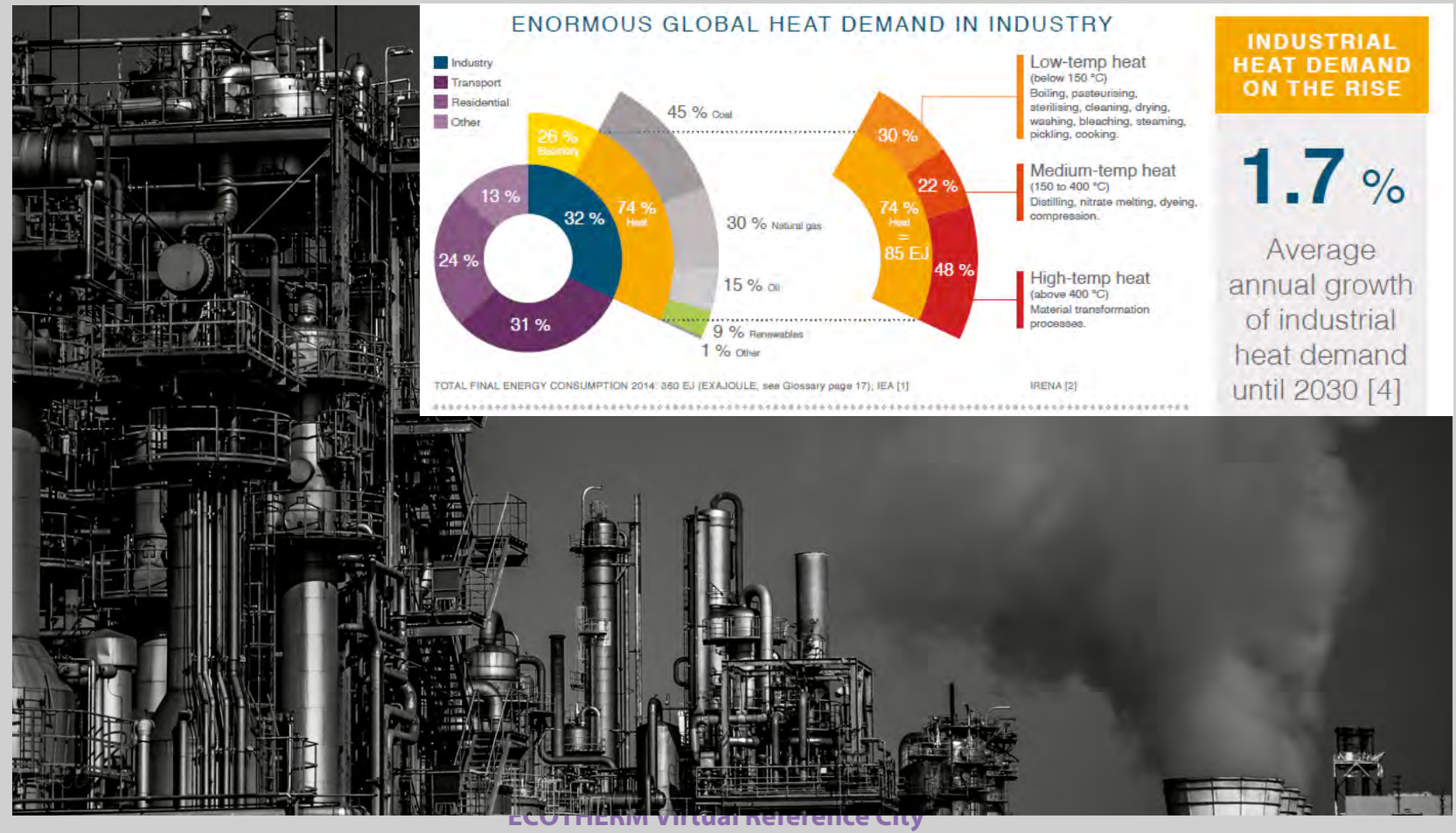




Solar Steam Generation

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



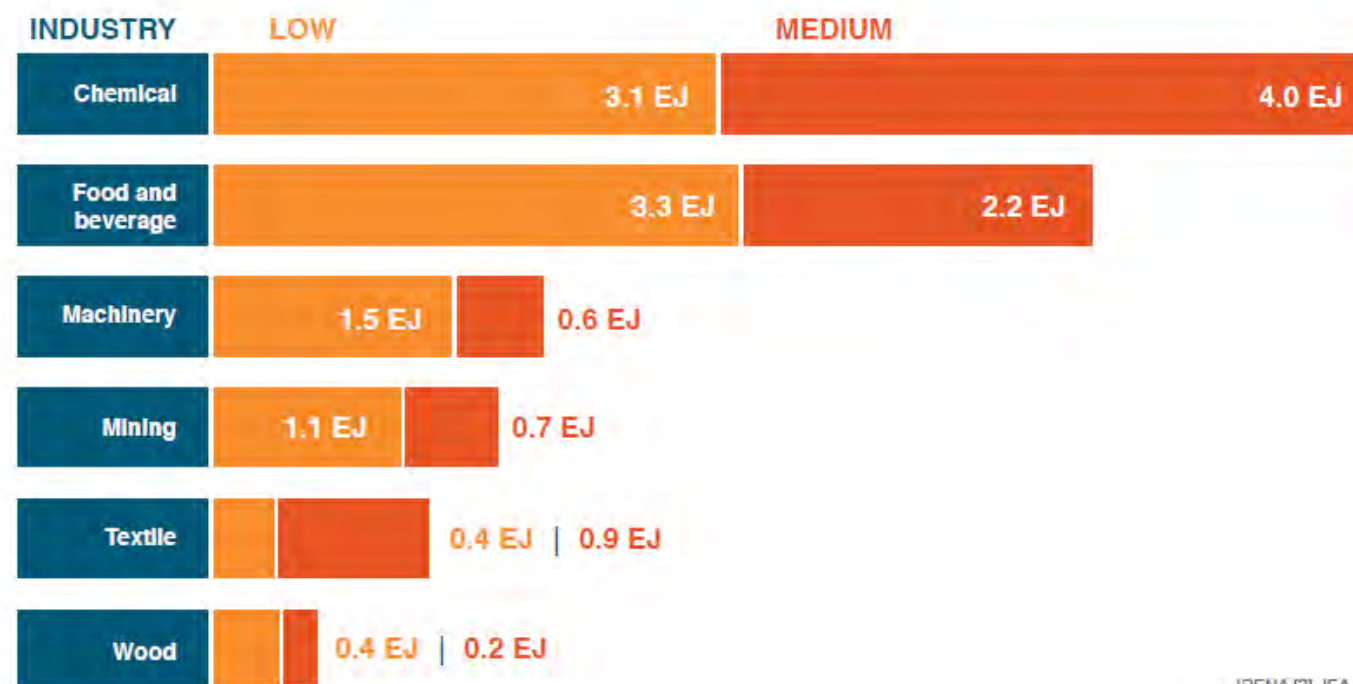
Industry Segments

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.

HEAT DEMAND

