cooling	8,178	23
Process heat	12,986	25
From R&D to market	294	2
Total	59,703	181

Austrian funding programme

45 projects nominated for monitoring (by end of May 2014)

Monitoring completed: 21 projects (6 SDH plants)

Monitoring ongoing (dashed bars): 7 projects (2 SDH plants)



Austrian funding programme

Example Eibiswald: Solar assisted biomass heating network

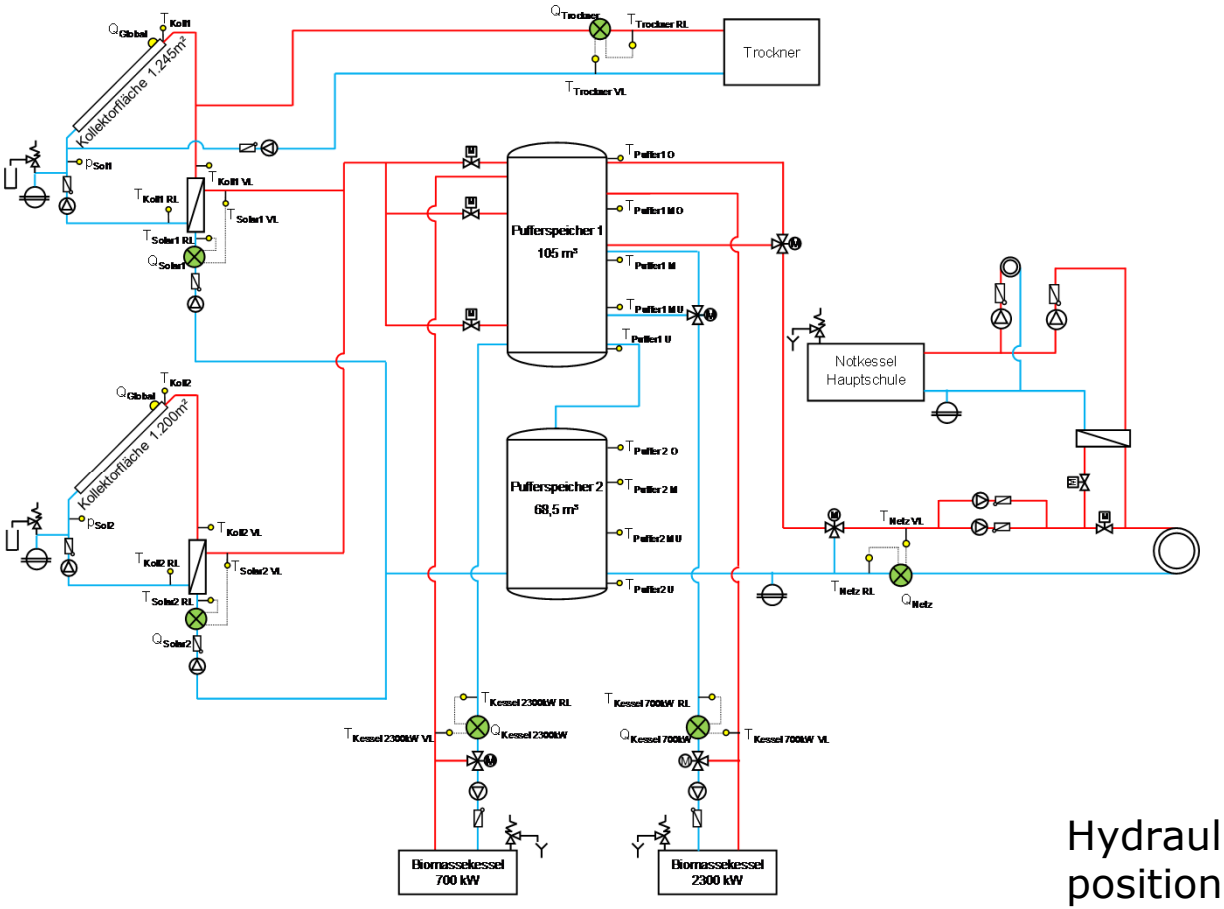
Network peak load: 4 MWth / Network length: 9,800m

