



## **Innovative Solar thermal systems for heating and cooling**

**Warsaw  
18<sup>th</sup> June 2009**

***Panagiotis Tsekouras***  
PhD Candidate  
Mechanical Engineer  
CRES - Solar Thermal Dept.



- The HIGH COMBI project
- SC+
- SC+ & SST
- SC+ & SST & GHE
- SC+ & SST & GHE & GHP
- The Greek plant

## *Symbolism*

*SC+:* Solar Combi plus systems

*SST:* Seasonal Storage Tank

*GHE:* Ground Heat Exchangers

*GHP:* Geothermal Heat Pump

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# The Project HIGH COMBI

*High solar fraction heating and cooling system with combination of innovative components and methods*

*Start Time*      June 2007

*Duration*        48 months

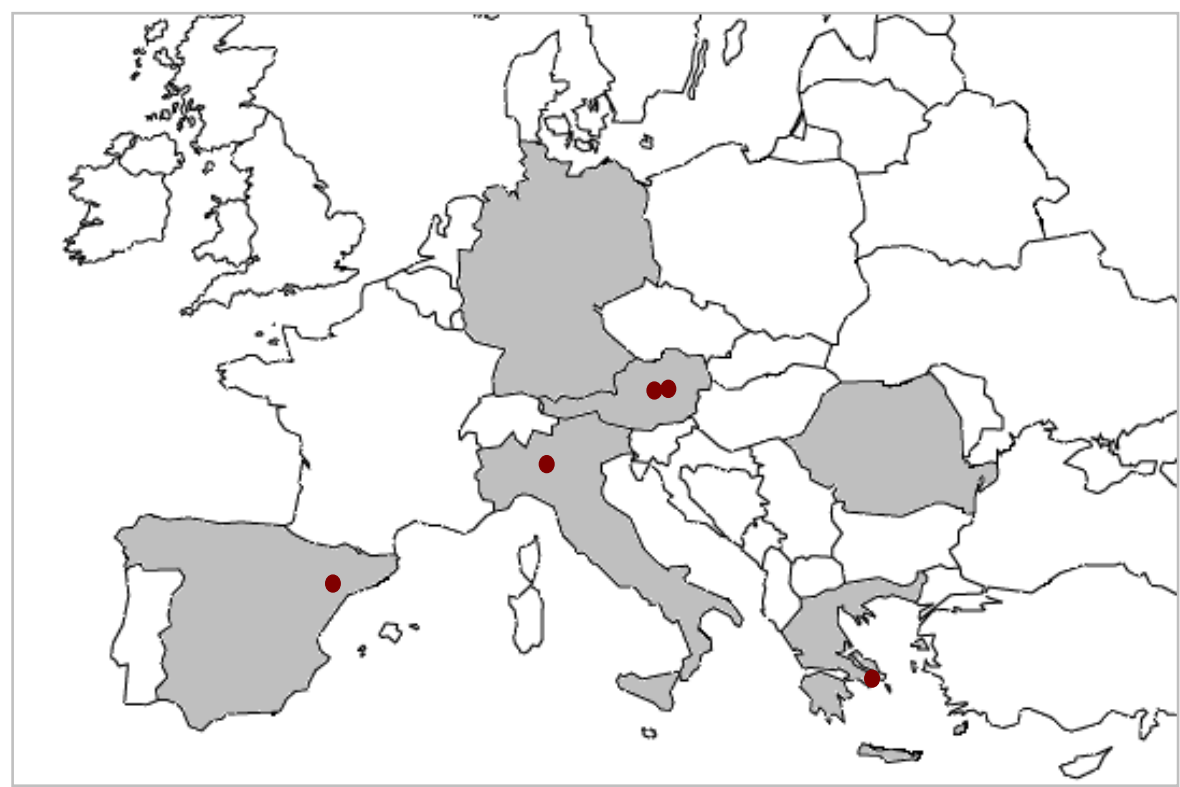
*Coordination*    Dr. Constantine Carytsas, *CRES (Centre for Renewable Energy Sources and Saving)*

- Scope*
- Develop high solar fraction systems by combination of different technologies of solar heating, cooling and storage.
  - Realize several demonstration plants.

