BIG Solar Graz

A new dimension of solar supply for big city DH

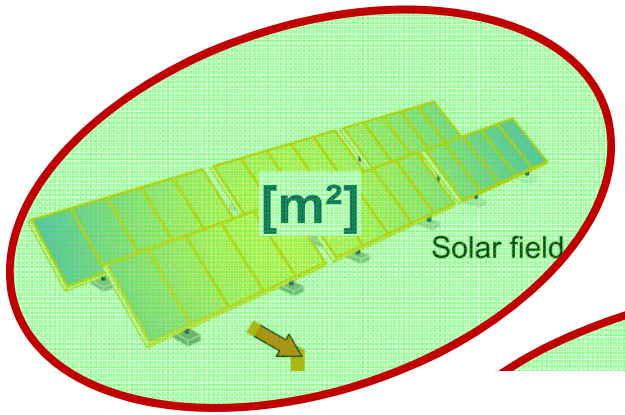
Solar Heating
Solar Cooling
Solar Process Heat
Solar District Heating

SOLID
solarinstallation+design

25 YEARS OF EXPERIENCE IN LARGE SOLAR THERMAL SYSTEMS

220 PLANTS IN 20 CONTRIES

What is this presentation about?



- second largest city of Austria
- 300.000 inhabitants

[Million m³]

[MW]

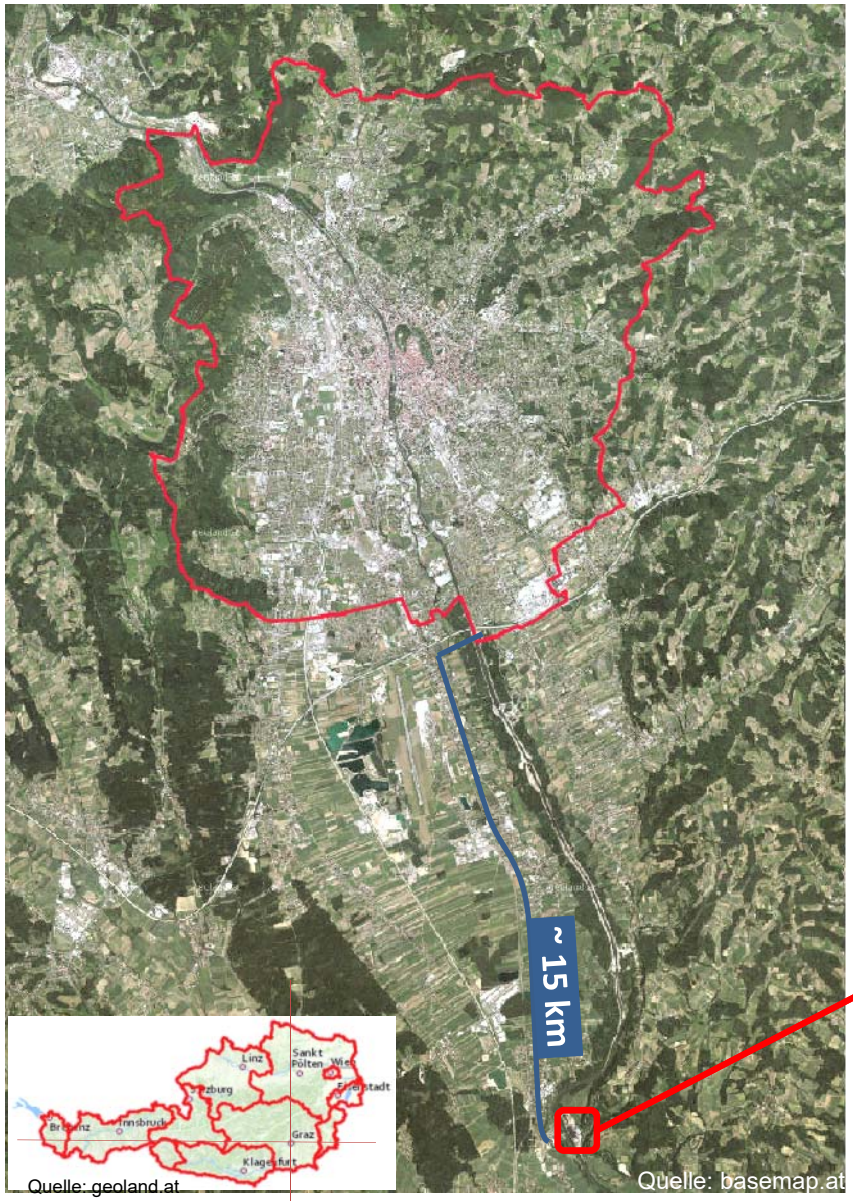
Outline …

1. Why do we need …
… solar energy?
… a seasonal pit storage?
… absorption heat pumps?

2. Dimensioning
→ Solar field
→ Storage Size
→ Heat pumps capacity

3. Sensitivity Analysis
+ Collector Eff.
+ Heat Pump Eff.
+ DH Temperatures

Why solar energy?



