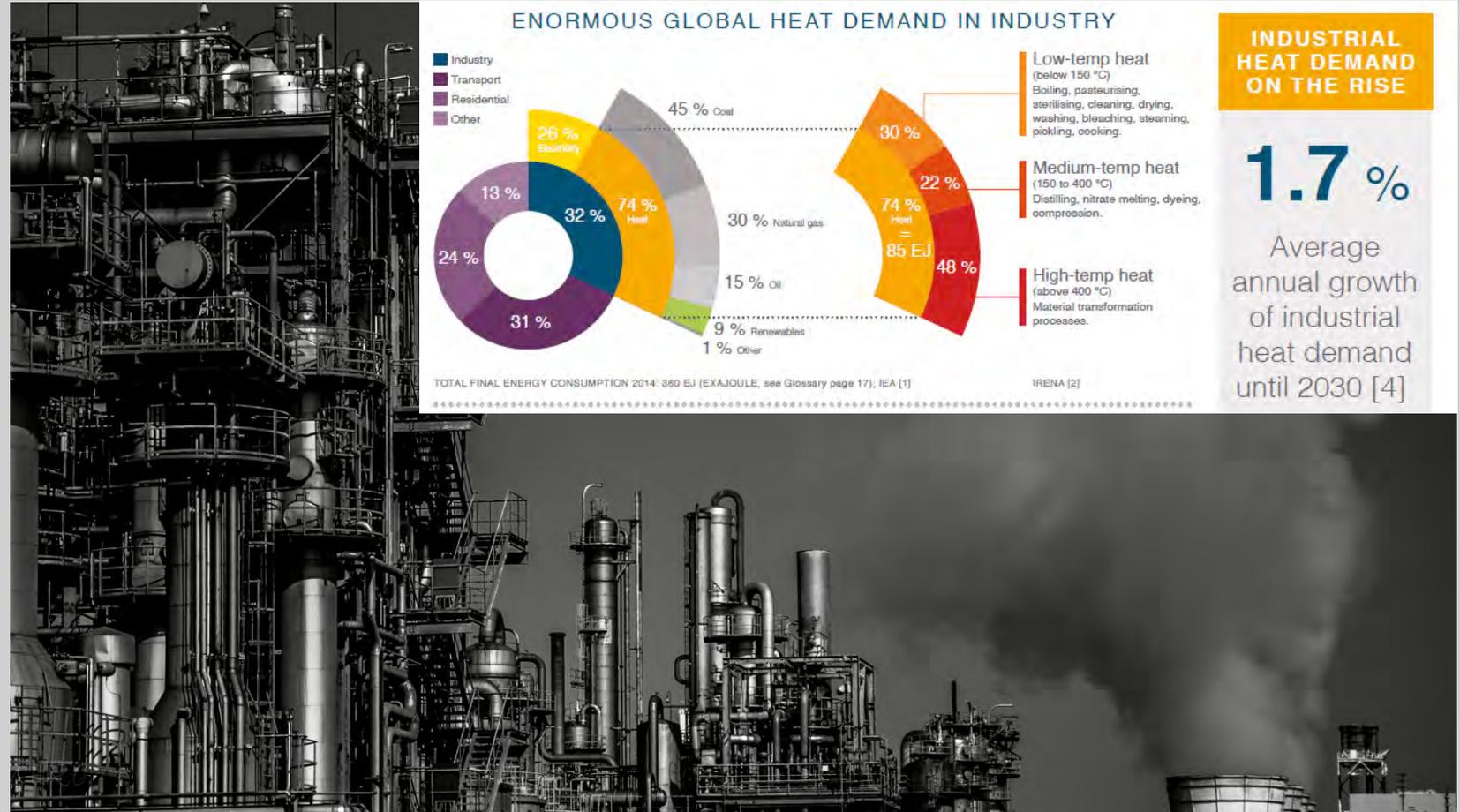




# Solar Steam Generation

# The Hidden Challenge

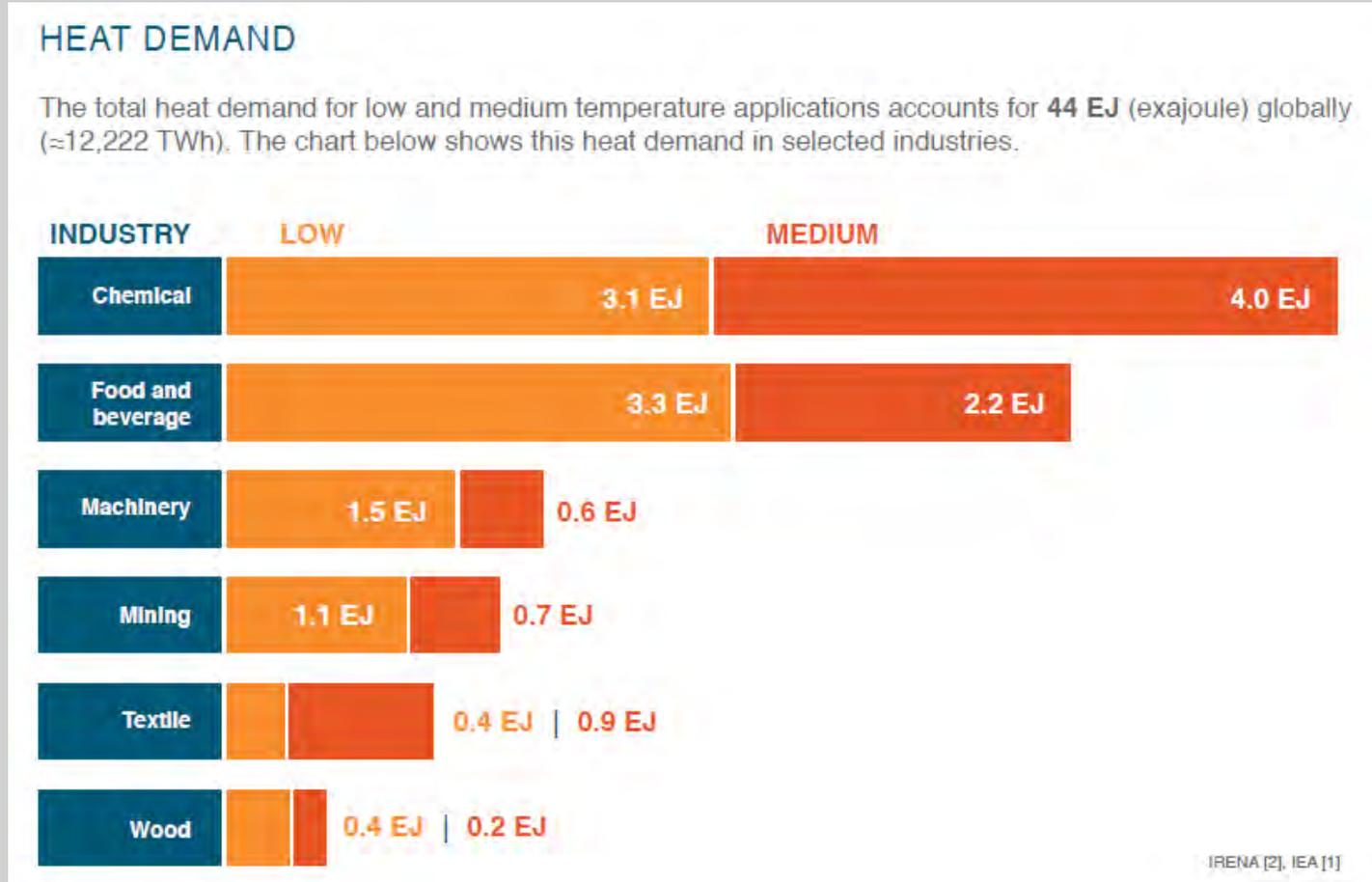
Heat accounts for 74% of the industrial energy consumption. It is mostly provided using fossil fuels.



