

7<sup>TH</sup> INTERNATIONAL CONVENTION  
OF ENVIRONMENTAL LAUREATES  
FREIBURG, GERMANY - 15 - 18 MARCH 2018



# Laureates' Symposium



## Supporters and Donators



## Associate Partners





◆ **Ahmet Lokurlu**

Germany

“Entropification of the food industry through a paradigm shift from conventional energy resources towards renewable, high temperature solar-based applications”



## De-Entropification Of The Food Industry Using Concentrated Solar Power (CSP)

SOLITERM Group  
Aachen/Germany

## Content of presentation

- **Company Introduction**
- **Introduction of High Temperature Solar Thermal Systems**
- **Overview about previous Applications**
- **Applications of PTC's in Food Industry**
- **Cold storage**
- **Drying Process**
- **Desalination**
- **Greenhouse with details**
- **Results**

## Soliterm Group

### Company Details:

- Founded by : Dr. Ahmet Lokurlu
- Year of Establishment : 1999
- Headquarter : Süsterfeldstraße 83,  
Aachen, Germany
- Production Unit : Izmir, Turkey

### Company Services:

- Worldwide supplier of Concentrated Solar Power (CSP) systems
- Construction, manufacturing, installation and maintenance of the systems
- Feasibility studies, financing and contracting



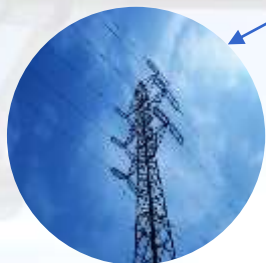


## Production Facility

- **Worldwide first and unique** automated production line of Parabolic Trough Collectors
- Since 2011, six fully automated stations are installed for welding, bending and packing of the mirrors
- **High quality production** guaranteed by precise alignment with 9 degrees of freedom
- **Production capacity of 40,000 PTC's** per year with a **capacity of 250 MW**



