Solar Process Steam

Example from Pharmaceutical Industry in Jordan

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Business Development
Background Jordan & Pharma

- Population of around 8 million
- High DNI and high fuel prices
- Ambitious strategy for renewables
- Strong pharmaceutical sector

Table 1. Overview of processes within pharmaceutical industry with substantial thermal energy demand

<table>
<thead>
<tr>
<th>Stage</th>
<th>Process</th>
<th>Heat demand</th>
<th>Cold demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production of bulk pharmaceutical products</td>
<td>Chemical synthesis</td>
<td>X</td>
<td>X</td>
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<tr>
<td></td>
<td>Fermentation</td>
<td>X</td>
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<td></td>
<td>Extraction</td>
<td>X</td>
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<td>Final product formulation</td>
<td>Granulation</td>
<td>X</td>
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<td></td>
<td>Coating</td>
<td>X</td>
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<td>Sterilization</td>
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Solar Process Heat

**SOLAR ENERGY:**
- Everywhere
- Abundant
- Clean
- Free
- Peaceful

**FOSSIL FUELS:**
- Inequitably distributed
- Limited
- Polluting
- Expensive
- Conflictual

**GLOBAL ENERGY DEMAND**

- **Industry**
- **Transportation**
- **Residential**

**ELECTRIC:**
- 25%
- e.g., lighting, electric drives, computers

**HEAT:**
- 75%
- e.g., cooking, drying, sterilization, dyeing
RAM Pharma Project

- RAM Pharma small pharmaceutical company
- Started early to adopt clean technologies
- Diesel demand for steam generation was major energy cost
- Suitable preconditions for installation of Fresnel collectors
- Realization of project in cooperation with GIZ
Technical Data

- 18 LF-11 Fresnel collector modules (aperture 396 m²)
- Ruth storage with a capacity of 2 m³
- Roof-top installation
- Direct steam generation in an U-loop of two strings
- Client steam circuit at 160°C, solar at up to 210°C
- Integration parallel to boiler at steam header
LF-11 Fresnel Collector

- High quality components up to 400°C
- Highest ground space efficiency
- Low wind loads allows roof-top installation
- Proven for direct steam generation

www.industrial-solar.de
Ruth Storage

Functions:
• Phase separation
• Pressure maintenance
• Buffer storage
• Water reservoir

Mokhtar et. Al. (2015); “Direct Steam Generation for Process Heat using Fresnel Collectors”
https://core.ac.uk/download/pdf/31019857.pdf
Performance

Fig. 4. Measurement Data from June 19th, 2015. A day with several high clouds and thus fluctuations in DNI.

https://core.ac.uk/download/pdf/82620465.pdf
Thanks for your interest

Video:

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