Community-scale heating / cooling systems with seasonal storage and solar thermal collectors
Presentation - Overview

- SOLID – Who we are
- Why BIG Solar Graz and how does it work?
- Resilient applications – What to do
Scope of services of SOLID

Large scale solar thermal plants (> 1 MW)

- Planning
- Plant installation
- Solar thermal collectors (manufacturer independent!)

... and services!

- Operations (remote monitoring, maintenance)
- Finance (national & international)
- Research & development
- Consulting

SOLID is the only full service provider for solar heat and cold
300 PLANTS IN 20 COUNTRIES

SOLAR HEATING
SOLAR COOLING
SOLAR PROCESS HEAT
SOLAR DISTRICT HEATING

25 YEARS OF EXPERIENCE IN LARGE SOLAR THERMAL SYSTEMS

SOLID
solarinstallation+design

SUBSIDIARIES IN USA, SINGAPORE, GERMANY
Solar Panels: 52,400 ft² → 3.5 MW
Cooling load: 500 tons / 1750 kW
ESCO, In operation since 2014

World’s most powerful Solar Cooling System
Overview of Graz
- The second largest city of Austria
- Approx. 300,000 inhabitants
- Approx. 120,000 people supplied by district heating

Actual situation:
- Peak load: 530 MW
- DH demand: 1.200 GWh/a
District heating in Graz

- **Heat supply Graz 2020 / 2030**
- **Conversion of district heating**

**Approx. 400 MW NEW are necessary**

Source: E-Stmk, C. Hackl, Vortrag: Erfahrungen mit Solar-Wärmeeinspeisung in Graz, 27.05.2015
Source: Wärmeversorgung Graz 2020/2030, Workshops

**District heating Graz: 2020 ?!**

- **2014**
- **86% of Energy provided by Mellach**

**Contract for delivery till 2020**

- **GuD**
  - 400 MW_{th}
  - 800 MW_{el}

- **Electricity market <> gas price**

- **End of technical life expectancy**

**Coal-fired power station**
- **230 MW_{th}
- 226 MW_{el}**
Requirements to systems relating to energy supply security

- Reliable technical operation: available energy at anytime
- Security of supply with independent long term energy supply
- Affordable energy provision and economic competitiveness
System concept of BIG Solar Graz

- second largest city of Austria
- 300,000 inhabitants

Quelle: Graz Tourismus
System concept optimum of BIG Solar Graz

Solar coverage: approx. 20%
Total capital expenditures: approx. 200 Mio. EUR
Annual avoided CO2-emissions: approx. 50,000 t CO₂
SOLID – Who we are

Why BIG Solar Graz and how does it work?

Resilient applications – What to do
A new dimension with Solar District Heating

Solar coverage of annual district heating demand today:

Canada: > 90% in Drake Landing

Denmark: 20-50% in several small cities

Austria: 20% Big Solar Graz, up to 12% in several DH grids

Source: DLSC

Source: PlanEnergi
Why intelligent DH grids

District heating network from the 60ies with high temperatures:

- Flow temperatures -> 115°C
- Return -> 57°C

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

Required solar system area < 0.8% of the city area

Comparison to other infrastructure areas in Graz

<table>
<thead>
<tr>
<th>Location</th>
<th>Area (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport Graz</td>
<td>~ 740</td>
</tr>
<tr>
<td>Motorway junction Graz Webling</td>
<td>~ 99</td>
</tr>
<tr>
<td>Generation System Mellach</td>
<td>~ 270</td>
</tr>
<tr>
<td>Big Solar concept</td>
<td>~ 247</td>
</tr>
</tbody>
</table>

Needed space for fast growing biomass for same energy output

Conventional biomass floor space requirement for same energy amount

factor of 30

factor of 55
Economic perspectives

Energy costs:

• With BIG Solar system we are competitive to big industrial heat generation costs

• Prices: gas versus solar heat
  – Today: solar 0-20% more expensive, but stable price
  – In 20-25 years: raise of gas price, solar price still stable

Financing costs:

• Higher Investment costs for solar system
• Provision of project financing
• No risk of energy cost fluctuations

→ 15-20% higher costs for a resilient system!
→ Higher Investment now for long-term resilient system!
Resilience with solar systems

• Reliable technical operation: available energy at any time
  – Best practice examples existing
  – Intelligent DH grids needed

• Security of supply with independent long term energy supply
  – The sun – an infinite resource without CO₂ emissions
  – Reduction of dependency of (imports of) fossil fuels
  – High energy output per ft² collector area, but floor space required

• Affordable energy provision and economic competitiveness
  – Low maintenance costs
  – Long-term price stability
  – Independent from the development of prices of fossil energy sources
  – Investment needed today to benefit „tomorrow“
Thank you for your attention!

SOLID GmbH
Puchstrasse 85, 8020 Graz, Austria
CEO: Christian Holter & Franz Radovic
Tel: +43 316 292840-0
office@solid.at
http://www.solid.at

SOLID California Inc.
4850 Pacific Highway, Suite 110
San Diego, CA 92110
C: (619) 718 1641
office@solid-ca.com
http://www.solid-ca.com/

Solar heat for industrial processes by SOLID: Gatorade, USA