2,400m²$_{gross}$ flat plate collector field (1997: 1,250m² / 2012: 1,150m²)
173.5 m³ energy storage (1997: 105m³ / 2012: 68.5m³)
Auxiliary heating: 2 biomass boilers (2.3+0.7 MW) + 1 oil boiler reserve
DH supply temperatures: 95/60 (winter), 70/50 (summer)

Monitoring: 05/2013 – 05/2014

Austrian funding programme

Example Eibiswald: Solar assisted biomass heating network

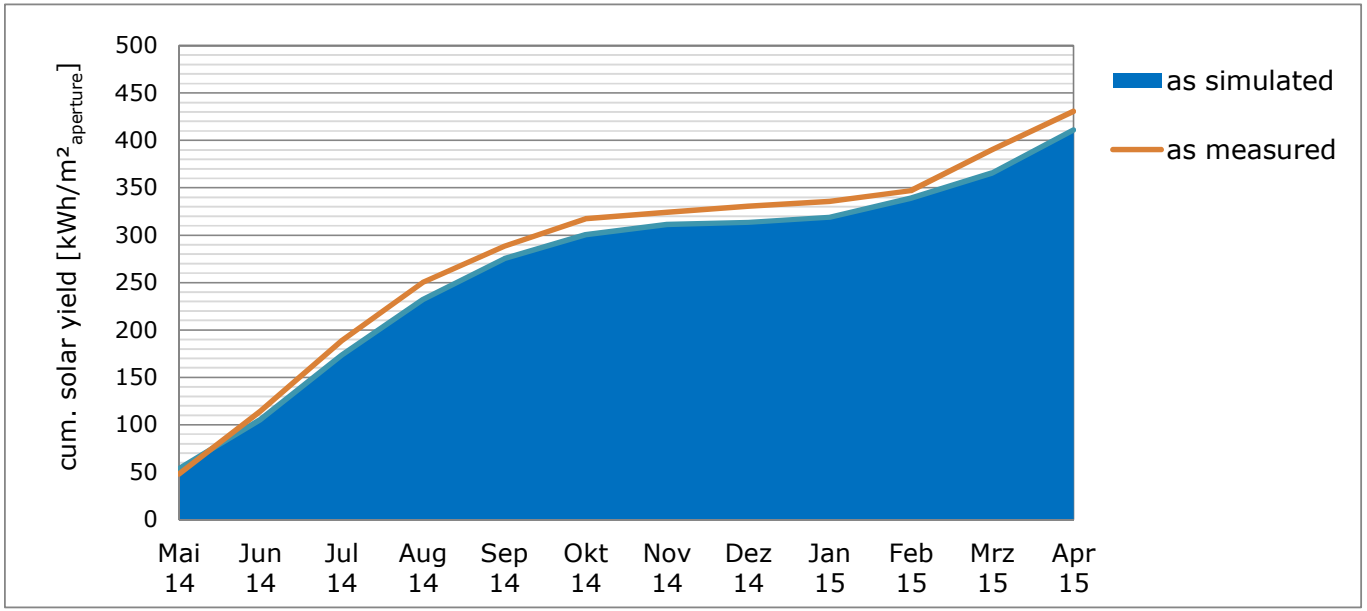


Hydraulic scheme including positioning of sensors for monitoring (AEE INTEC)

Austrian funding programme

Example Eibiswald: Solar assisted biomass heating network

District heating supply: 7,642 MWh/a (as measured)
Solar energy yield: 966 MWh/a* (as measured)
Solar fraction: 13%
Investment costs: 326 k€ (1,150m² ST plant + 68.5m³ storage)
→ specific costs: 283 €/m^2_{gross}

