

SOLTIGUA

CONCENTRATING SOLUTIONS



HIGH TEMPERATURE COLLECTORS

SO.PRO Workshop - Intersolar Munich 2011

Soltigua is an Italian company which designs and manufactures linear concentrating solar collectors which produce heat up to 250°C.

Soltigua's product portfolio includes two different types of concentrating collectors:

- PTM series (Parabolic Trough Collectors)
- FTM series (Linear Fresnel Collectors)

This makes Soltigua's offer unique on a worldwide basis.

Soltigua also develops concentrating solar solutions for distributed heat generation, air conditioning and polygeneration requirements.



1 –HIGH TEMPERATURE COLLECTORS: WHY?

Applications



- Process heat up to 250°C
 - Production of hot water and steam
 - Heating of thermal oil
 - Generation of hot air



- Solar cooling
 - Production of air conditioning with LiBr absorption chillers
 - Cooling at $T \leq 0^{\circ}\text{C}$ with ammonia chillers



- Polygeneration
 - Electricity production with low temperature turbines (ORC)
 - Solar co-generation and tri-generation
 - Desalination

Applications: by industry

INDUSTRIAL SECTOR	PROCESS	TEMPERATURE[°C]
Food and beverages	Washing	80 – 150
	Pasteurization	80 – 110
	Sterilization	130 – 150
	Drying	130 – 240
	Cooking	80 – 100
Plastics	Extrusion and Drying	150 – 180
Chemical	Heat treatment	150 – 180
	Boiling	95 – 105
	Distillation	110 – 300
	Drying	150 – 180
Paper	Bleaching and drying	130 – 180
Textile	Washing	80 – 100
	Heat treatment	80 – 130
	Bleaching	60 – 100
	Dyeing	100 - 160
Industrial cleaning	Steam Washing	150
Commercial sector	Air conditioning	180
All	Electricity generation/Polygeneration	250-300

Solar Cooling - the concept

- An absorption chiller is fed with the heat collected by solar collectors.
- The chiller is environmentally friendly: it uses a natural refrigerant (a mixture of water and lithium bromide). There is no impact on ozone depletion or on global warming
- The primary energy resource is the sun
- Electricity consumption is very low
- Main consumption is water in the cooling tower
- CO2 emissions are greatly reduced

High temperature solar cooling

- High temperature parabolic collectors make it possible to use double effect absorption chillers, whose performance is twice the one of single effect chillers which are driven by low temperature collectors (1.42 vs 0.7)



For a given cooling requirement:

- A smaller collector field is required
- Water consumption in the cooling tower is reduced by 27%

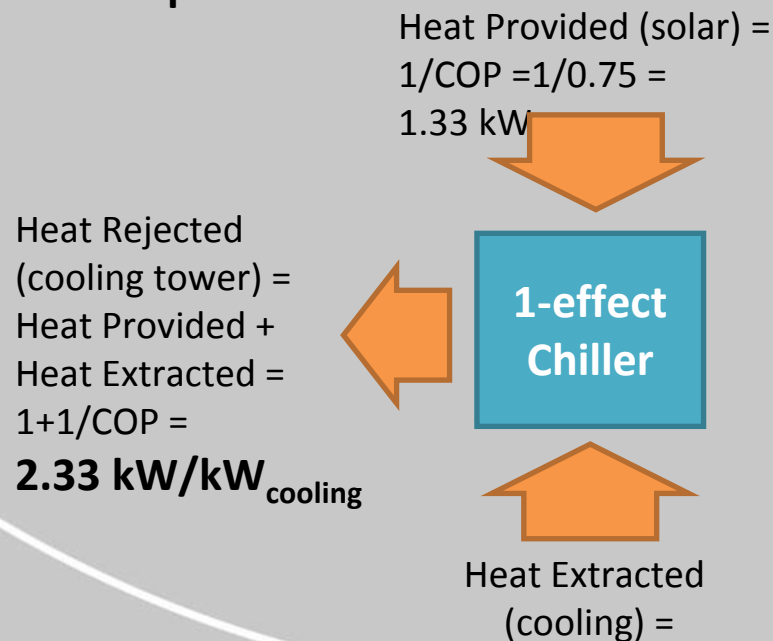
Solar Cooling Ratio

	Low Temperature	High Temperature
Peak performance per net sqm installed	Evacuated tube collectors+ single effect absorption chiller	Parabolic troughs + double effect absorption chiller
Collectors Efficiency	0.6	0.5
Chiller Efficiency (COP)	0.75	1.42
Total System Performance	0.45	0.71 +57%