## Different Applications from SOLITERM PTC's



Electricity



Steam



Space Heating



Cooling

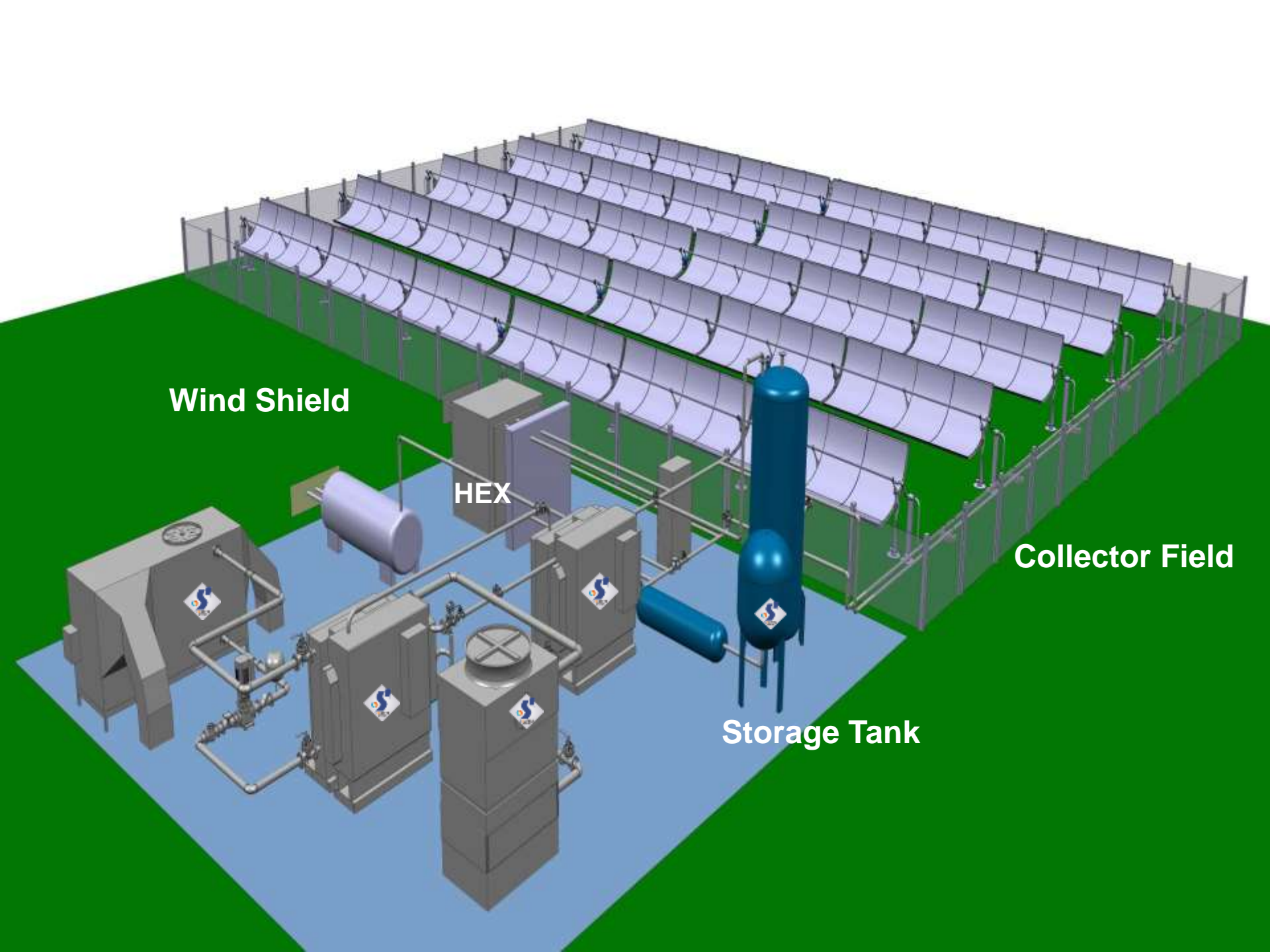


Fresh Water

## Target Groups







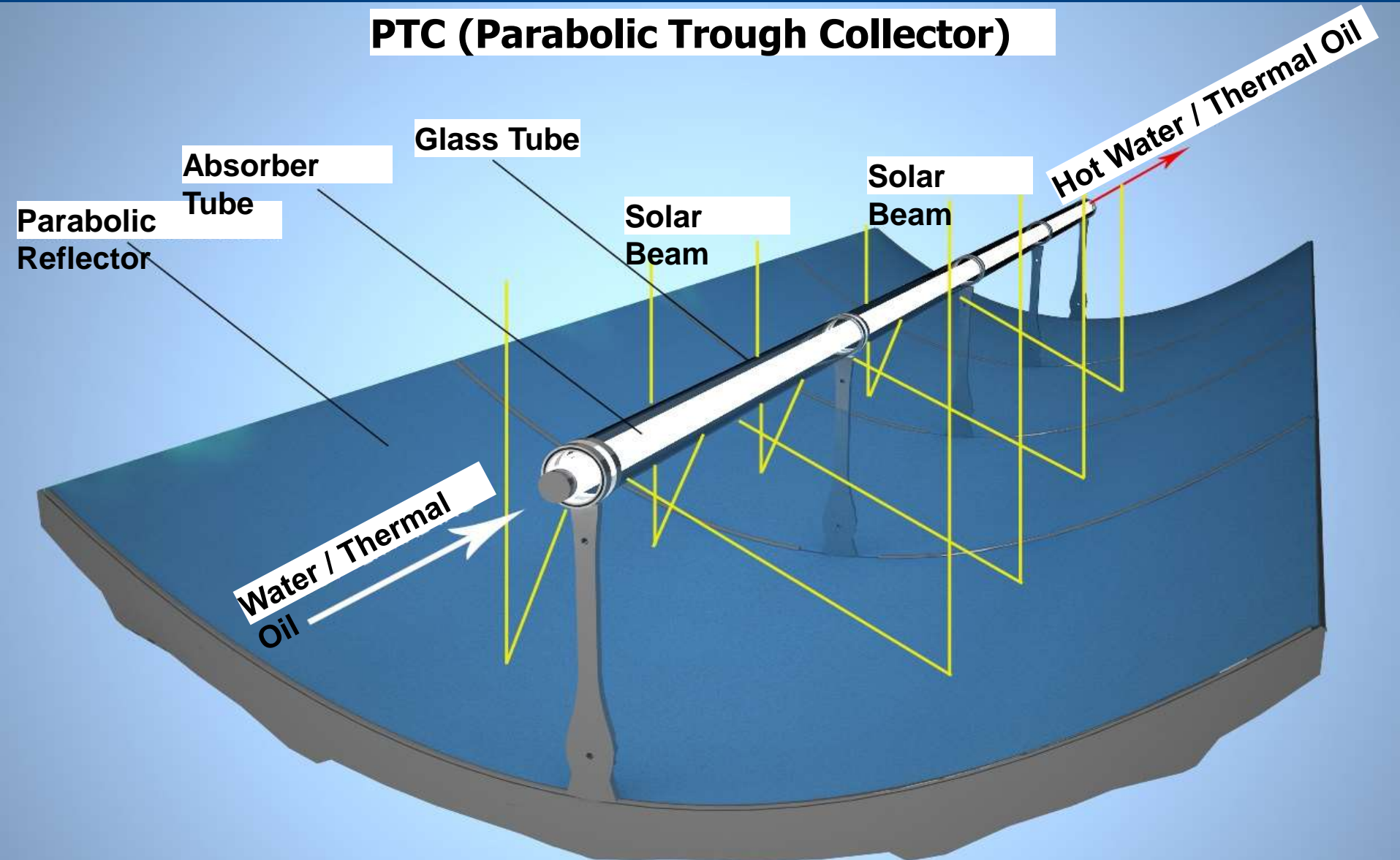
Wind Shield

HEX

Collector Field

Storage Tank

## PTC (Parabolic Trough Collector)



**SOLITERM PTC1800 V3**

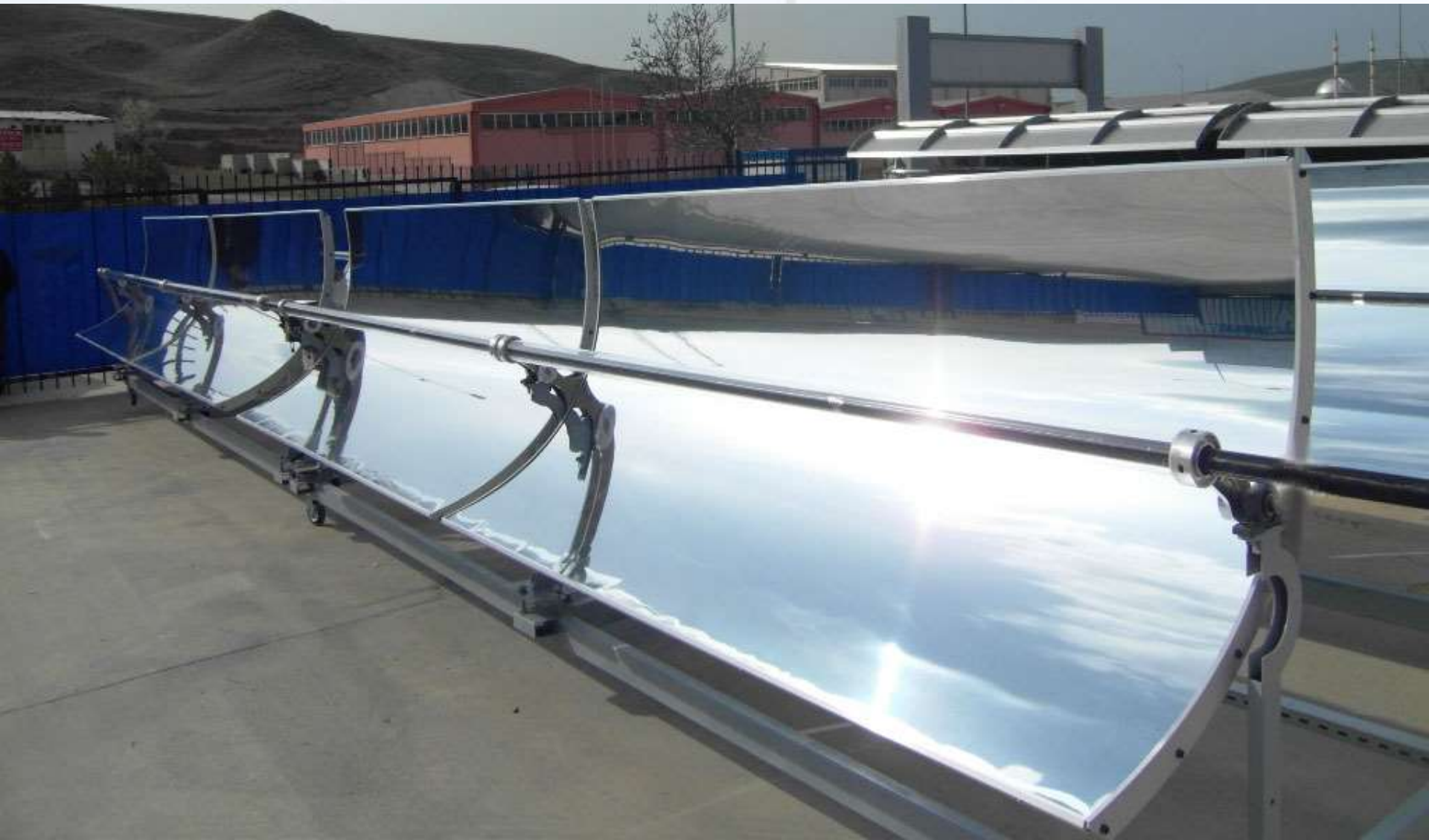






THE COOLEST IDEA SINCE THE INTRODUCTION OF SOLAR ENERGY

## PTC 1100



**SOLITERM PTC3000 V1**

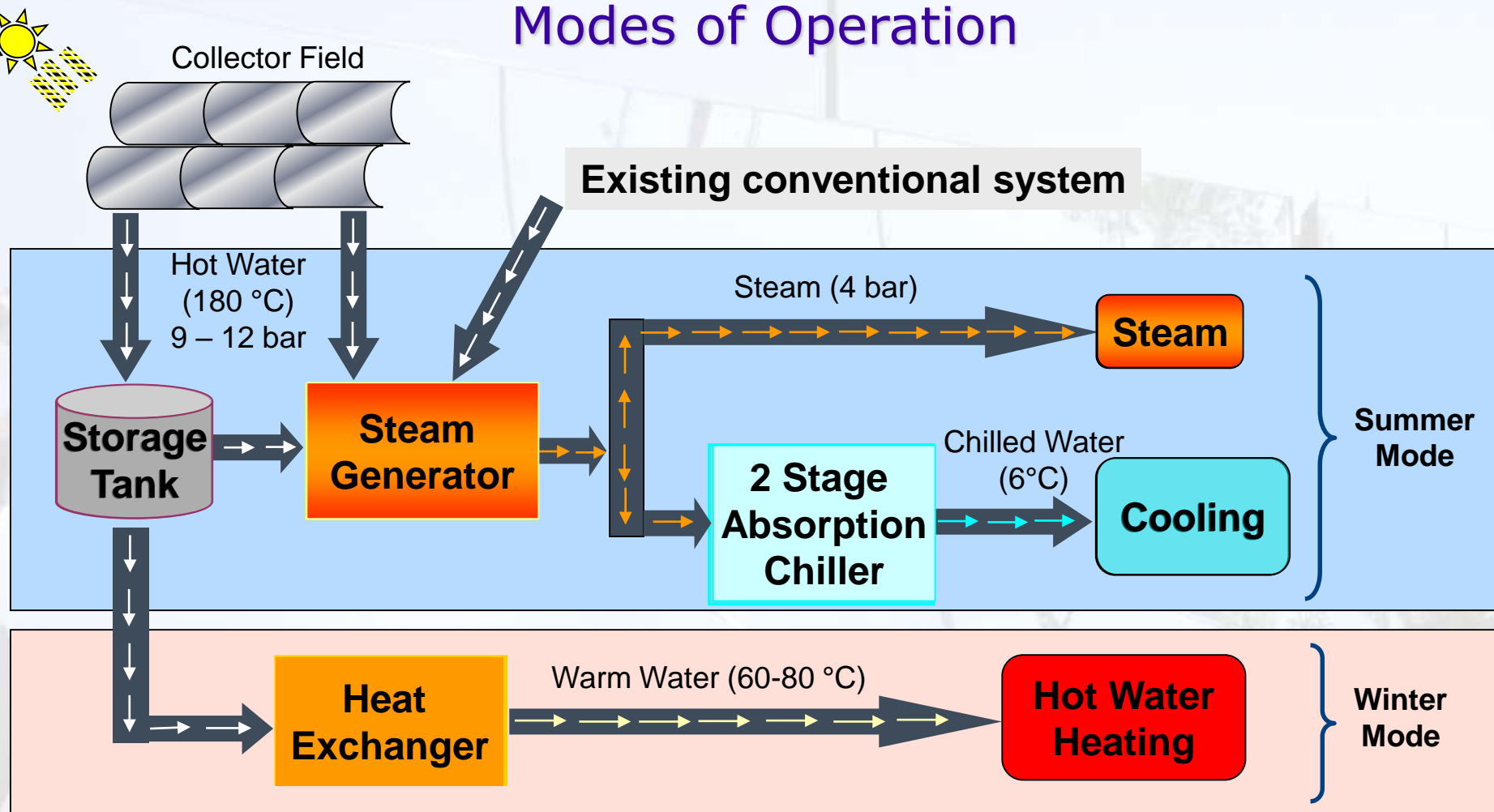




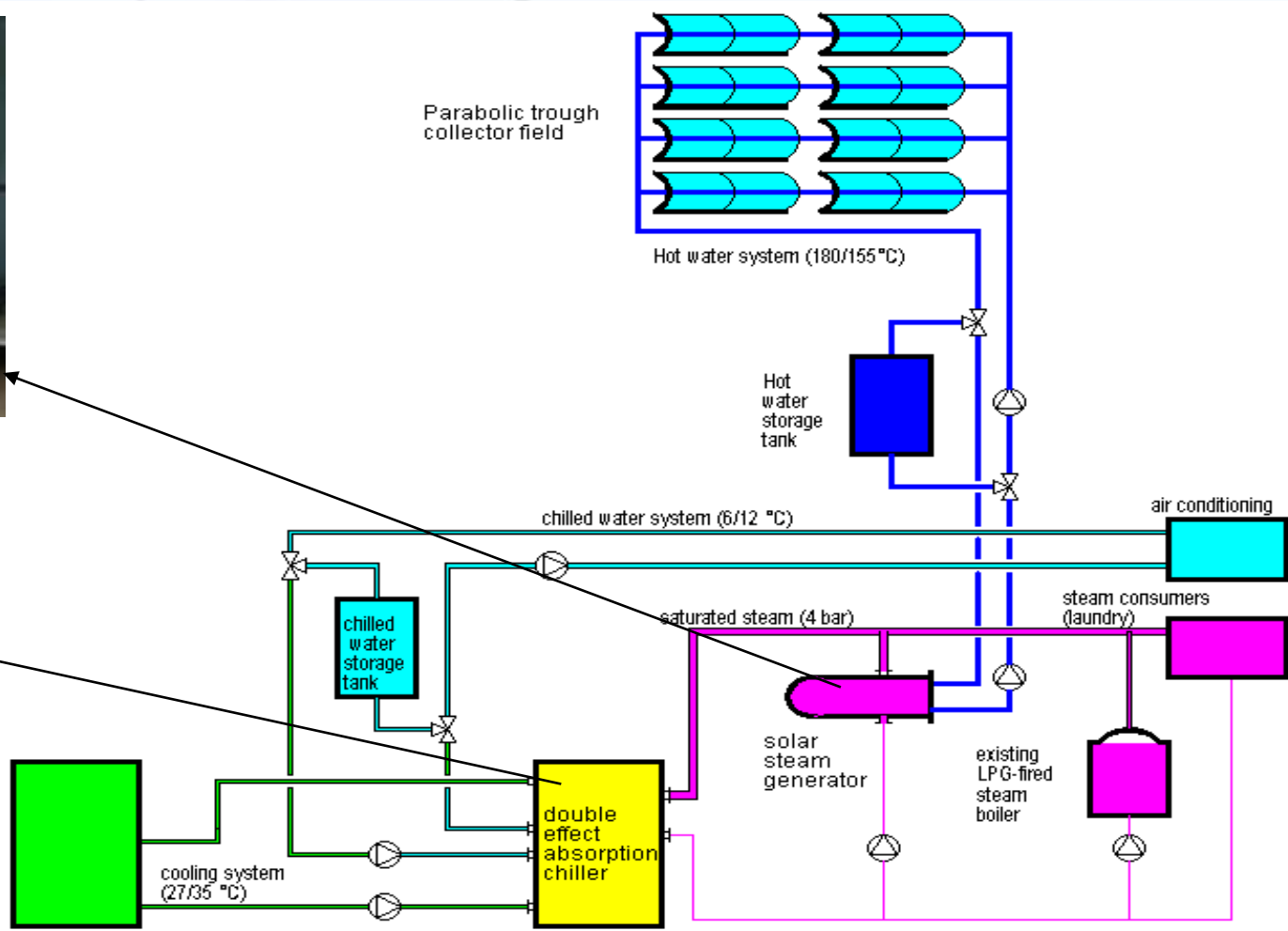
# SOLITERM PTC4000 V1



## Modes of Operation



## SOLITERM SYSTEM









**PepsiCo Plant**



# THE COOLEST IDEA SINCE THE INTRODUCTION OF SOLAR ENERGY







IberOtel Plant



# THE COOLEST IDEA SINCE THE INTRODUCTION OF SOLAR ENERGY



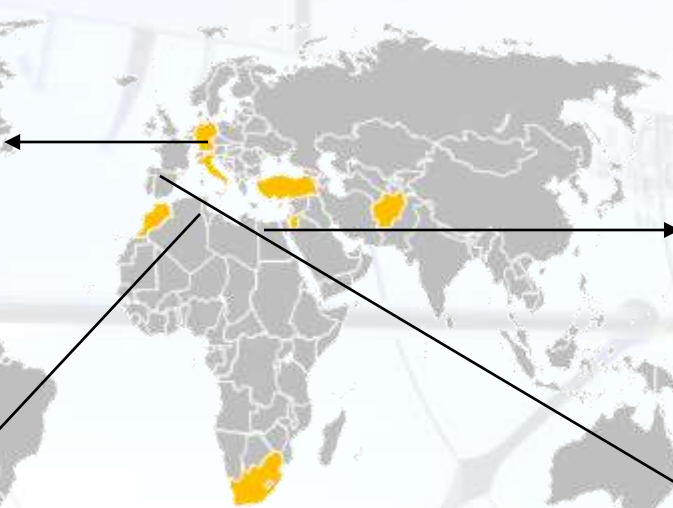
← **Florans, Italy**  
**Direct steam generation & Cooling**

**Casablanca, Maroc**  
**Cooling & Heating** →



**Tri Generaqtion, Cyprus**  
**Electricity, Cooling & Heating**

## Some Realized Projects







Worldwide  
