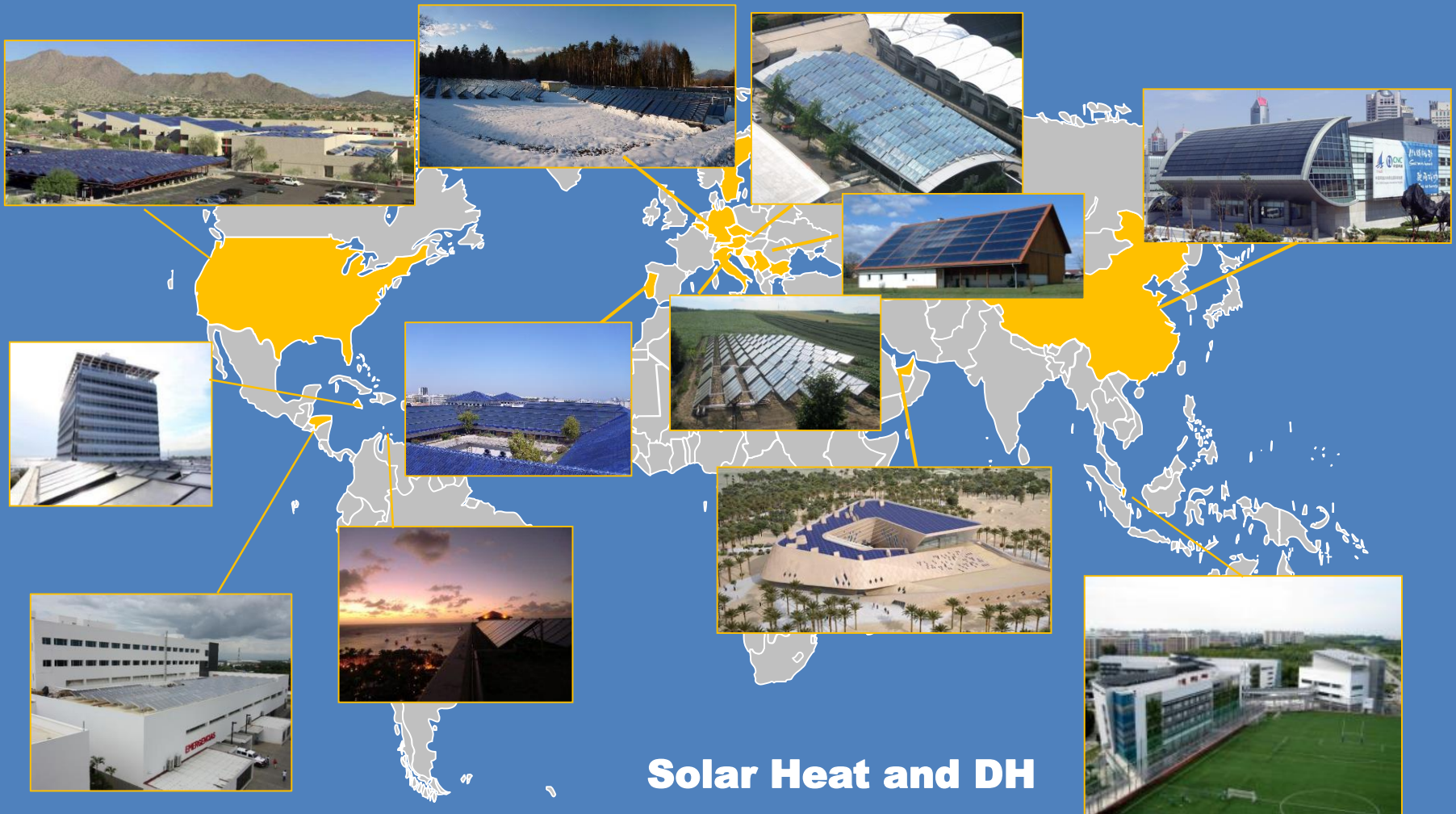




BigSolar for the decarbonization of current district heating systems Potentials & Challenges



