

Solar Process Steam

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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

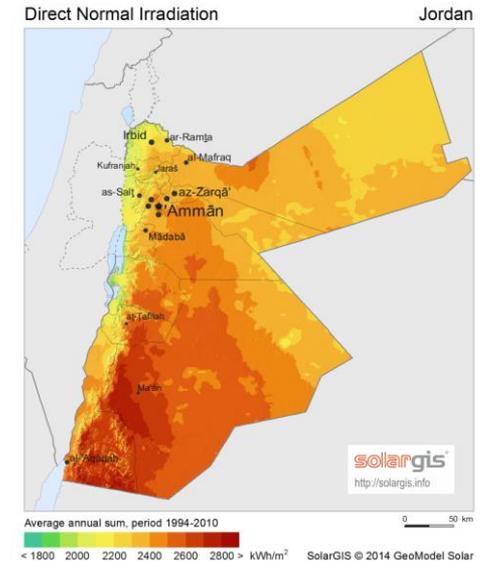


Table 1. Overview of processes within pharmaceutical industry with substantial thermal energy demand

Stage	Process	Heat demand	Cold demand
Production of bulk pharmaceutical products	Chemical synthesis	X	X
	Fermentation	X	X
	Extraction		
Final product formulation	Granulation	X	X
	Coating	X	X
	Sterilization	X	

NO_x PM
O₃ SO_x
CO₂

SOLAR ENERGY:

- Everywhere
- Abundant
- Clean
- Free
- Peaceful

⚡ 25%

ELECTRIC:

e.g. lighting, electric drives, computers

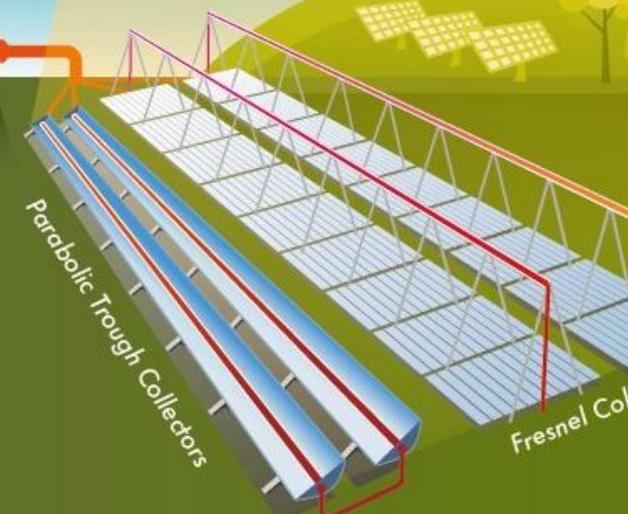
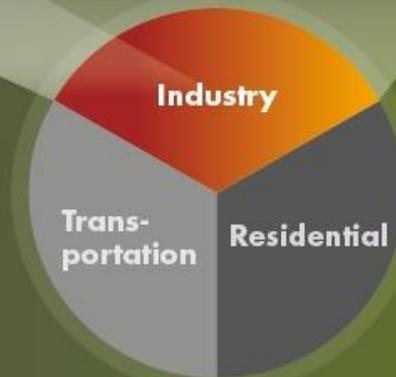
🔥 75%

HEAT:

e.g. cooking, drying, sterilization, dyeing

FOSSIL FUELS:

- Inequitably distributed
- Limited
- Polluting
- Expensive
- Conflictual



GLOBAL ENERGY DEMAND

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

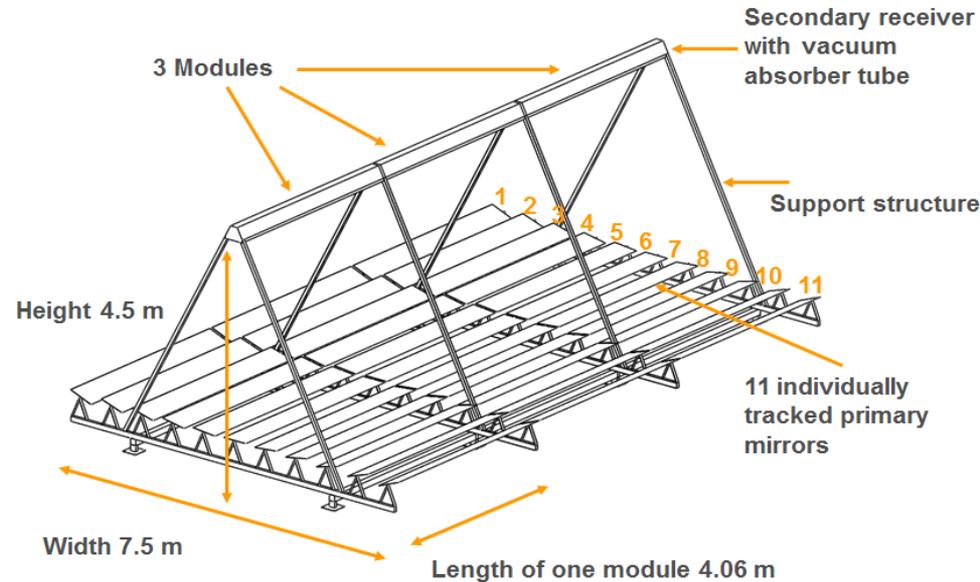


RAM

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
- Highest ground space efficiency
- Low wind loads
- Proven for direct steam generation