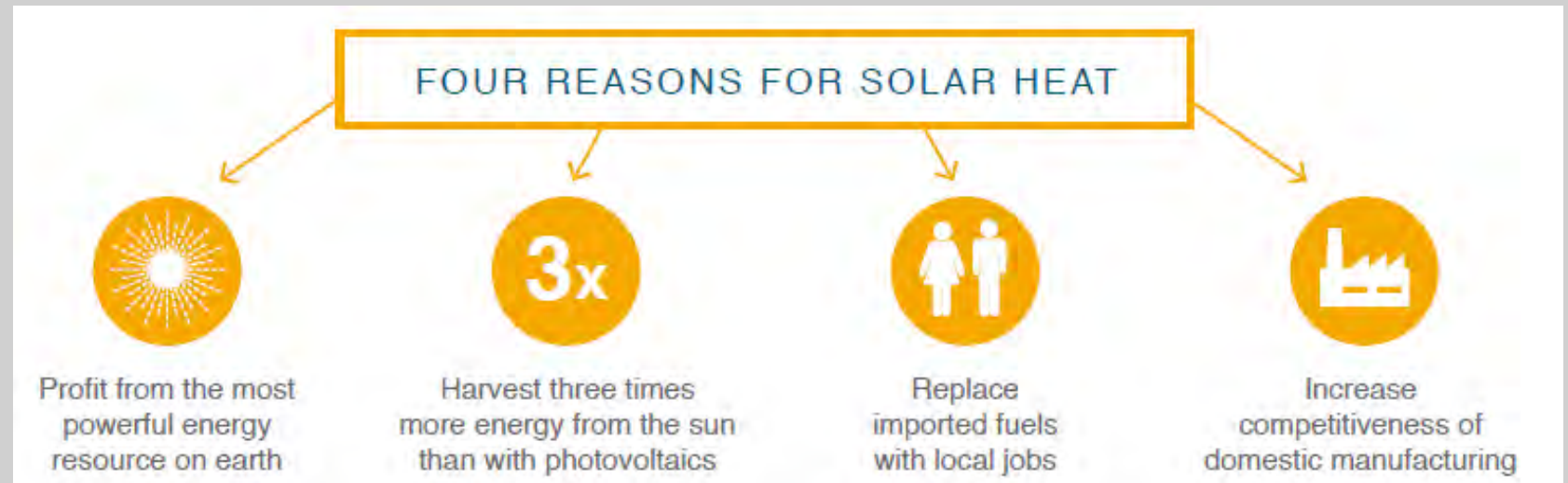
The total heat demand for low and medium temperature applications accounts for **44 EJ** (exajoule) globally (≈12,222 TWh). The chart below shows this heat demand in selected industries.



IRENA [2], IEA [1]

