Contributions of Solar Thermal to Energy Efficiency in the Tourism Sector

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Agenda

- Short Presentation Fraunhofer Gesellschaft – Fraunhofer ISE
- Introduction Solarthermal Applications
- State of the Art
- Cost
- Case Studies
- Conclusions
Fraunhofer Gesellschaft

- Largest Organization for Applied Research in Europe
- 67 institutes and research units
- Staff of more than 23,000
- €2 billion annual research budget
  - 2/3 contract research on behalf of industry and publicly funded research projects
  - 1/3 base funding by the German federal and state governments
Fraunhofer Institute for Solar Energy Systems (ISE)

- Performing Research for the Energy Transition
- Staff: 1300

- Energy Efficient Buildings
- Silicon Photovoltaics
- III-V and Concentrator Photovoltaics
- Dye, Organic and Novel Solar Cells
- Photovoltaic Modules and Power Plants
- Solar Thermal Technology

- Hydrogen and Fuel Cell Technology
- System Integration and Grids – Electricity, Heat, Gas
- Energy Efficient Power Electronics
- Zero-Emission Mobility
- Storage Technologies
- Energy System Analysis
annual world energy demand 510 EJ (~16 TW cont.)
Solarthermal Collector Technology

- **50-150°C**
  - Vacuum tube collector
  - DHW and space heating
  - Source: Ritter XL

- **30-80°C**
  - Flat plate collector
  - DHW and space heating
  - Source: Wagner Solartechnik

- **20-30°C**
  - Polymer absorber
  - Heating of swimming pools
  - Source: Roth Werke
Types of Collector

Flat Plate Collector

source: Wagner Solartechnik

- Supply pipe
- Meander-tube
- Return pipe
- Insulation
- Absorbersheet
- Glas cover

Wagner Solartechnik
Types of Collector

source: Viessmann Werke GmbH & Co KG

Direct Flow Vacuumtube collector

Heat transfer pipe
Absorber
Vacuum tube
Supply pipe
Insulation
Return pipe
Solarthermal combi system for space heating and DHW
Solarthermal preheating system for domestic hot water (DHW)
Solarthermal heating of a swimming pool
Solarthermal Cost of Energy

- Heating of swimming pools
- Domestic hot water Southern Europe*
- Domestic hot water Central/Northern Europe*
- Combi-systems Central/Northern Europe*
- District heating Central Europe*

Investment Solarthermal Installation

Investment for solarthermal installations 100m² - 500m² (order of magnitude)

- Polymer Absorber System 100-250 EUR/m²
- Flat Plate Collector System 350-600 EUR/m²
- Vacuum Tube Collector System 550-900 EUR/m²
Case Study Hotel Torviscas Canary Islands

source: Wagner Solartechnik
### Case Study Hotel Torviscas Canary Islands

<table>
<thead>
<tr>
<th>Name</th>
<th>Hotel Torviscas</th>
<th>Solarthermal Collector</th>
<th>320m² Wagner LBM HTF</th>
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</thead>
<tbody>
<tr>
<td>Location</td>
<td>Adeje, Canary Islands</td>
<td>Thermal Storage</td>
<td>25m³</td>
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<tr>
<td>Application</td>
<td>Domestic Hot Water, Contracting Scheme</td>
<td>Solar Savings</td>
<td>336 MWh/yr</td>
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<tr>
<td>Energy Demand</td>
<td>460 MWh/yr</td>
<td>Solar Fraction</td>
<td>73%</td>
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<tr>
<td>Fossil Fuel</td>
<td>Oil</td>
<td>Year of Installation</td>
<td>2012</td>
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</table>
Case Study Hotel Torviscas Canary Islands

source: Wagner Solartechnik
Case Study Hot Springs Resort Vita Classica Germany

source: Ritter XL
### Case Study Hot Springs Resort Vita Classica Germany

<table>
<thead>
<tr>
<th>Name</th>
<th>Hot Springs Resort Vita Classica</th>
<th>Solarthermal Collector</th>
<th>200m² Paradigma CPC 45 Star Azzuro</th>
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</thead>
<tbody>
<tr>
<td>Location</td>
<td>Bad Krozingen, Germany</td>
<td>Thermal Storage</td>
<td>4 Storage Tanks tot. 8m³</td>
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<tr>
<td>Application</td>
<td>Domestic Hot Water</td>
<td>Solar yield</td>
<td>89 MWh/yr</td>
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<tr>
<td>Energy Demand</td>
<td>4380m³ water/yr 229 MWh/yr</td>
<td>Solar Fraction</td>
<td>39%</td>
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<td>Fossil Fuel</td>
<td>Natural gas</td>
<td>Year of Installation</td>
<td>2011</td>
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</tbody>
</table>
Case Study Hot Springs Resort Vita Classica Germany

1 collector field
2 2x3m³ buffer storage
3 2x1m³ DHW storage
4 gas boiler
5 heating circuit

source: Ritter XL
Collector Fields - Impressions

source: Wagner Solartechnik
Collector Fields - Impressions

source: Wagner Solartechnik
Collector Fields - Impressions

source: Viessmann

source: Roth Werke
Conclusions

- Solarthermal technology for hotels and pools is well established
- Solarthermal technology proofed to be efficient
- Solarthermal technology can be cost competitive even without subsidies
Thank you for your attention!

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