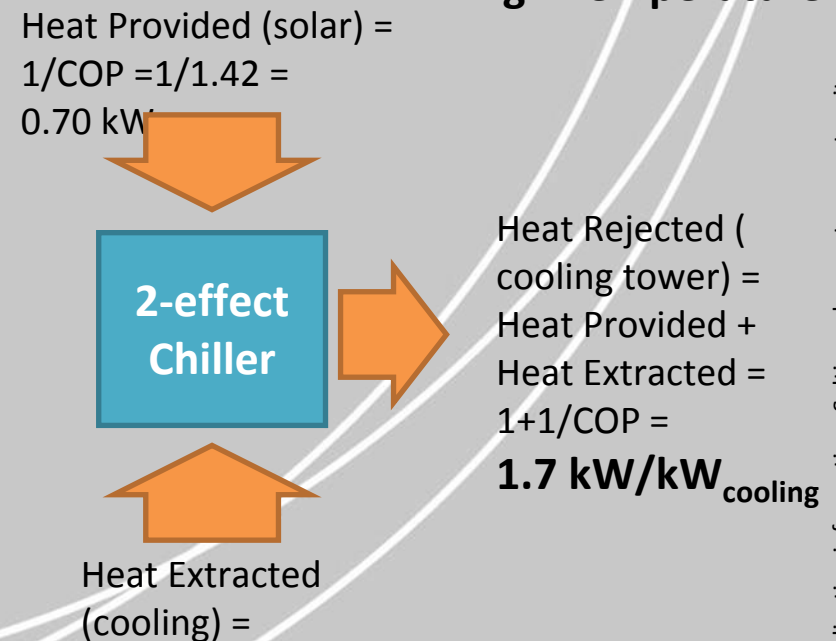
Up to **57%** increase in Cooling Yield per square meter of collecting surface installed

Water Consumption

Low Temperature



High Temperature



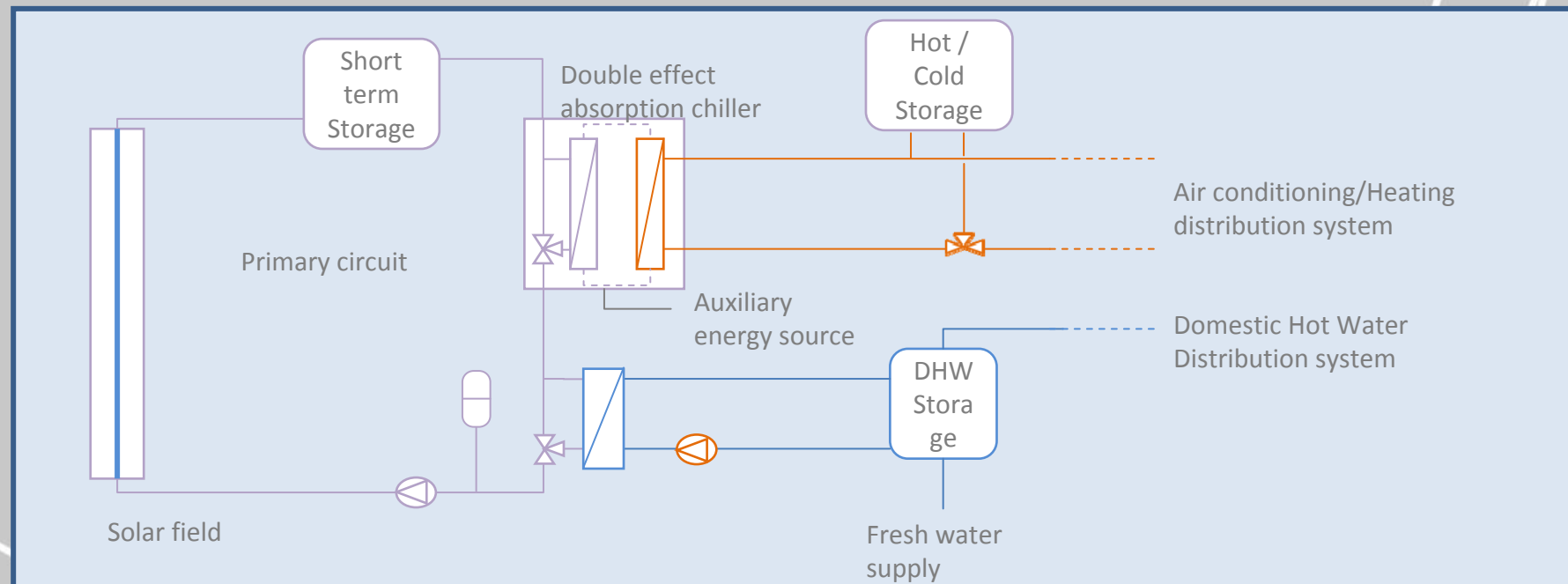
27% water savings in the cooling tower (+lower electricity consumption)