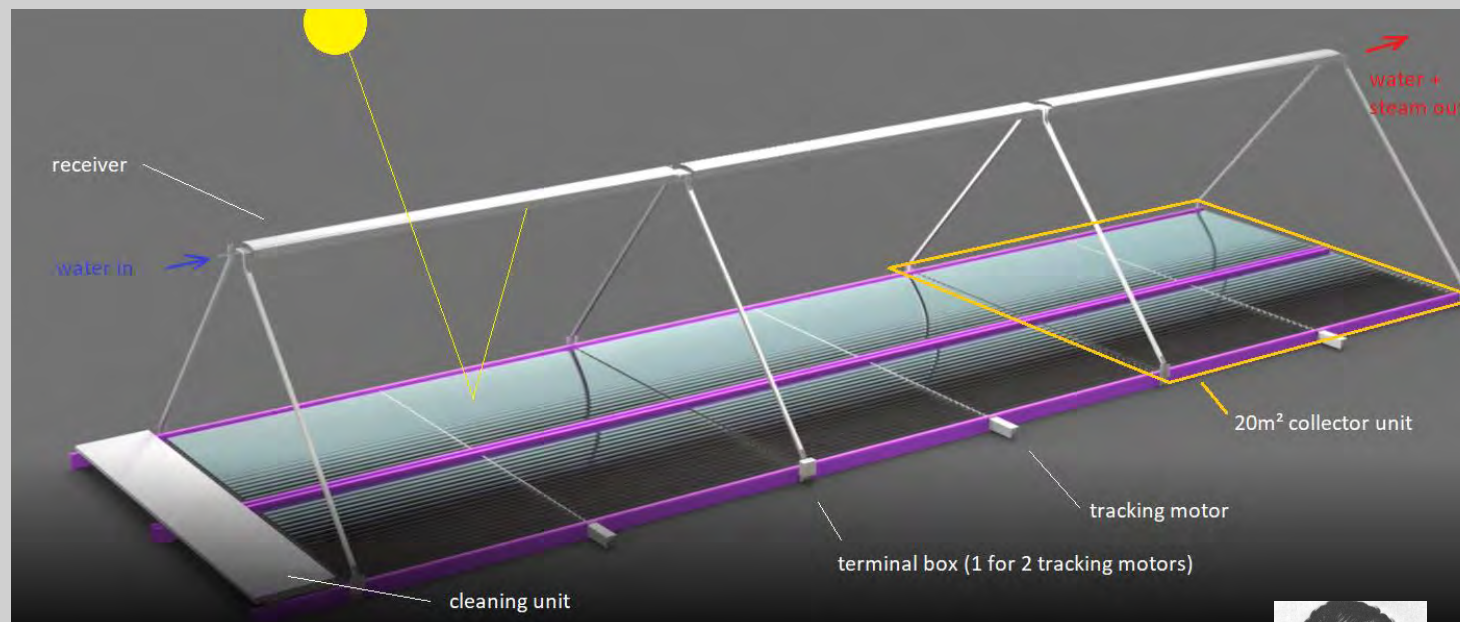
ECOTHERM Solar Steam Boiler

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.



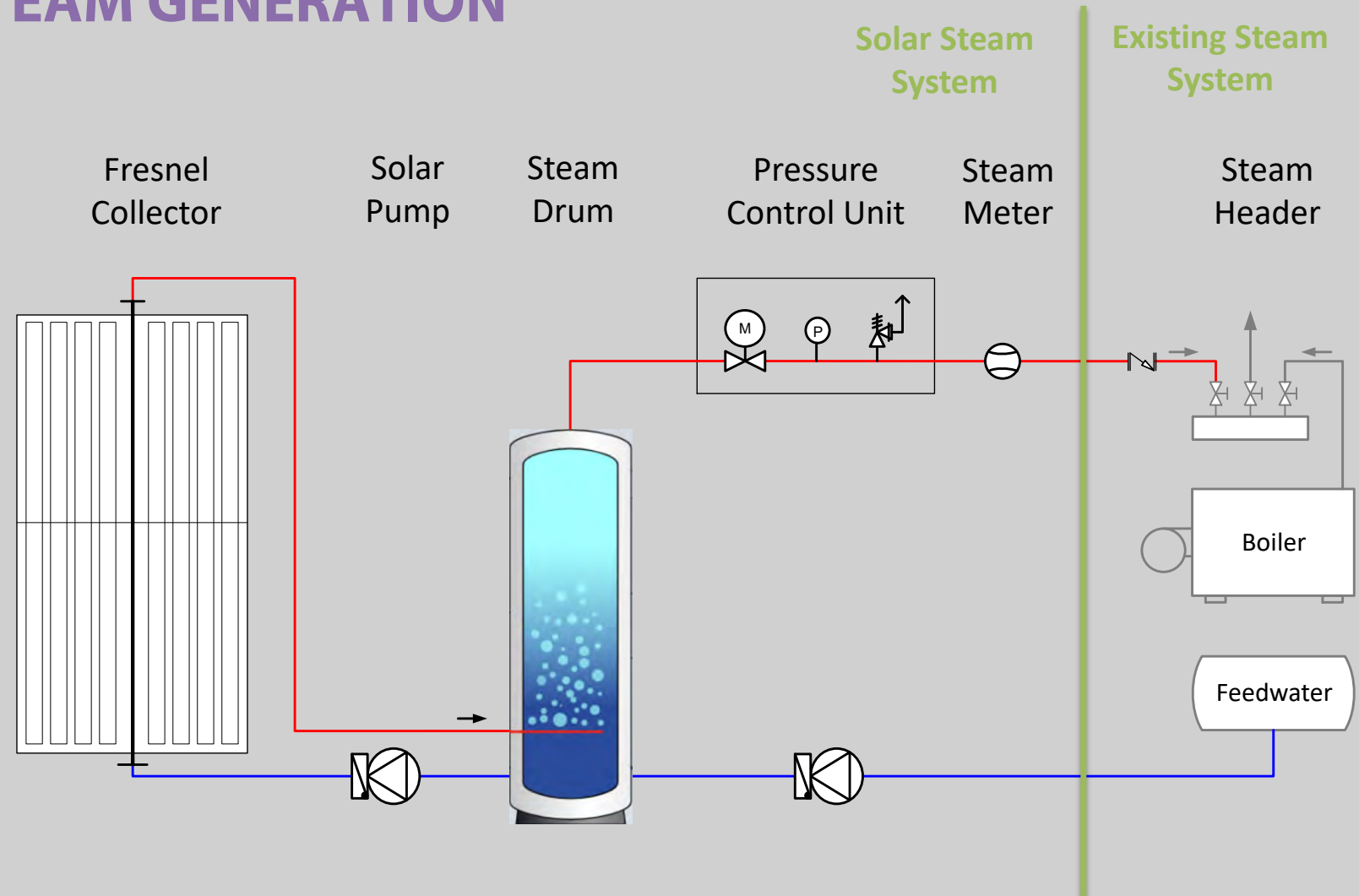
History: Augustin-Jean Fresnel (1788 –1827), was a French engineer and who studied the behaviour of light both theoretically and experimentally. He is best known as the inventor of the fresnel lens.