# Industry Segments

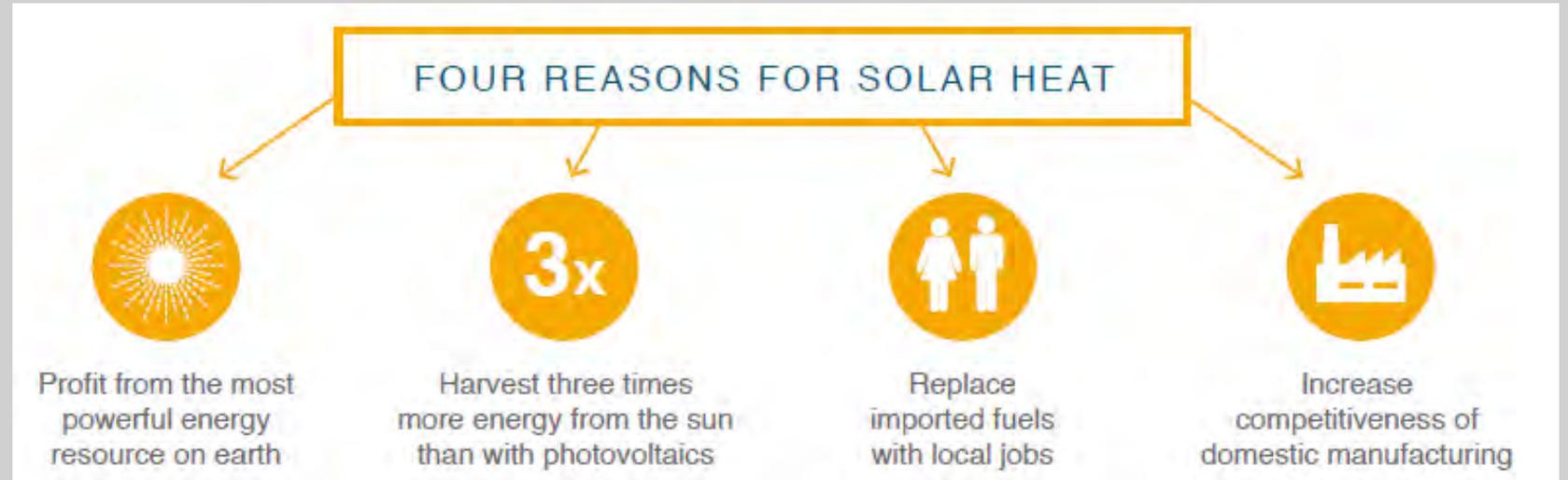
Steam is widely used in different industrial segments all around the world.

Steam provides heat in the production process for both low and medium temperature range.



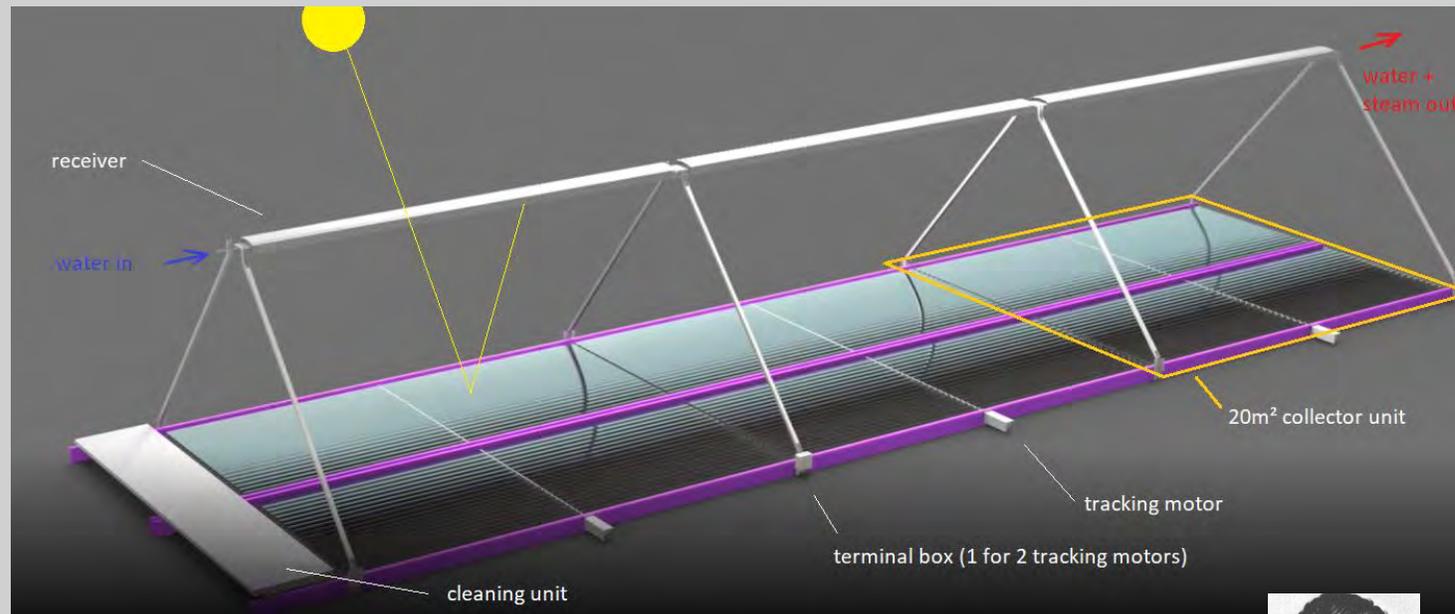
## ECOTHERM Solar Steam Boiler

ECOTHERM solar boilers offer an economic solution to reduce the fossil fuel consumption of existing steam systems.