Actual situation:

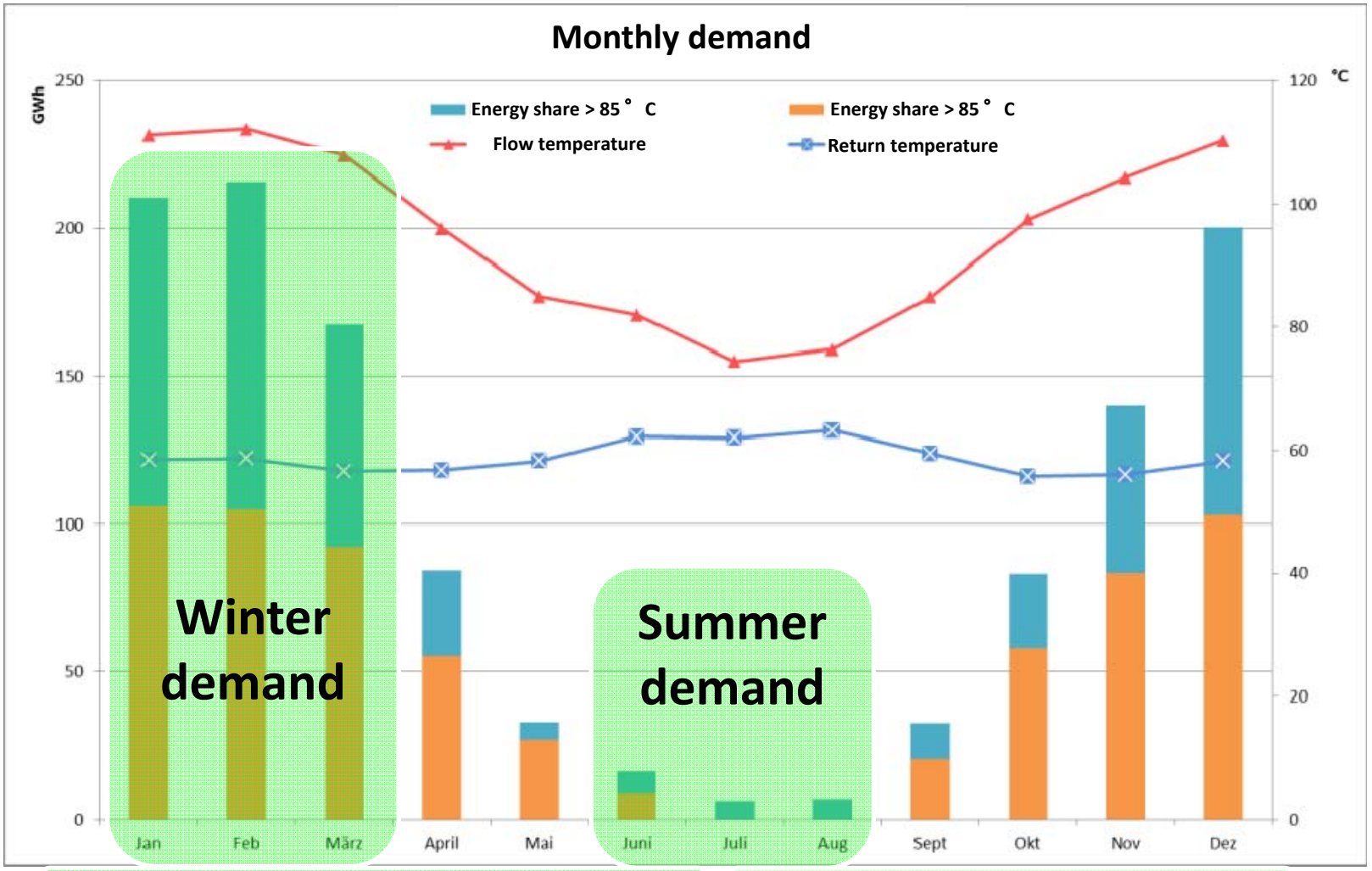
- Peak load: 530 MW
- DH demand: 1.200 GWh/a
- 86 % provided by CHP (gas)

Future situation:

- Delivery contract will end by 2020
- Approx. 400 MW necessary

→ **Sustainable reliable solution**

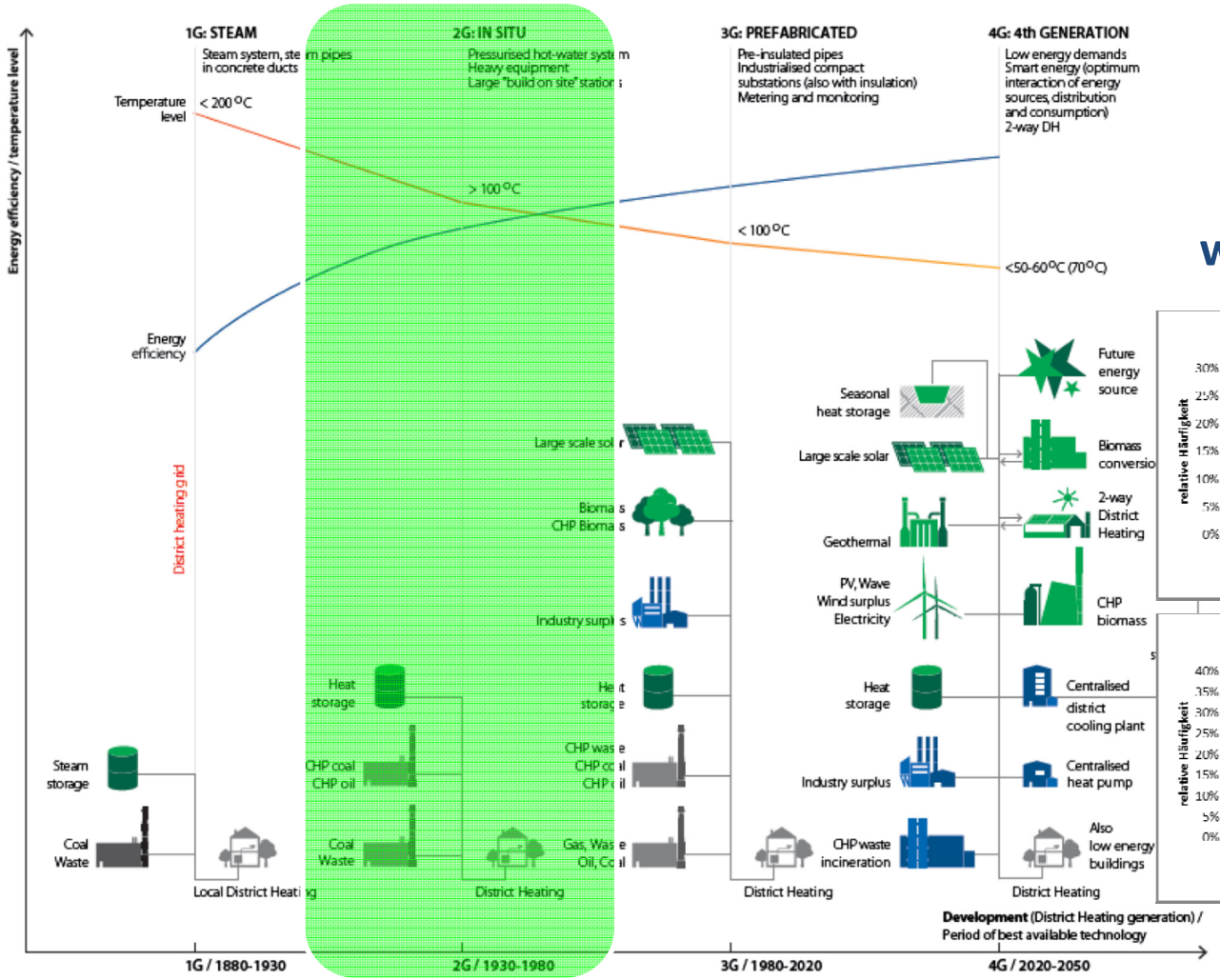
Why big seasonal storage?