# Consortium & Plants

## 6 Participating Countries

- *Austria*
- *Italy*
- *Germany*
- *Greece*
- *Romania*
- *Spain*



## 5 Demonstration Plants

- *Austria (2)*
- *Italy*
- *Greece*
- *Spain*

## Consortium



# Overview



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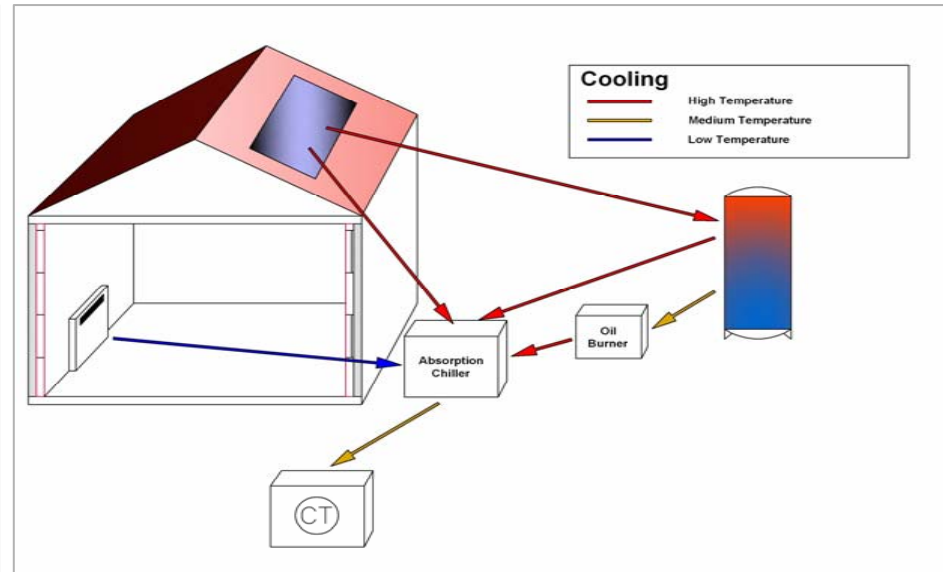
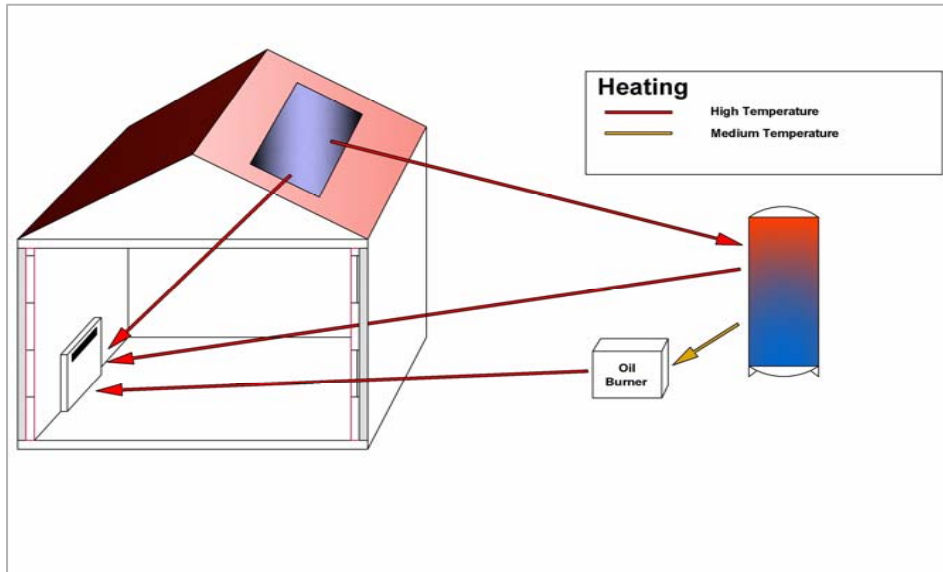
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SC+

HIGHCOMBI





# SC+, Case Study

## Solar Combi + system for residential house in Wiesloch, Germany



Source: Brinkmüller



Source: SolarNext

### Characteristics

- 40 m<sup>2</sup> Flat Plate Collectors
- 2,000 l Hot Water Storage
- 7.5 kW Cooling Capacity (SorTech – Adsorption Chiller)
- 22kW Cooling Tower