# Principle of ECOTHERM Fresnel Collector

Linear Fresnel reflectors use long, thin segments of mirrors to focus sunlight onto a fixed absorber located at a common focal point of the reflectors. These mirrors are capable of concentrating the sun's energy to approximately 30 times its normal intensity. This concentrated energy is transferred through the absorber to heat up fluids or evaporate water for direct steam production.



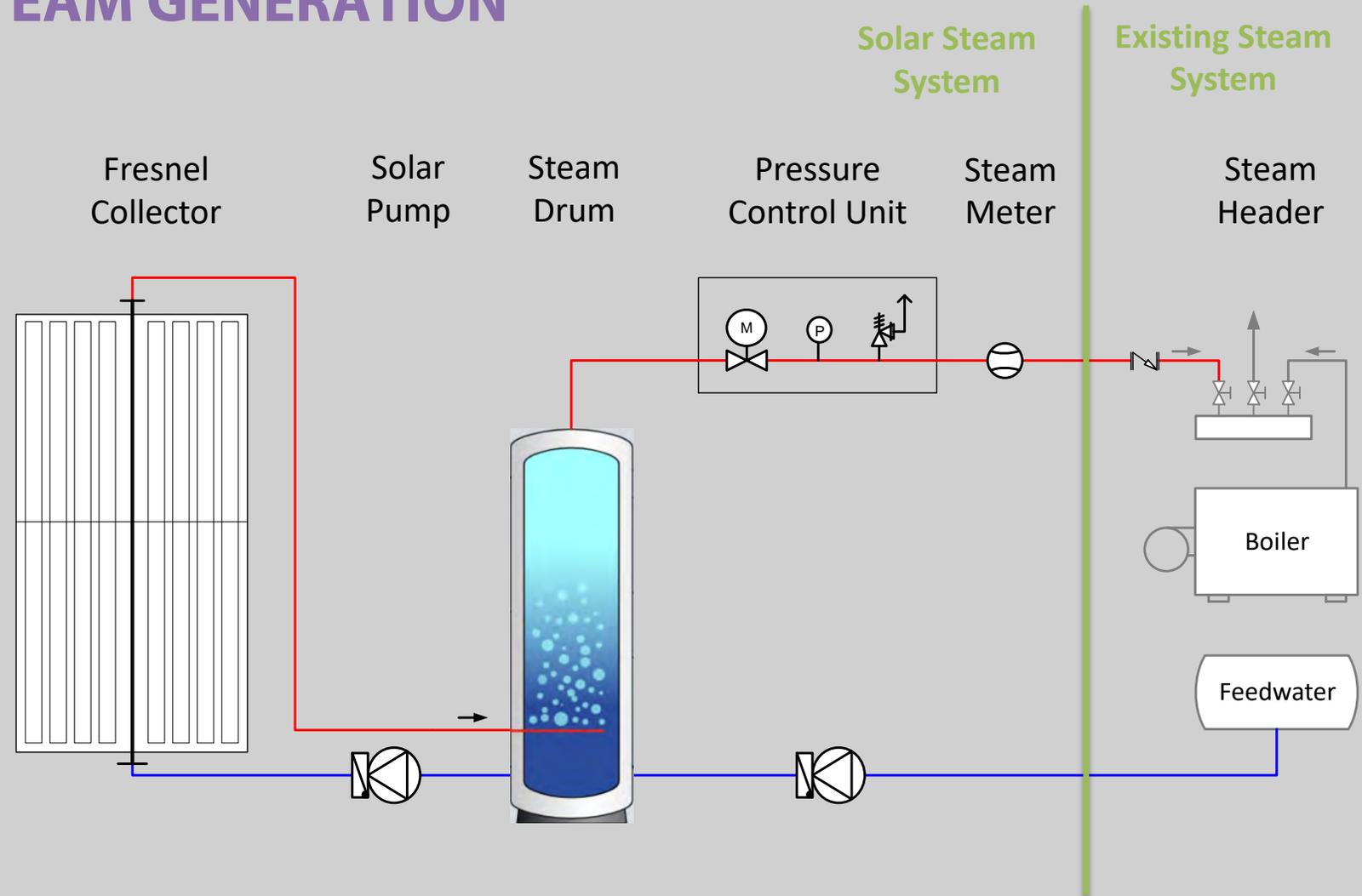
History: Augustin-Jean Fresnel (1788 –1827), was a French engineer and who studied the behaviour of light both theoretically and experimentally. He is best known as the inventor of the fresnel lens.