INTEGRATION FOR STEAM GENERATION



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

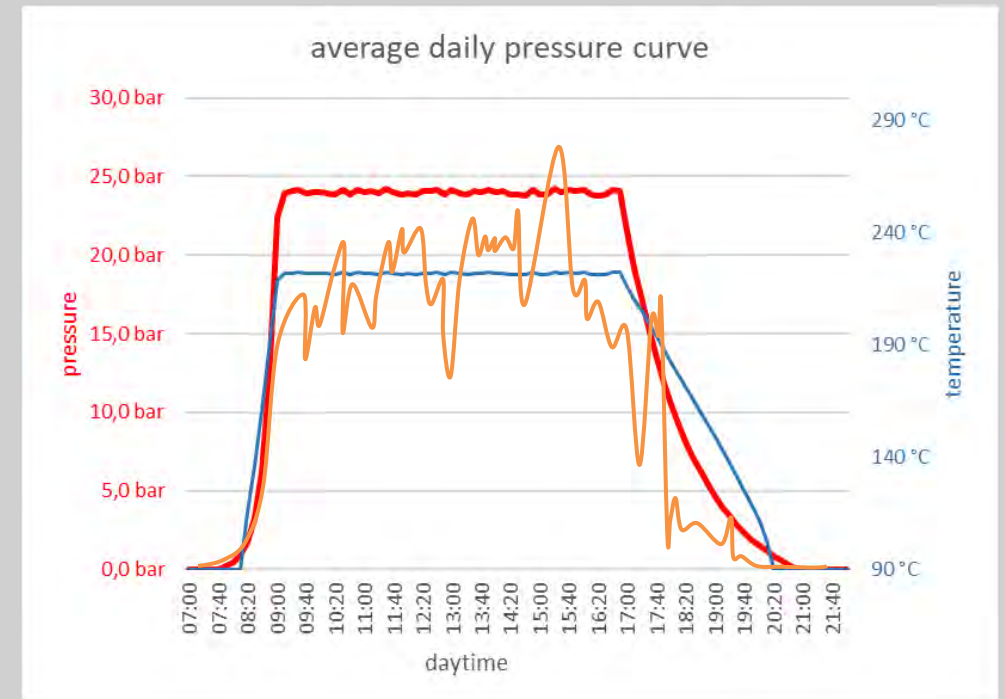


INTEGRATION FOR STEAM GENERATION

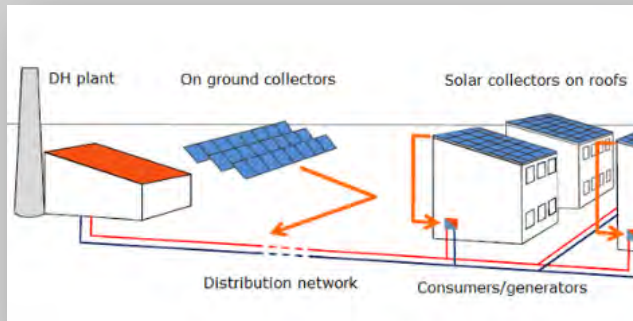
ECOTHERM Steam Drum → The link between solar field and steam consumers