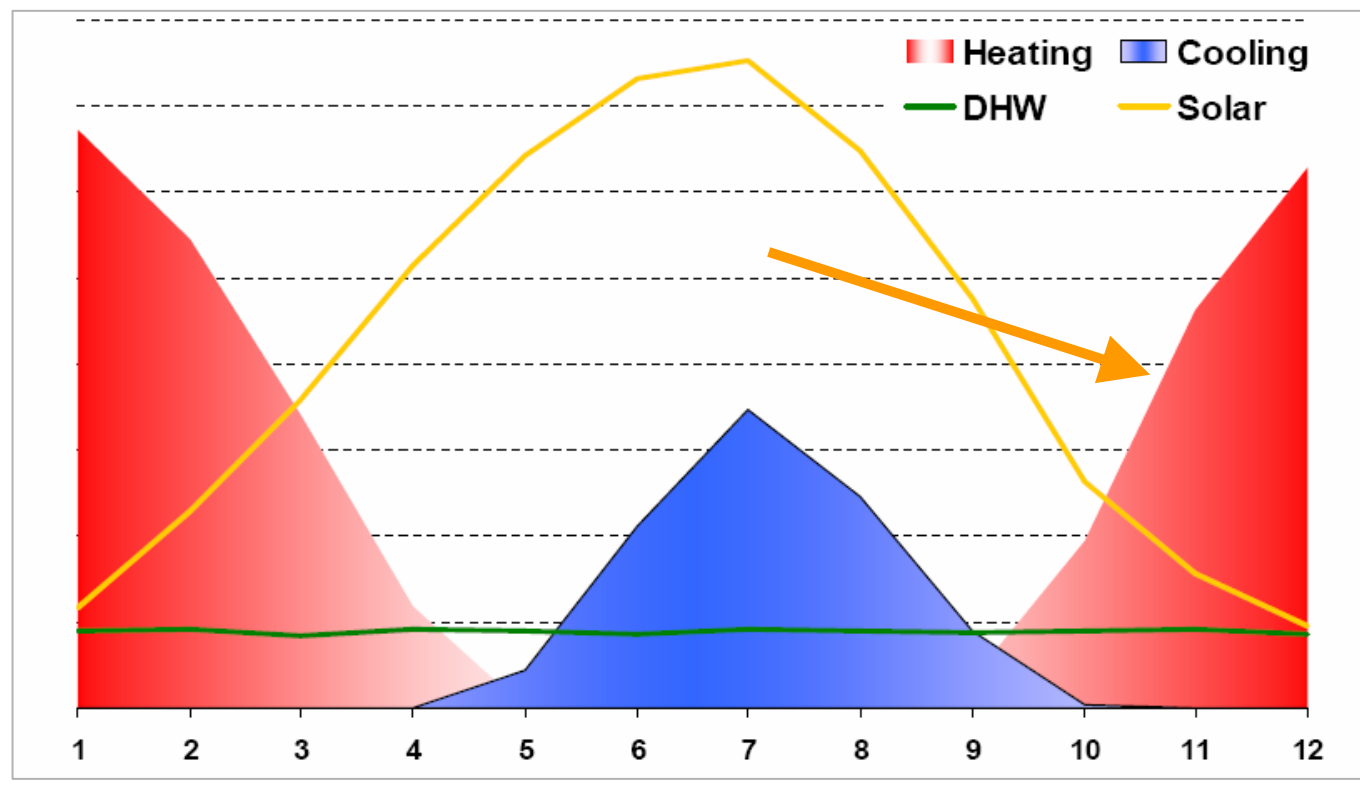
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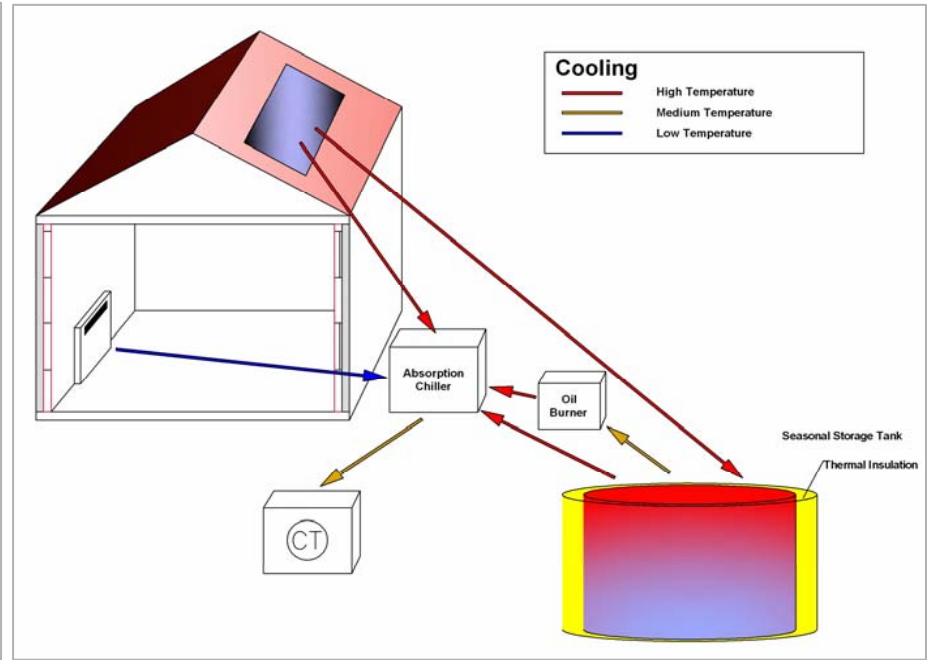
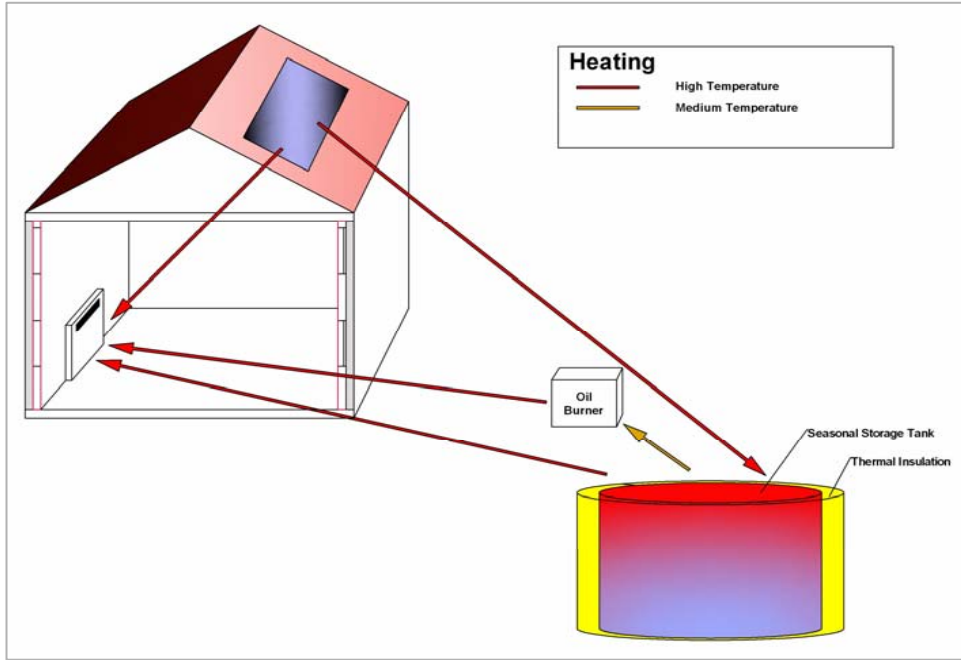
# Why use energy storage?