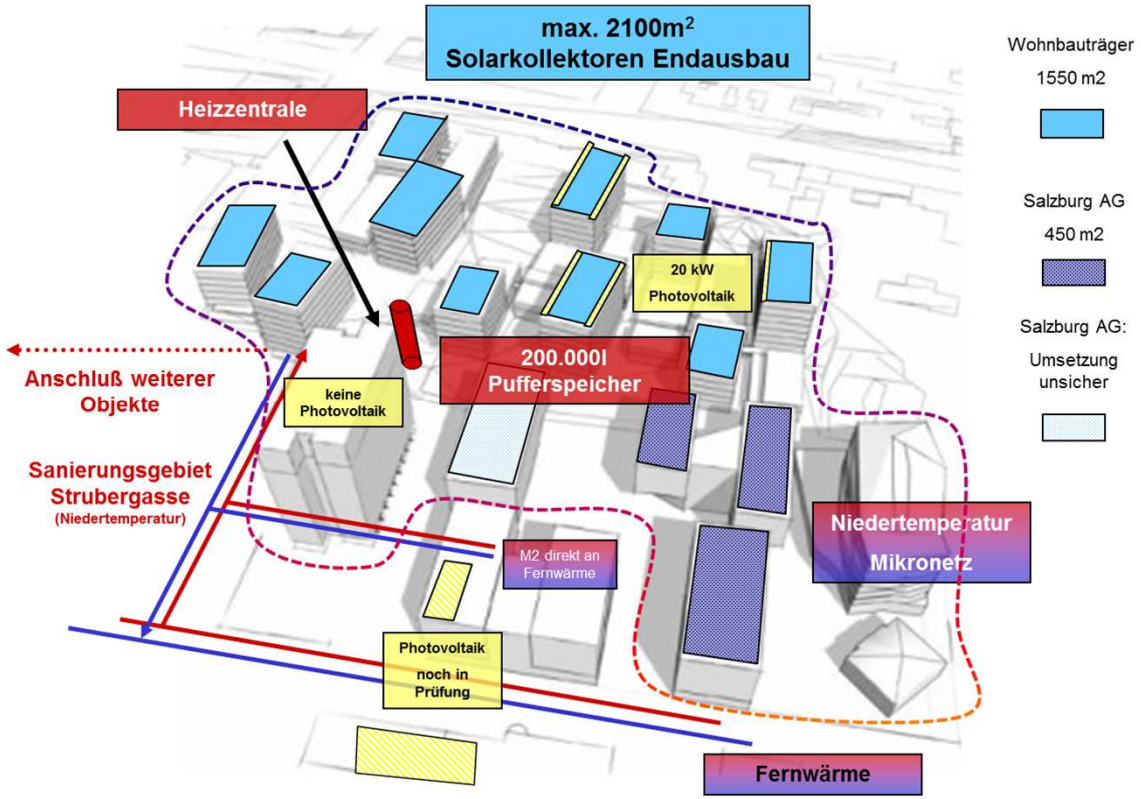


* corresponds to a specific solar yield of 394 kWh/(m^2_{gross}·a) resp. 430 kWh/($m^2_{aperture}$·a)

Austrian funding programme

Example Salzburg-Lehen: Low-temperature SDH grid

Solar thermal system connected to a low-temperature heating network supplying around 68,000m² of heated floor area



Salzburg AG

Austrian funding programme

Example Salzburg-Lehen: Low-temperature SDH grid

Solar thermal system connected to a low-temperature heating network supplying around 68,000m² of heated floor area

2,048m^2_{gross} flat plate collector field (mounted on 13 separate roofs)