Hotel in So

SOLITEM GROUP

GREEN SUN









# THE COOLEST IDEA SINCE THE INTRODUCTION OF SOLAR ENERGY

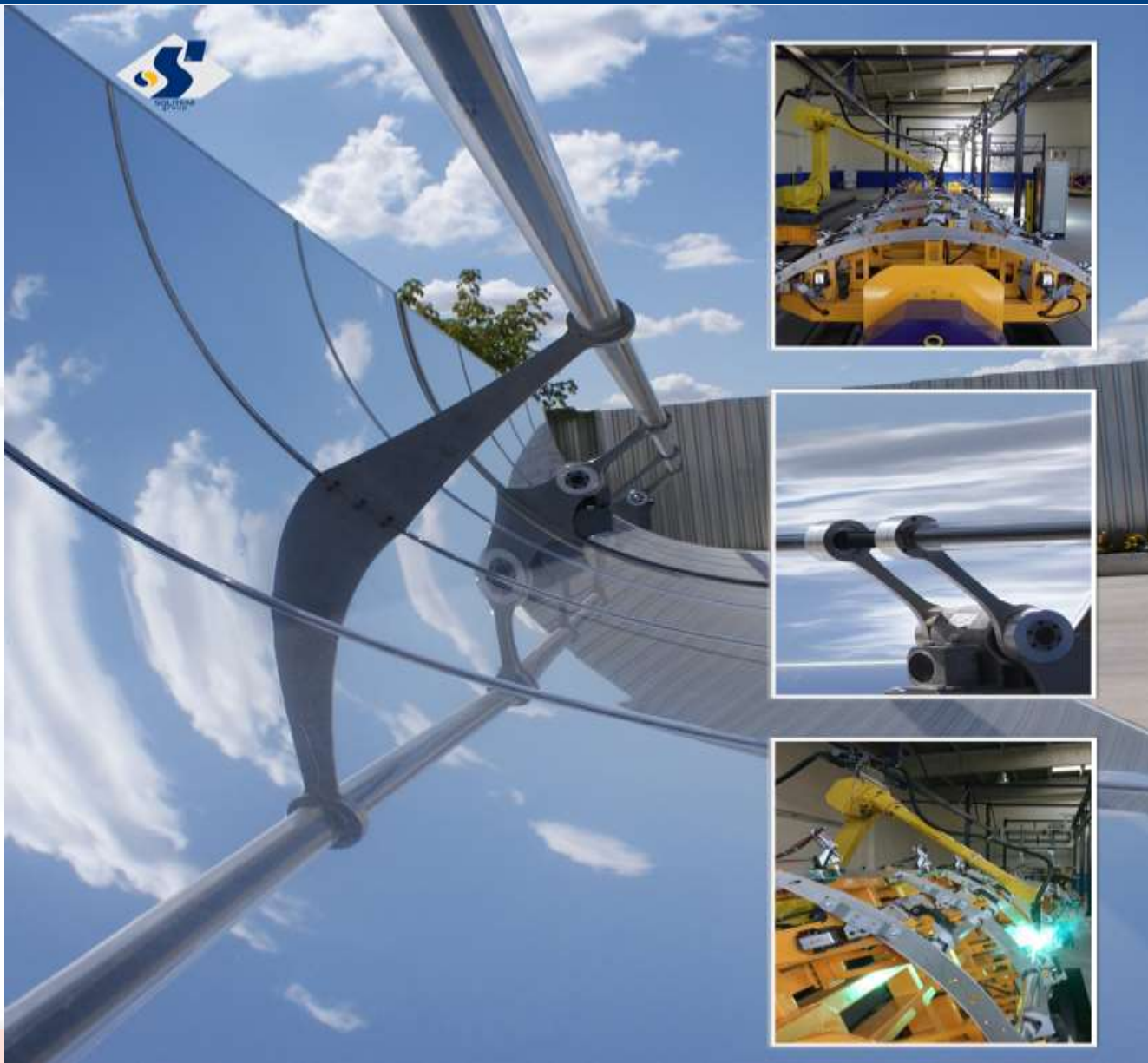




THE COOLEST IDEA SINCE THE INTRODUCTION OF SOLAR ENERGY

**NEW!!!**

**Worldwide first  
And Unique  
AUTOMATED  
PRODUCTION  
LINE**







# THE COOLEST IDEA SINCE THE INTRODUCTION OF SOLAR ENERGY











# THE COOLEST IDEA SINCE THE INTRODUCTION OF SOLAR ENERGY











As financing options, Solitem offers to selected clients :

- **Project Financing**
- **Energy contracting**
- **System Leasing**

e.g. Energy contracting allows the customer to only pay for the energy actually delivered, while plant operations and service is taken care off by SOLITEM.

## Benefits to the customer

- Future energy prices become a known quantity
- High security of supply
- Contracting reduces risk of information asymmetry

Some people invest in small things if they were not troubled in great needs.



TUI Hotel „Iberotel  
Dalaman Turkey

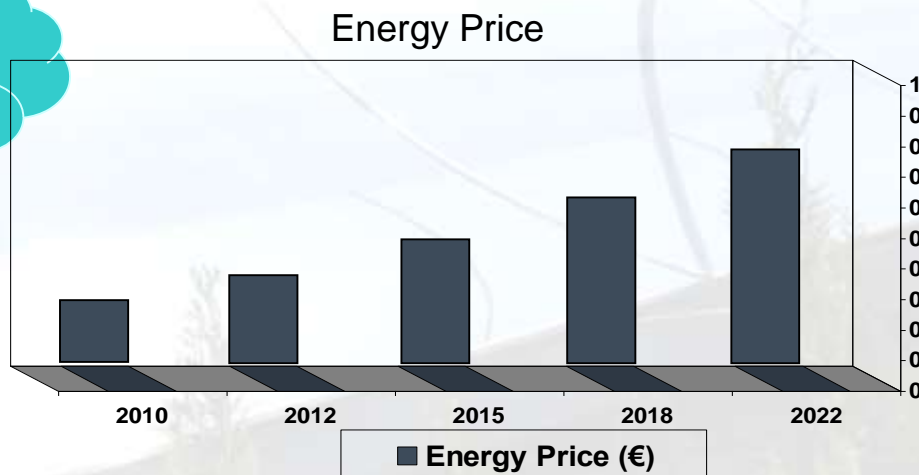
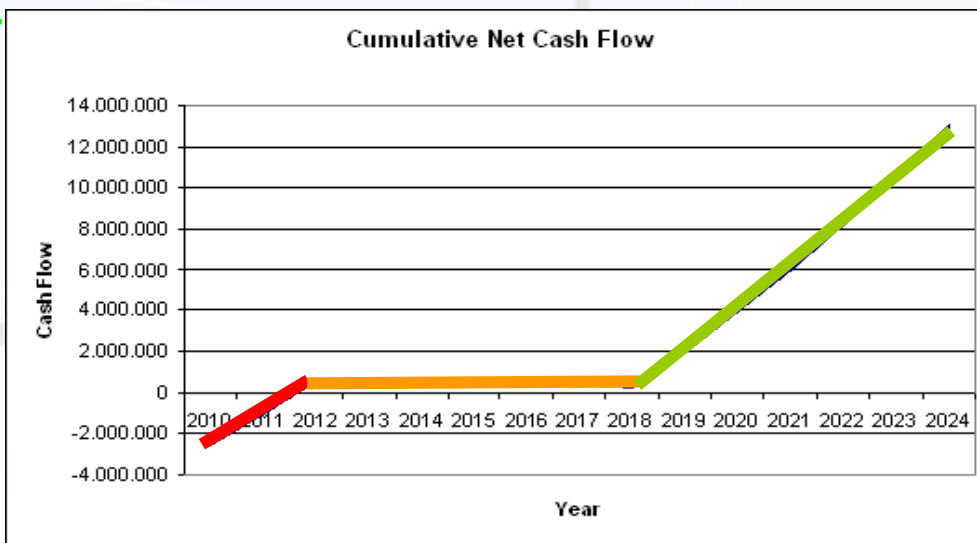