Field-proven solar cooling solutions



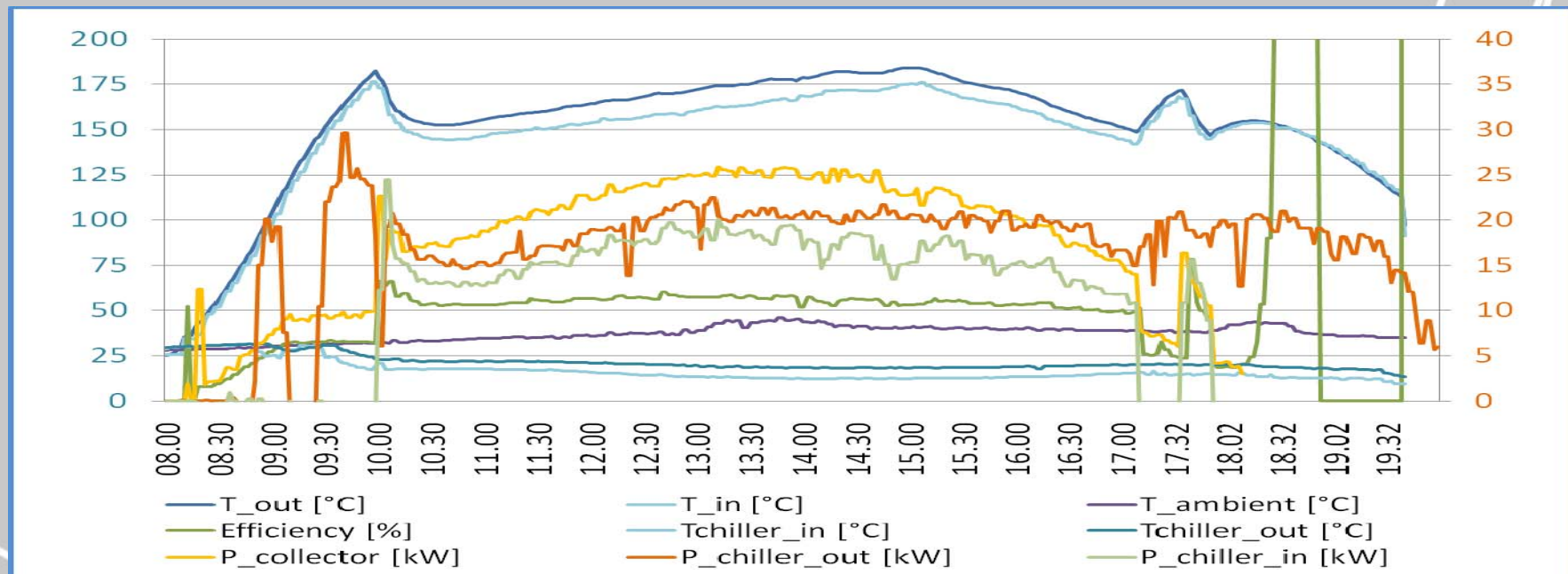
With 23 KW of installed capacity, Soltigua has realised two years ago the first double effect solar cooling system in Italy. The plant is providing air conditioning to the company's offices.

Solar cooling layout



Multipurpose utilisation around the year

Daily operations (summer 2010)

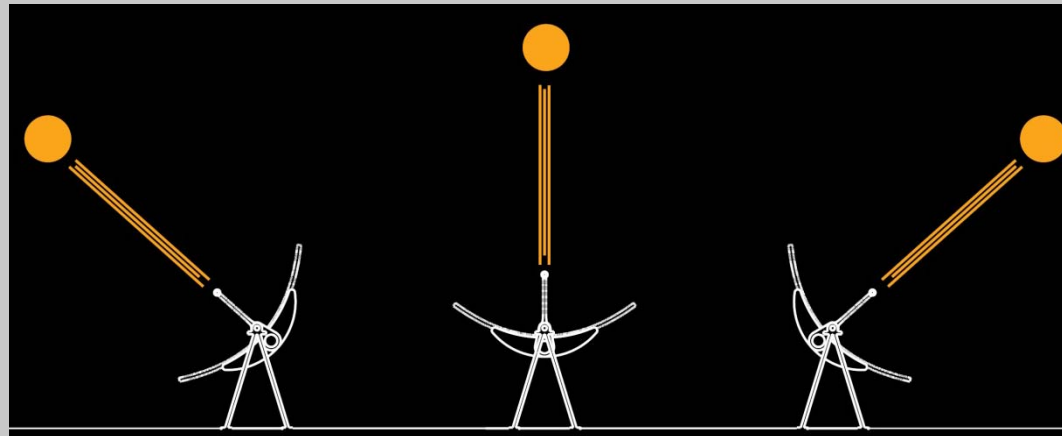


Cooling supplied for more than 7 hrs/day with solar energy!

2 –HIGH TEMPERATURE COLLECTORS: WHAT?