Winter : Summer = 20:1

compared to DK → 5:1

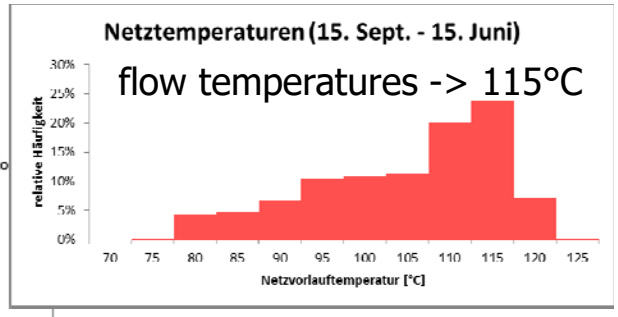
Why heat pumps?

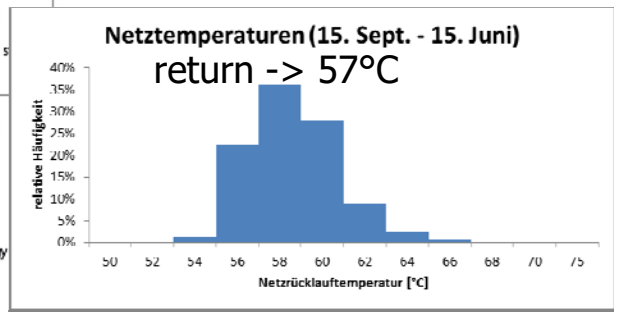


Source: Henrik Lund, 4th Generation District Heating (4GDH)

District heating network from the 60ies

with high temperatures:

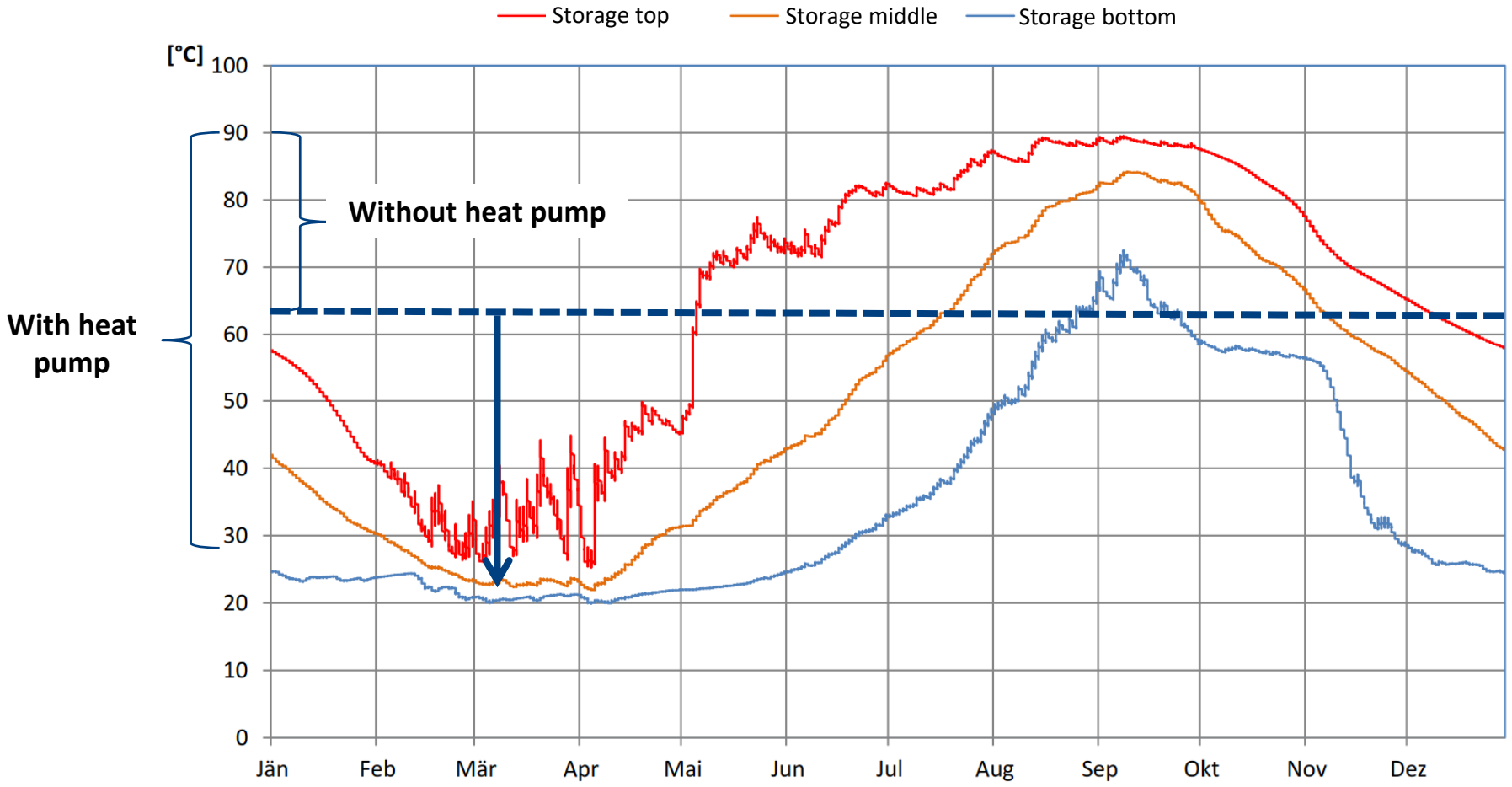




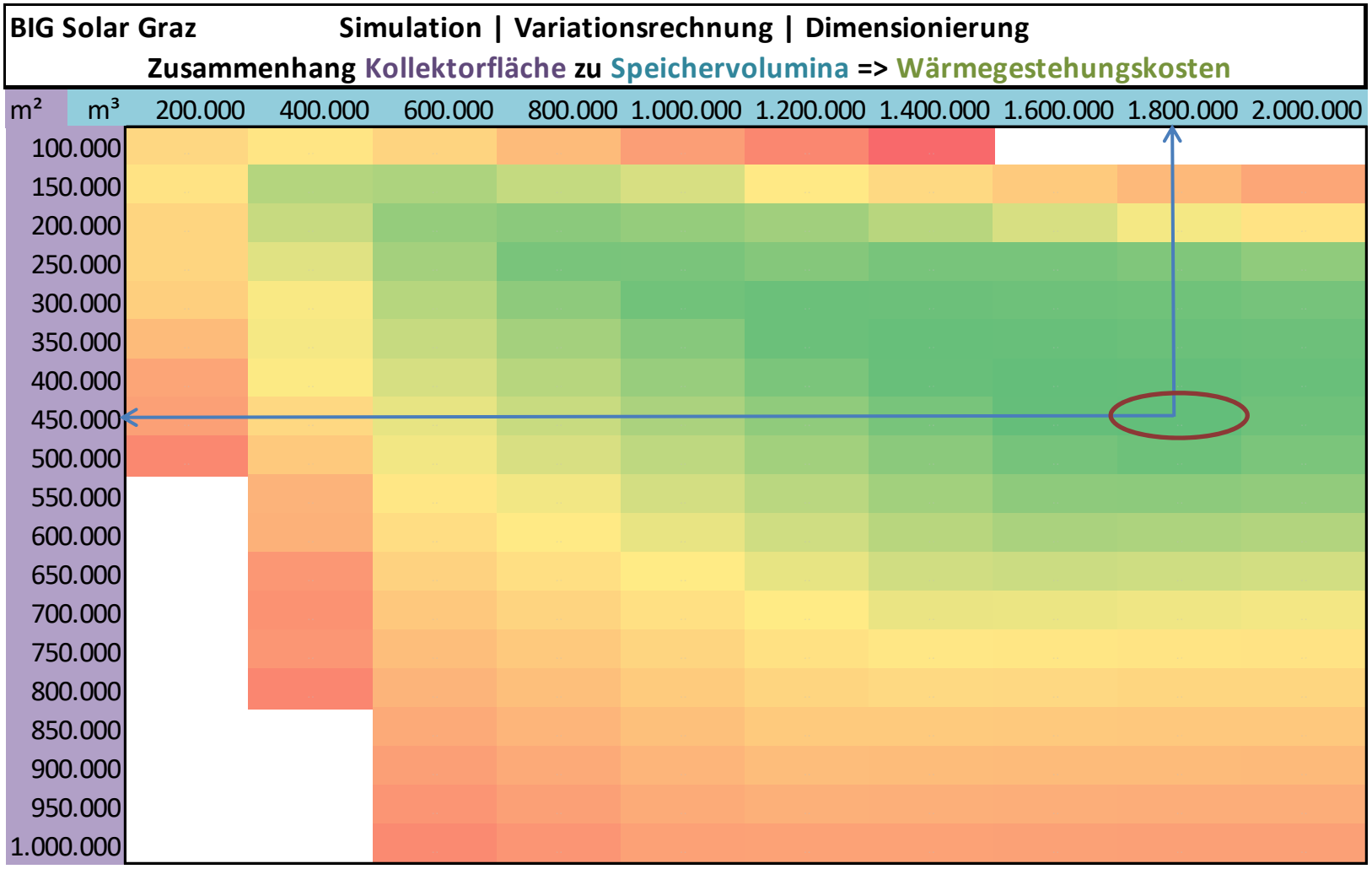
Why heat pumps?