— Solar Irradiation
— Steam pressure
— Temperature

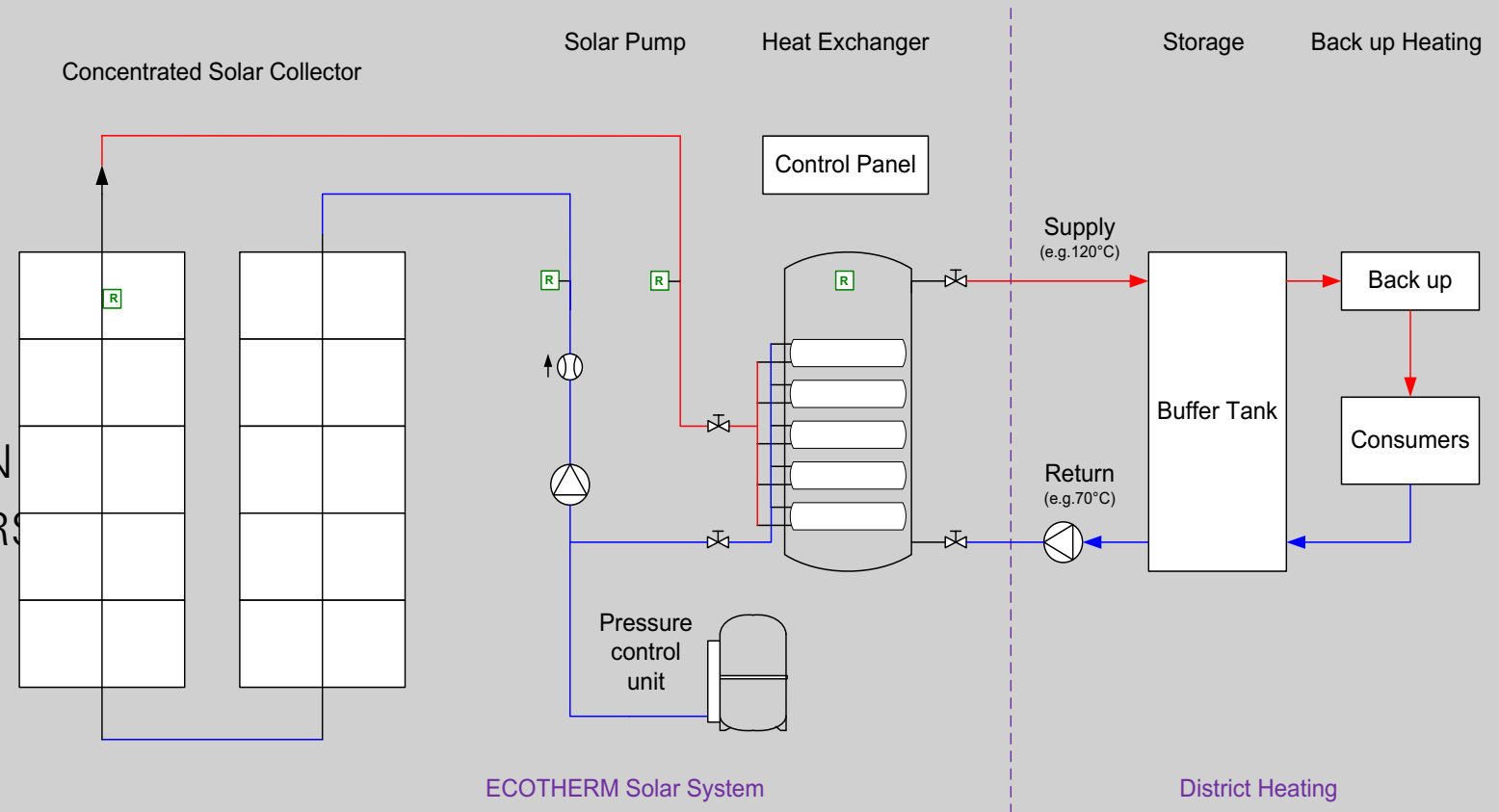


INTEGRATION FOR HOT WATER / THERMAL OIL APPLICATIONS

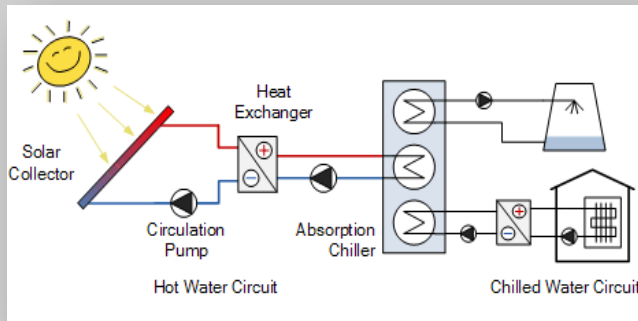


Sample application: district heating

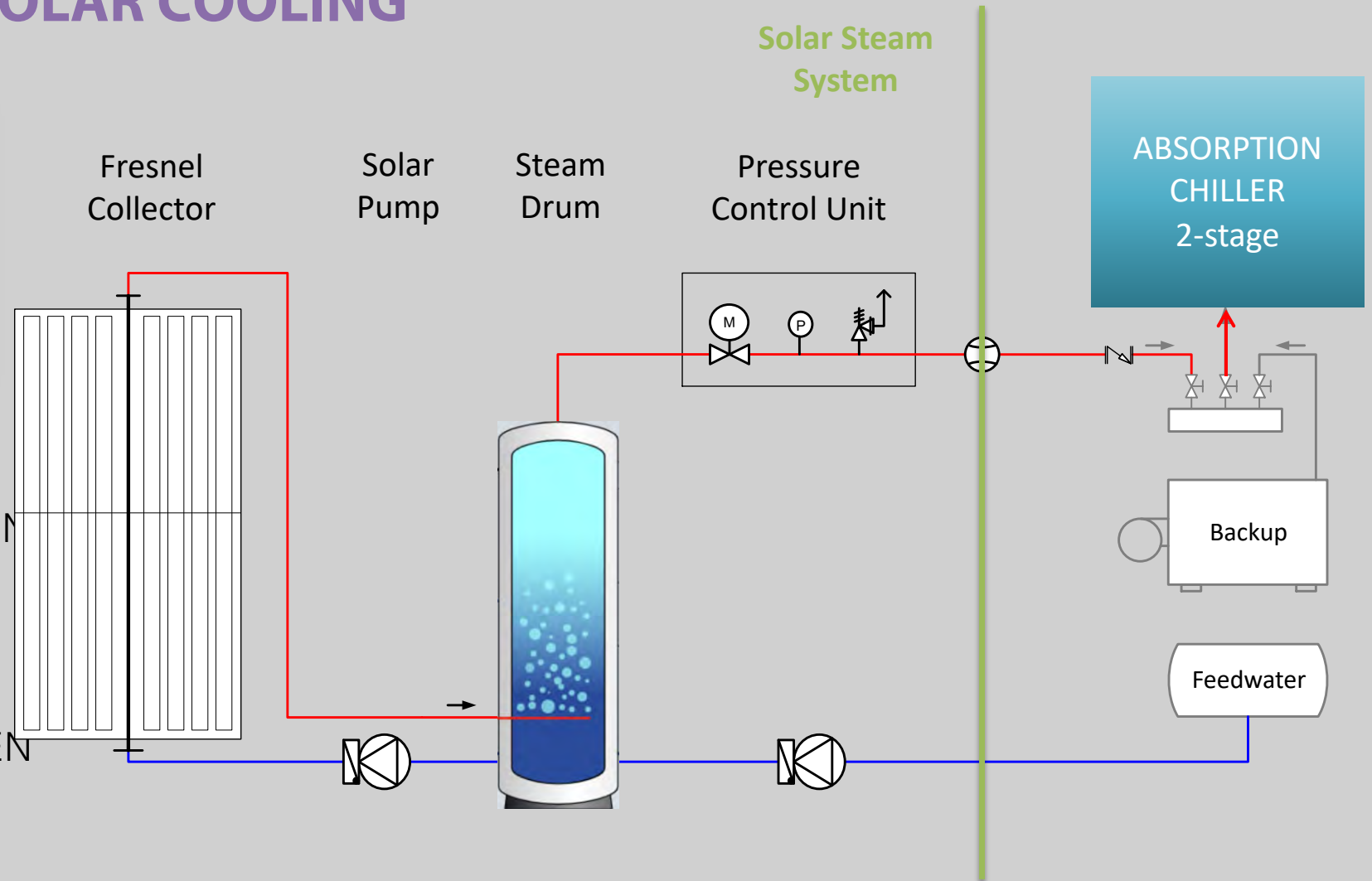
- FULLY AUTOMATIC OPERATION
- IN COMBINATION WITH BOILERS
- EASIER LOWER-COST SYSTEM
- HOT WATER UP TO 250 DEGREES