up to 400°C

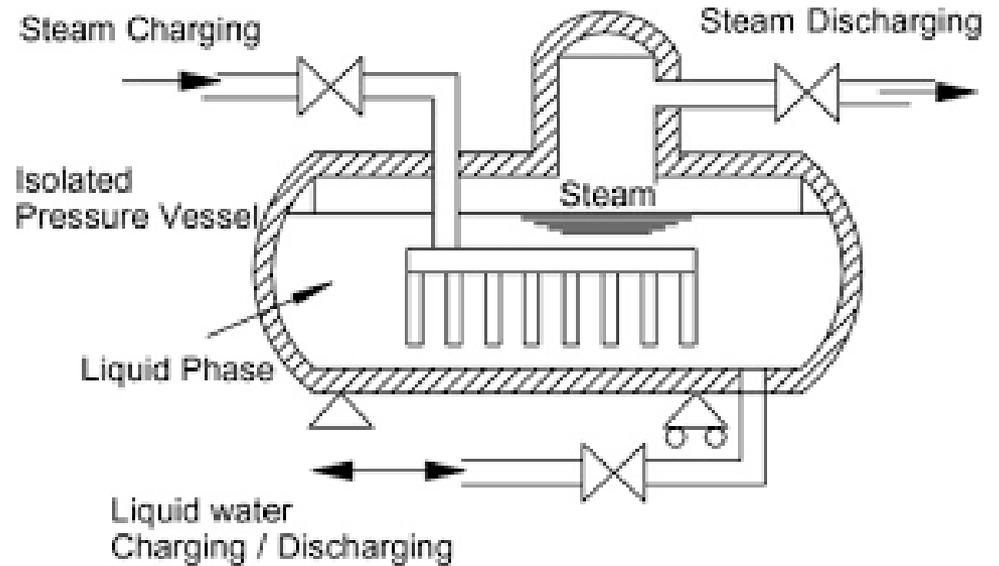
allows roof-top installation



Ruth Storage

Functions:

- Phase separation
- Pressure maintenance
- Buffer storage
- Water reservoir

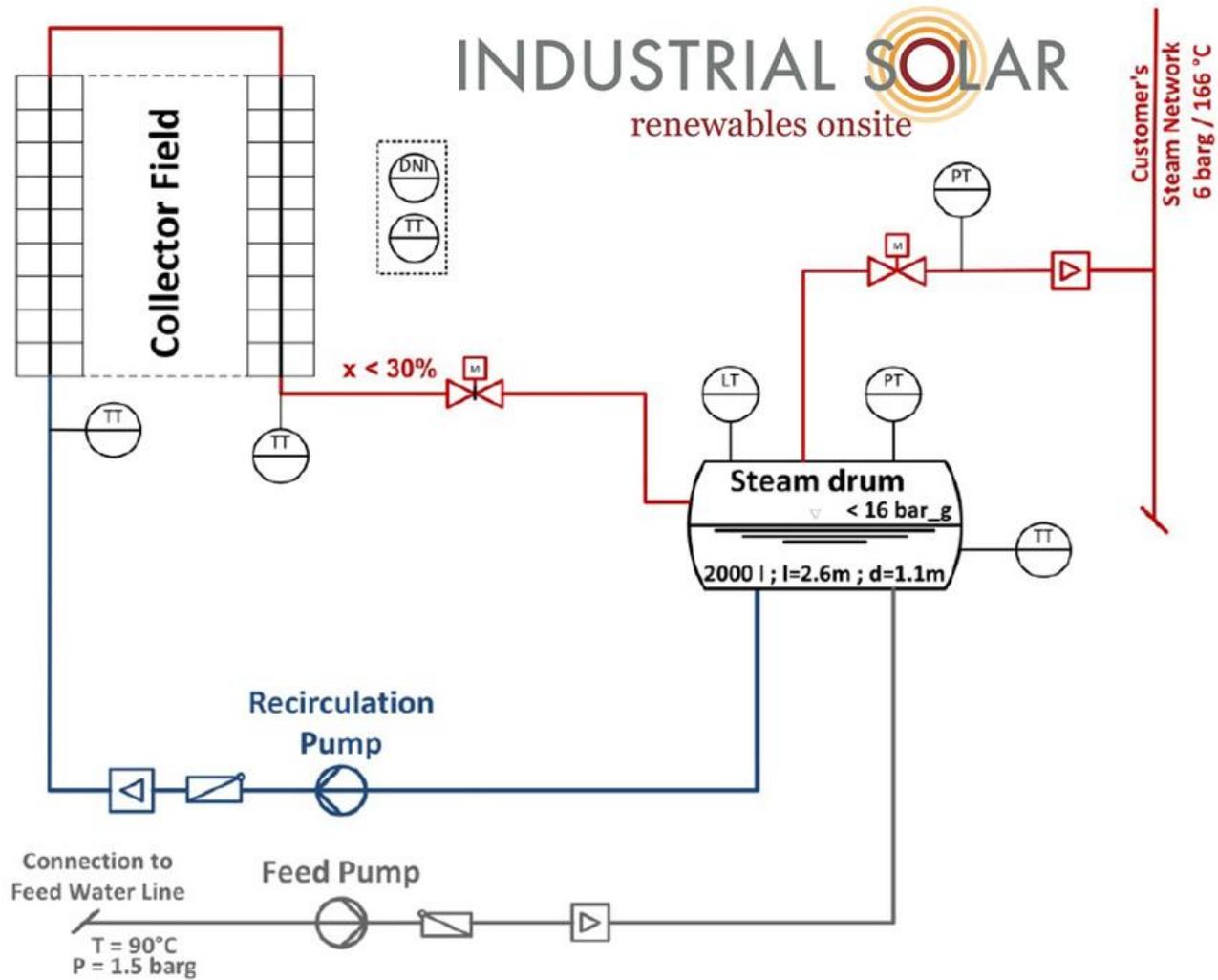


Mokhtar et. Al. (2015); "Direct Steam Generation for Process Heat using Fresnel Collectors"

<https://core.ac.uk/download/pdf/31019857.pdf>



Simplified P&ID





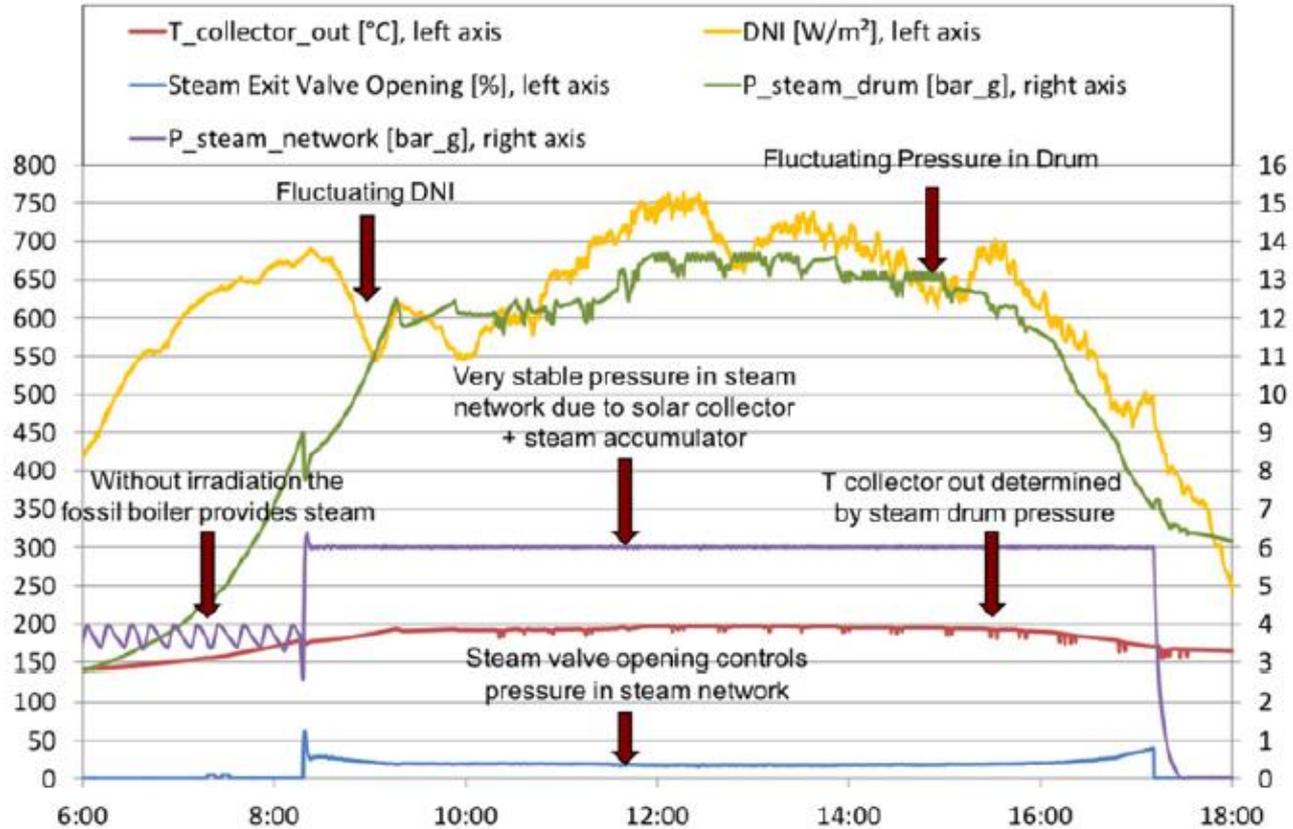


Fig. 4. Measurement Data from June 19th, 2015. A day with several high clouds and thus fluctuations in DNI.

<https://core.ac.uk/download/pdf/82620465.pdf>

Thanks for your interest

Video:
http://bit.ly/2015RAM_EN

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