# THE COOLEST IDEA SINCE THE INTRODUCTION OF SOLAR ENERGY

2010

Payback + Saving

2016 - 2018

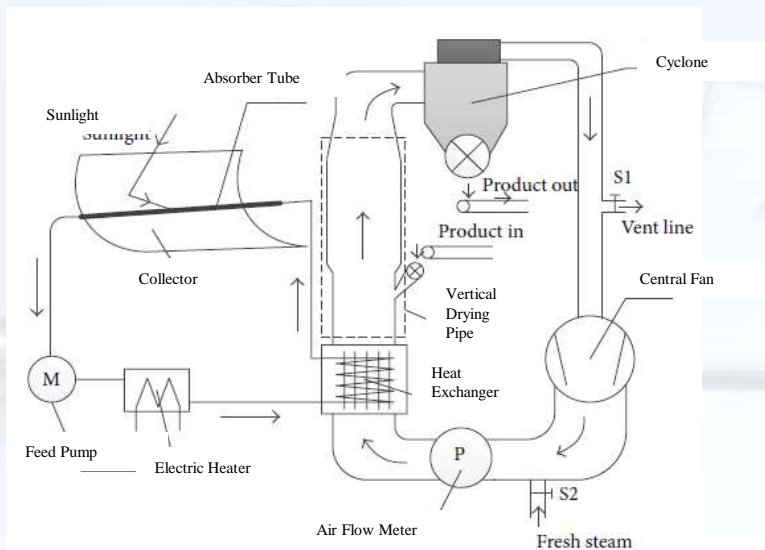




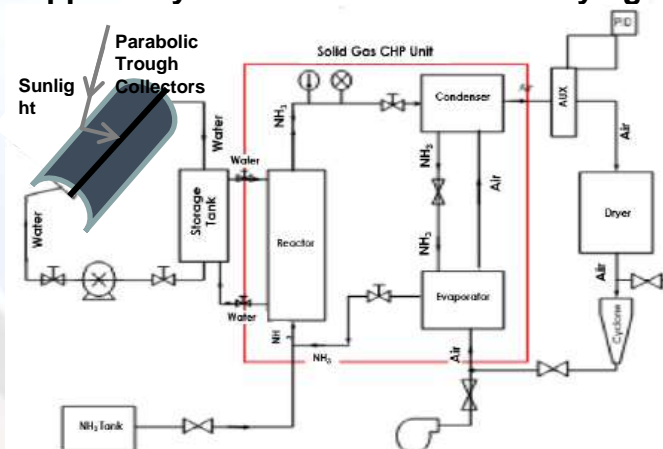
## Content of presentation

- Company Introduction
- Introduction of High Temperature Solar Thermal Systems
- Overview about previous Applications
- **Short overview**
  - Applications of PTC's in Agriculture and Food Industry
  - Drying Process
  - Cold storage
  - Desalination
  - Greenhouse application with details
- Results

## Solar Drying – Advanced Drying Methods



**PTC supplied System for Fluidized Bed Drying Cut Goods**

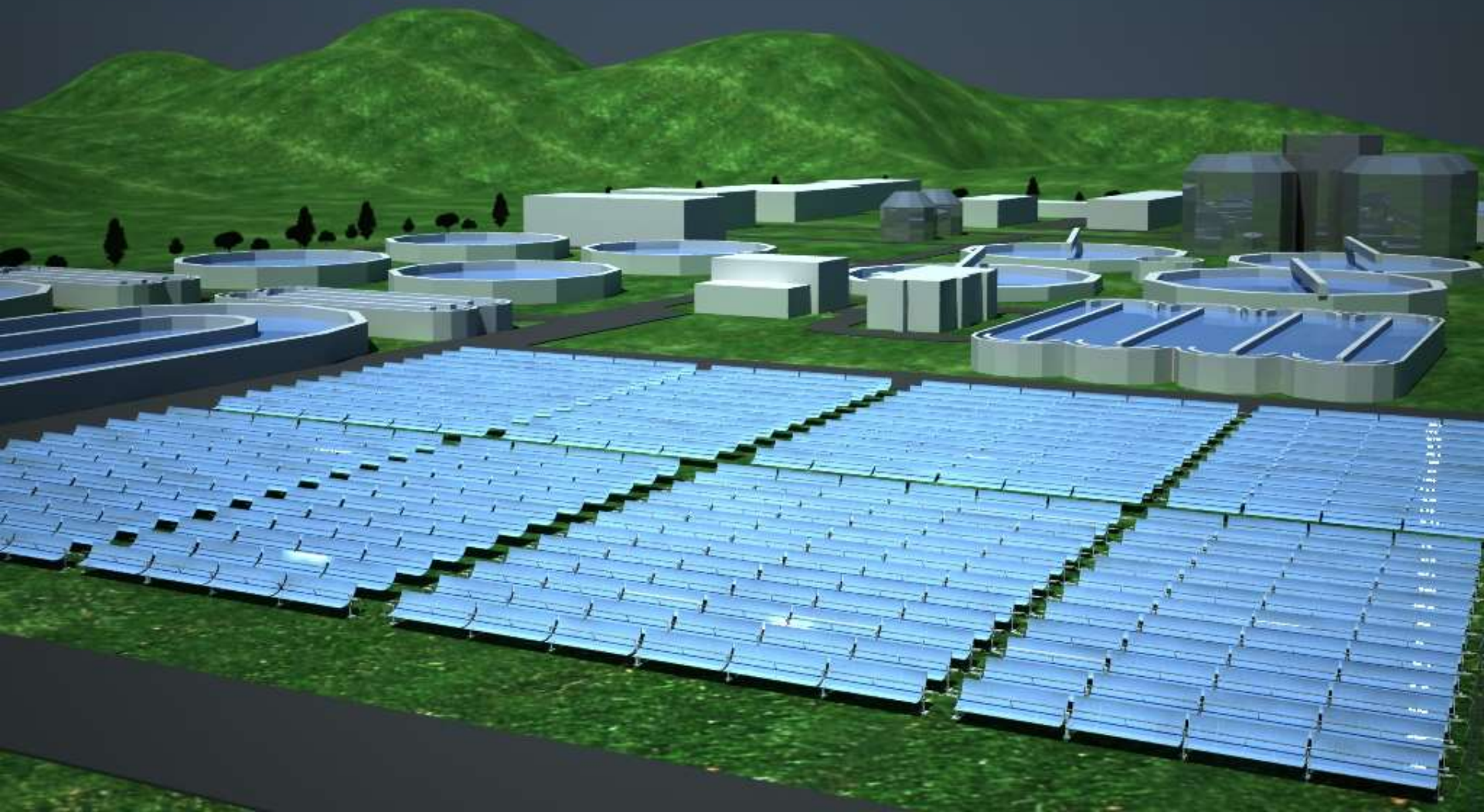


**PTC fed solar drying system with chemical heat pump (CaCl<sub>2</sub>/NH<sub>3</sub>)**

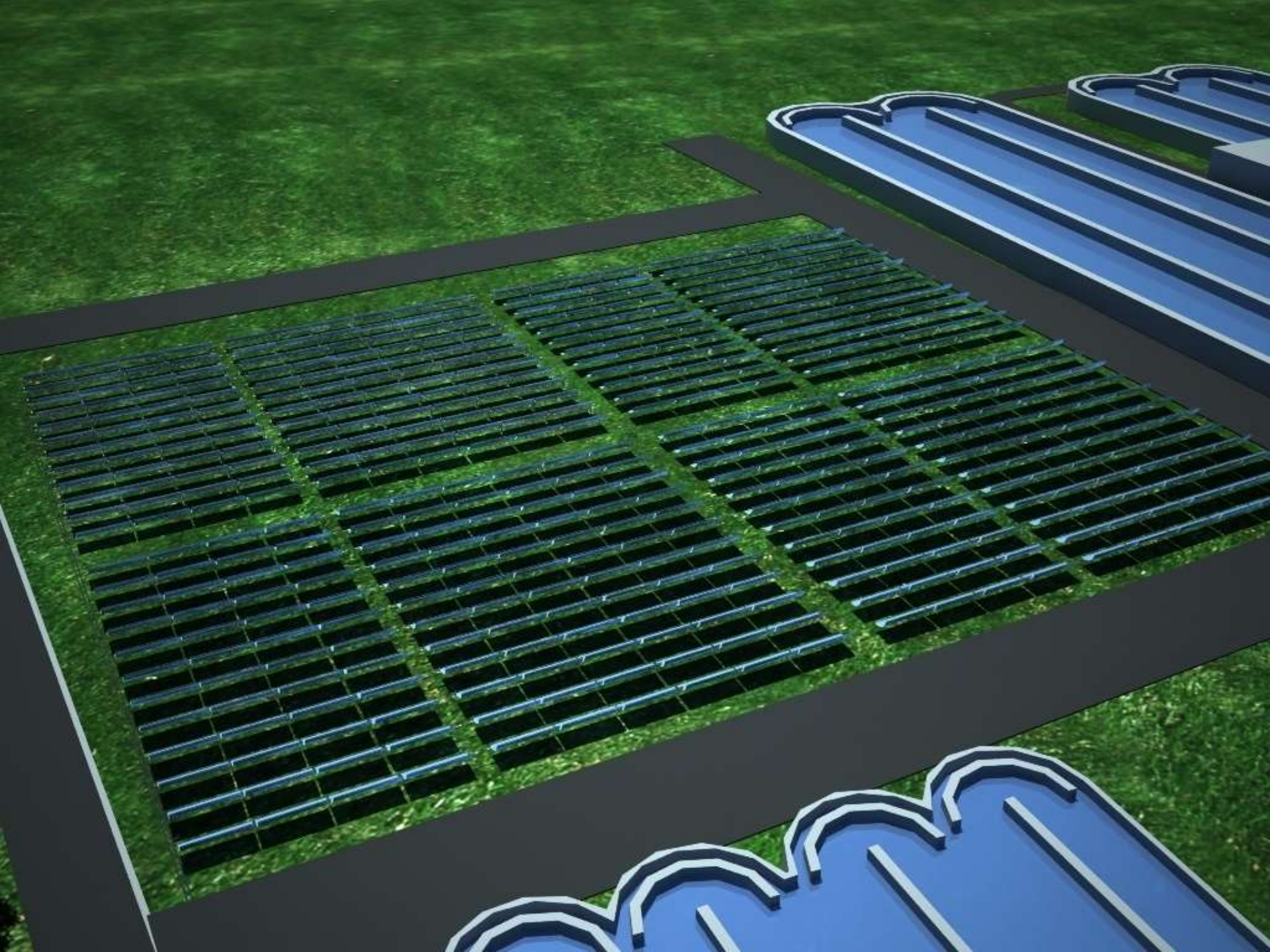
Source: Tiwari A (2016) A Review on Solar Drying of Agricultural Produce. J Food Process Technol 7: 623