Solar Heat and DH

Solar Cooling

Solare Process Heat



26 YEARS EXPERIENCE IN LARGE-SCALE SOLAR THERMAL

300 SYSTEMS BUILT IN MORE THAN 20 COUNTRIES

OFFICES IN THE USA, SINGAPORE, GERMANY

City of Graz - Overview



The second largest city of Austria

Approx. 300.000 inhabitants

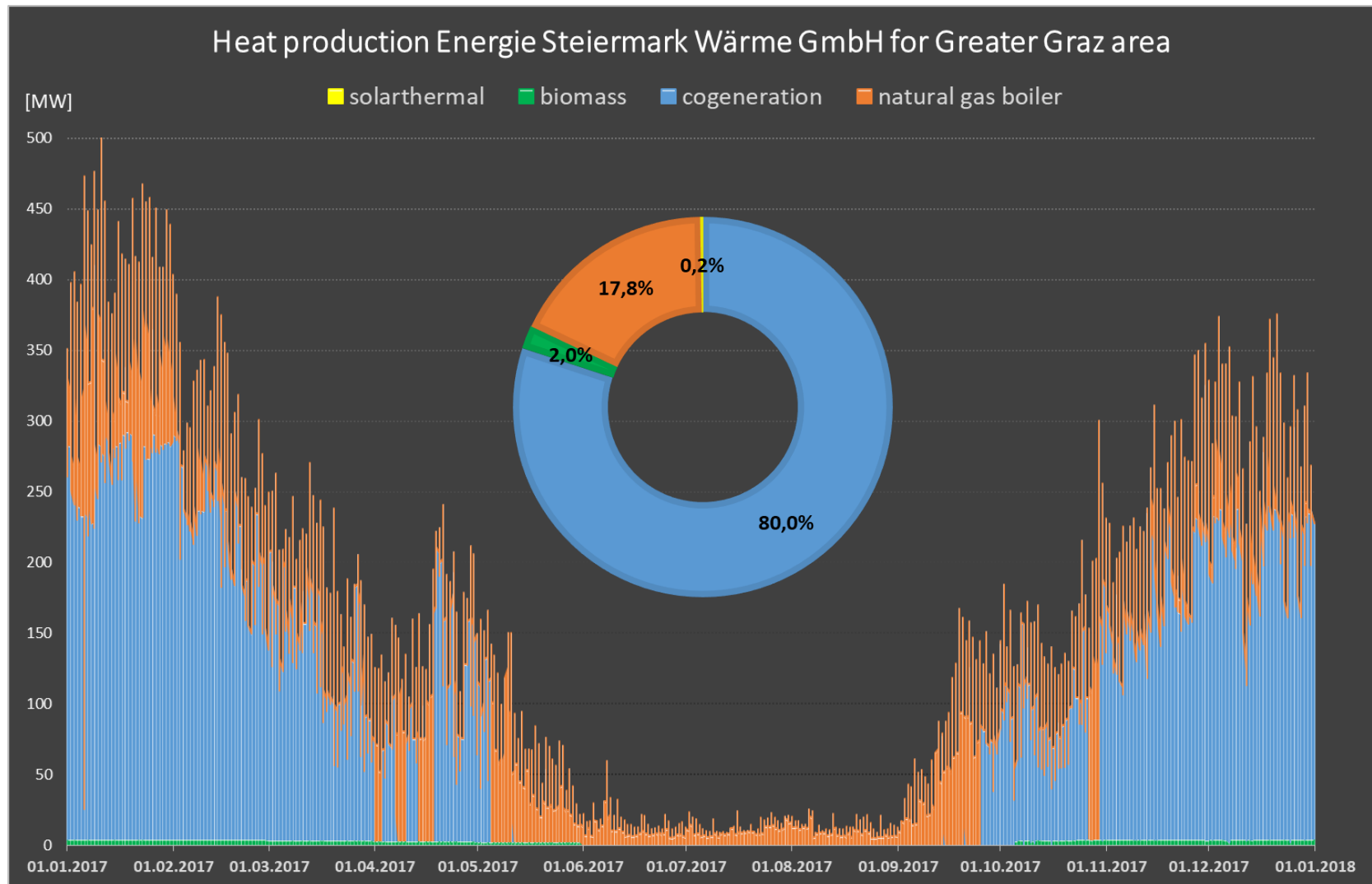
Approx. 120.000 people supplied by district heating