Storage temperatures over the year

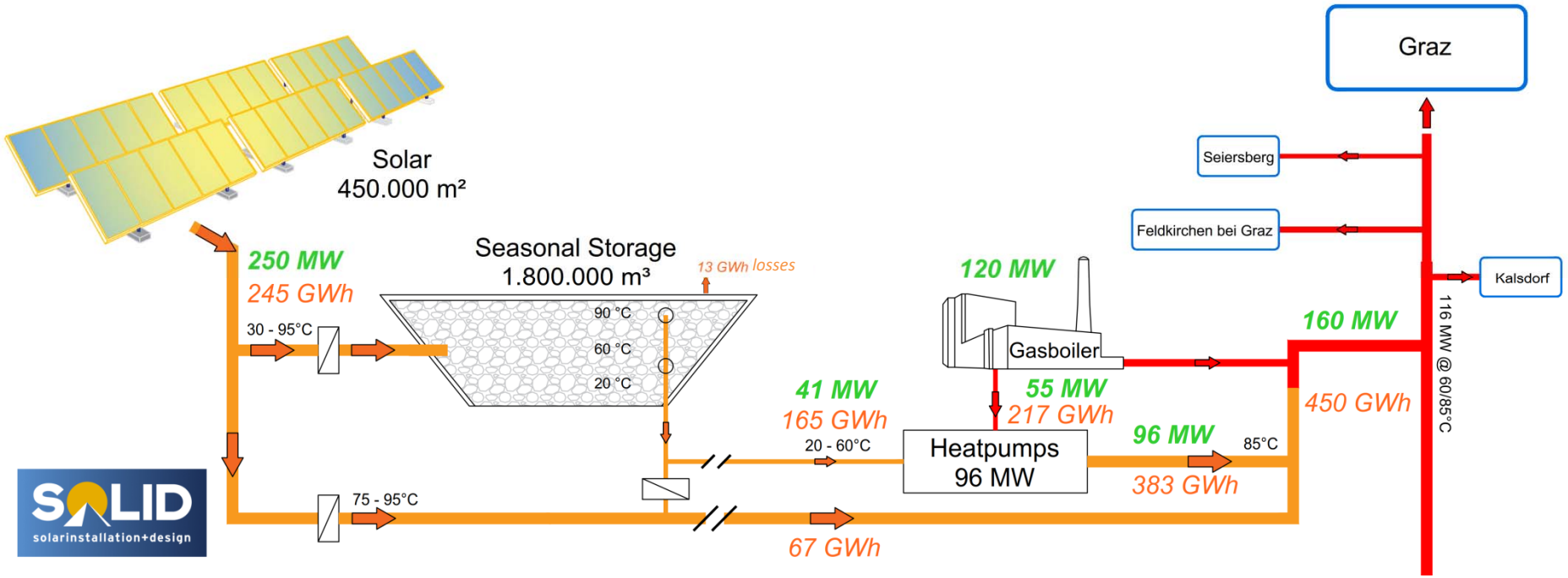
450.000 m², 1,8 Mio m³



Dimensioning



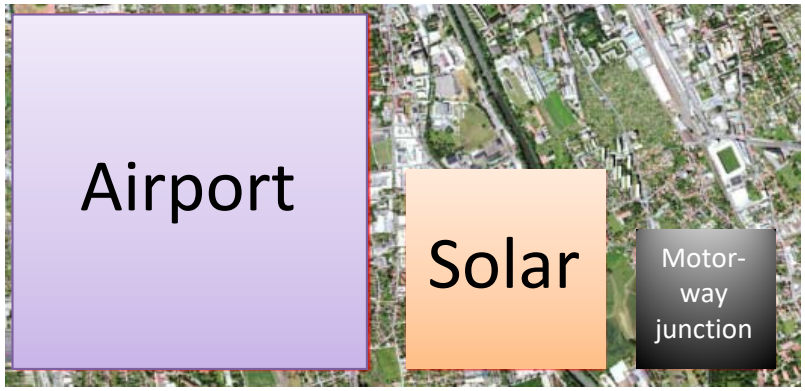
Specifications of Optimal Solution



Solar coverage: approx. 20 %

Total capital expenditures: approx. 200 Mio. EUR

Required Space



Required solar system area
< 0,8 % of the city area

Needed space for
