

Feasibility study on solar thermal process heat in the beverage industry

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Content

- Background and objectives of solar thermal process heat and integration into district heating systems
- Data analysis of a industrial site in Germany
- Technical and economic results of a feasibility study



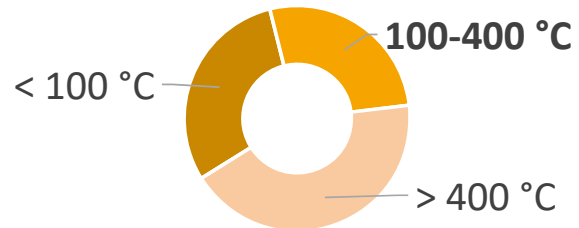
Protarget AG

Concentrated solar power (CSP) provides solar process heat for different applications



- mining,
- food and **beverage**,
- pulp and paper,
- manufacturing and
- chemical production

Process heat demand

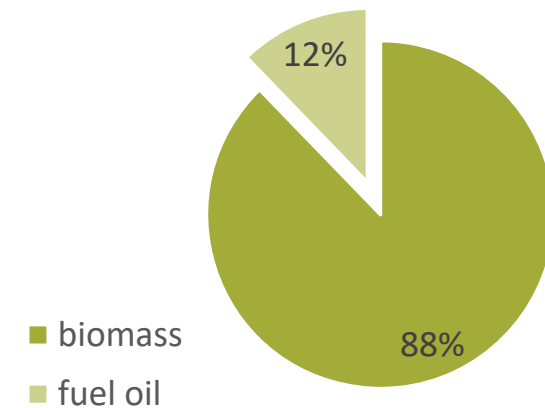
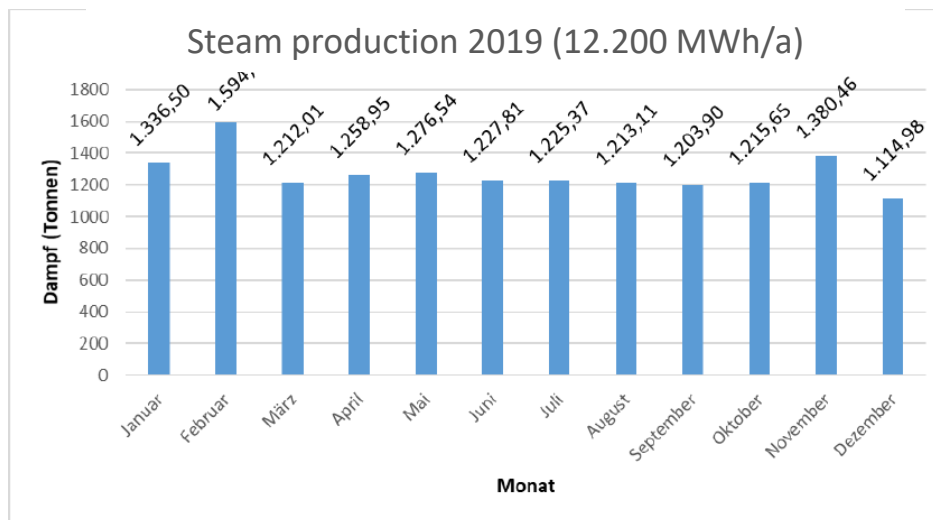


Objectives

- To what extent can a solar thermal steam system replace the fossil fuelled steam production?
- What are the operating parameters and dimensions of a solar field?