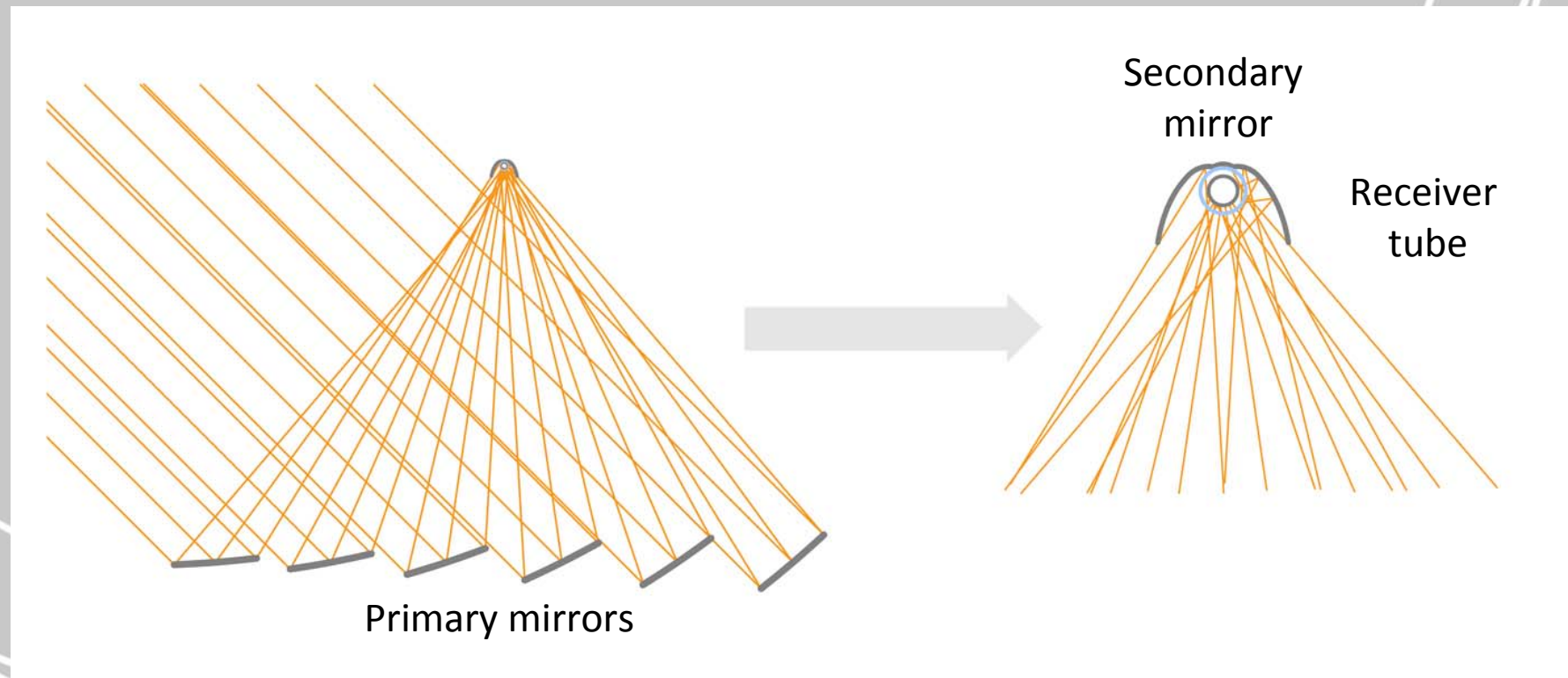
The concept

The collectors continuously track the sun during the day. The mirrors concentrate the sunlight on the receiver tube, reaching high operating temperatures (up to 250°C).



As a result, solar energy can be used in areas previously considered not suitable for renewable energies.

Linear Fresnel: the concept



High temperature collector technologies



PTM – parabolic trough collector



FTM – linear Fresnel collector

COMMON FEATURES

- Modular design
- Selectively coated receiver
- Weather-resistant mirrors
- Sun tracking drive and motor
- Hot-dip galvanized frame
- PLC- based controller
- Fluid: hot water (up to 110°C) or thermal oil
- Working pressure: up to 8 bar
- Maximum fluid working temperature: 250°C
- Electric panel at 230 V



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PTM – parabolic trough collector

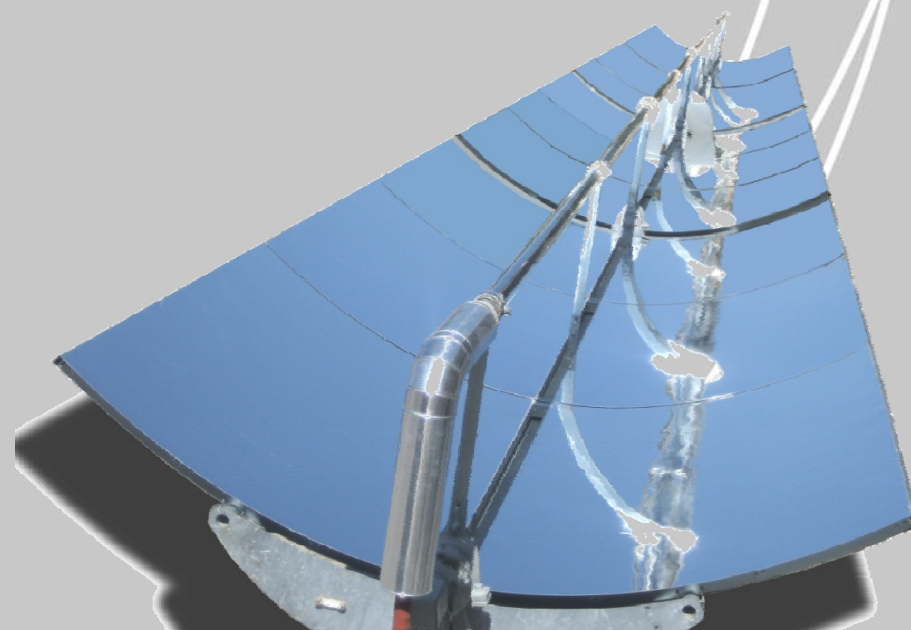
TECHNICAL FEATURES

Modular design:

- Surface = 13.5 sqm/module
- Length = 6.2 mt/module
- Cord = 2.4 mt
- Peak power = 570W/sqm (7.7 kW/module) @DNI of 1000 W/sqm, Tamb= 30°C, Tout = 200°C

Up to 6 modules driven by the same motor (n.1 PTM36):

- 37 mt –long / 80 sqm / 46 kW_{peak}



NEXT ENERGY™ LOGICAL EXCELLENCE

In 2010 PTM has been awarded the “Towards the A-class building” prize at the MCE2010, Europe’s largest trade fair for heating and air conditioning.

The prize was given to the best innovations for building energy systems.

