Solar Thermal Systems in Europe and Finland

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What is the DGS?

DGS activities:

Publications:
- Manuals PV and Solar Thermal systems

Development of PV simulation software

PV Simulation Software SolEm

DGS Manuals:
- Solar Thermal Systems and PV Systems

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What is the DGS?

- Local section of the **German Solar Energy Society**, the oldest nationwide **solar organisation** in Germany (3,000 members)

- **Manuals PV Systems, Solar Thermal Systems and Bioenergy Systems** in English, Spanish, Italian and Portuguese for experts

- See [www.greenpro.de](http://www.greenpro.de)
What is the DGS?

Solar School Berlin:
– Training for technical and sales staff: engineers, architects, trade workers, sales managers, consultants
– since 1996 more than 2500 persons and companies have been trained

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What is the DGS?

Projects with DGS participation

- **Planning and services** for PV and solar thermal projects
- Computer simulation and predicting yield of large solar thermal or PV systems for banks and investment societies
- Monitoring of solar systems
- Quality assurance for solar energy systems: RAL initiative and label

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Finland – Annual Global Radiation

Inari 708 kWh/m²

Kemi 846 kWh/m²

Nurmes 855 kWh/m²

Helsinki 962 kWh/m²
Germany – Annual Global Radiation

Mittlere Jahressummen in kWh/(m²·a)

- > 1200
- 1181 – 1200
- 1161 – 1180
- 1141 – 1160
- 1121 – 1140
- 1101 – 1120
- 1081 – 1100
- 1061 – 1080
- 1041 – 1060
- 1021 – 1040
- 1001 – 1020
- 981 – 1000
- 961 – 980
- 941 – 960
- < 941

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Annually installed heat power in European Countries

Market Data 2006 (est)

Newly installed: 2 100 MWth = 3.0 Mio m²

 Totally installed: 13 300 MWth = 19.0 Mio m²

Data: ESTIF, 2006; preliminary
European Solar Thermal Markets 2006

- Germany: 50%
- Austria: 10%
- Greece: 8%
- France: 7%
- Italy: 6%
- Spain: 6%
- Czech Rep: 1%
- Portugal: 1%
- Sweden: 1%
- Denmark: 1%
- Poland: 1%
- Switzerland: 2%
- UK: 2%
- Cyprus: 2%

European Market 2006:
- 3.0 Mio m²
- 2.1 GWth

Quelle: ESTIF/BSW

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Solar Thermal Systems in Europe

Solar Thermal Markets 2006 in Europe

 Installed solar thermal power in MWth

 kWth per 1000 inhabitants

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Domestic water heating – Solar system
Domestic water heating and space heating system
Typical solar fraction / Emissions

System:

- 7,2m² Collector area
- Domestic Water Heating and Space Heating
- Geographical Latitude 49,5°
- Reheating with oil

source: www.oekolonomie.de
Visions of the solar thermal industry for the year 2030

The active solar house (heat demand covered 100% with solar systems) is the building standard.

Multifamily building with 100% solar heating built in Switzerland in 2007.
Visions of the solar thermal industry for the year 2030

50% of the low temperature heat demand will be covered by solar thermal systems
Visions of the solar thermal industry for the year 2030

From installing a large number of components ... ... to prefabricated systems
Arguments for Solarthermal District Heating

• Proven technology: Many systems in operation since > 20 years
• ”Low” specific investment
• Flexible: Can be applied in connection to existing and new DH plants
• Possible to have solar heat in cities
• Potential related to existing and future development of DH plants !

source: Jan-Olof Dalenbäck
Solarthermal District Heating

Neckarsulm II / Germany

- Supply Area: 6 Multifamily buildings, School, Hostel, Shopping center
- Heated Area: 20,000 m²
- Collector Area: 2,700 m²
- Type of Storage: Borehole seasonal long term storage

source: BINE; www.energienetz.ch; www.dlsc.ca

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Solarthermal District Heating

Neckarsulm II / Germany

- Storage: 20,000 m³
- Total Heat requirement: 1663 MWh/a
- Solar Heat: 832 MWh/a
- Costs: 1,45 Mio €
- Solar fraction: 50%
- Used simulation program: TRNSYS

source: BINE; www.energienetz.ch; www.dlsc.ca

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## Solarthermal District Heating – Existing Plants