**Disadvantage:** *Unexploited solar energy*  
**Solution:** *Seasonal Storage Tank*



*Building energy demands and solar production*

# SC+ & SST



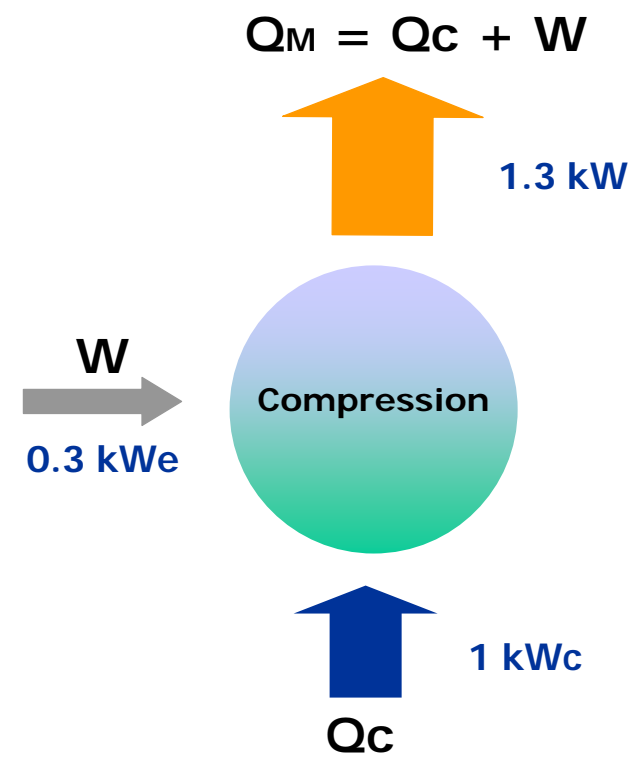
# Overview



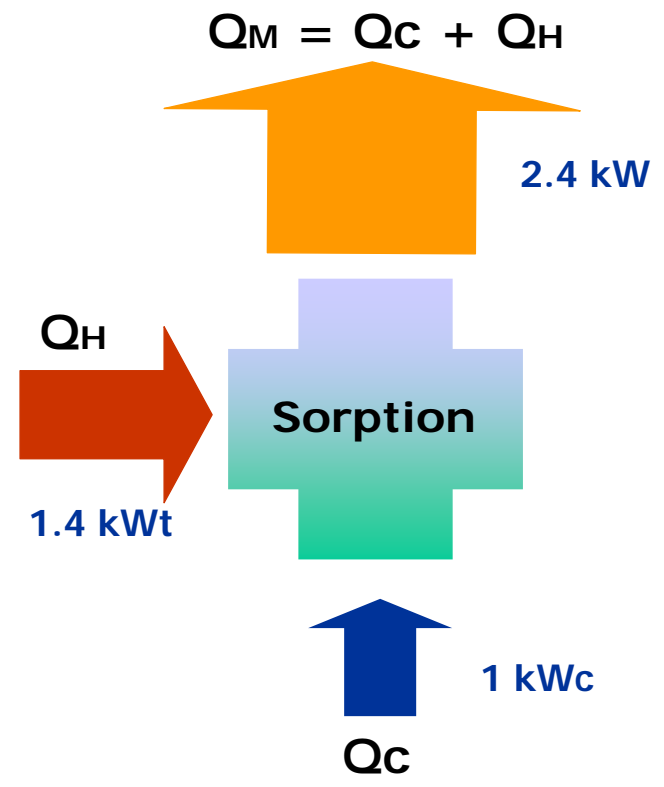
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# Principle of Cooling Operation