- Solar Thermal (PTC-Technology) compared to Solar Air Dryers gives higher sun absorption and higher heat storage capacity which is necessary for drying on industrial scale
- Drying is bringing moisture of goods down; for food this is extending shelf life
- High temperature drying gives fast-dried products well-suited for afterward grinding
- Drying pasta at High temperature (HT) drying (60–85°C) or ultra-high temperature (UHT) drying (85–110°C) is another process and gives improved cooking quality, better color and bacterial control for egg products
- Actually ultra-high temperature (UHT) drying (85–110°C) is common for pasta which gives drying times 4–5 h for long goods and 2–3 h for short goods (High temperature(HT) drying is 8h)

# Sludge Drying Process with PTC Systems







## Layout PTC driven MED-TVC Plant



PTC 1800

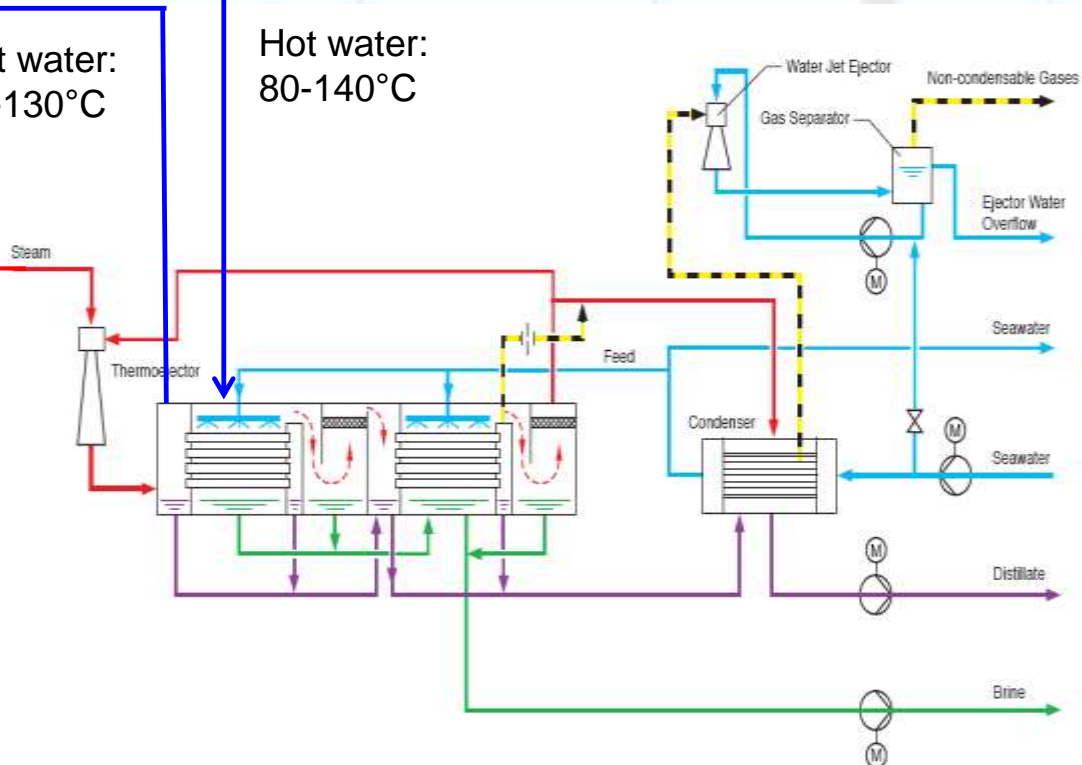
Hot water: 145- 175°C  
Hot water: 160 -185°C

Steam Generator

Steam Ejector with  
5 to 8 bar

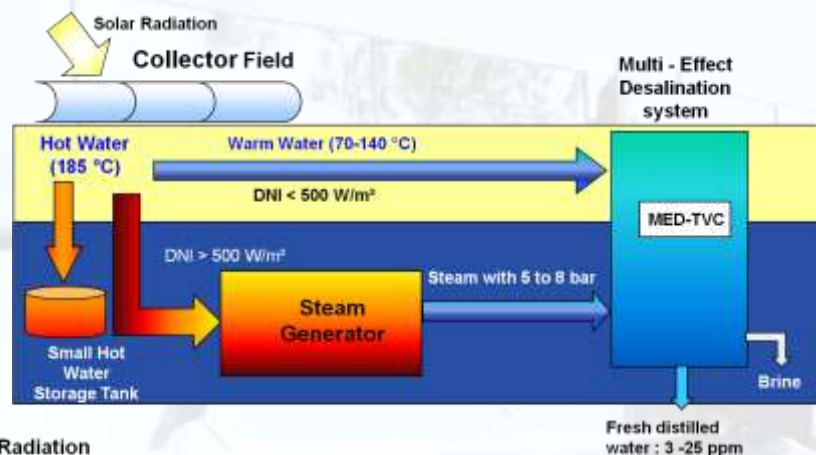
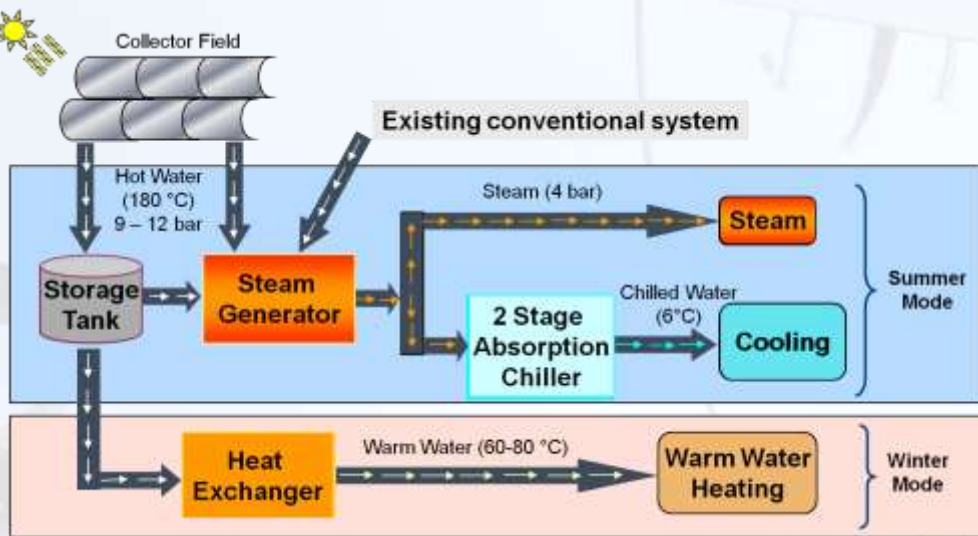
Hot water:  
70-130°C

Hot water:  
80-140°C

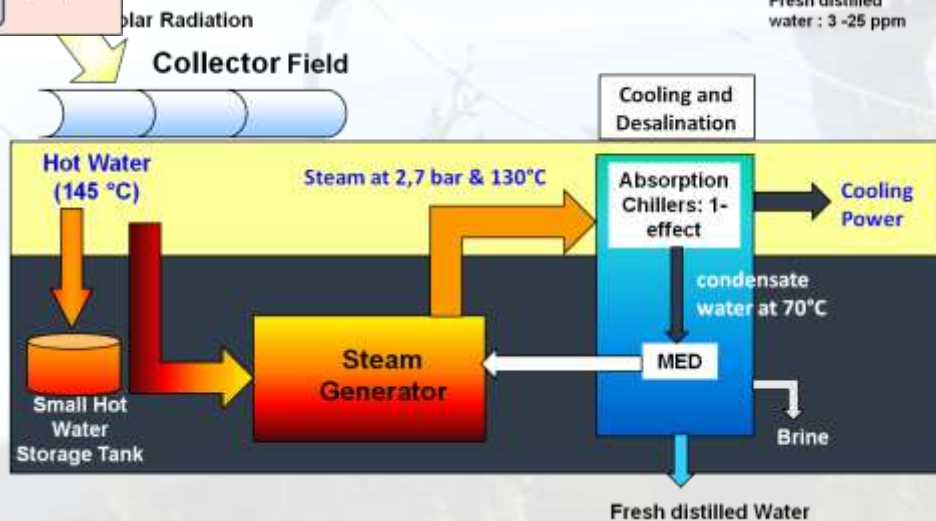




## Possibilities to feed Desalination Processes by PTC's



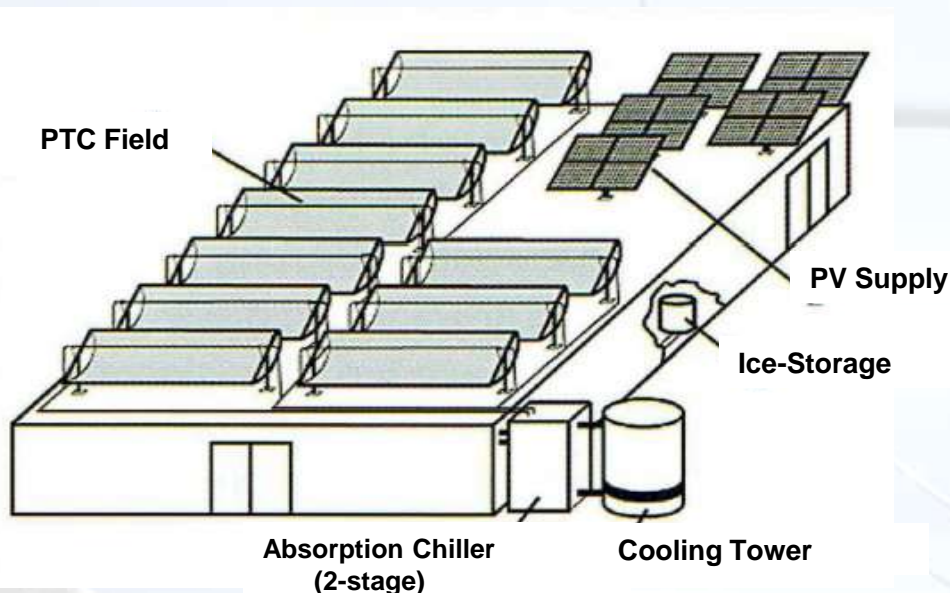
Desalination Technology	Cost (€/m³)
MSF	1,18
MED	<b>1,08</b>
RO	0,93
RO + brine booster	0,85