fast growing biomass
for same energy ouput

factor of 30

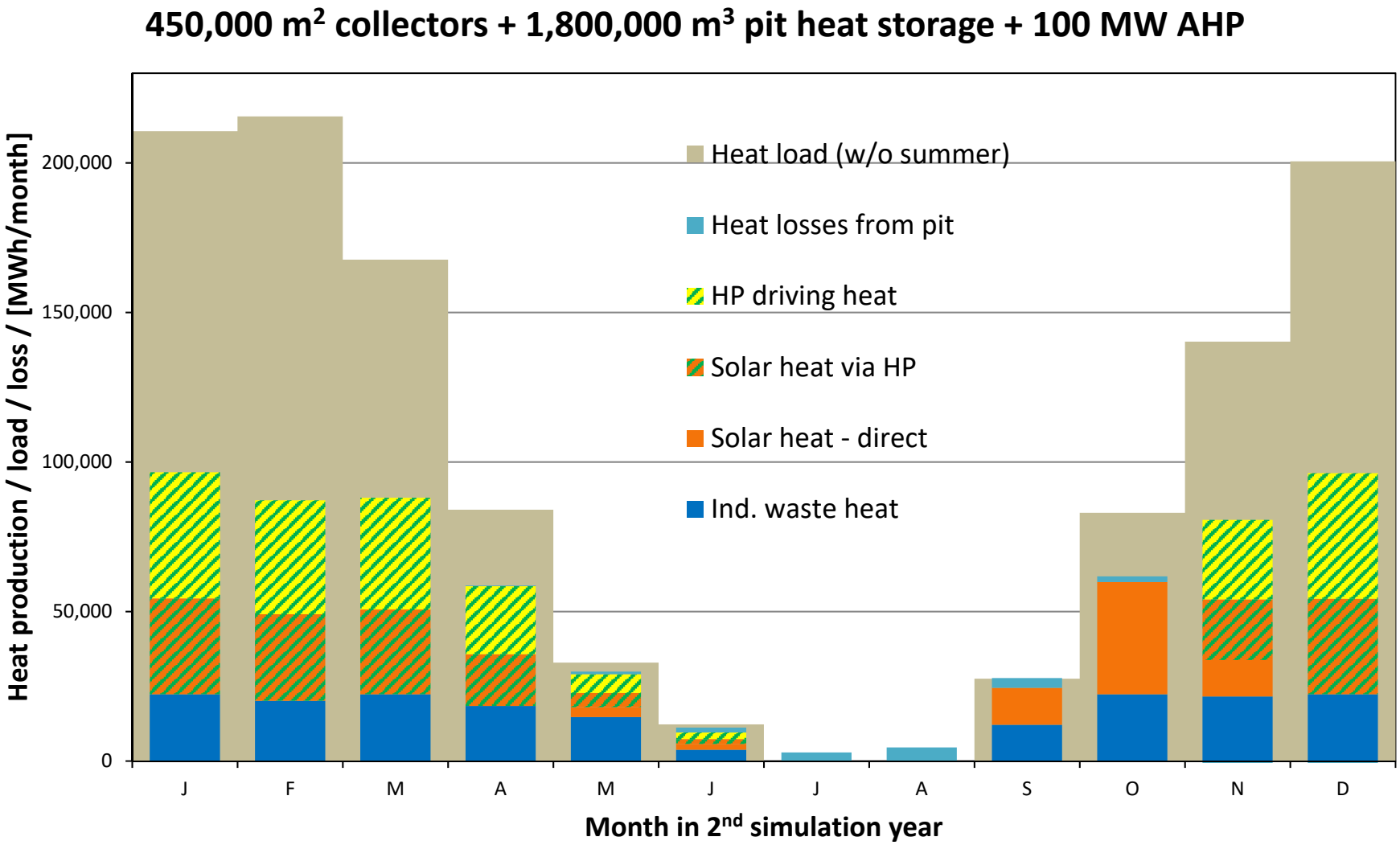
Comparison to other infrastructure areas in Graz

Big Solar concept	~ 100 ha
Airport Graz	~ 300 ha
Motorw. junc. Graz West	~ 40 ha
Generation plant Mellach	~ 110 ha

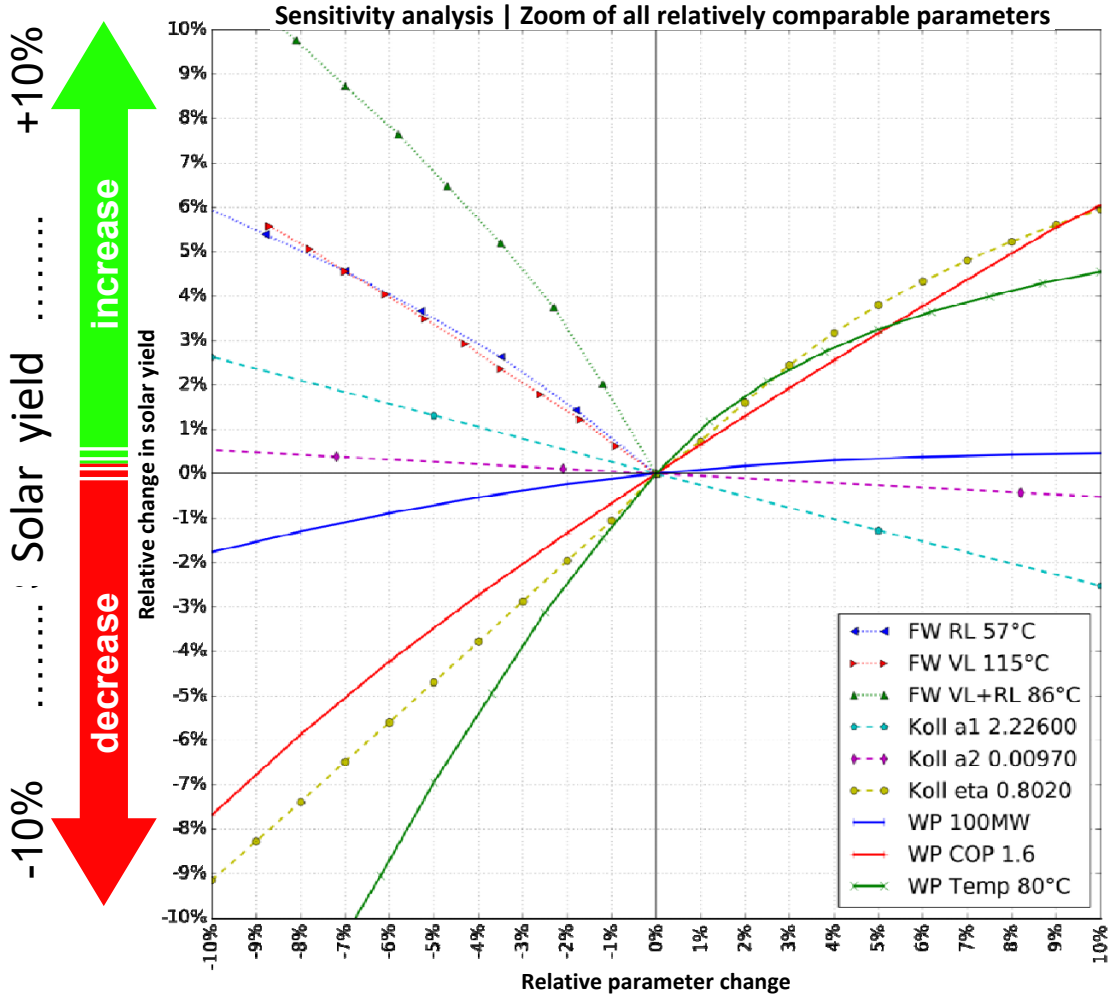
Conventional biomass
floor space requirement
for same energy amount