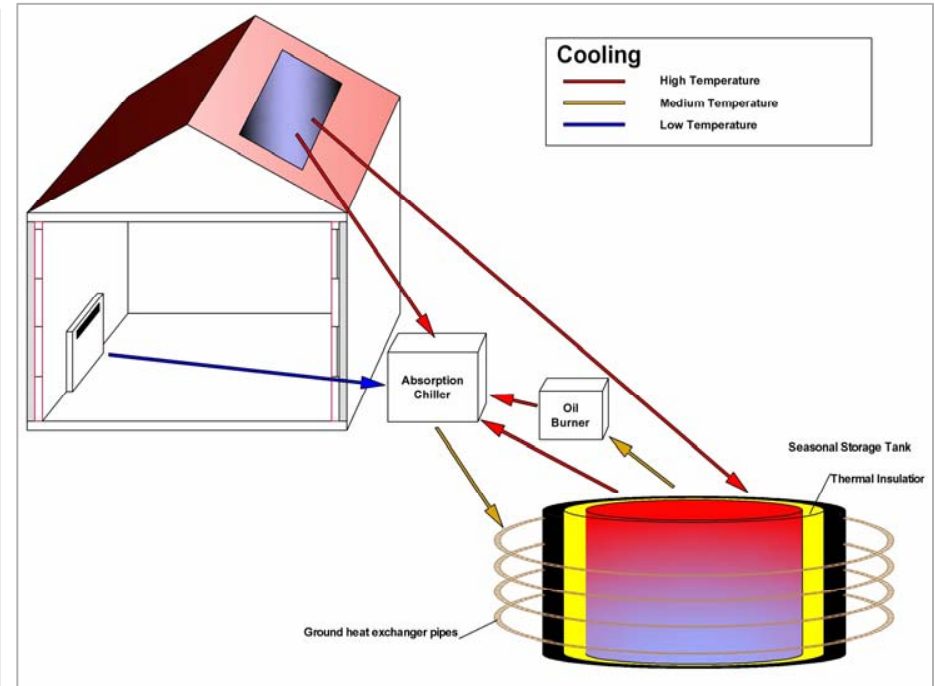
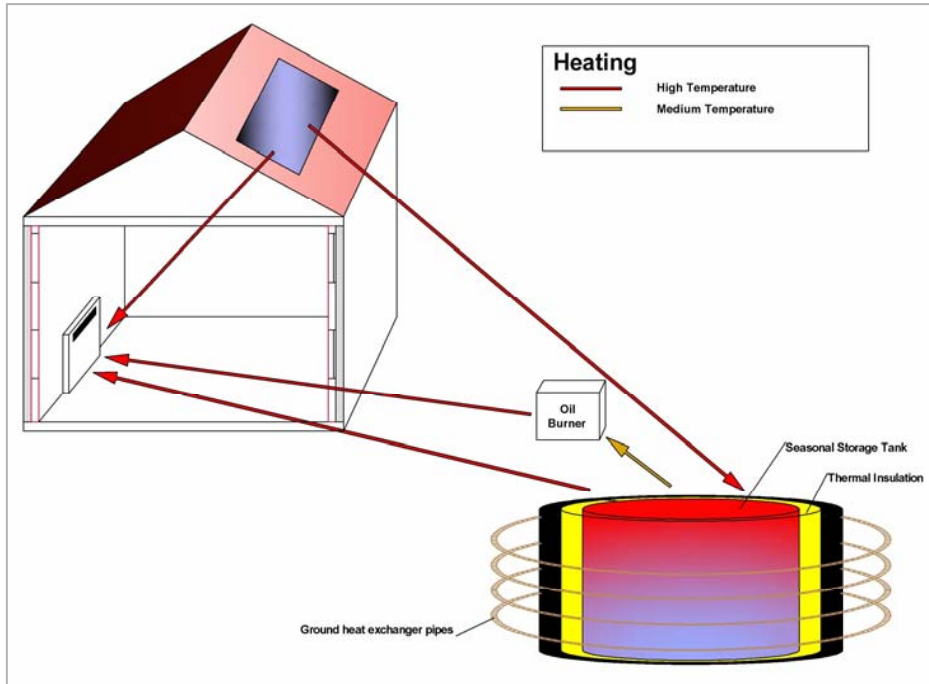
## Conventional Chiller