INTEGRATION FOR SOLAR COOLING



- FULLY AUTOMATIC OPERATION
- TWO-STAGE ABSORPTION CHILLER
- $COP > 1$
- STEAM OR HOT-WATER DRIVEN (TEMPERATURE $\approx 150^{\circ}C$)

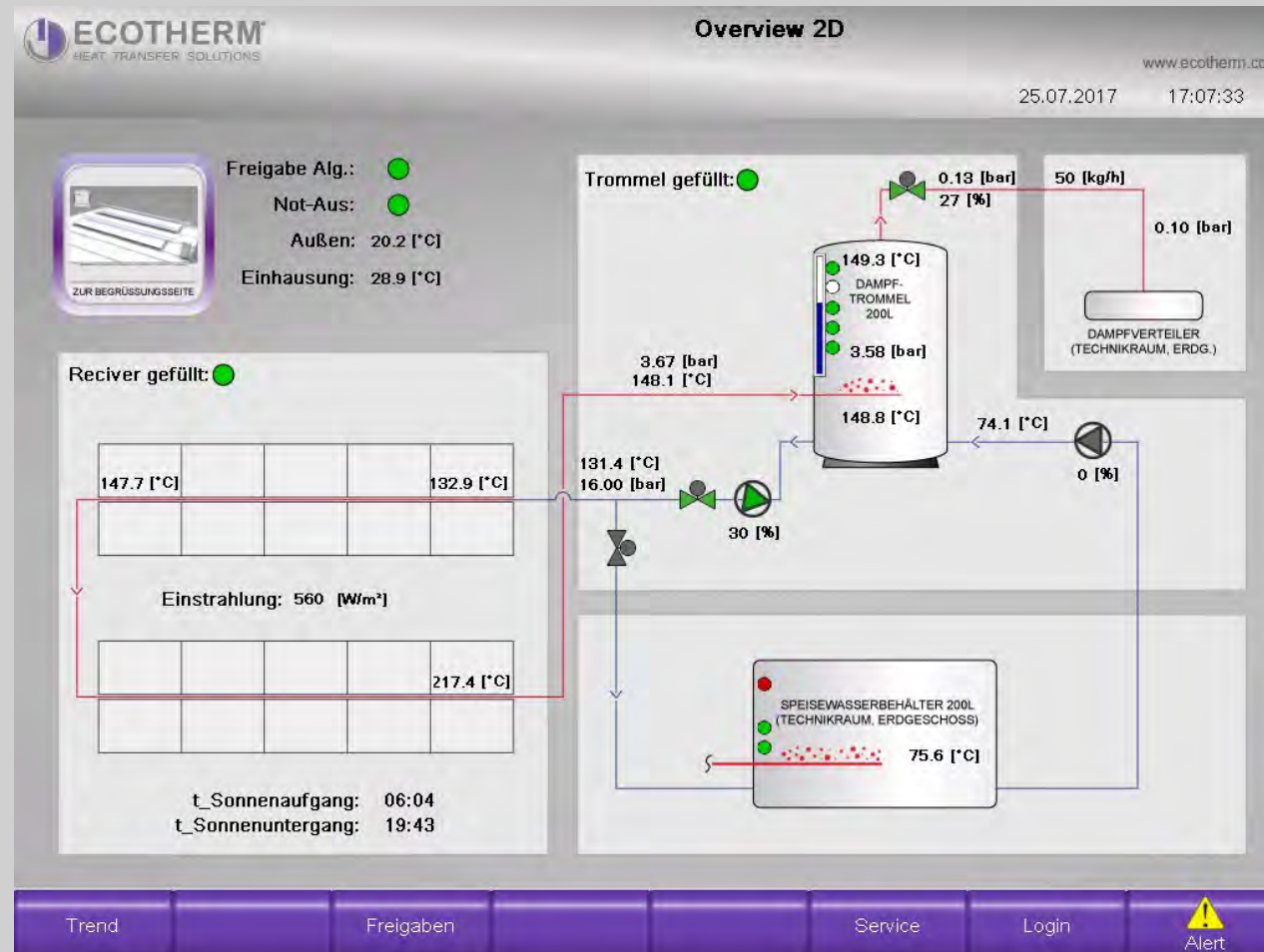


Fully Automatic Operation

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.