<table>
<thead>
<tr>
<th>Plant, Year in operation</th>
<th>Owner, Country</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marstal, 1996-</td>
<td>Marstal Fjernvarme, DK</td>
<td>18 300</td>
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<tr>
<td>Kungälv, 2000-</td>
<td>Kungäv Energi AB, SE</td>
<td>10 000</td>
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<tr>
<td>Nykvarn, 1984-</td>
<td>Telge Energi AB, SE</td>
<td>7 500</td>
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<tr>
<td>Falkenberg, 1989-</td>
<td>Falkenberg Energi AB, SE</td>
<td>5 500</td>
</tr>
<tr>
<td>Neckarsulm, 1997-</td>
<td>Stadtwerke Neckarsulm, DE</td>
<td>5 263</td>
</tr>
<tr>
<td>Ærøsköping, 1998-</td>
<td></td>
<td>4 900</td>
</tr>
<tr>
<td>Friedrichshafen Rise, 2001-</td>
<td></td>
<td>4 050</td>
</tr>
<tr>
<td>Ry, 1988-</td>
<td></td>
<td>3 575</td>
</tr>
<tr>
<td>Hamburg; 1996-2MW, 2002-</td>
<td>Hamburger Gaswerke, DE</td>
<td>3 000</td>
</tr>
<tr>
<td>Sarantis, 1998-</td>
<td>Sarantis S.A., GR</td>
<td>2 700</td>
</tr>
<tr>
<td>Nordby, 2002</td>
<td>Samsø Energiselskab, DK</td>
<td>2 500</td>
</tr>
<tr>
<td>Groningen, 1985-</td>
<td>De Huismeester, NL</td>
<td>2 400</td>
</tr>
<tr>
<td>Breda, 1997</td>
<td>Van Melle, NL</td>
<td>2 400</td>
</tr>
<tr>
<td>Anneberg, 2002-</td>
<td>HSB Bf Anneberg, SE</td>
<td>2 400</td>
</tr>
<tr>
<td>Augsburg, 1998-</td>
<td>Bayerisches Staatsministerium, DE</td>
<td>2 000</td>
</tr>
</tbody>
</table>

**17 plants > 2000 m² !**

Source: Jan-Olof Dalenbäck

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Solar Energy for District Heating in Kungälv/Sweden

• Completed in August 2000

• 38 local oil-fired systems replaced

• Supplemented by two 12MW oil-fired Boilers, one 13MW wood-chip-fired boiler and 10000m² solarthermal collectors

• 1000m³ buffer storage

• About 200 single-family-houses and 200 other buildings, including schools and industrial buildings, are connected to the local district heat network
Other Examples for Solar Energy District Heating

Falkenberg/Sweden, 5,500 m² collectors, 6% of the local heat delivered

Marstal/ Denmark, 18,300 m² collectors, 10,000 m³ buffer storage, 30% of the local heat delivered, **Energy woods need > 10 times larger land area!**
<table>
<thead>
<tr>
<th>Country</th>
<th>Coverage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iceland</td>
<td>95 %</td>
</tr>
<tr>
<td>Estonia</td>
<td>52 %</td>
</tr>
<tr>
<td>Poland</td>
<td>52 %</td>
</tr>
<tr>
<td>Denmark</td>
<td>51 %</td>
</tr>
<tr>
<td>Sweden</td>
<td>50 %</td>
</tr>
<tr>
<td>Slovakia</td>
<td>40 %</td>
</tr>
<tr>
<td>Finland</td>
<td>49 %</td>
</tr>
<tr>
<td>Hungary</td>
<td>16 %</td>
</tr>
<tr>
<td>Austria</td>
<td>13 %</td>
</tr>
<tr>
<td>Germany</td>
<td>12 %</td>
</tr>
<tr>
<td>Netherlands</td>
<td>03 %</td>
</tr>
<tr>
<td>UK</td>
<td>01 %</td>
</tr>
</tbody>
</table>

Source: Jan-Olof Dalenbäck; Euroheat & Power
Visions of the solar thermal industry for the year 2030

From costly systems ....

... to significant cost reduction

A significant cost reduction has taken place by at least a factor of two

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Solarthermal Systems in Agriculture – Piglet Breed

- System Tested in Münsterland Germany
- 65m² Collector Area
- Natural Gas Reheating
- System Saves 3.200m³ Natural Gas per Year

- Other Farms Use the Heat Behind PV-Collectors to Dry Their Straw

Solar coverage rate(%):

(20% annual average)
Thanks for your attention