District heating demand: 1.200 GWh/a

Peak load: 530 MW



Load profile



Energy Strategy Development

- **Team „Wärmeversorgung Graz 2020/2030“** (Utilities, City, Energy Agency): regular meetings and workshops started in 2013
- **Green Paper Heat Supply Graz:** Current Status, developments until 2020/2030
- **„Calls for Contributions“** 13 topics;
9 Workshops with 150 participants, -> 38 proposals for measures
- **Detailed Analyses of Measures: 16**
- **Implemented measures or under preparation: 7**
- **Public presentations: „Future of Heatsupply in the bigger Graz Area“** : 150 Participants
- **Research & Innovationprograms: 3**
- **International Exkursion: 4** (Denmark, Swiss, Sweden, Germany)
- **Simulation of existing and potential future Heat sources**

2013

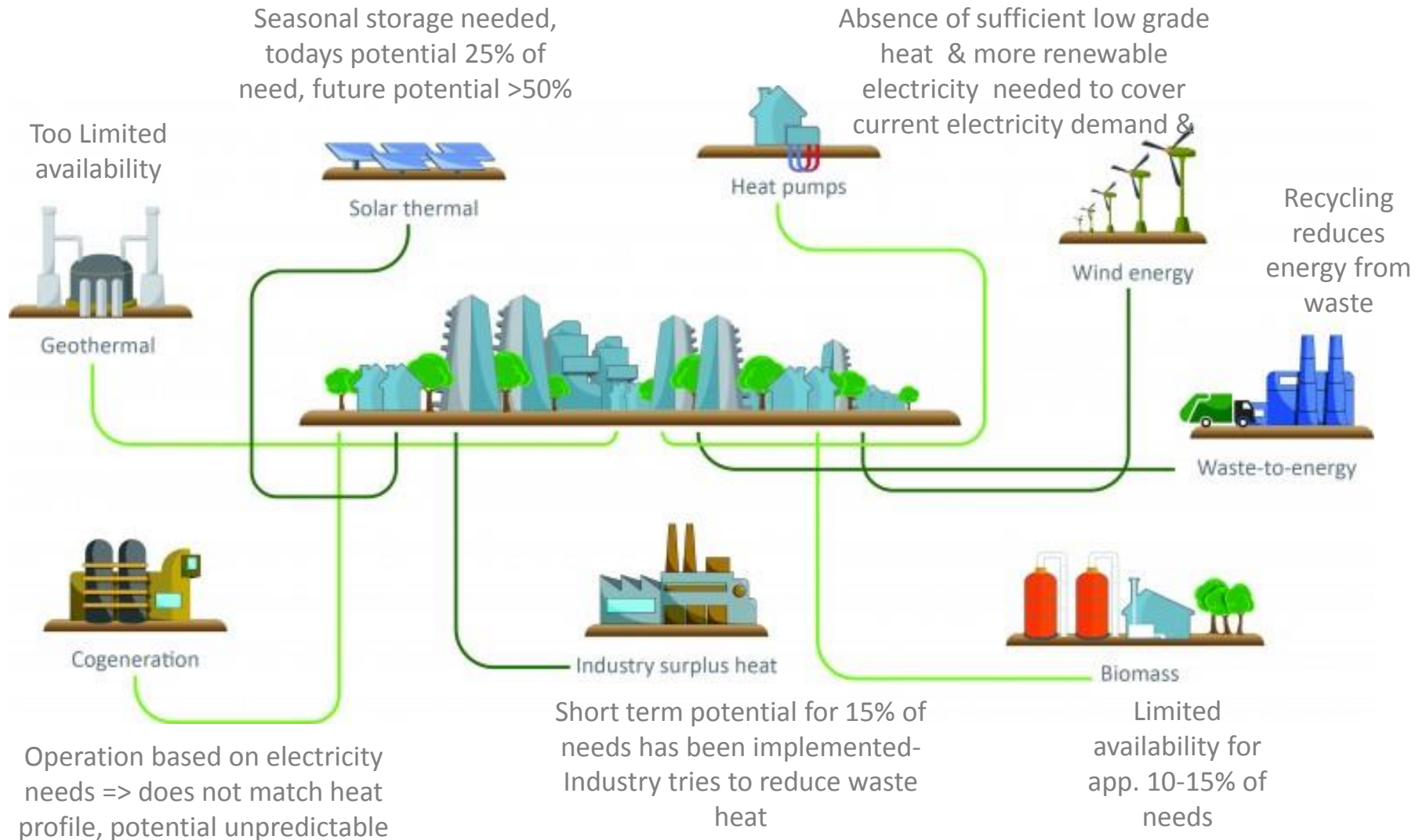
2014

2015

2016

ongoing

Energy mix of the future



Storing summer sun for winter heating

- 5-20% solar fraction with storage
- 30-60% solar fraction with seasonal storage
- Heat demand