Fresnel Collector
(CSP)



Power Regulation
& Pressure Control



Feed-in to steam
header

Madrid Solar Output

Project Example

Location MADRID 2.000m²

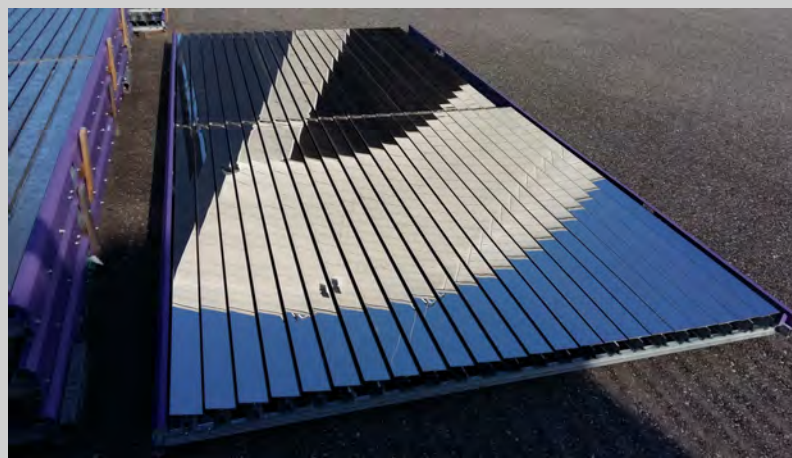
150° C direct steam generation

DNI (solar radiation)	1.928	kWh/m ² year
DNI peak	1.000	W/m ²
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 ²	1,7	t/h
Peak thermal output for 2.000m ²	1,1	MW
Annual steam generation	1.960	t/year

Installation

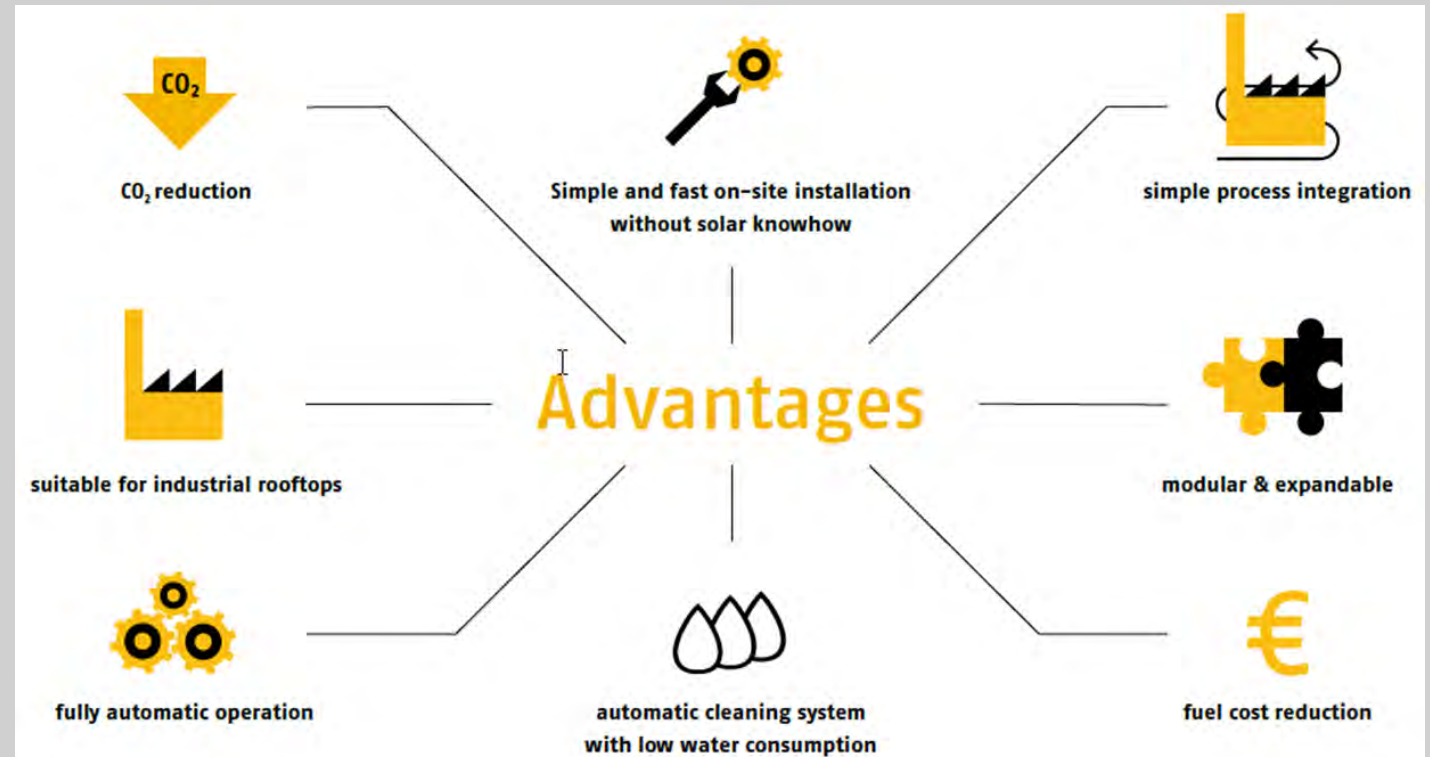
Premanufactured mirror modules are installed rapidly directly on the roof or any prepared substructure.