factor of 55

Simulated Monthly Generation Shares

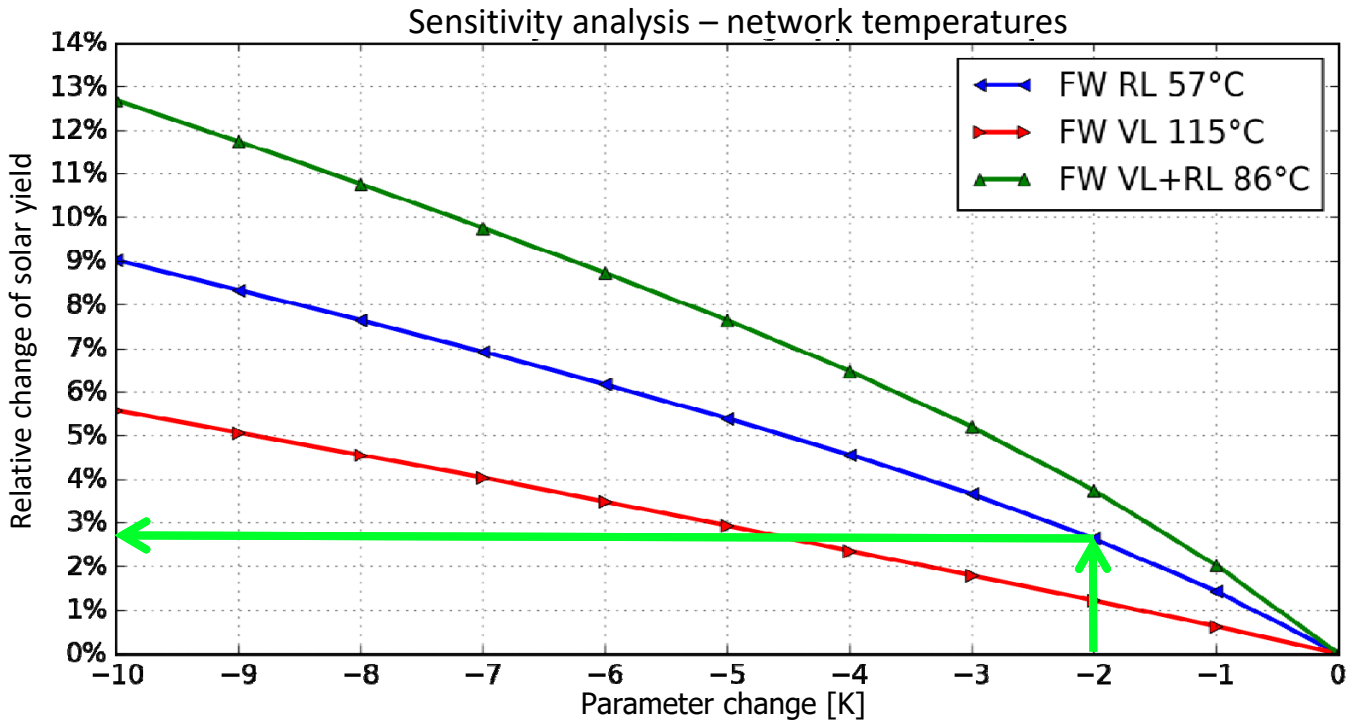


Sensitivity Analysis



- Temperatures of DH
- Collector parameters
- Heat pump parameters

Sensitivity - Network Temperature



Example:

Reduction return 57 °C → 55 °C increase in solar yield: 2.8 % → 6.860 MWh/year

increase in profit (at 35 €/MWh): 240.000 €/year

4th Generation, return flow → 47°C increase in profit (at 35 €/MWh): ~ 1 Mio €/year

Further increase of renewable share!