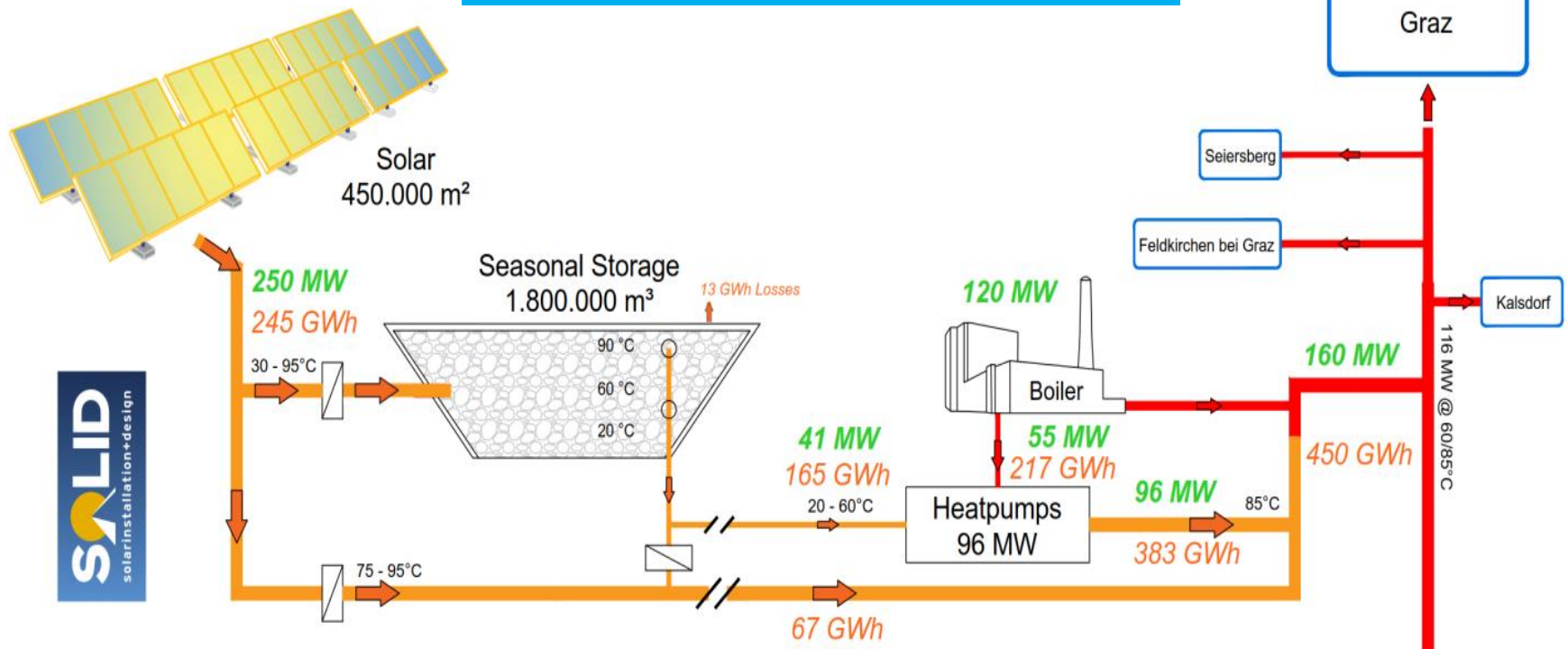


SUN MEETS 100% OF
HOT WATER NEEDS

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Results of Feasibility

Graz: 20% solar share (245 GWh/a)



Target Costs Heat < 40€/MWh for production and management

“BIG SOLAR”