200 m³ energy storage

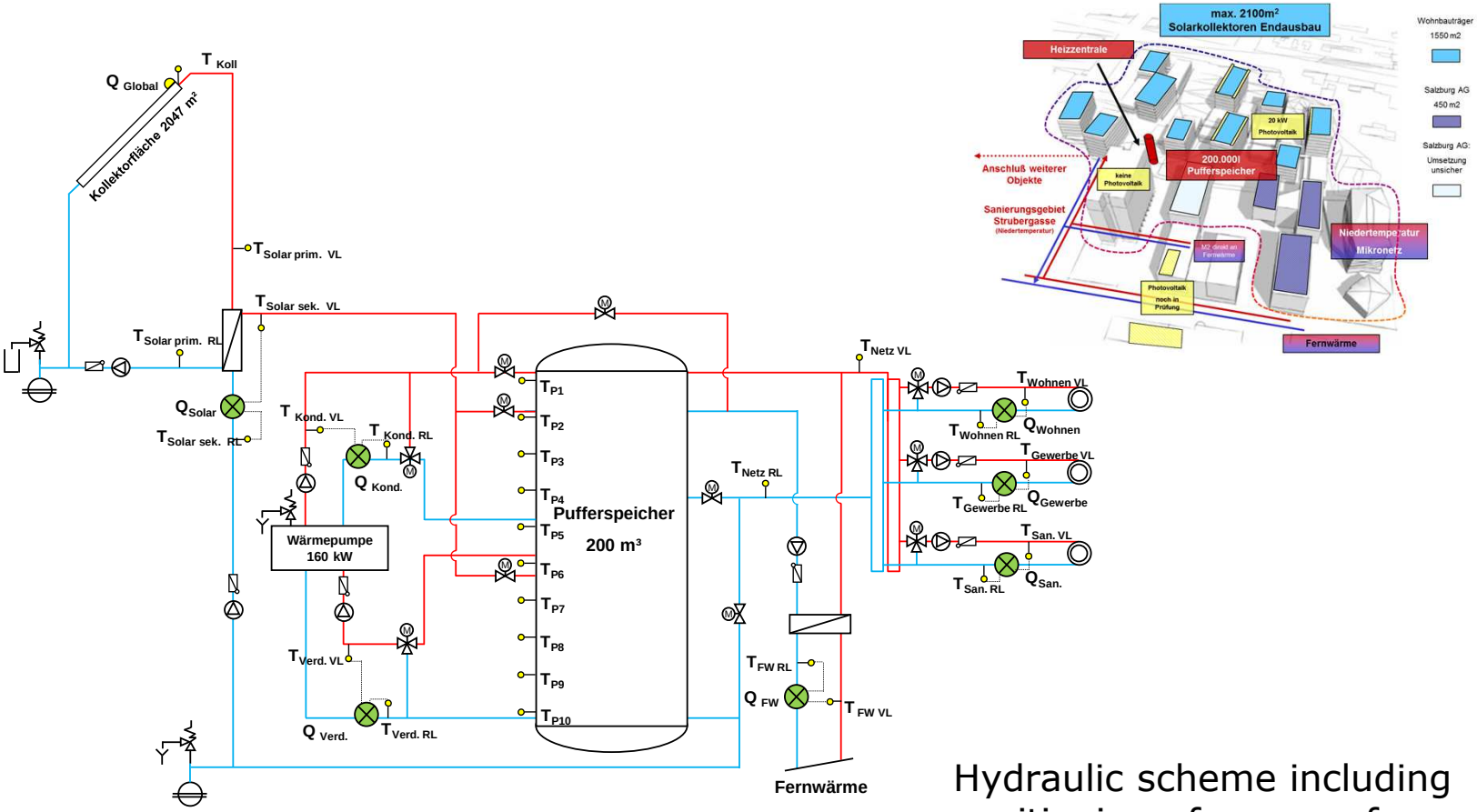
Auxiliary heating: storage integrated HP (160 kW_{th}) + district heating