## Sorption Chiller



# SC+ & SST & GHE



# Overview



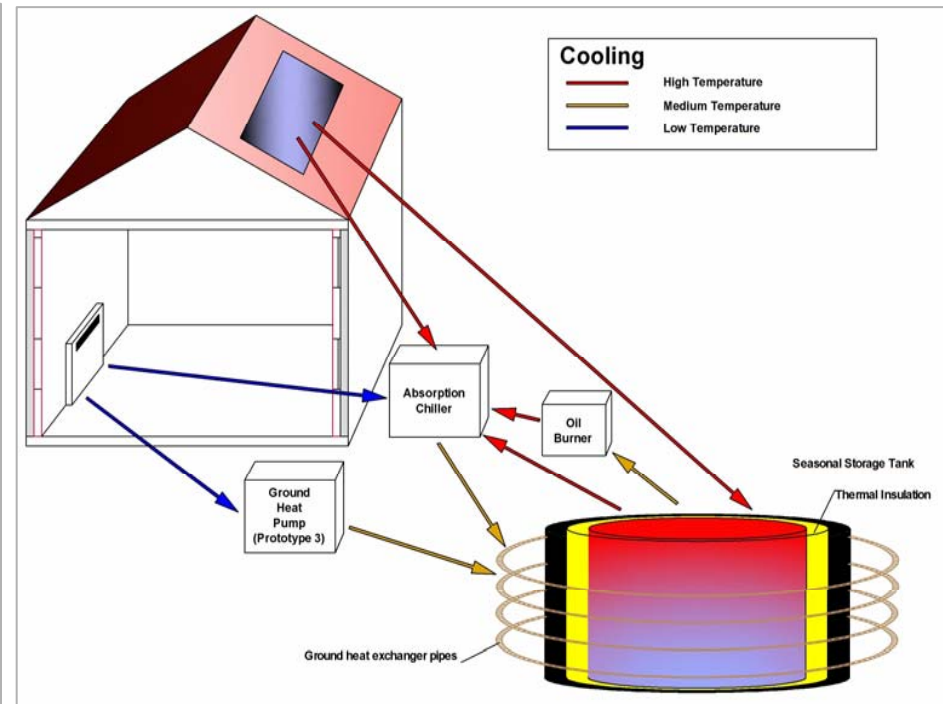
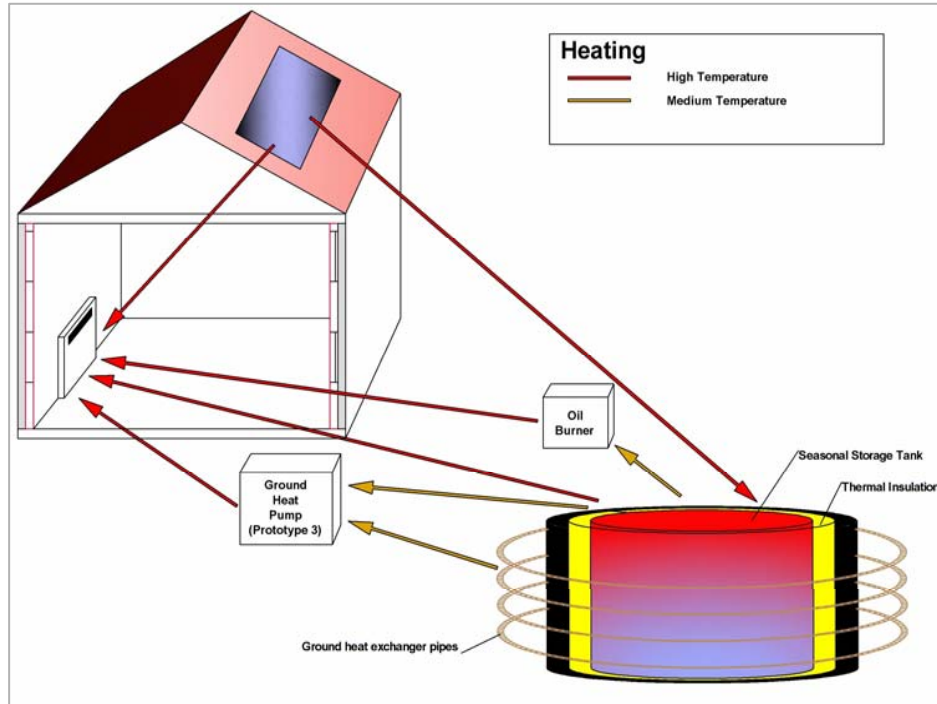
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# Innovative Geothermal Heat Pump



# SC+ & SST & GHE & GHP



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## *Characteristics*

- Solar system for heating and cooling (absorption chiller)
- End user is CRES's offices in Athens
- Use of Seasonal Storage Tank (SST)
- Innovative heat rejection system thermally coupled with the SST
- High Solar Fraction over 80%
- Possible integration of a geothermal heat pump