## PTC Driven Cold Storage of Crops

### PTC driven Cold Storage



- Cold storage is necessary to preserve Crops from disease and pests
- Producer strive for a lossless storage so that they can sell at high price periods
- Ability to serve the market as long as possible
- Depending on sort of crop short term and long term storage is necessary
- Essential to ensure proper post harvest operations
- About 20 to 30 % of total crop production go waste due to lack of cold storages (esp. India and Africa)

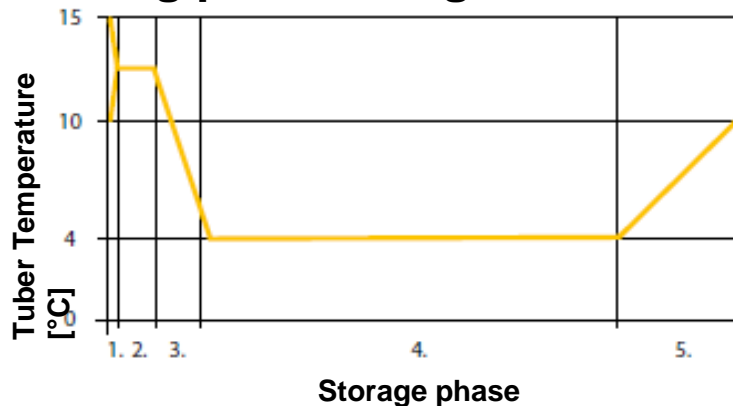
## Cold Storage of Potatoes

Potato production worldwide in 2004:

Continent/ country	Area harvested (Million ha)	Production (million tonnes)	Yield (Tonnes/ha)	Seed production (Million tonnes)
Europe	8.29	140.40	16.94	25.48
China	4.60	75.05	16.31	2.80
Russian federation	3.15	37.00	11.75	9.50
India	1.40	25.00	17.86	2.10
Africa	1.15	13.74	11.91	1.27
USA	0.47	20.42	43.19	1.10

Source: <https://www.researchgate.net/publication/306095107>

### Storing potatoes right:



Storage phases: 1) drying, 2) wound healing, 3) cooling down, 4) conservation, 5) warming

Source: N.N., Lagerung von Kartoffeln, KTBL Fachartikel

- Potatoes stored primarily in long-term storage
- Storage mainly that producer can sell at high price periods
- Several Air Changes per day are necessary for conservation
- at 25°C product loading temperature there is a need for 15°C Pull down temperature in 24 hours



## Cold Storage of Tunisian Dates



**Fruit characteristics at different development stages (Kimri, Khalal, Rutab, Tamar)**

Attribute	<i>Kimri</i>	<i>Khalal</i>	<i>Rutab</i>	<i>Tamar</i>
Edible	No	Yes	Yes	Yes
Color	Green	Yellow/Red	Partially browned	Amber/Dark brown
Texture	Hard	Hard/Crisp	Softened	Soft/Chewy
Moisture	85%	50–85%	30–40%	20–25%
Sucrose	++++	+++	++	+
Reducing sugars	+	++	+++	++++
Tannins	++++	+++	++	+
Astringency	++++	+++	++	+
Storability	Perishable	Very perishable	Perishable	Non-perishable

Low (+), Moderate (++), High (+++), Very High (++++).

Source: [https://www.researchgate.net/publication/277693159\\_Dates\\_Postharvest\\_Science\\_Processing\\_Technology\\_and\\_Health\\_Benefits](https://www.researchgate.net/publication/277693159_Dates_Postharvest_Science_Processing_Technology_and_Health_Benefits)

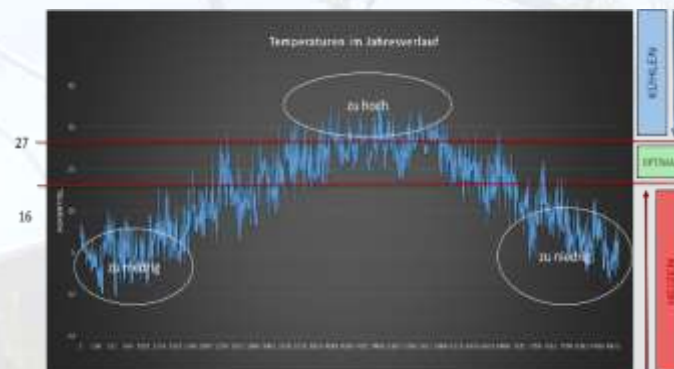
- Traditionally dates are dried to a level of moisture that ensures protection from external hazards and preservation at ambient temperature (Tamar stage, moisture below 20% needed)
- Market demand increases** for fruit with higher moisture content which has moisture up to 85%
- Storage mainly that producer is flexible in selling in periods of maximum 6-8 weeks for this highly perishable dates





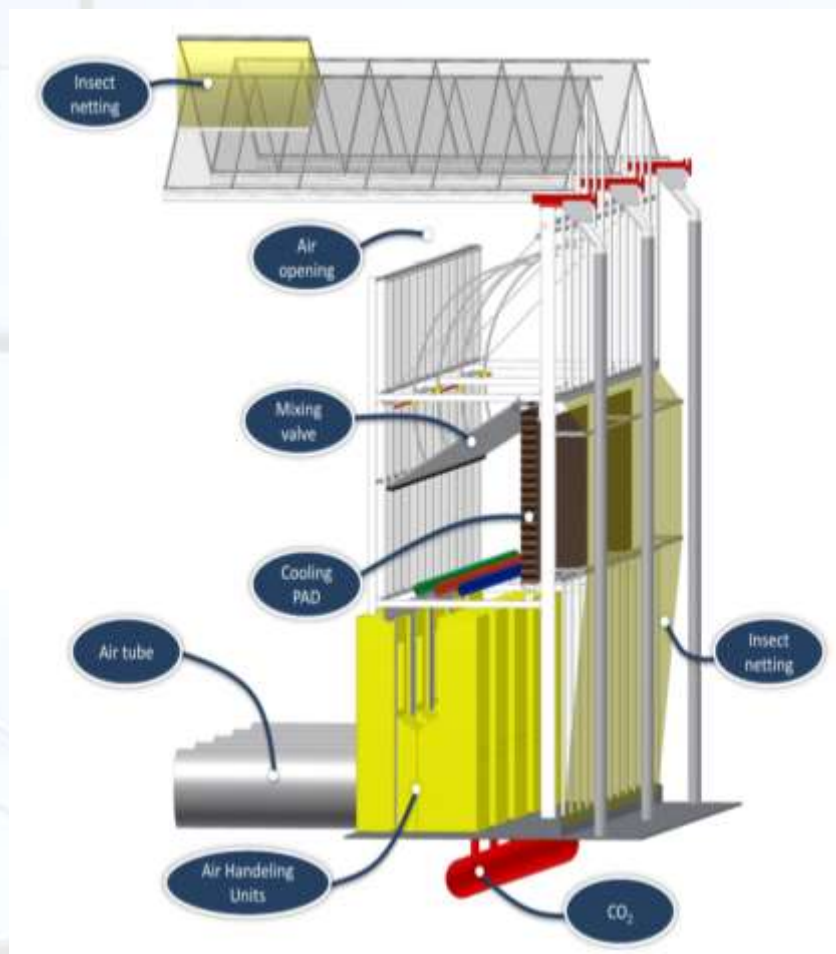
## Solar tempered greenhouses

- Lightweight PTC's are mounted on the roof of the greenhouses
- Their shade reduces the sunlight intensity and can replace sun shields
- Active air conditioning with heat exchangers and absorption chillers powered by PTC's
- During the night, temperature levels can be maintained using low grade waste heat from abandoned mine shafts