DH supply temperatures: 65/35

Monitoring: 07/2013 – 06/2014

Austrian funding programme

Example Salzburg-Lehen: Low-temperature SDH grid

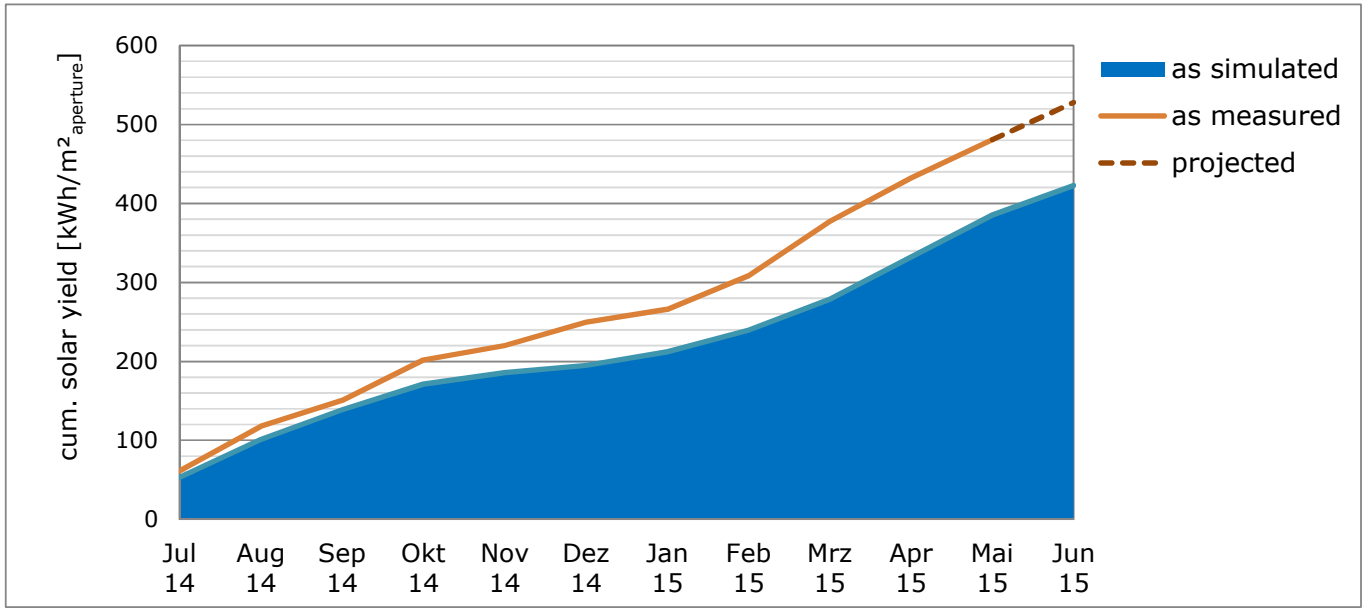


Hydraulic scheme including positioning of sensors for monitoring (AEE INTEC)

Austrian funding programme

Example Salzburg-Lehen: Low-temperature SDH grid

District heating supply: 3,893 MWh/a (as measured)
Solar energy yield: 979 MWh/a* (as measured)
Solar fraction: 25%
Investment costs: 850 k€ (ST plant + storage + control)
→ specific costs: 415 €/m²$_{gross}$