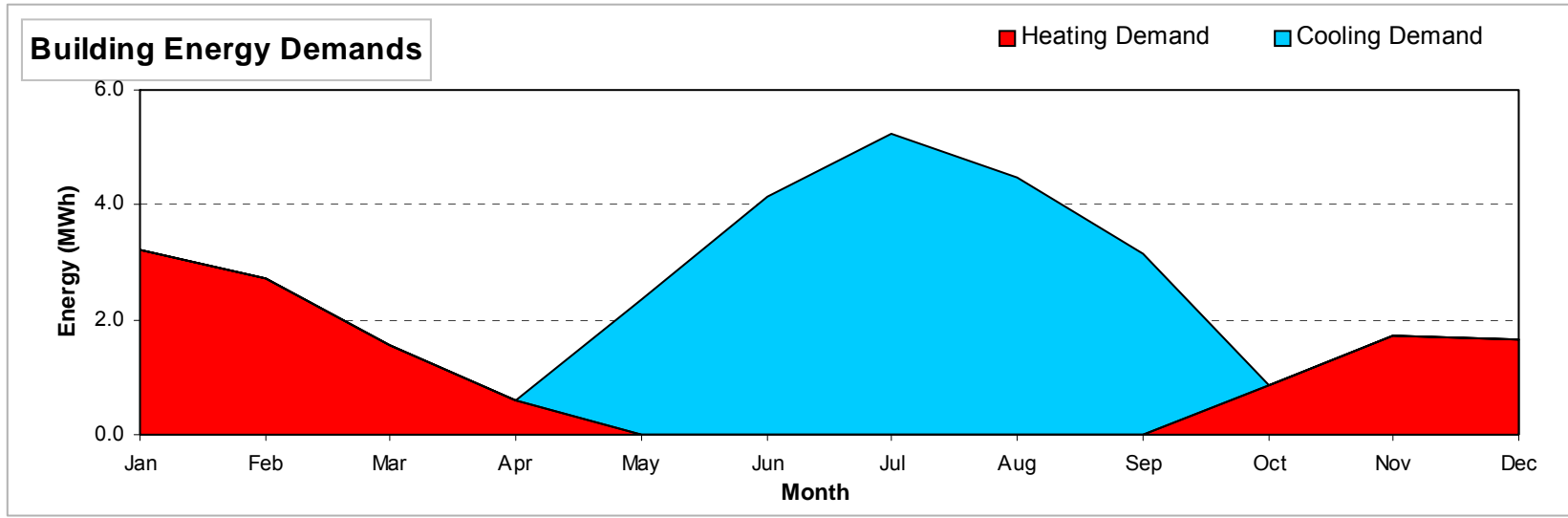
# Building



CRES Offices (Building No 3), Athens

# Building Data

Building Data	
Area	426.6 m <sup>2</sup>
Heating Load (max)	31.7 KW
Heating Energy Demand	12.3 MWh
Cooling Load (max)	33.2 KW
Cooling Energy Demand	19.4 MWh
DHW Demand	-
Heating / Cooling Distribution System	Fan Coils



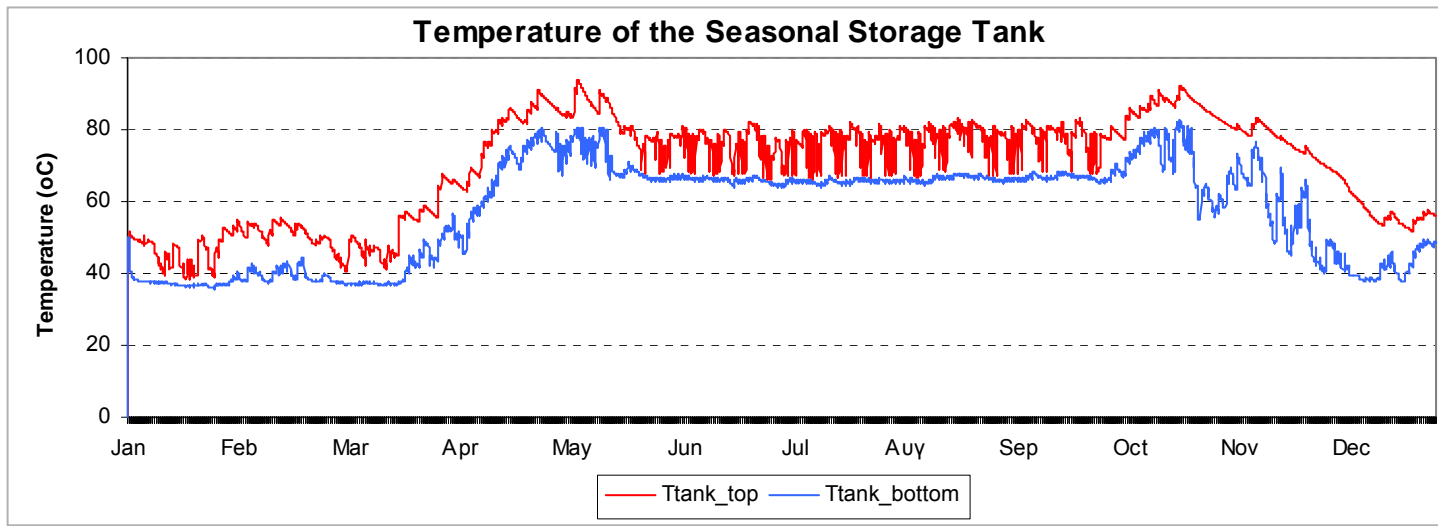
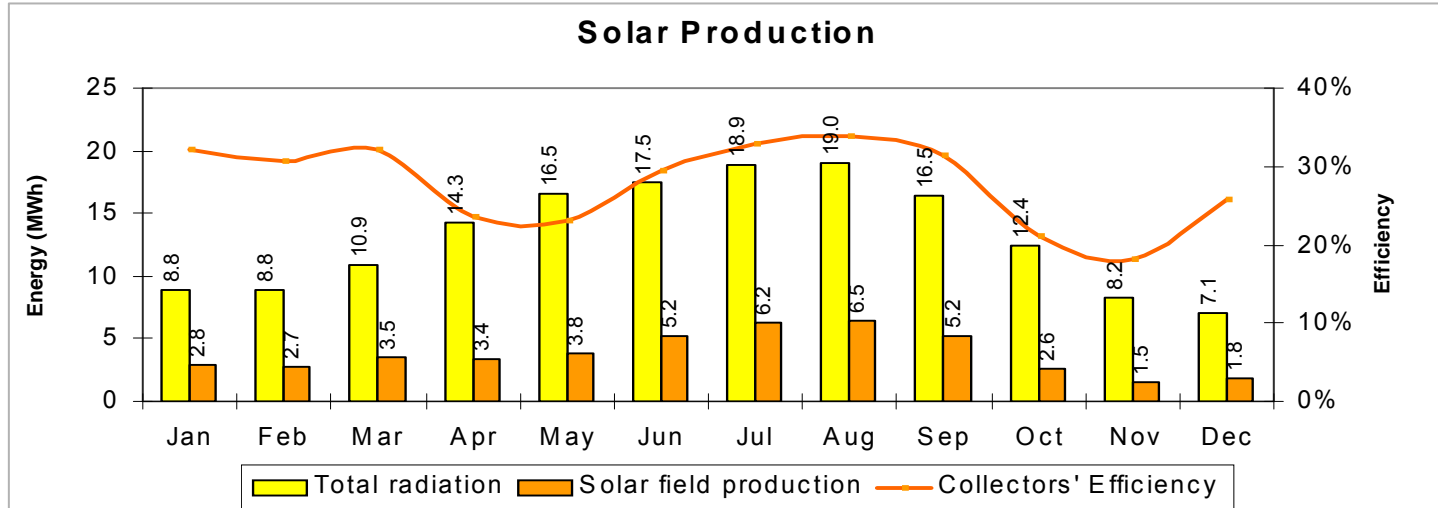
# Solar System I