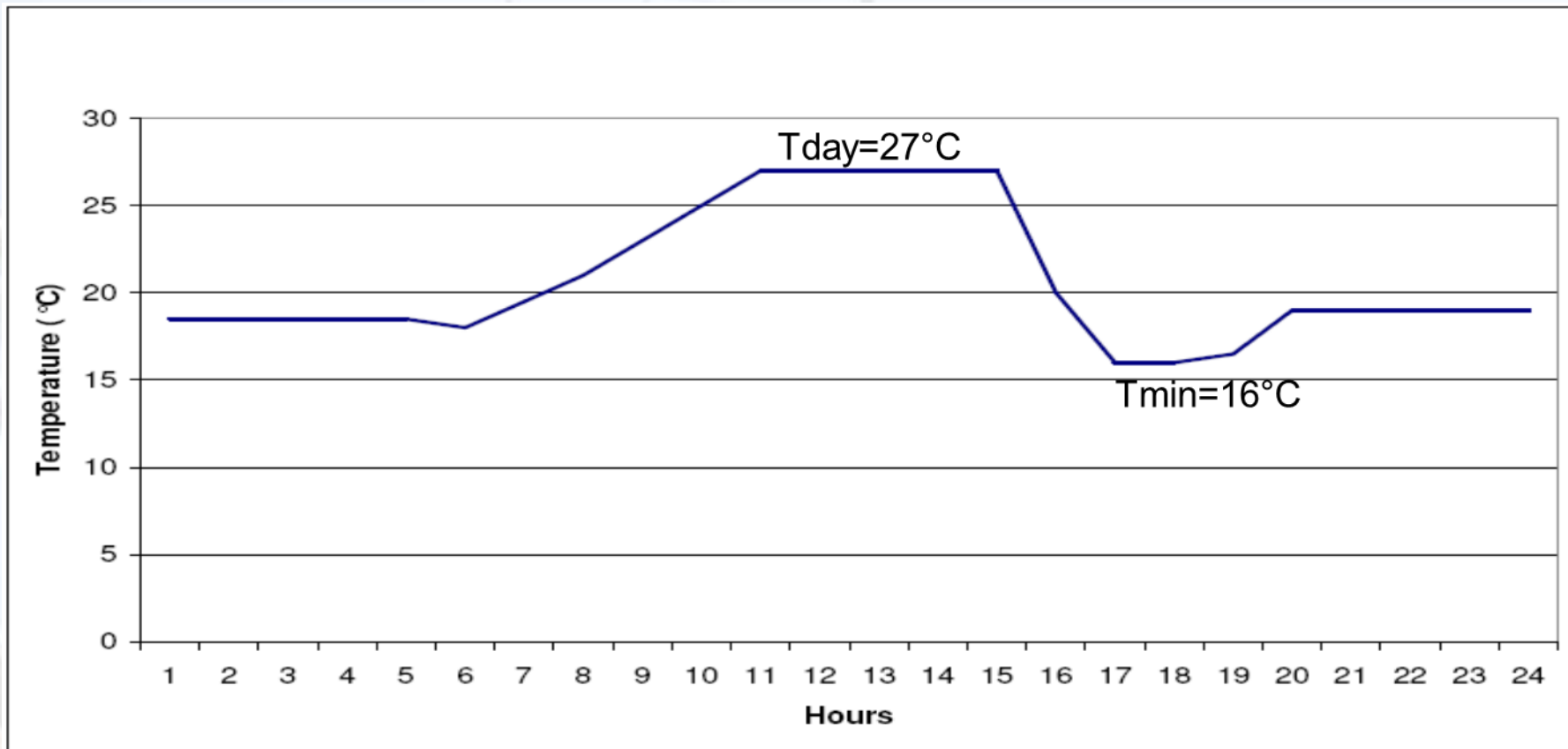
## SOLITERM Ultra climate System Solution

- Greenhouse, roof (air vents)
- Climate chamber
- Air Handling Units
- Screen
- Water and Electricity
- Energy
- Climate computer

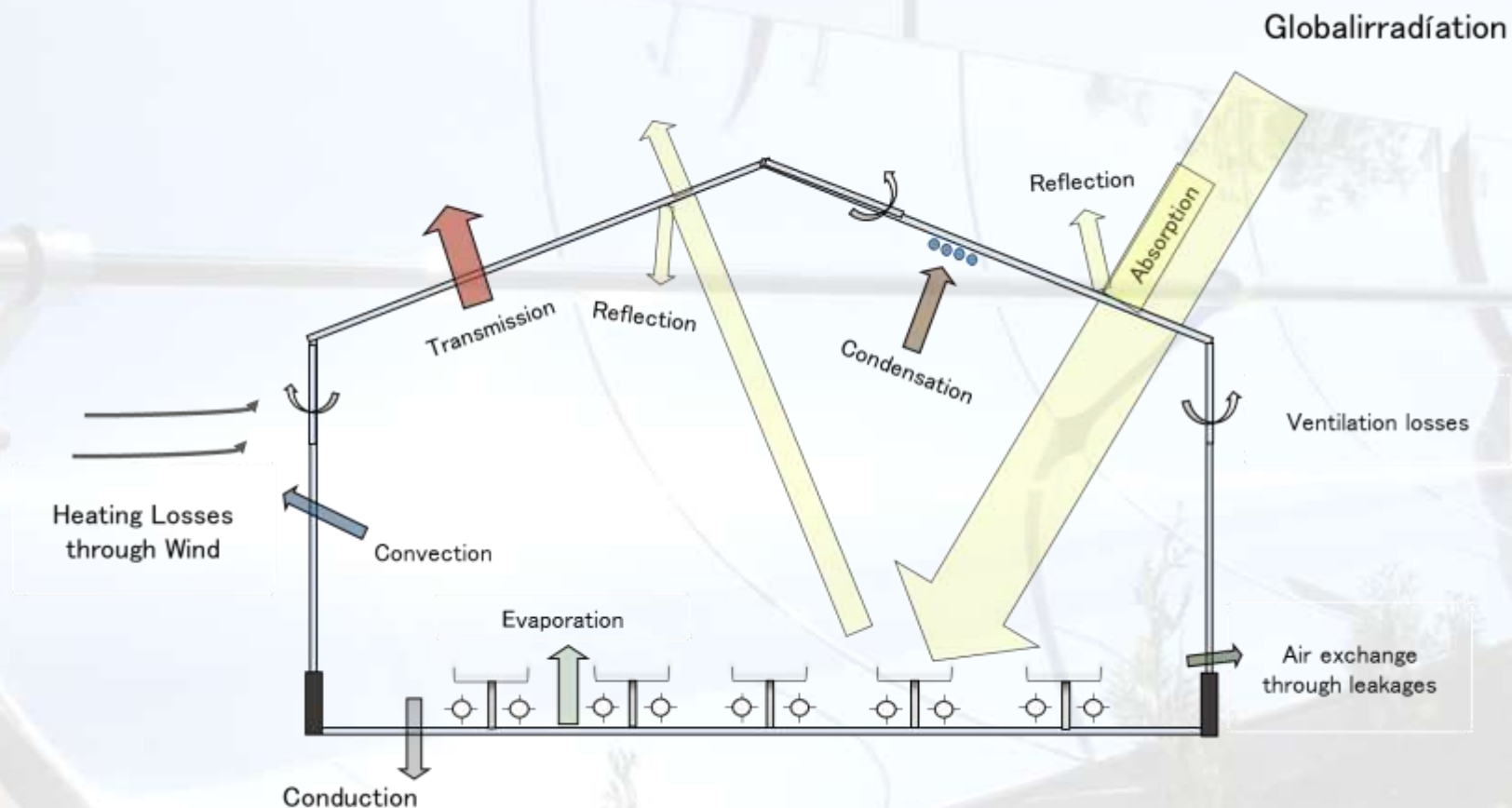




## Ideal Temperatures for Tomatoes

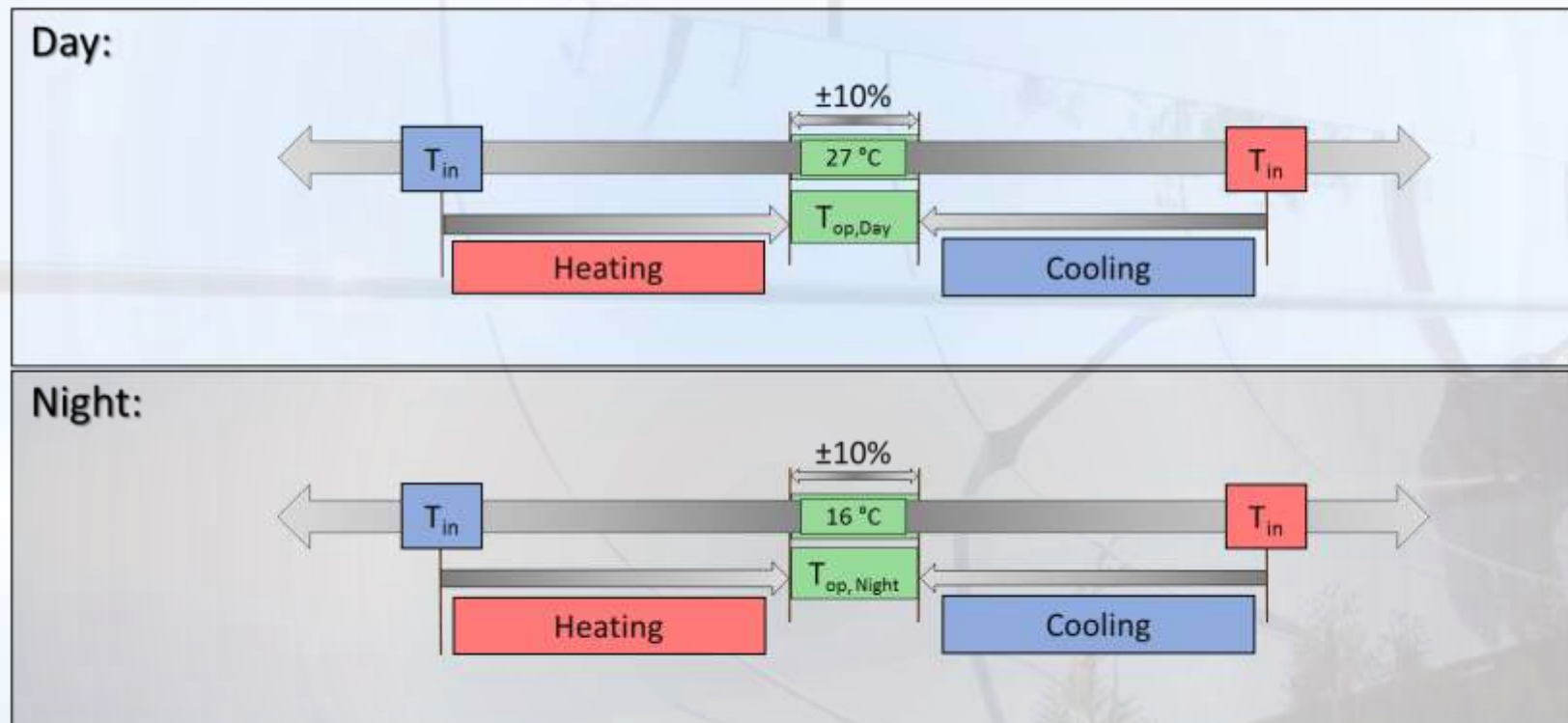


## Energy Balance of a Greenhouse

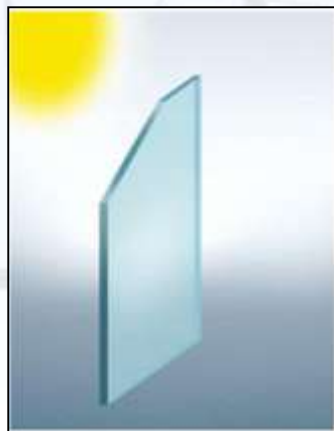




## Optimal Temperature for Tomato Growth



## Type of Glazing



	Single Glazing (4 mm)	Double Glazing (4+12+4)	Double Glazing (4+12+4) + Low E
U-Value [ $\text{W}/(\text{m}^2 \cdot \text{K})$ ]	5.7	2.7	1.6
Transmissivity [%]	89	80	79
G-Value [%]	85	75	55

- Better U-Value for glass will give higher energy savings.