Purely indicative information. Soltigua does not guarantee its accuracy

FTM - linear Fresnel collector

TECHNICAL FEATURES *(Available July 2011)*

- Modular design:
 - Surface = 22.5 sqm/module
 - Length = 6.3 mt/module
 - Width = 5 mt
 - Height = 3.5 mt
 - Peak power = 490 W/sqm (11 kW/module)@DNI of 1000 W/sqm, Tamb= 30°C, Tout = 200°C - *estimated*
- Up to 6 modules driven by the same motor:
 - 36 mt –long / 135 sqm / 66 kW_{peak}



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Ongoing developments

- EN 12975 has been extended to concentrating collectors in Dec.2010
- First certification up to 250°C is being completed in Enea's Trisaia laboratory (on PTM)
- Solar Keymark standard is being adapted to include concentrating collectors

3 –HIGH TEMPERATURE COLLECTORS: HOW?

Soltigua's solar design method

1. ASSESS

- Site assessment
 - Solar radiation
 - Avail. space & constraints
- Process assessment
 - Load profile
 - Existing energy sources
- Preliminary economics

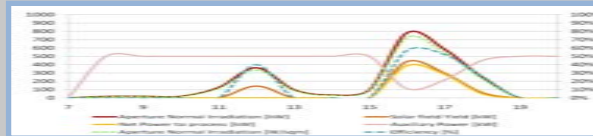


2. PLAN

- Integration concept
- Solar field working conditions
- Optimal solar field size

3 DESIGN

- Control logic
- Primary & secondary loop
- Local norms (e.g. structural)



4. INSTALL

- Attention to details (e.g. insulation)

5. OPERATE

- Operating strategy
- Mirror cleaning
- System mainten.



Based on:

- Field experience in own premises

- Worldwide projects

An example: Indian case study

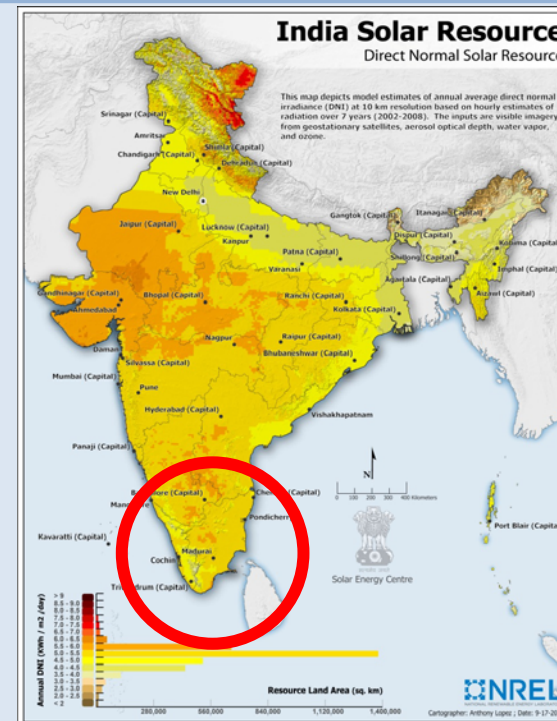
Location: Tamil Nadu

Coordinates: XXX

Process: textile industry

DNI: 1'768 kWh/sqm

$T_{\text{average daily}} = 27.4^{\circ}\text{C}$



Assess: Existing Process

Fluid Temperature: 100° –
135°C

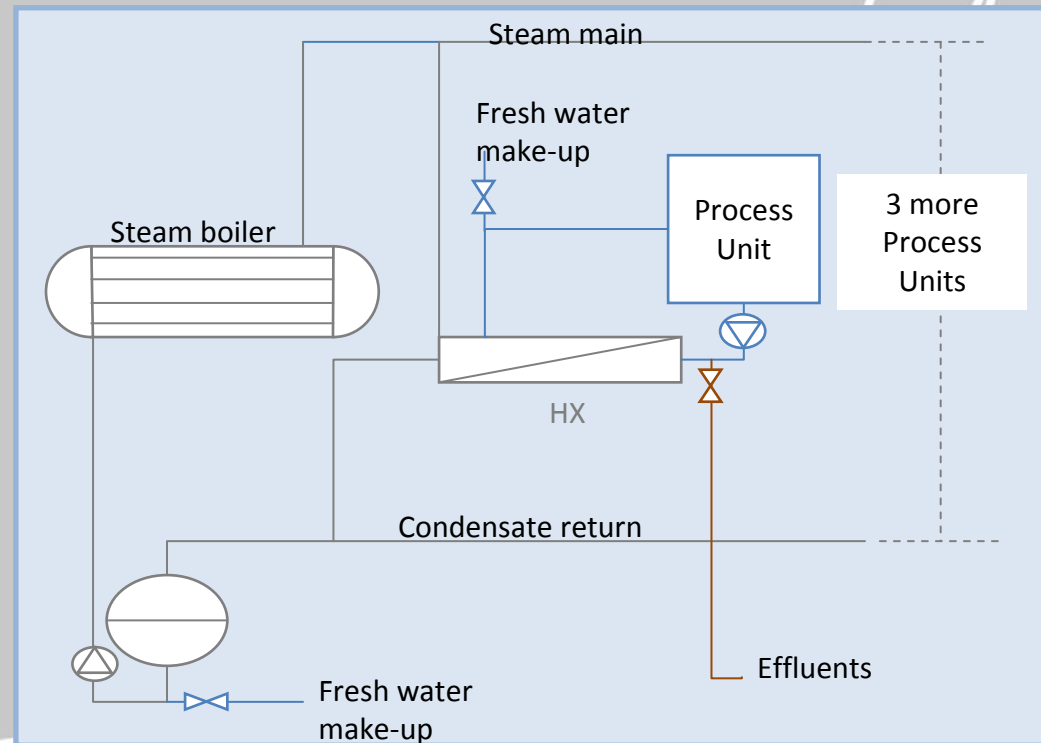
Capacity installed: 600 kW_{th}

Working time: 8-20

Steam pressure: 5-6 bar

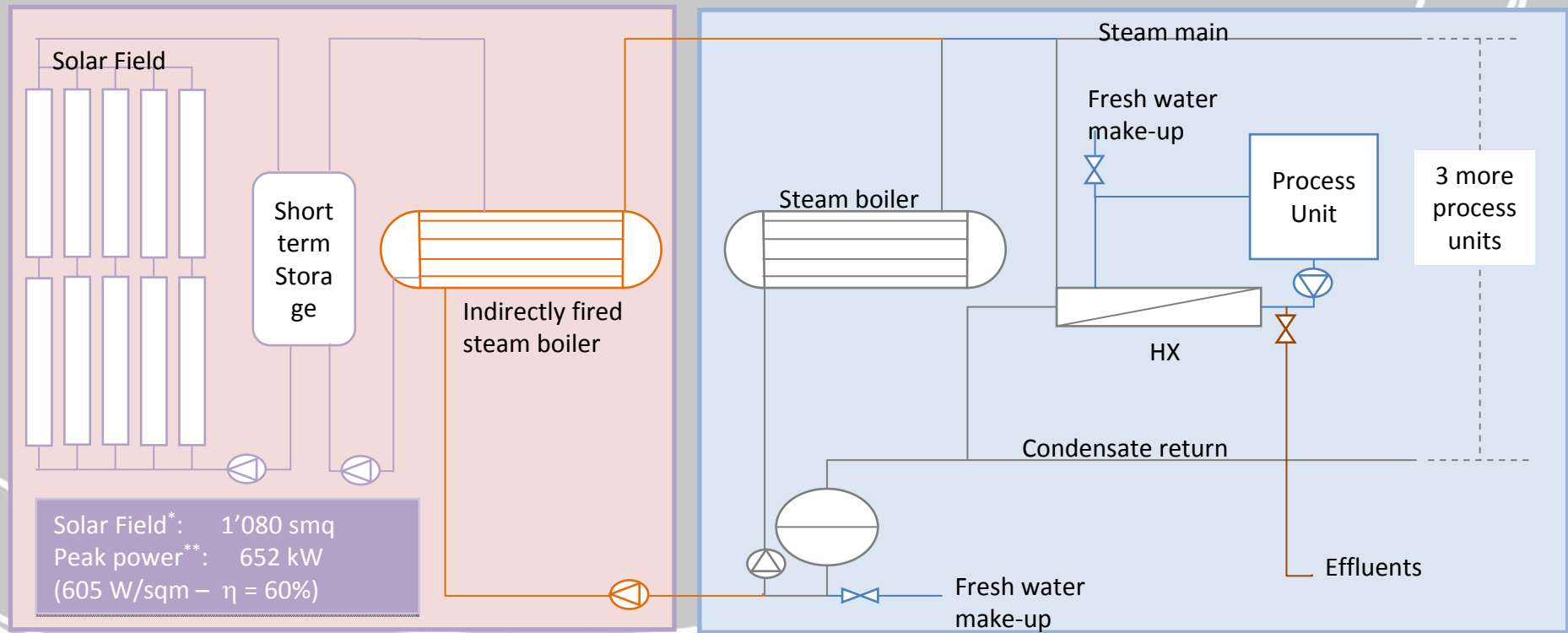