Energy System Data		
	Type	Unit
Collectors	Flat Plate	90 m <sup>2</sup>
Primary Circuit Fluid	Mixture of propylene glycol and water	30 %
Chiller	Absorption	35 kW
Heat Rejection	GHE & Cooling Tower	
Storage	Buried Cylindrical Tank	60 m <sup>3</sup>
Heating supply/ return Temperature	Fan Coils	45 / 38 °C
Cooling supply/ return Temperature	Fan Coils	7 / 12 °C

**Estimated Solar Fraction over 80%**

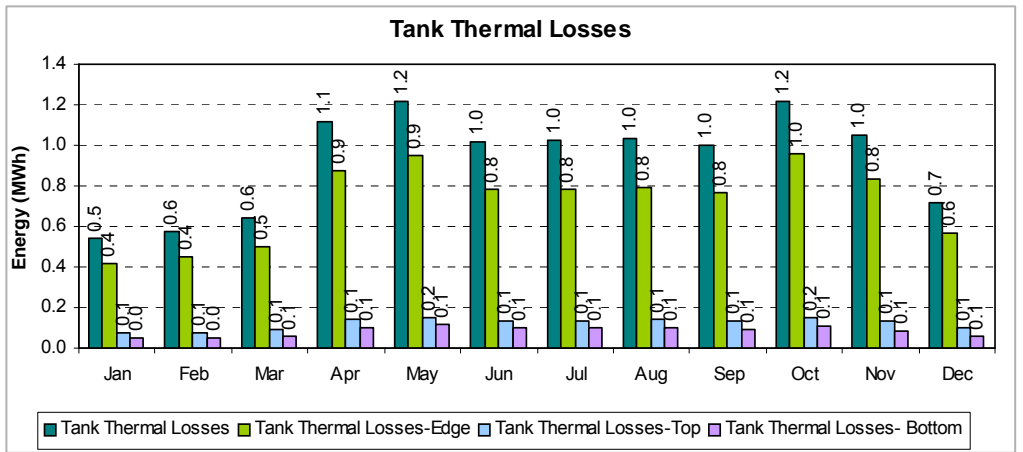
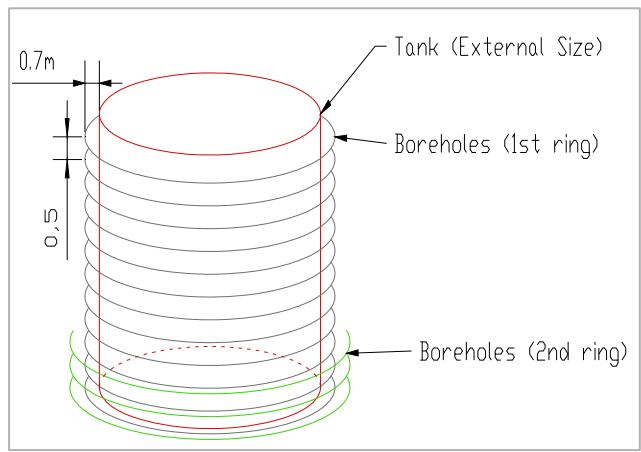
# Solar System II





# Storage System

Innovative Seasonal Storage		
	Type	Unit
Storage	Cylinder	60 m <sup>3</sup>
Position	Underground (T <sub>ground</sub> ~ 15°C)	1 m
Restrictions	High Water Level	8 m
Structure	Steel & Concrete	
Insulation	Polyurethane & Chipped Tyres	0,4 W/(m <sup>2</sup> K)



*Thank you for your attention!*

***Centre for Renewable Energy Sources and Saving  
Solar Thermal Department***

*19km. Marathonos av., 19009, Pikermi  
tel. 00302106603300, fax. 00302106603301*

[www.cres.gr](http://www.cres.gr)