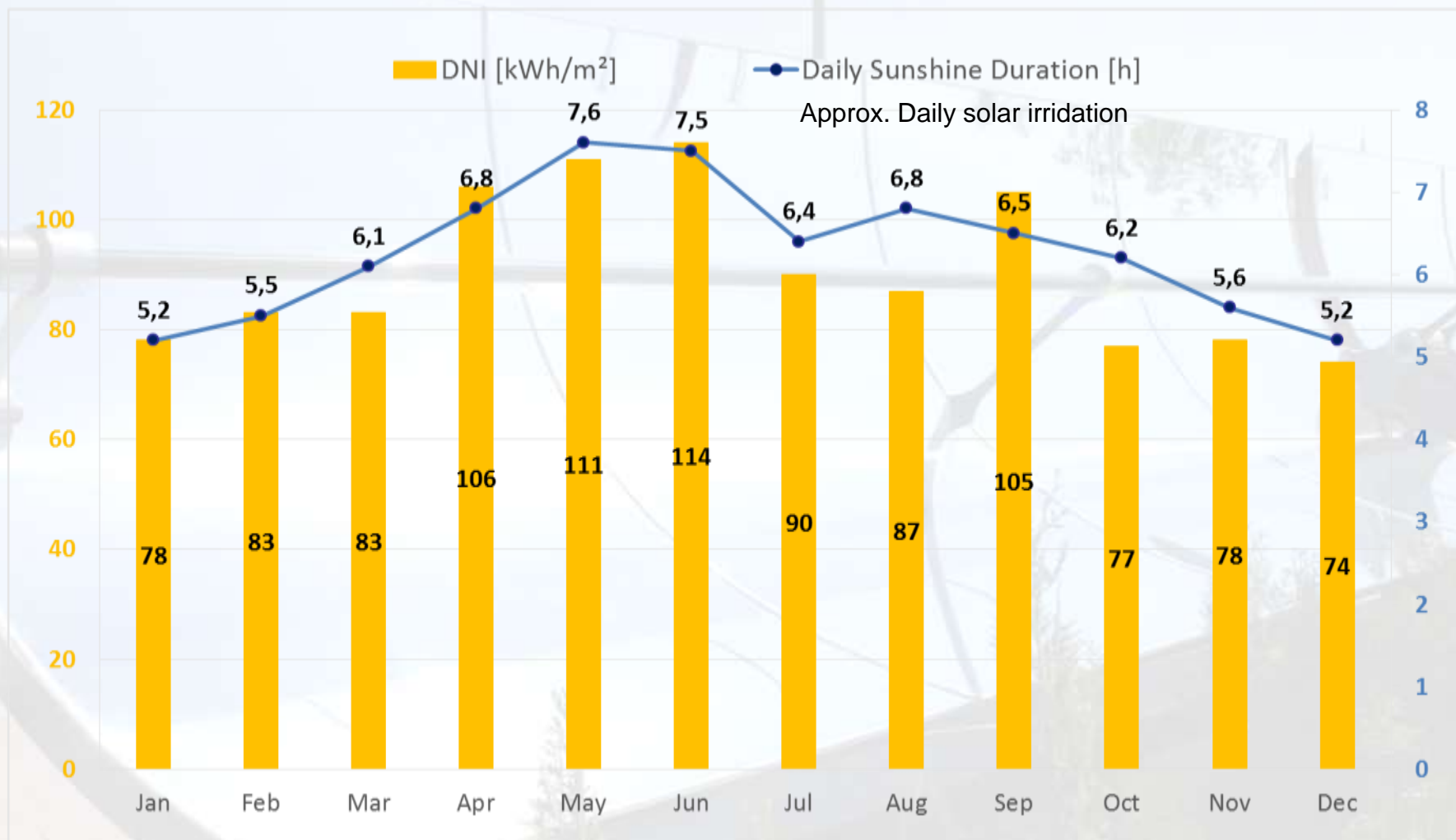
## Greenhouse Project in Suqian, China

Length: 150 m  
Width: 72 m  
Height: 6 m  
Ground area: 10,800 m<sup>2</sup>  
Volume : 64,800 m<sup>3</sup>  
Plants Grown : Tomatoes

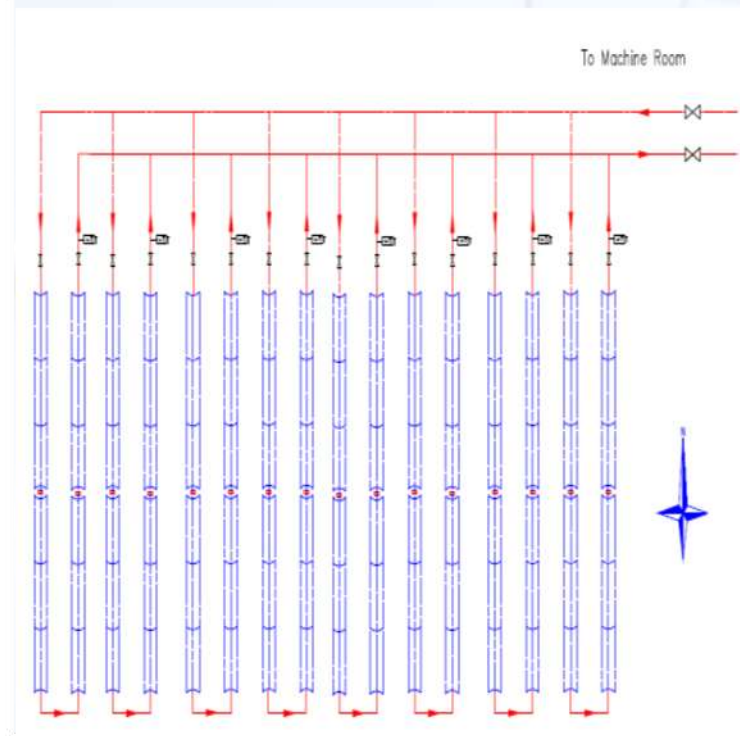




## Monthly DNI Values, Direct solar irradiation



## Design of Solar Field



- ❑ No. of collectors : 550
- ❑ Solar Field Capacity : 2500 kW
- ❑ Installed cooling Capacity : 3500 kW
- ❑ Mirror surface Area : 4950 m<sup>2</sup>
- ❑ Mounting Area : 10,000 m<sup>2</sup>

## Monthly Energy Savings from Solar Field

Single Glazing

No. of Collectors = 550

Month	Monthly DNI (kWh/m2)	Useful Solar energy (MWh)	Cooling Energy Demand (MWh)	Heating Energy Demand (MWh)	Total Energy Demand (MWh)	Energy Surplus/Deficit (MWh)	Fuel Savings (MWh)	Electricity Savings (MWh)
Jan	78	263	-	546	546	-283	658	0
Feb	83	279	-	384	384	-105	463	0
Mär	83	279	-	308	308	-29	371	0
Apr	106	357	-	128	128	229	154	0
May	111	374	310	57	221	152	69	111
Jun	114	384	416	0	297	87	0	149
Jul	90	303	424	0	303	0	0	151
Aug	87	293	408	0	291	1	0	146
Sep	105	353	310	37	258	95	45	111
Oct	77	259	218	98	254	5	118	78
Nov	78	263	-	311	311	-48	375	0
Dec	74	249	-	477	477	-228	575	0
Total	1086	3655	2.086	2.346	3.779	124	2827	745

96,7% of Energy consumption through Solar Filed, only 3,3% from Backup system

Energy Demand by Double Glazing is **19,5 %** lower than by Single Glazing



## Advantages of the combined system

- Energy savings due to Solar heating and cooling.
- Higher production resulting in economic gains.  
(e.g.: up to 100kg/m<sup>2</sup> tomato harvest)
- Early supply in market will fetch higher prices.  
(e.g.: 2-3 weeks early supply to market can fetch double price)
- Better quality and food safety of Tomato produce.
- Hydroponics farming saves water.





## Basic Outcomes

- Solar Power is **not any longer more expensive** and **almost competitive** when using solar thermal systems like PTC
- **Solar Thermal is available everywhere** and sustainable solution for most kinds of energy supply with least resource consumption, environmental impact and zero emissions
- Solar thermal systems are **highly flexible in the ability to combine with conventional fossil energy sources** as using the supplied heat (simultaneous production of process heat and cold and/or electricity)
- **Provides Minimal Footprint:** Not only for the future but also right now this makes them the tool of choice for De-Entropification all manmade energy-devouring processes, not just food production

**Several awards and TV Reports are showing the interest, respect and hope given to this new technology made by SOLITERM !**

## Some of our Awards

- R.I.O. Innovation Award
- Energy Globe Award
- Global 100 Eco-Tech Award
- European Solar Prize
- Sustainability Award
- Global Hero of the Environment  
( *Time Magazin* )



- ZDF Heute Journal  
( *Sonnenenergie zur Kälteerzeugung* )
- ZDF Reportage  
( *Kälte aus Sonne, Klimaanlage der Zukunft* )
- RTL II Welt der Wunder
- Euronews SOLITERM







# THE COOLEST IDEA SINCE THE INTRODUCTION OF SOLAR ENERGY



7<sup>TH</sup> INTERNATIONAL CONVENTION  
OF ENVIRONMENTAL LAUREATES  
FREIBURG, GERMANY - 15 - 18 MARCH 2018



# Laureates' Symposium



Supporters and Donators



Associate Partners