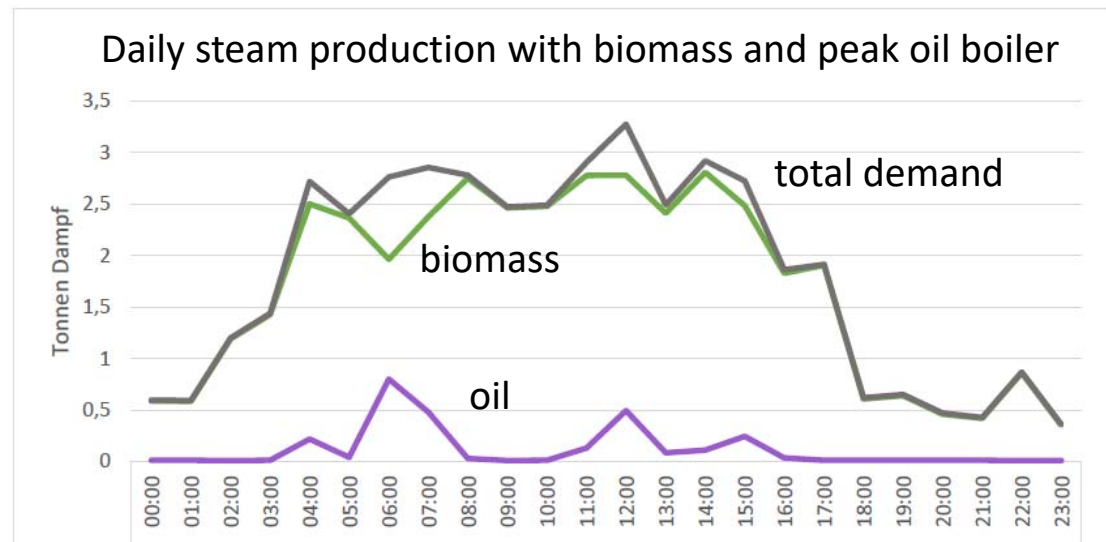
Initial situation

- Steam demand is almost constant over the year
- 12% are covered by fossil fuel which should be replaced



Daily load curve of steam demand

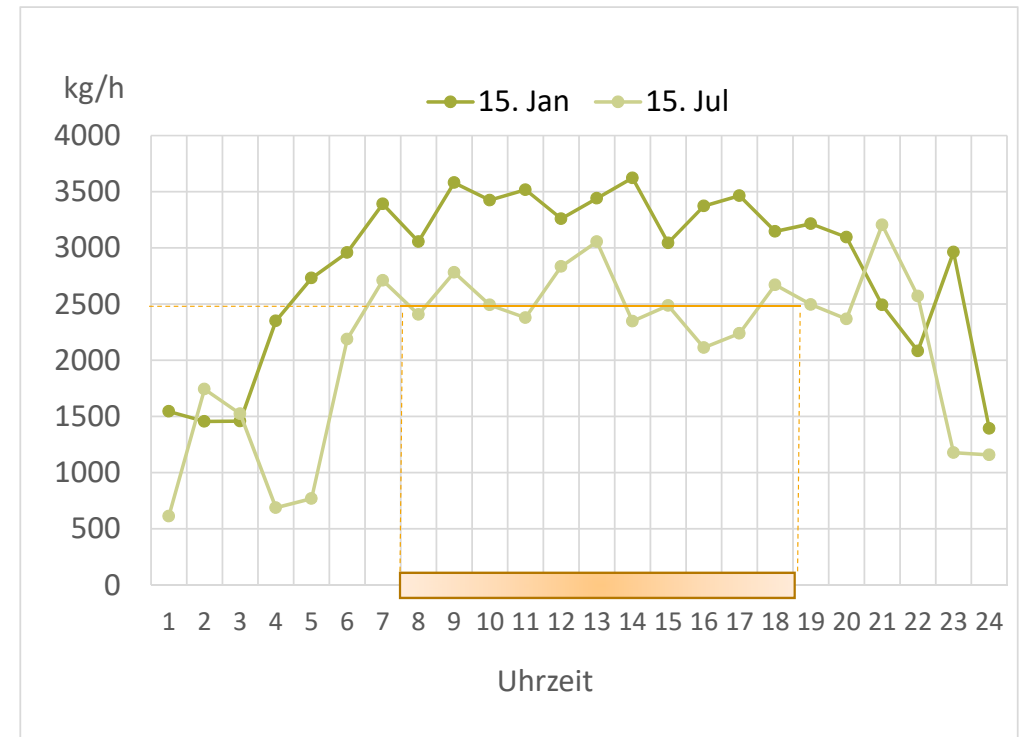
- Load profile corresponds to solar radiation
- High demand during the day



Dimensioning solar thermal steam production

Solar steam production is dimensioned for base load coverage during summer days

Result:
basic steam load: 2.500 kg/h



Steam load profile at winter and summer day

Results of technical layout

Solar system specification

Specific solar radiation: DNI 919 kWh/m²a

Efficiency of CSP collector: 47%

Nominal mirror area: 3.360 m² (12 rows)

