Mirroxx Fresnel Collectors for Process Heat, Solar Cooling and Polygeneration

Task 38 Follow up Definition Workshop
March 28th, 2011 – Paris / France

Technology Introduction

Mirroxx Fresnel collectors are designed to generate heat at 130 - 400 °C

- **250 - 450 °C**
  - Large PTC and Fresnel
  - Utility scale power generation
  - Industrial process heat

- **130 - 220 °C**
  - Small PTC and Fresnel
  - Industrial process heat solar cooling
  - Commercial water heating
  - Distributed power generation

- **90 - 130 °C**
  - Vacuum tube CPC collectors
  - Solar cooling (single stage)
  - Low temperature process heat

- **40 - 80 °C**
  - Flat plate collectors
  - Domestic water heating, space heating
Dimensions

- Height: 4.5 m
- Width: 7.5 m
- Length of one module: 4.06 m
- 11 rows of primary mirrors

Technology

- Mirroxx Fresnel collector perfectly suited for roof top installation
- Length: modular in steps of 4m
- Total width: 7.5m
- Aperture width: 5.5m
- Height: 4m
- Weight: 27 kg/m²
- Peak power: 560 W/m²
Facts & Figures

- Heat transfer fluid
  - Pressurized water
  - Steam
  - Thermal oil

- Receiver SCHOTT PTR® 70
  - Maximum pressure up to **120 bar** (different versions 40, 60, 120 bar)
  - Maximum temperature up to **380 °C** with thermal oil
    up to **330 °C** with saturated steam or pressurized water
  - Thermal loss per m² of primary reflector $u_1 = 0.00043 \text{ W/(m}^2\text{K})$ (according to DLR)

Summary Advantages

- Low wind load
- Good weight-spread
- High ground usage factor
- No north-south alignment necessary

- Rooftop installation

- Primary mirrors made of flat glass vs. aluminum (durability, reflectivity)
- Precise temperature and power control
- Less absorber tube per m² allows high quality 70 mm vacuum absorber tube (industrial standard)
- Remote control and monitoring via LAN and internet

- Industry

- Stationary receiver, no flexible connections
- Concentrated sunlight hits absorber tube always from below

- Steam

- Easy cleaning (flat glass / good access)
- Low water demand for cleaning
- Reliable components (mirror/tube/drives)

- Low O&M
Applications

- Process Heat
- Steam
- Cooling
- Absorption Chillers
- ORC-Turbines
- Steam Engines
- Poly-Generation

Mirroxx Solar Cooling

- Mirroxx Fresnel process heat collector
  - High ground usage, good weight spread, low wind load
  - High efficiencies at high operating temperatures

- 2E absorption chillers
  - Driven by a 16 bar pressurized water circuit – low system costs
  - Chillers from different manufacturers at competitive prices

- 3E absorption chillers
  - Driven by 250°C saturated steam – higher system costs
  - Few chiller types available at higher prices
  - High COP – backup with gas burner is more efficient than compression chiller with electricity from grid
  - Best ground usage = highest cooling capacity per covered area
### Market

Various applications and markets for process heat and cooling

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<th>Examples</th>
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<td>Washing, Cooking, Pasteurization, Sterilization</td>
<td>1-10 MWth</td>
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<td>Beverage:</td>
<td>Drying, Cold</td>
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<td>Mining:</td>
<td>Steam for Drying</td>
<td>5-20 MWth</td>
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<td>Manufacturing:</td>
<td>Tube Production, Steam</td>
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<tr>
<td>District Cooling</td>
<td>Buildings:</td>
<td>Data Centers, Shopping Malls, Hotels, Office</td>
<td>1-10 MWth</td>
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<td>Process Cold:</td>
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<td>Poly-Generation</td>
<td>Cold Storage:</td>
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<td>Building Areas:</td>
<td>Hospitals, Hotels, Holiday Resorts</td>
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<td>Micro CSP</td>
<td>Industry:</td>
<td>Combined Heat and Cooling or Power</td>
<td>5-30 MWth</td>
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<tr>
<td></td>
<td>Building:</td>
<td>Combined Heat and Cooling or Power</td>
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<td>Power:</td>
<td>Decentralized Power Generation for Industrial Zones, Villages, etc.</td>
<td>1-10 MWel</td>
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Huge market in regions with DNI > 1500 kWh/m²/a
Recent Installations

- Completion of direct steam generation system
- Installation Abu-Dhabi
- 1400 m² / 700kW Installation in Qatar

14 September 2010
2022 World Cup goes to Qatar

Qatar applies for FIFA World Cup with a solar stadium

References

- Freiburg I: 2005
- Bergamo / Italy: 2006
- Sevilla / Spain: 2007
- Grombalia / Tunisia: 2008
- Freiburg II: 2009
- Masdar / Abu Dhabi: 2009
- Doha / Qatar: 2010
First contacts and discussions
Concerning lobby organisation for concentrating solar thermal collectors
Concerning standards and certification
First unofficial tests
Hail test
No damage to primary mirrors with iceballs with diameters of 25 mm and 35 mm up to a maximum speed of 30 m/s
Destruction only possible with plastic balls at higher speeds

Certification

Thank you for your attention!

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