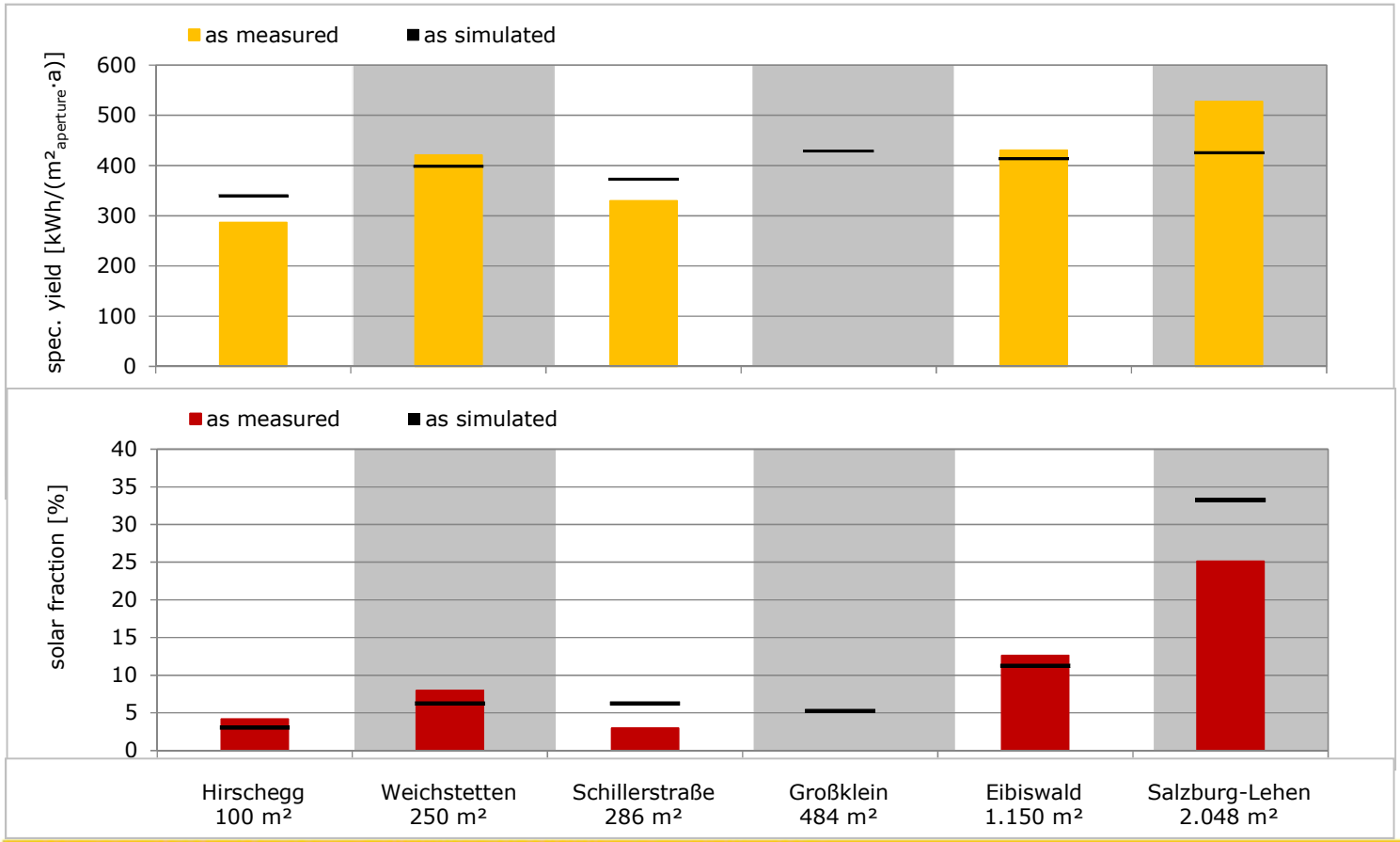
* corresponds to a specific yield of 478 kWh/(m²$_{gross}$·a) resp. 528 kWh/(m²$_{aperture}$·a)

Austrian funding programme

Summary of results (6 Austrian SDH plants)

spec. solar yield (as measured): 287 – 528 kWh/($m^2_{aperture}$·a)