## INTEGRATION FOR STEAM GENERATION



- FULLY AUTOMATIC OPERATION
- IN COMBINATION WITH BOILERS
- EASY SYSTEM INTEGRATION
- NO CHANGES ON EXISTING SYSTEM

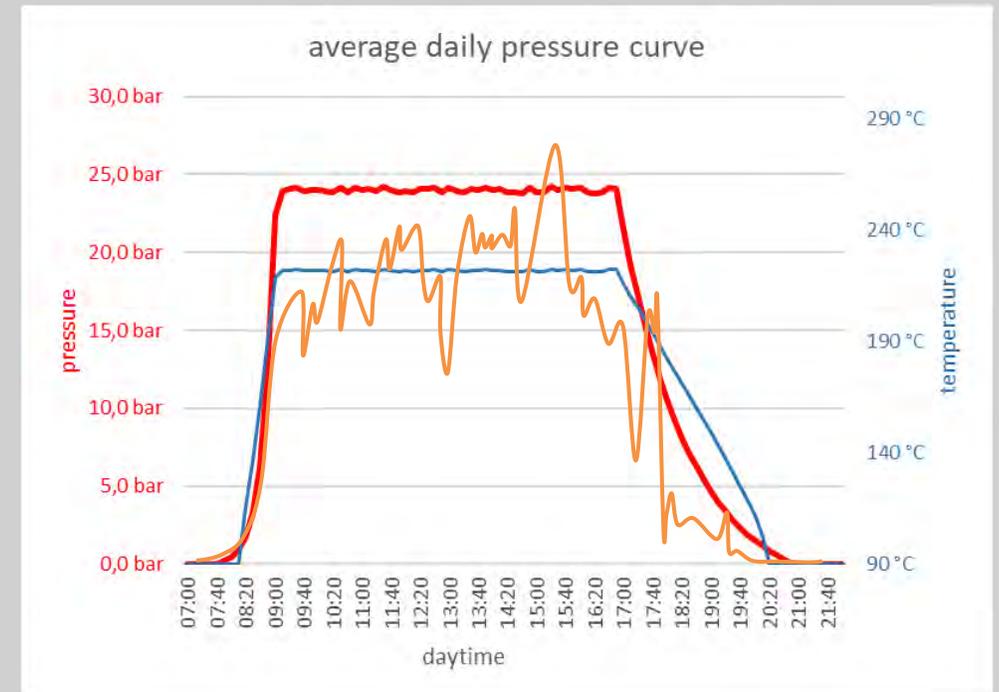


## INTEGRATION FOR STEAM GENERATION

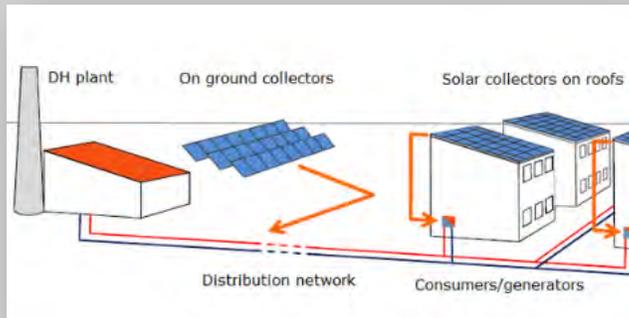
**ECOTHERM Steam Drum** → The link between solar field and steam consumers