Current fuel: crude oil

Available space: 2'300 sqm

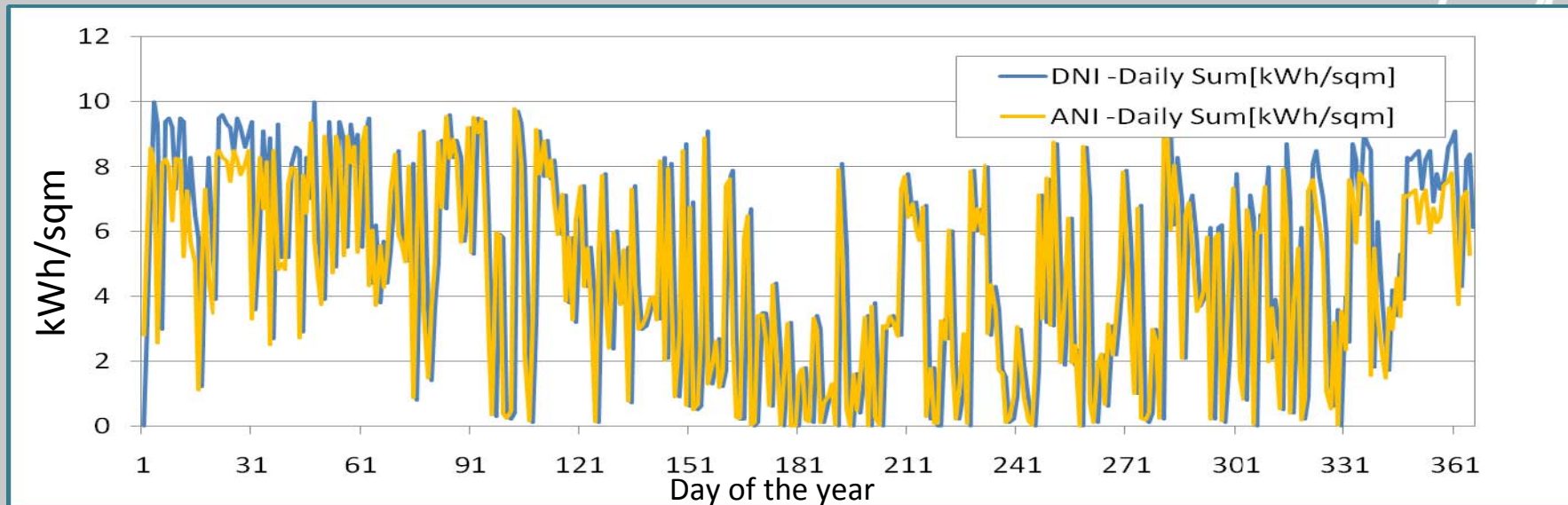


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Plan: Solar Integration



Plan: Solar data analysis



DNI = 1'768 kWh/sqm

ANI = 1'678 (N-S alignment)

Percentile:

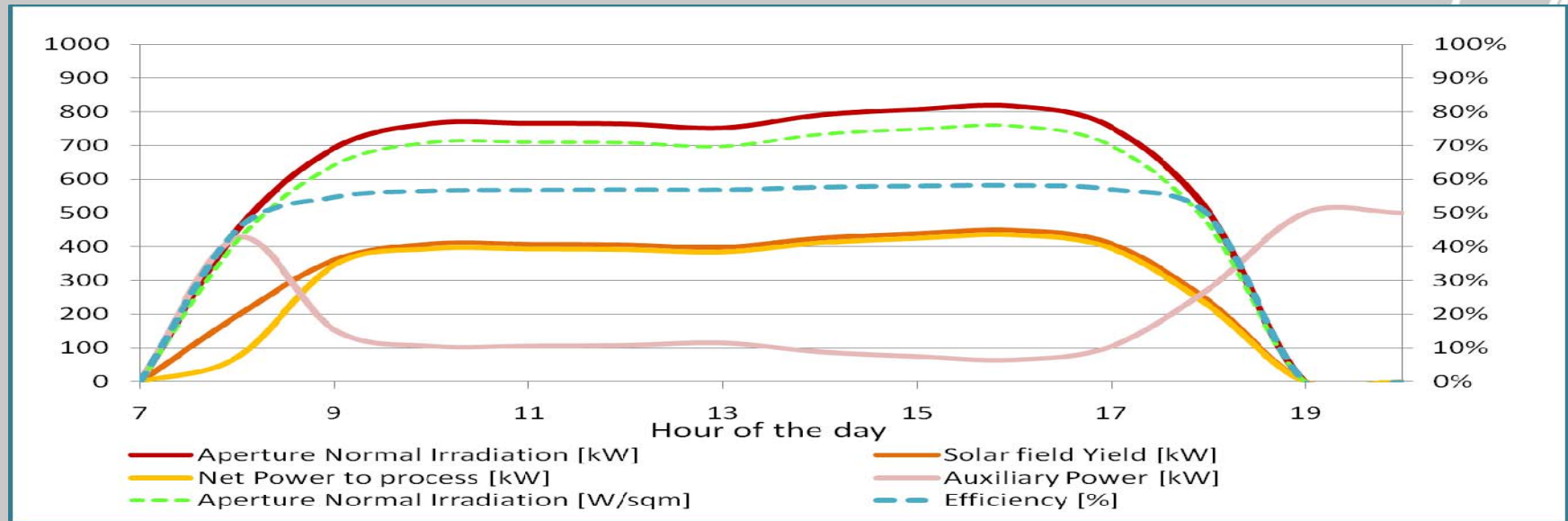
[25%] = 7.2 kWh/sqm [50%] = 4.6 kWh/sqm [75%] = 2.1 kWh/sqm

daily average = 4.8 kWh/sqm

daily average = 4.6 kWh/sqm

Sunny day – 25% percentile

kW / (green dotted line in W/sqm)