Key challenges- Area



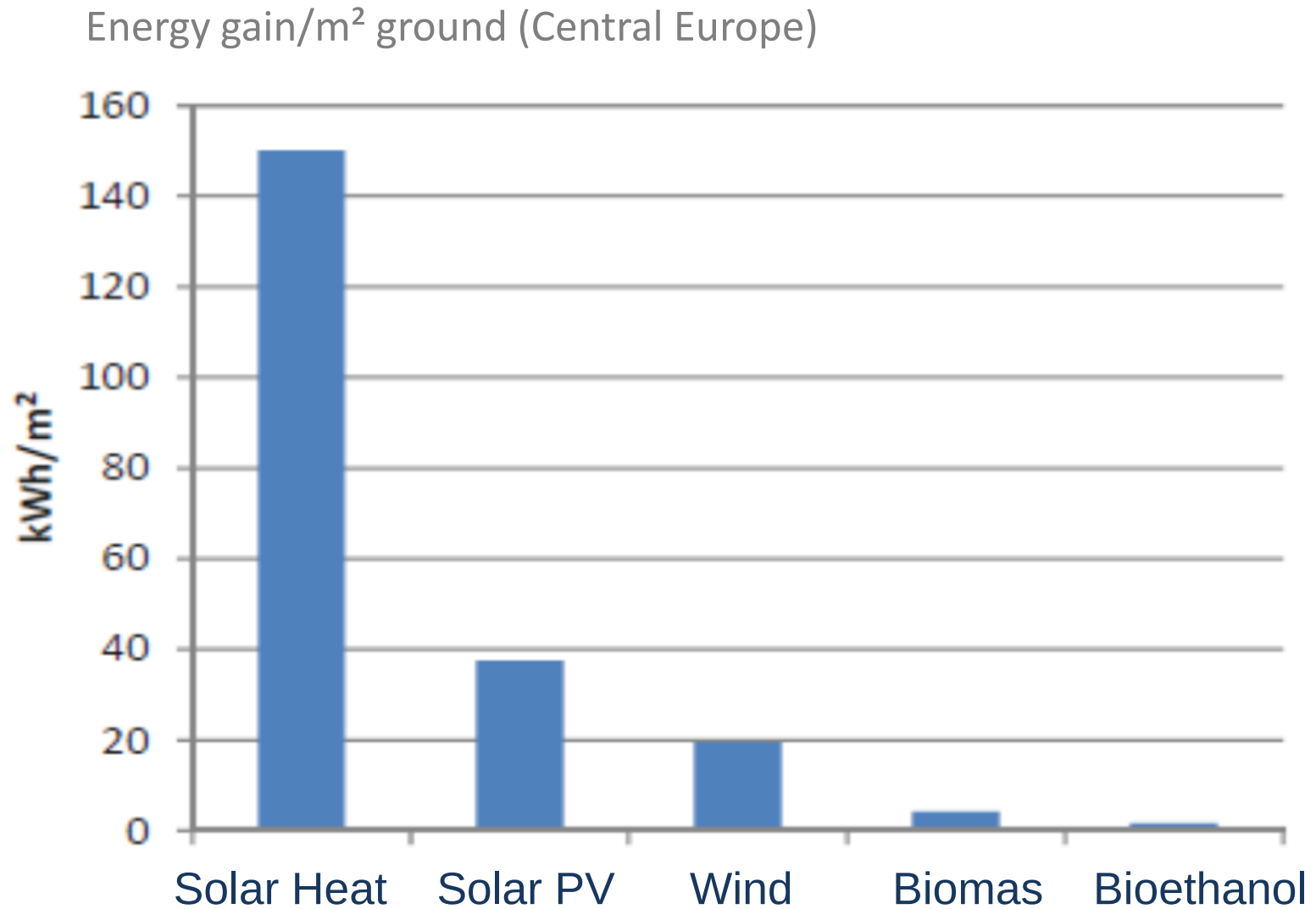
Comparison to other infrastructure areas in Graz