- Solar Irradiation
- Steam pressure
- Temperature

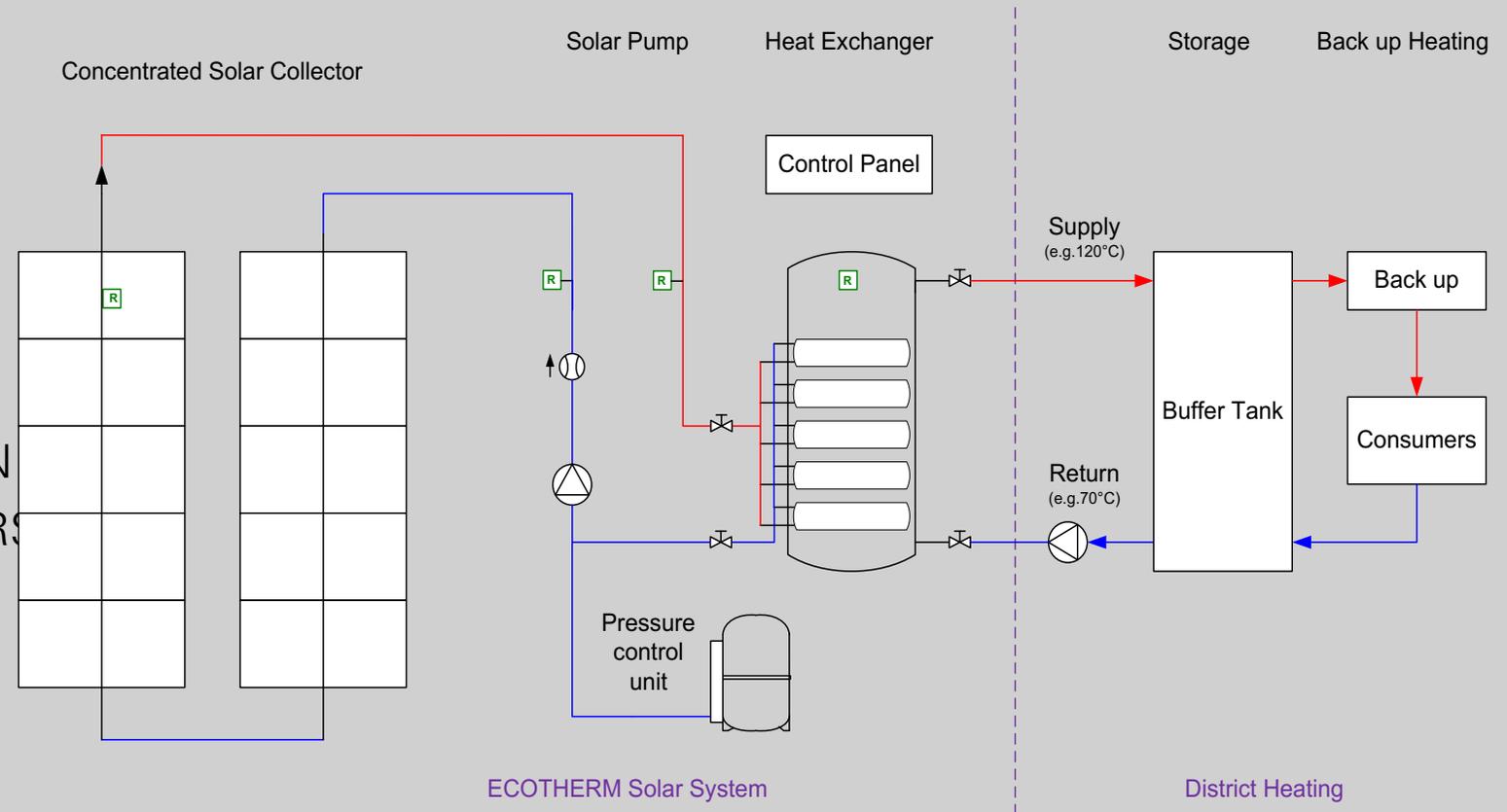


## INTEGRATION FOR HOT WATER / THERMAL OIL APPLICATIONS

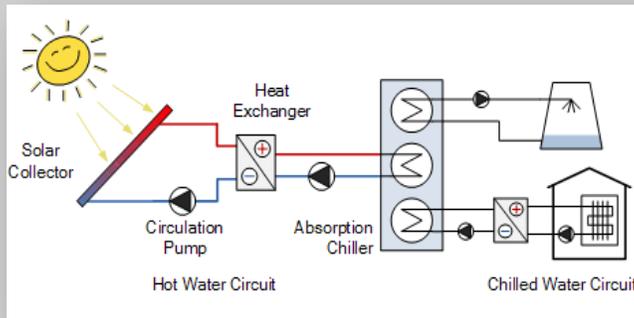


Sample application: district heating

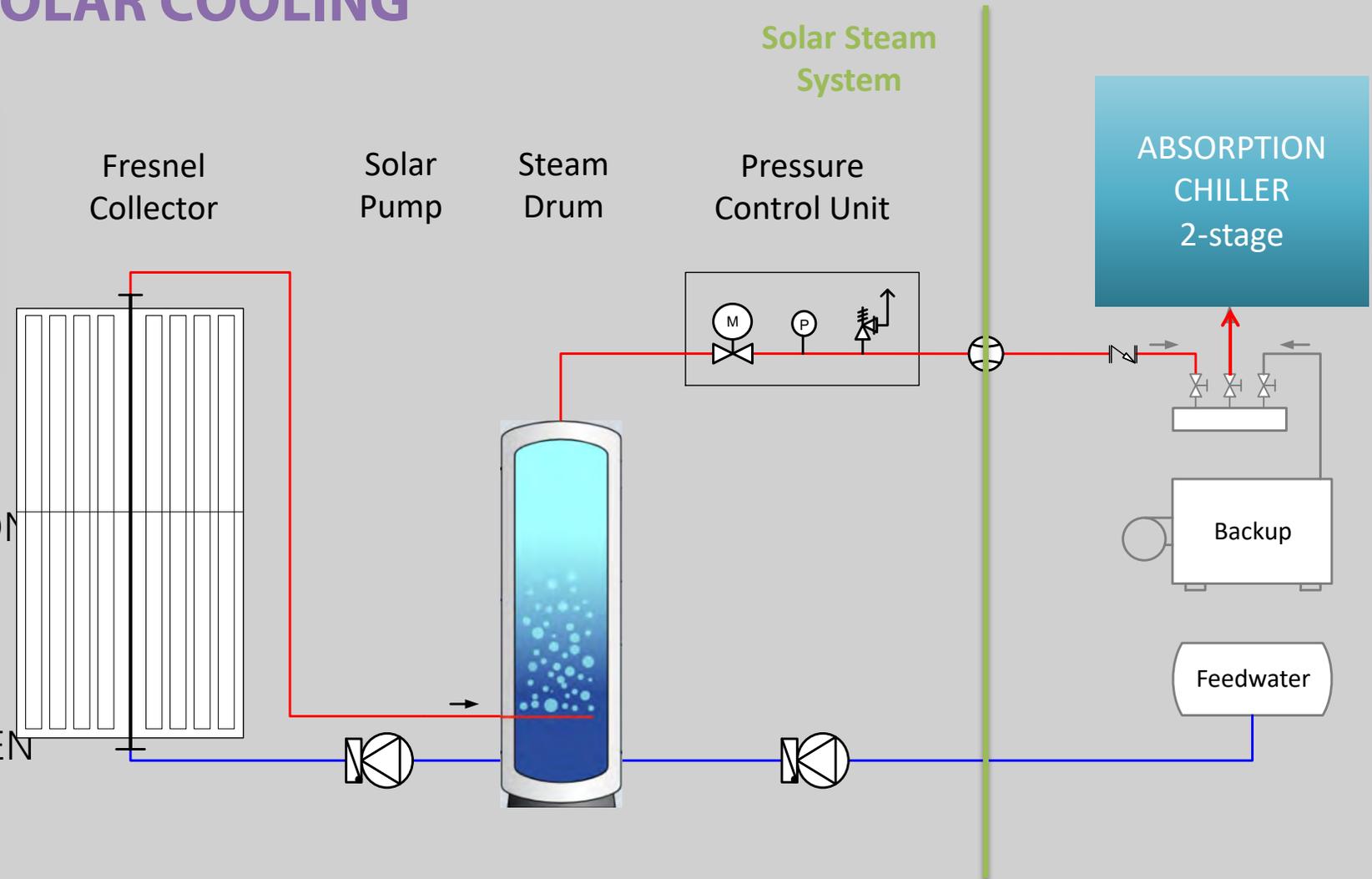
- FULLY AUTOMATIC OPERATION
- IN COMBINATION WITH BOILERS
- EASIER LOWER-COST SYSTEM
- HOT WATER UP TO 250 DEGREES



## INTEGRATION FOR SOLAR COOLING



- FULLY AUTOMATIC OPERATION
- TWO-STAGE ABSORPTION CHILLER
- COP > 1
- STEAM OR HOT-WATER DRIVEN (TEMPERATURE ≈ 150C)