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/m² 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 10m² mirror surface
- Guaranteed System Efficiency
- Collector efficiency certified by solar test centre (AIT according to ISO 9806:2013)
- TUV approved

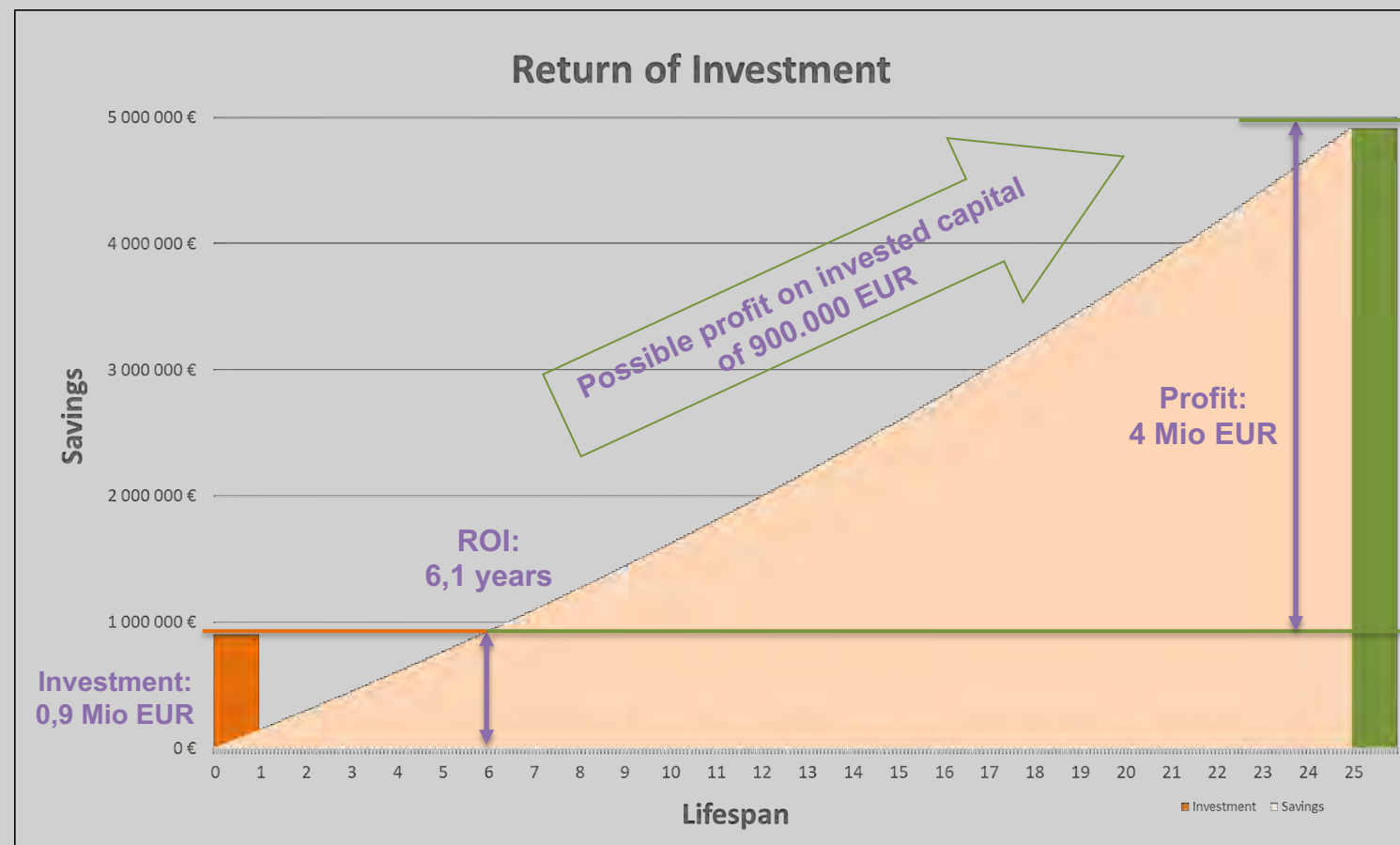


Investment opportunity

Golden End → free energy source after payback period

sample calculation based on:

- DNI: 2200 kWh/m²a
- Solar field size: 2.250 m²
- 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.



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



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

ECOTHERM® Solar Steam System: 200 m² 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 m² Mirror Area for Givaudan (Chemical Industry) in Sant Celoni, Spain



ECOTHERM® Solar Steam System: 400 m² Mirror Area for Bo de Debò (Food Industry) in Barcelona, Spain



Locations

Minimum solar radiation: 1800kWh/m²year (Direct Normal Irradiation – DNI)