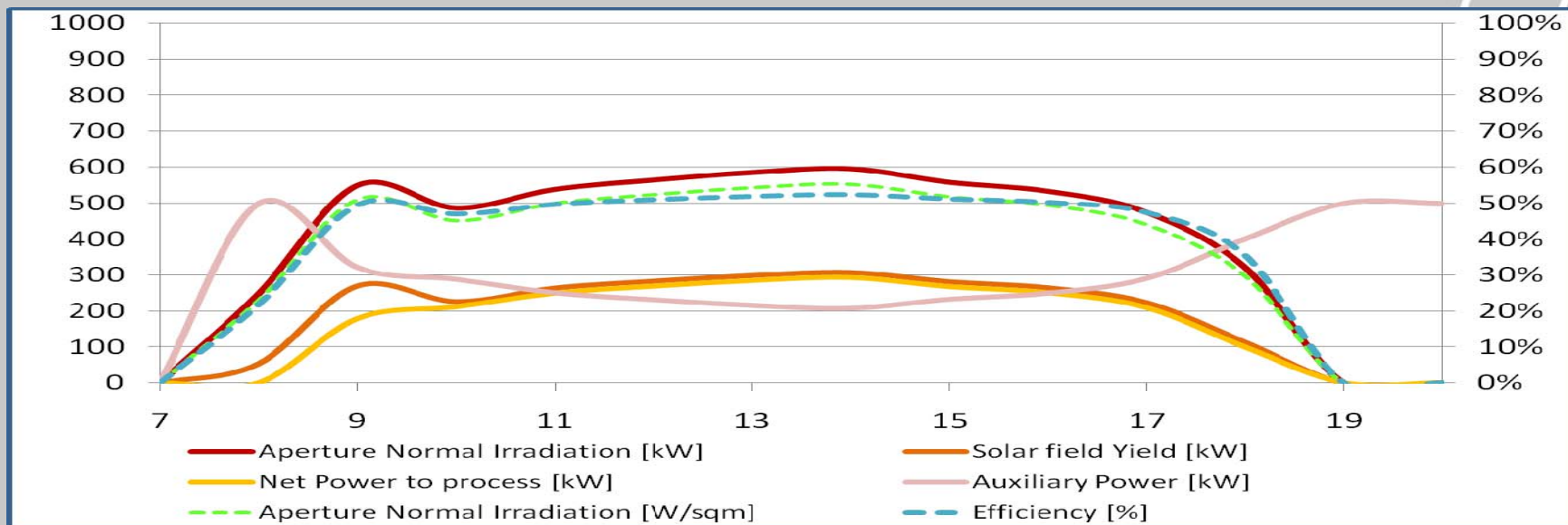


% (blue dotted line)
Purely indicative information. Soltigua does not guarantee its accuracy

- Average solar field efficiency at 57% for ≈ 10 hrs
- Average net output to process at +400kW for ≈ 10 hrs
- Total system contribution to process = 58%

"Median day" – 50% percentile

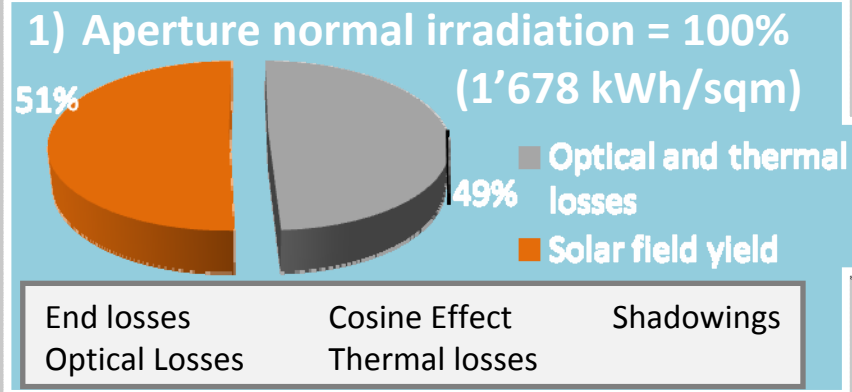
kW / (green dotted line in W/sqm)



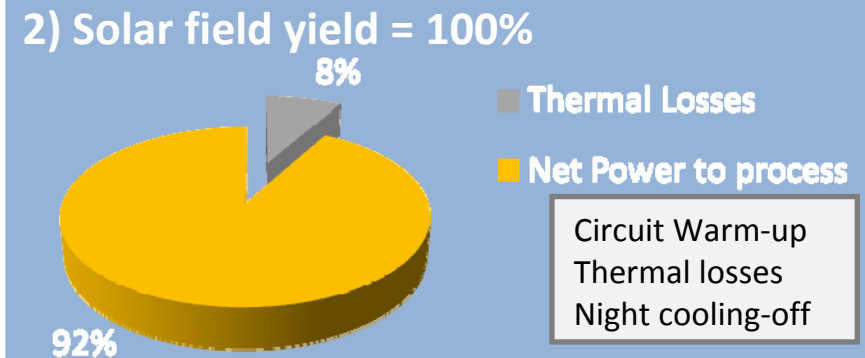
- Average solar field efficiency at 50% for ≈ 8 hrs
- Average net output to process at 250kW for ≈ 8 hrs
- Total system contribution to process = 36%

% (blue dotted line)
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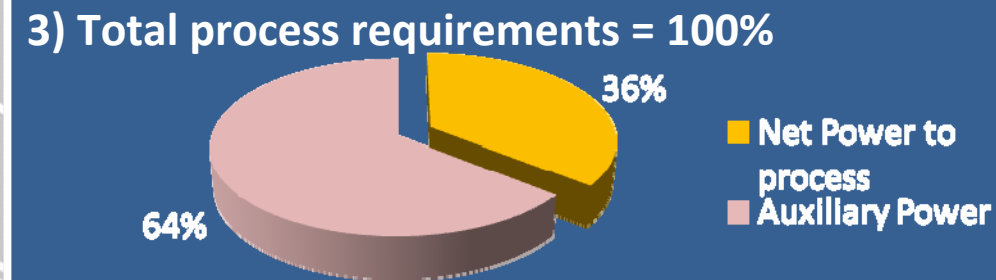
Yearly results



Solar field



Primary circuit



Total net production	= 842 MWh
Specific net production	= 781 kWh/sqm
N° of hour of operations	= 2'602 hrs
Average Net Power	= 324 kW

Conclusions

- High temperature collectors can broaden the field of application of solar energy to solar process heat and to many more fields of application
- Two high performance collector technologies are already available and the choice of the best one is case-specific
- Together with technological achievements, standard certification and system oriented approach provide complete solutions to industrial clients



Come and visit us at booth B2.117!

www.soltigua.com