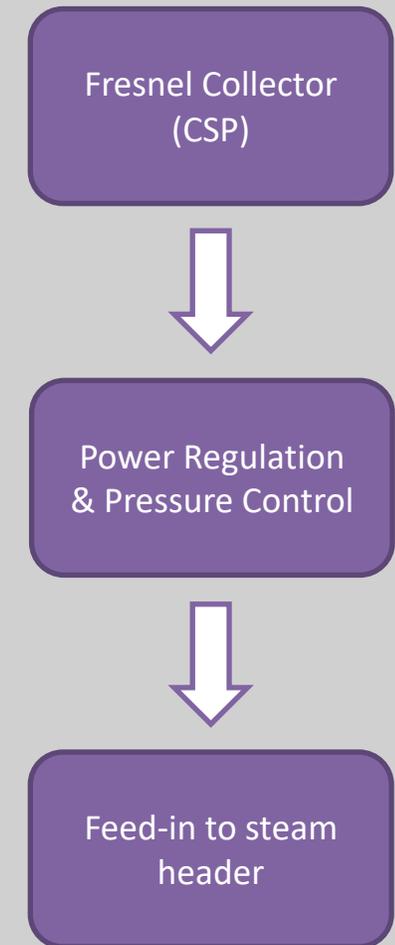
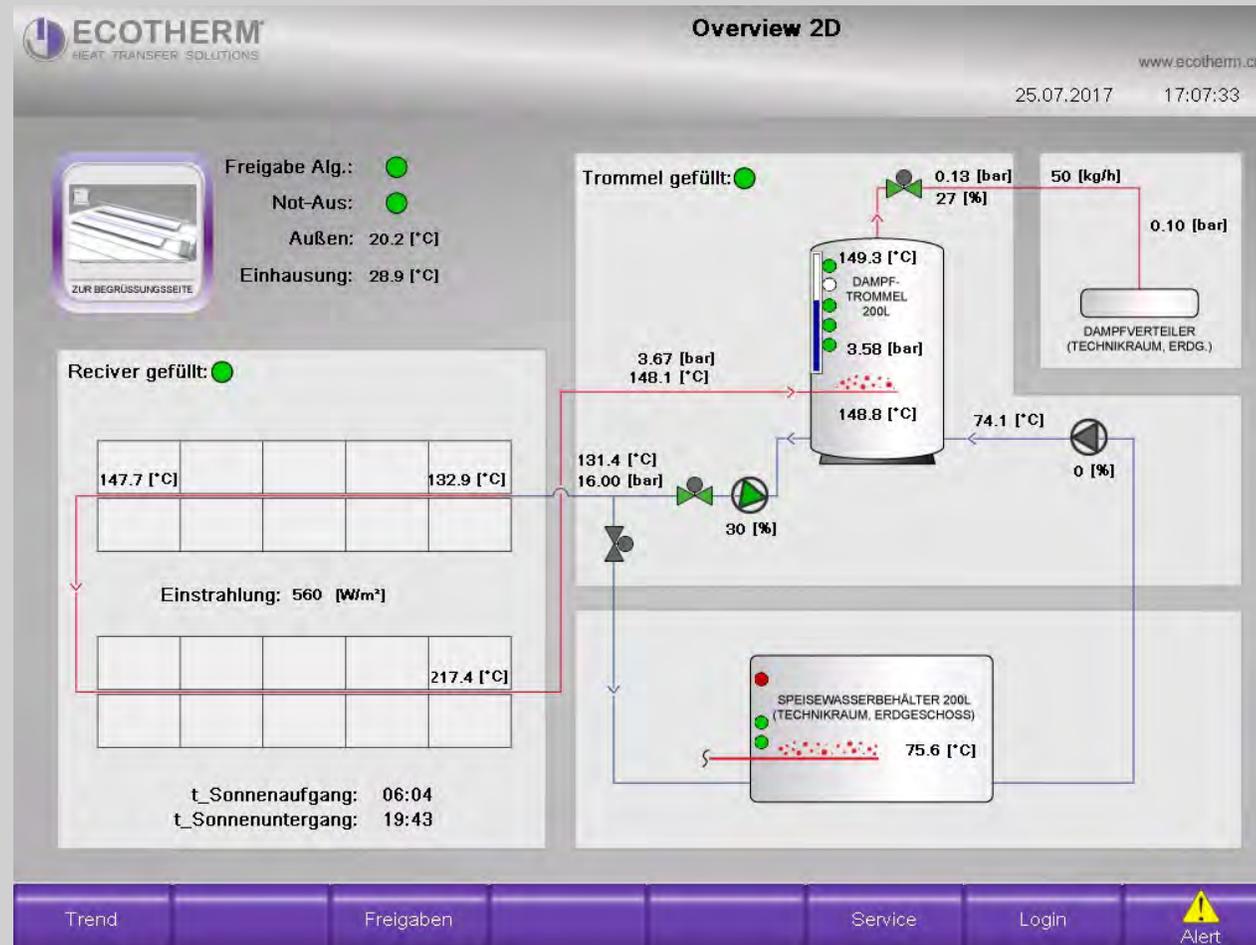


# Fully Automatic Operation

ECOTHERM solar boilers can start and shut down automatically every day.

The operation data can be monitored and reviewed via remote control any time.

The pressure control unit ensures constant steam pressure in the steam line towards the production.



# Madrid Solar Output

## Project Example

Location MADRID 2.000m<sup>2</sup>

150° C direct steam generation

DNI (solar radiation)	1.928	kWh/m <sup>2</sup> year
DNI peak	1.000	W/m <sup>2</sup>
Optical peak efficiency	57,7	%
Peak efficiency at noon incl. thermal losses	53,7	%
Annual efficiency	33,2	%
Annual thermal output	1,3	GWh
Peak steam production for 2.000m <sup>2</sup>	1,7	t/h
Peak thermal output for 2.000m <sup>2</sup>	1,1	MW
Annual steam generation	1.960	t/year

## Installation

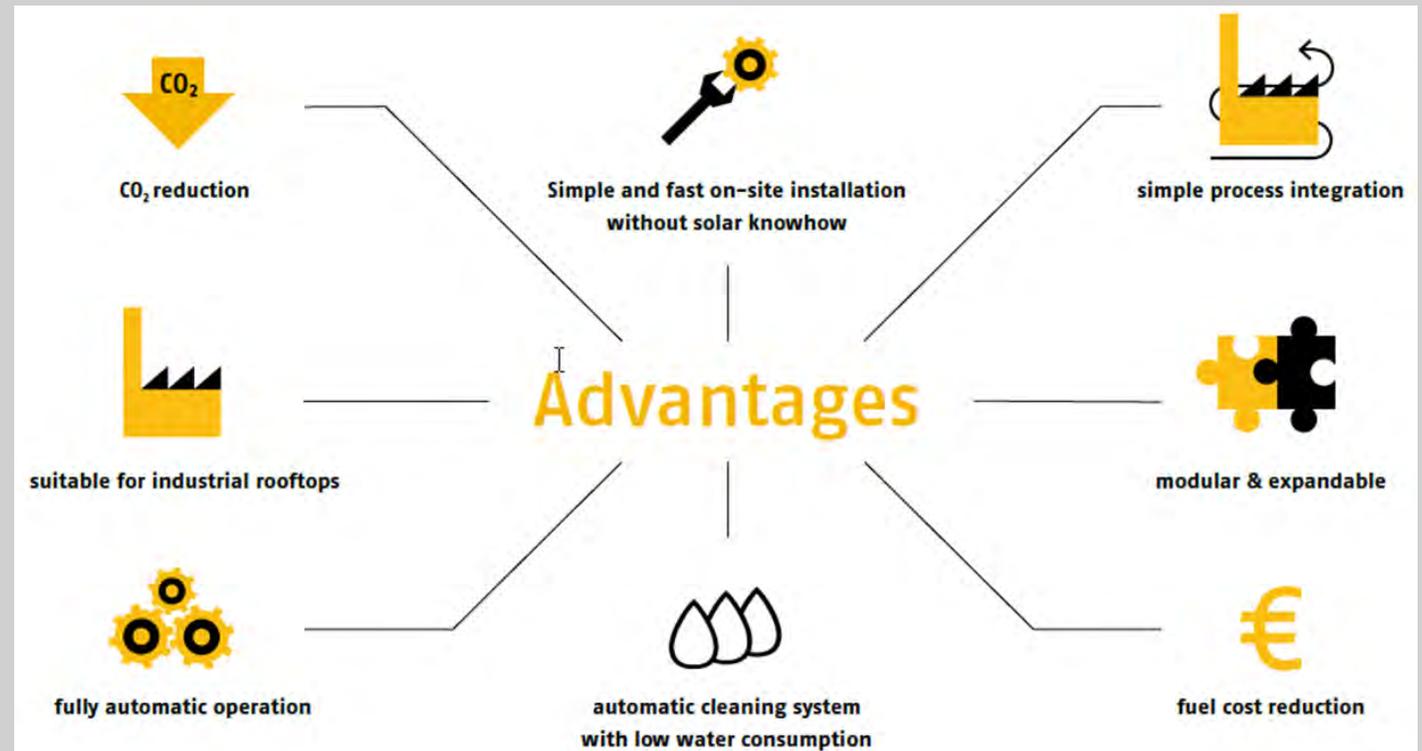
Premanufactured mirror modules are installed rapidly directly on the roof or any prepared substructure.