Sensitivity – Climate Change

Solar yield depending on used climate data for the simulation

Original data for simulation: 1961-1990

Current Steps According to Utility

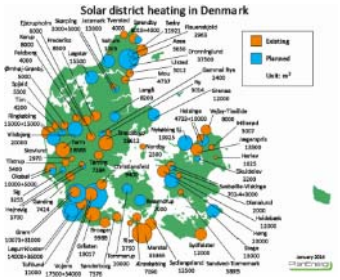
- Acquisition of land
- Further development of the system concept:
  - Strategy for operation and control
  - Safety aspects
- Preparation of permissions and administrative procedures

Targeted date for completion of approving:

2nd Quarter 2018

Summary

- Economic competitiveness
  (despite high network temperatures)



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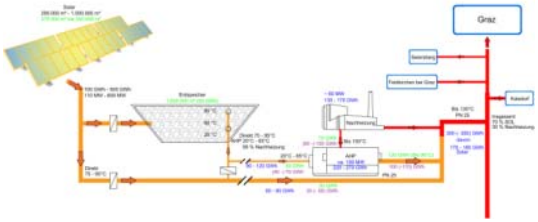
- System solution for available heat at anytime



- Security of supply

- Long-term price stability
  - refinancing costs are projectable, independent from the development of prices of fossil energy sources

- 4th Generation DH
  - lower network temperatures → solar solutions benefit / REN share increases / system efficiency

Future solar-city Graz

Unterstützt durch:

For further information visit: www.solid.at

Erneuerbare Energien 2015-3, Zeitschrift für nachhaltige Energiezukunft, AEE Intec
Solarwärme neu gedacht - Fernwärme für Europas Städte
http://www.aee.at/aee/index.php?option=com_content&view=article&id=874&Itemid=113

Erneuerbare Energien 2016-1
BIG Solar Graz: 500.000 m² Solarkollektoren für 20 % Solaranteil bei Grazer Fernwärme
http://www.aee.at/aee/index.php?option=com_content&view=article&id=908&Itemid=113

City of Graz – Green Future of District Heating in Graz:
http://www.grazer-ea.at/cms/aktuelles/idart_2277-content.html

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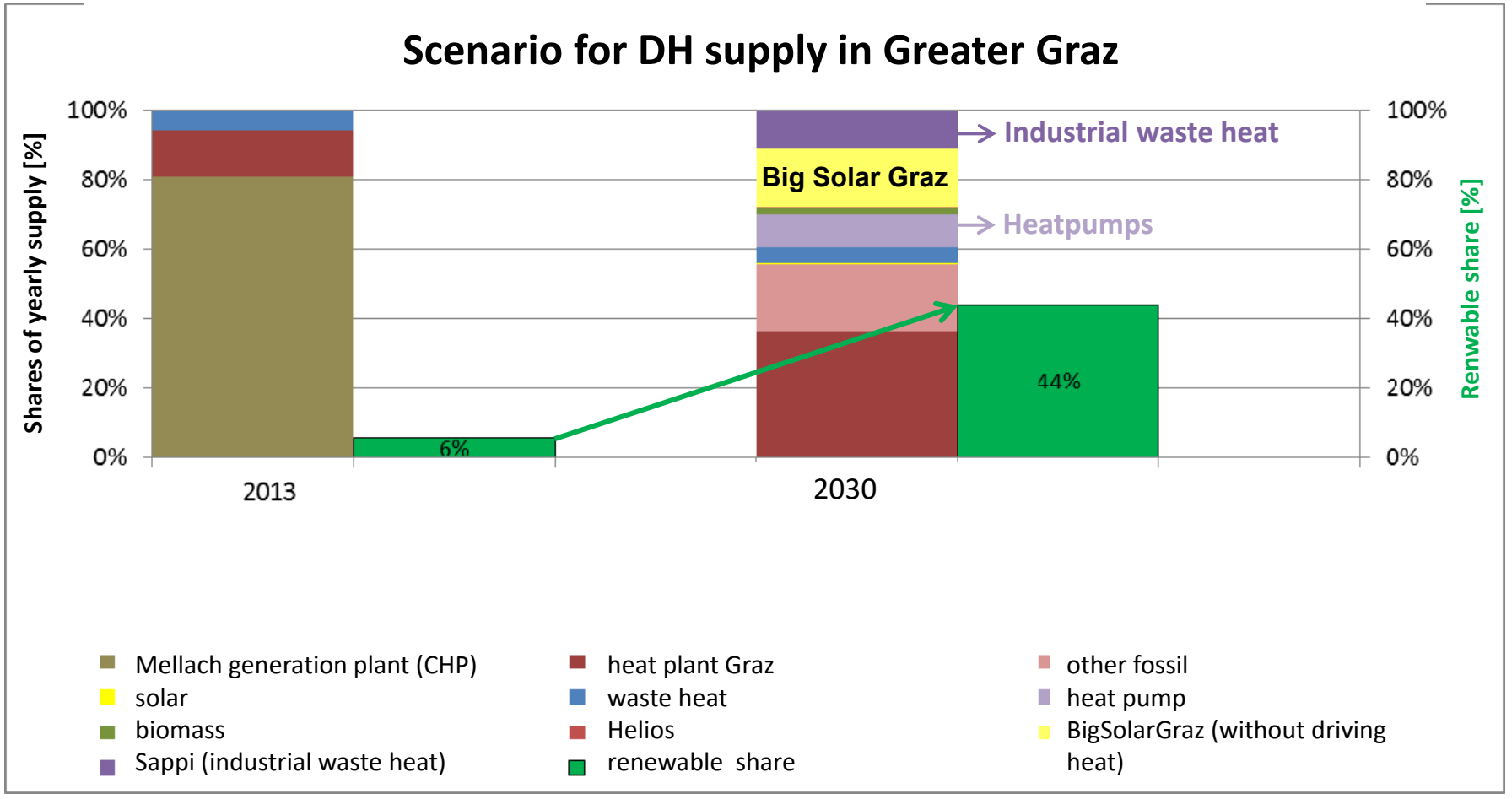
PLAN for future of DH in Graz

Condition today → **from 2030 onwards**



Source: Grazer Umweltamt & Energie Agentur, Prutsch, Götzhaber, Papousek; Vortrag bei Fernwärmetagen in Velden, 16.3.2016