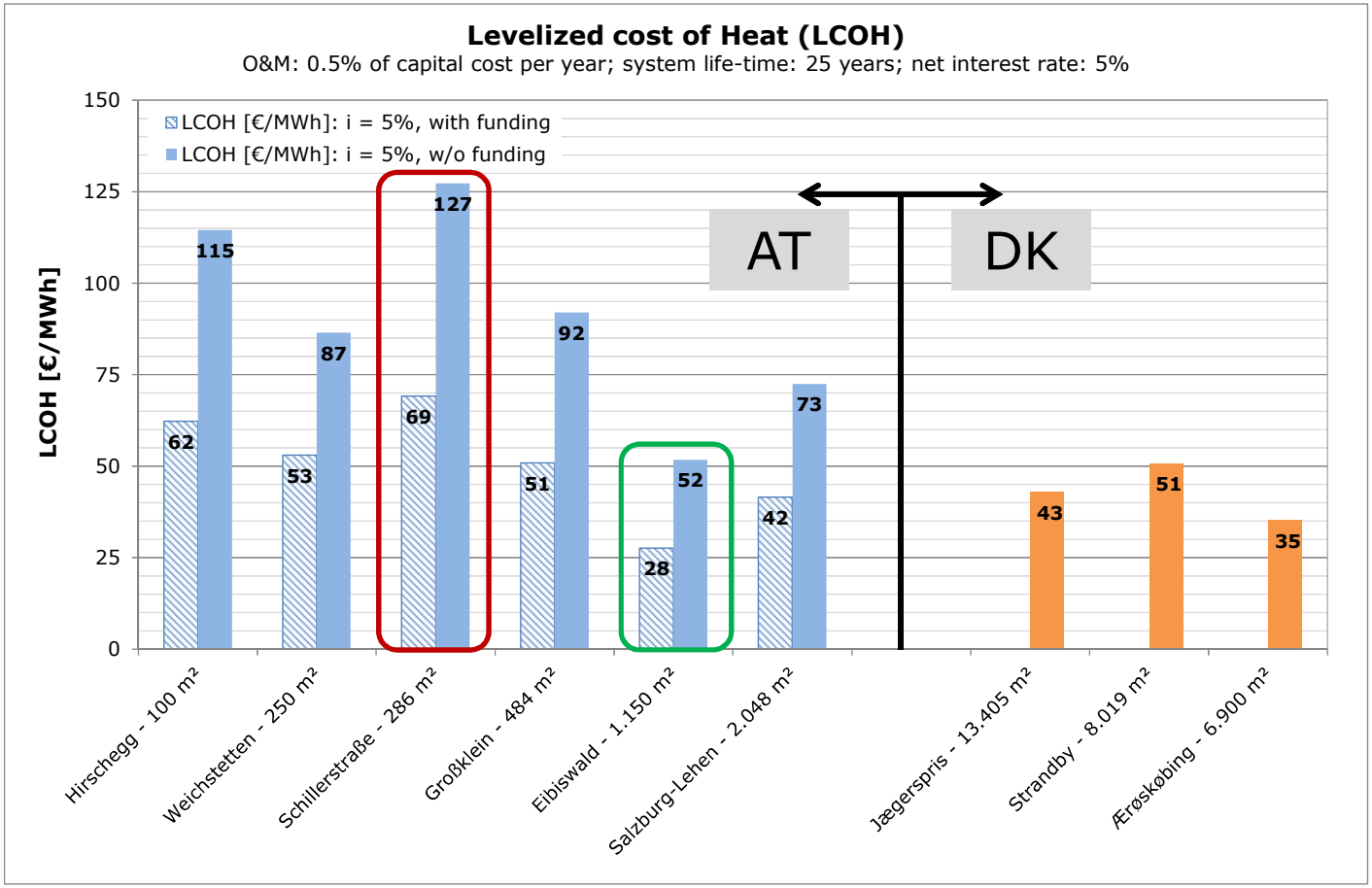
solar fraction (as measured): 3-25%



Austrian funding programme

Summary of results (6 Austrian + 3 Danish SDH plants)

spec. solar thermal system costs AT (n=6): **283** – **657** €/m²$_{gross}$



Summary and outlook

Large potential for SDH in Austria – especially in urban, sub-urban and municipal areas with existing district heating infrastructure

The Austrian funding programme is well accepted and brought a considerable market momentum for commercial large scale ST applications

Today, solar district heating in Austria is a technologically advanced niche market but demands funding in order to be competitive with conventional supply technologies

Potentials for cost reductions need to be further exploited (e.g. standardization) and new/adapted business models need to be established (e.g. consumer co-operatives, ESCO's, Crowd-Investing…)

Summary and outlook

The role of solar thermal heat in urban environments need to be investigated in a holistic context → Future changes in the whole energy system and their implications need to be considered!

IEA SHC Task 52 "SolarUrban"

Task 52
Solar Heat and Energy Economics in Urban Environments

Operating Agent: Fraunhofer ISE (Sebastian Herkel)
Duration: 01/2014 – 03/2018
Link: http://task52.iea-shc.org/

Subtask A: Energy Scenarios (AAU, DK)
Subtask B: Methodology, Tools, Case Studies (Sorane SA, CH)
Subtask C: Technology and Demonstrators (AEE INTEC, AT)

Thank you for your attention!

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