Steam drum including control cabinet are delivered preassembled and prewired.



## USP's

- Pre-assembled mirror module including drive and control
- Transport in compact units
- Easy to install
- Low area exposed to wind
- Low surface loading (25 kg/m<sup>2</sup> roof load)
- Perfect suitable for roof-top installation
- Mirrors easy to clean due to flat structure
- Same efficiency but lower system cost compared to competition
- Plants of individual size consist of several modules of 10m<sup>2</sup> mirror surface
- Guaranteed System Efficiency
- Collector efficiency certified by solar test centre (AIT according to ISO 9806:2013)
- TUV approved

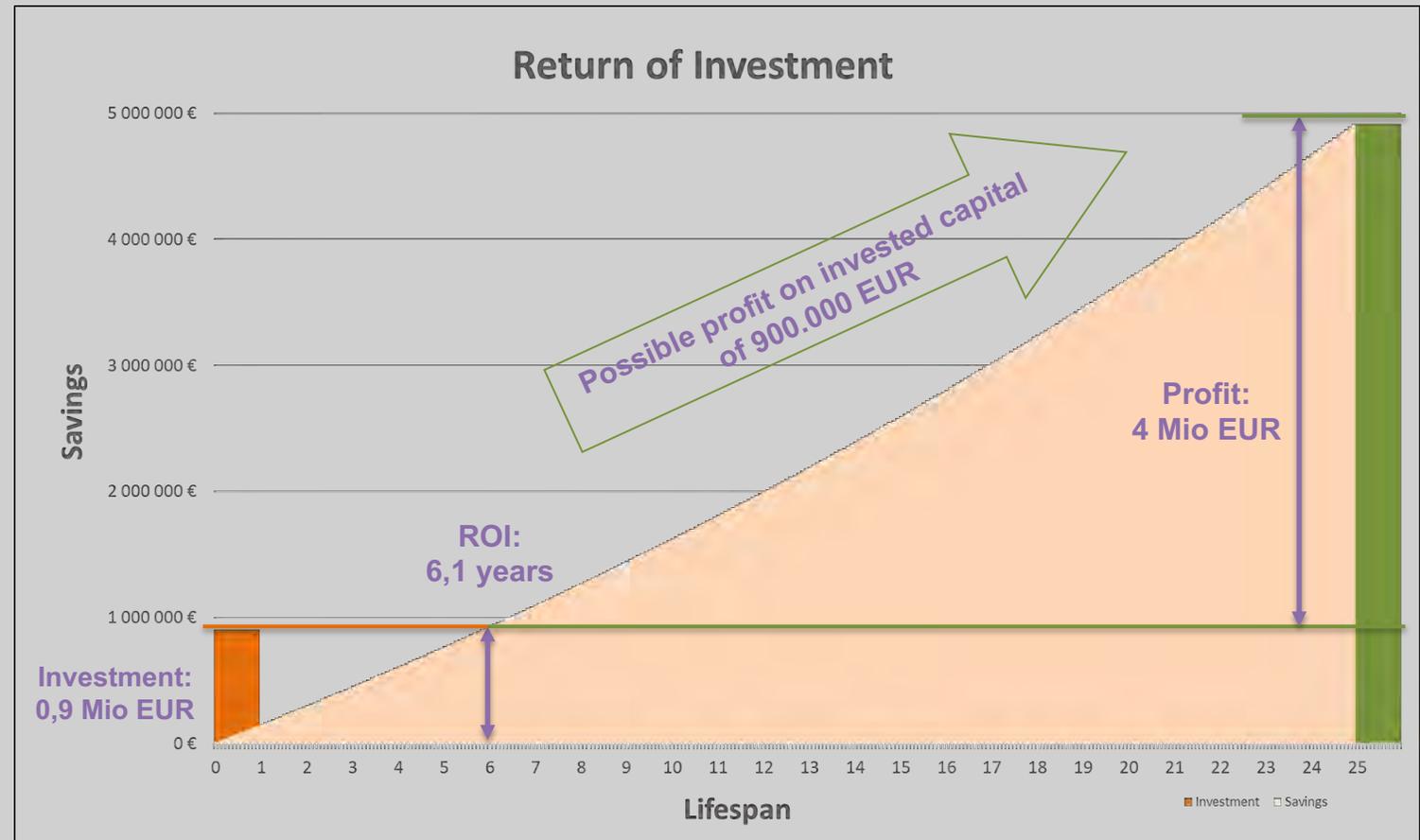
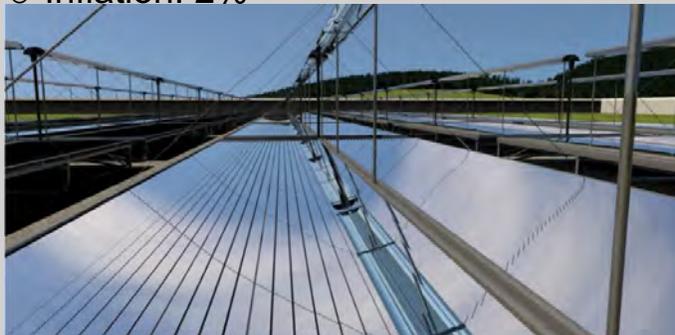


# Investment opportunity

**Golden End → free energy source after payback period**

sample calculation based on:

- DNI: 2200 kWh/m<sup>2</sup>a
- Solar field size: 2.250 m<sup>2</sup>
- Steam pressure: 6 bar
- Operation: 7 days per week
- Life span: 25 years
- Actual steam price: 42 €/ton
- Fuel price increase: 2,5% p.a.
- Inflation: 2%