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

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

**Areas for renewable energy need
to become a part of urban
planning!**

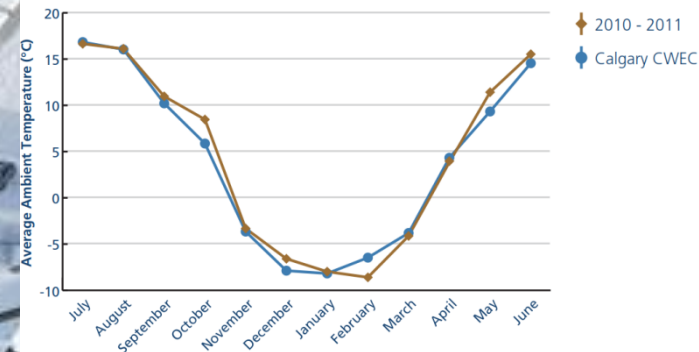
Key challenge Area



Drake Landing, Canada

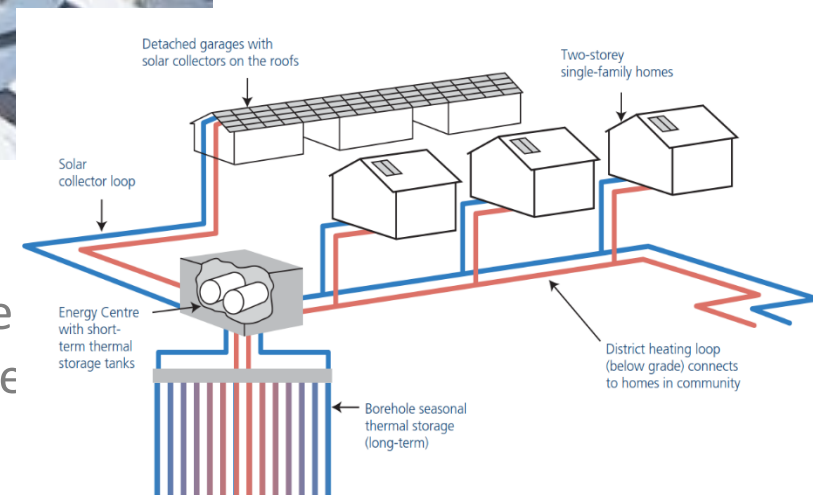


Ambient Air Temperature



- 798 solar collector modules (2293 m²)
- 240 m³ of water for short-term heat storage
- 34,000 m³ of earth for seasonal heat storage

System covers >90 %



Vojens, Denmark

BigSolar (incl. seasonal storage)

Vojens, DK (2014):

50% Solare Deckung (35 GWh/a)

207.000 m³
seasonal storage

70,000 m² collectors (50 MW)

Quelle: <http://www.vojensfjernvarme.dk>



Langkazi, China



月份	采暖耗热量 需求 [MWh]	太阳能 产热量 [MWh]	电锅炉取热量 [MWh]	太阳能供暖 保证率 [%]
1	2,643	2,197	446	83.1%
2	2,262	2,065	197	91.3%
3	2,149	1,613	536	75.1%
4	1,726	1,566	160	90.7%
5	1,458	1,476	0	100%
6	0	1,472	0	-
7	0	1,285	0	-
8	0	1,381	0	-
9	0	1,582	0	100%
10	1,764	2,040	0	100%
11	2,194	2,195	0	100%
12	2,573	2,655	0	97%

Projects under Development

- Detailed Studies and Feasibilities for app. 20 cities show major potential in regards of economic competitiveness, land needs and technical interfaces
- Some central European Projects are in the phase of preparation for implementation (securing land, permits, financing)
- The system works in different climates and under different interfaces to existing environment.
- The more modernized the DH- net, the higher solar fraction can be achieved
- BigSolar represents a clean technology that can be locally implemented and that can deliver significant shares of district heating independent from world energy prices and supply chains

Potentials

- Depending on temperatures in DH, climate, other existing heat sources today Big Solar systems can cover 10-90% of a District Heating demand.
- Solar Fractions of up to 50% already today are often competitive.

Potential for Investment structure in 20 years- A change supply

Austria	4.4 Bio €	12 TWh	50% of DH
EU	70 Bio €	200 TWh	30% of DH
China	200 Bio €	700 TWh	

Summary

- Some realized BigSolar projects in operation in small municipalities < 10,000 inh. (Denmark, Canada, China)
- Several projects in development phase in Austria and South East Europe in larger municipalities (30,000 – 1,000,000 inh.)
- Technology is ready to go but will improve still in the next years
- Institutional requirements are necessary (e.g. for securing land, public authorization process, funding options, capacity building)
- Big Solar has a huge potential and can contribute to decarbonizing DH significantly

Thank you for your attention!



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