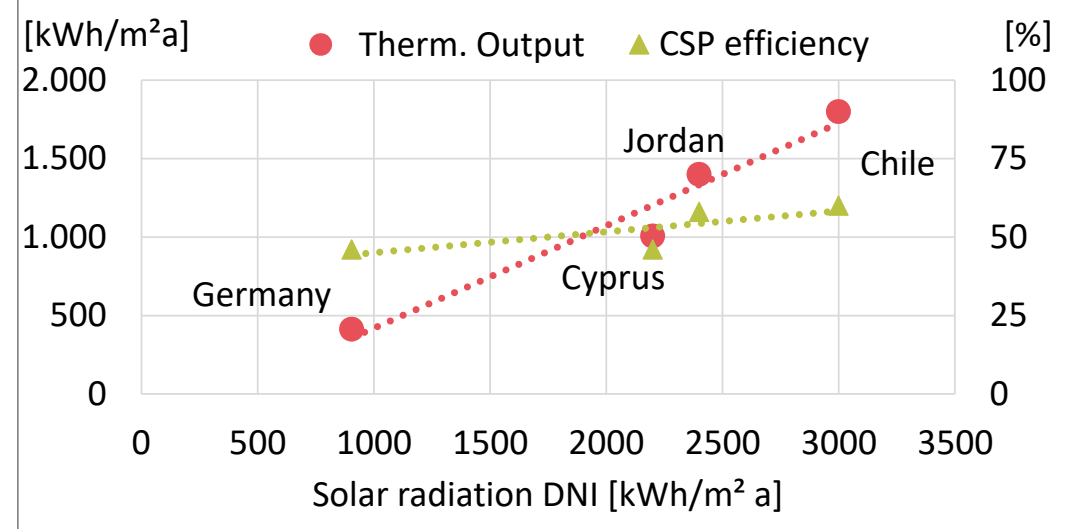
Solar field: ca. 12.000 m² (114m x 106m)

Performance data

Specific thermal output: 430 kWh/m²a

Steam production: 2,5 t/h
(8 bar, 180 °C)

Annual steam production 1.420 MWh/a
(steam mass: 2081 t/a)



Reference projects for solar thermal steam production

Results of economic analysis

1,5 MW solar steam system
Steam output 2.081 t/a (1.420 MWh/a)

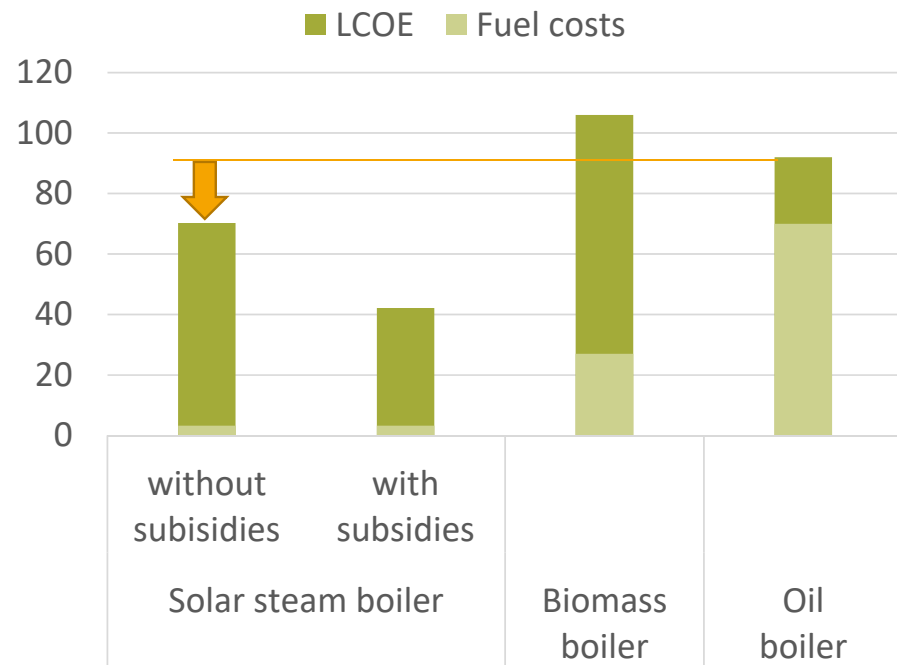
Specific Investment 800-900 EUR/kW

**Solar steam system is profitable against
conventional steam system**

Reference data for biomass and oil:
Hansen, K. (2019): Decision-making based on energy costs:
Comparing levelized cost of energy and energy system costs. Energy
Strategy Reviews, 24, <https://doi.org/10.1016/j.esr.2019.02.003>.

Levelized Cost of Energy (LCOE) and fuel costs of
solar steam boiler compared to conventional boiler

EUR/MWh



Summary

- Solar thermal process heat is proven technology.
- Combination of concentrated solar power and biomass steam boiler allow for CO₂-free steam production.
- Solar thermal steam production with CSP can be economic at central European sites.
- Financial support helps to accelerate technological innovations and market integration.

Contact

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