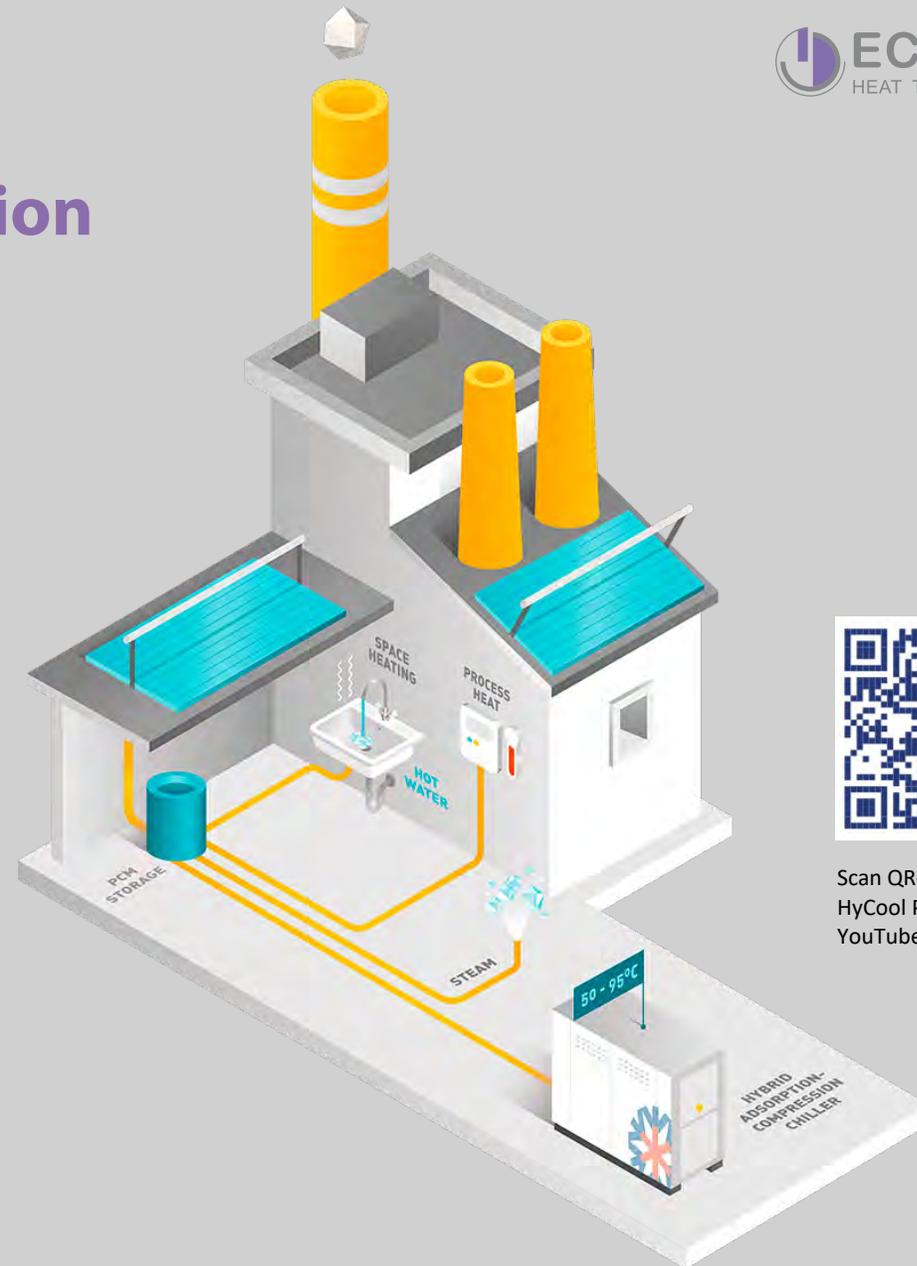


# HyCool: The Industrial Solar Cooling Solution

With the HyCool project EU, ECOTHERM demonstrates that solar heat can become a reliable energy source for greener, more energy-efficient industrial processes.

We designed and implemented our Solar Steam System in two industrial pilots while allowing a flexible and easy integration of the system into existing industrial environments.

Solar steam generation is designed to save energy costs and reduce CO2 emissions by reducing the overall consumption of fossil fuels.



Scan QR-Code to watch  
HyCool Project Video on  
YouTube.



A 4-year innovation action project  
funded by the EU's Horizon 2020 programme

## ECOTHERM® Solar Steam System: 200 m<sup>2</sup> Mirror Area

for Headquarters in Hartkirchen, Austria

ECOTHERM developed its pilot project for solar steam in 2015 as the first on-roof Fresnel system in Austria.

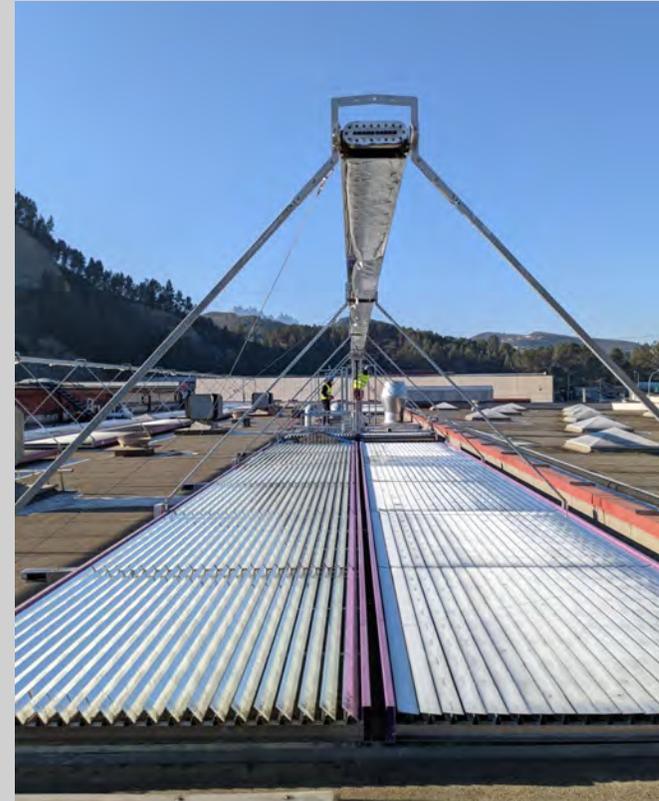


Scan QR-Code to watch  
Solar Steam Explainer  
Video on YouTube.

# ECOTHERM® Solar Steam System: 800 m<sup>2</sup> Mirror Area for Givaudan (Chemical Industry) in Sant Celoni, Spain



## ECOTHERM® Solar Steam System: 400 m<sup>2</sup> Mirror Area for Bo de Debò (Food Industry) in Barcelona, Spain



# Locations

Minimum solar radiation: 1800kWh/m<sup>2</sup>year (Direct Normal Irradiation – DNI)

