

EUROREAN FORUM ON SOLAR THERMAL SYSTEMS
BUCAREST, ROMEXPO 29-30 OCTOBER 2009



SOLAR THERMAL SYSTEMS IN EU PUBLIC BUILDINGS

Michaelis Karagiorgas

Docteur Ingenieur

BONAIR Ltd

TYPE OF APPLICATION OF STS IN PUBLIC BUILDINGS

- DHW-DOMESTIC HOT WATER

(hospitals, health centers, sport centers, spas, elder care facilities, prisons,...)

- SPACE HEATING

(office buildings, theaters, shopping centers,...)

- SPACE COOLING

(office buildings, theaters, shopping centers,...)

PARALLEL PROMOTION

Public buildings too, same as the hotels will hunt the green image



Hotel EL GRECO
(plants on the rooftop, 1160m² area)



Hotel CRETA PALACE
(natural lighting 16,2 m²)



Hostel – ELOYNDA
(PV 6.4kW_p stand alone)



Hostel of the MEDUCA
(Geothermal heat pumps with 24°C 1 x 120kW, 1 x 80 kW)



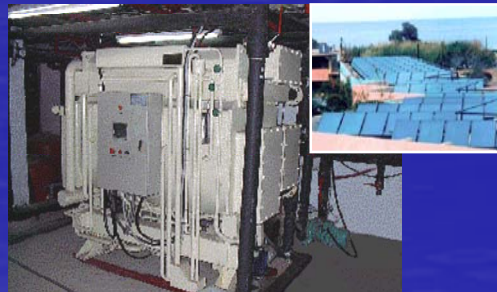
NTUO Baths of Traianoupolis
(Floor heating 37°C, 450kW exchanger)



Hotel ATRION
(2 olive kernel boilers 100.000 kcal/h & 120.000 kcal/h)



Hotel SANI BEACH
(283 m², flat solar collectors)



Hotel RETHIMNO VILLAGE
(448m² +199m² f.s.c for 105 kWcool)



ALDEMAR Hotel complex,
(2783m² of solar collectors)

in combination with RES techniques



GRANDE BRETAGNE

(air to air heat recovery exchangers
86.000m³/h)



ATHENS CITY HOTEL COMPLEX

(High efficiency 2,5MWcool
centrifugal variable speed chiller)



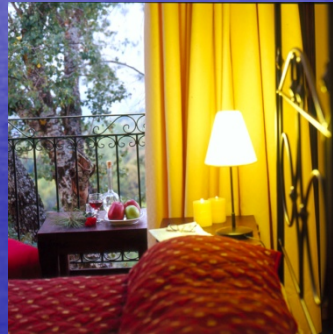
Club HOTEL LOUTRAKI

(5MWcool centrifugal chiller with
heat recovery CDS for hot water)



ESPEROS PALACE

(ice storage facility with 2800 kWh ice
bank capacity)



HOTEL LANASSA

(256 indoor lighting spots/3,7kW total after
pin-based technology)



HOTEL CECIL, (external
insulations 2620m²,
retrofitting project)



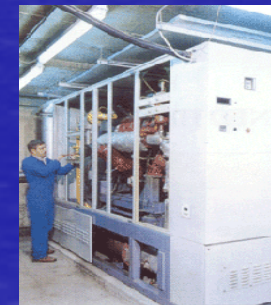
ILISSOS HOTEL

(Gas engine air conditioning 560kWcool)



CAPE SOUNION / GRECOTEL

(530kWcool air sourced Heat Pump)



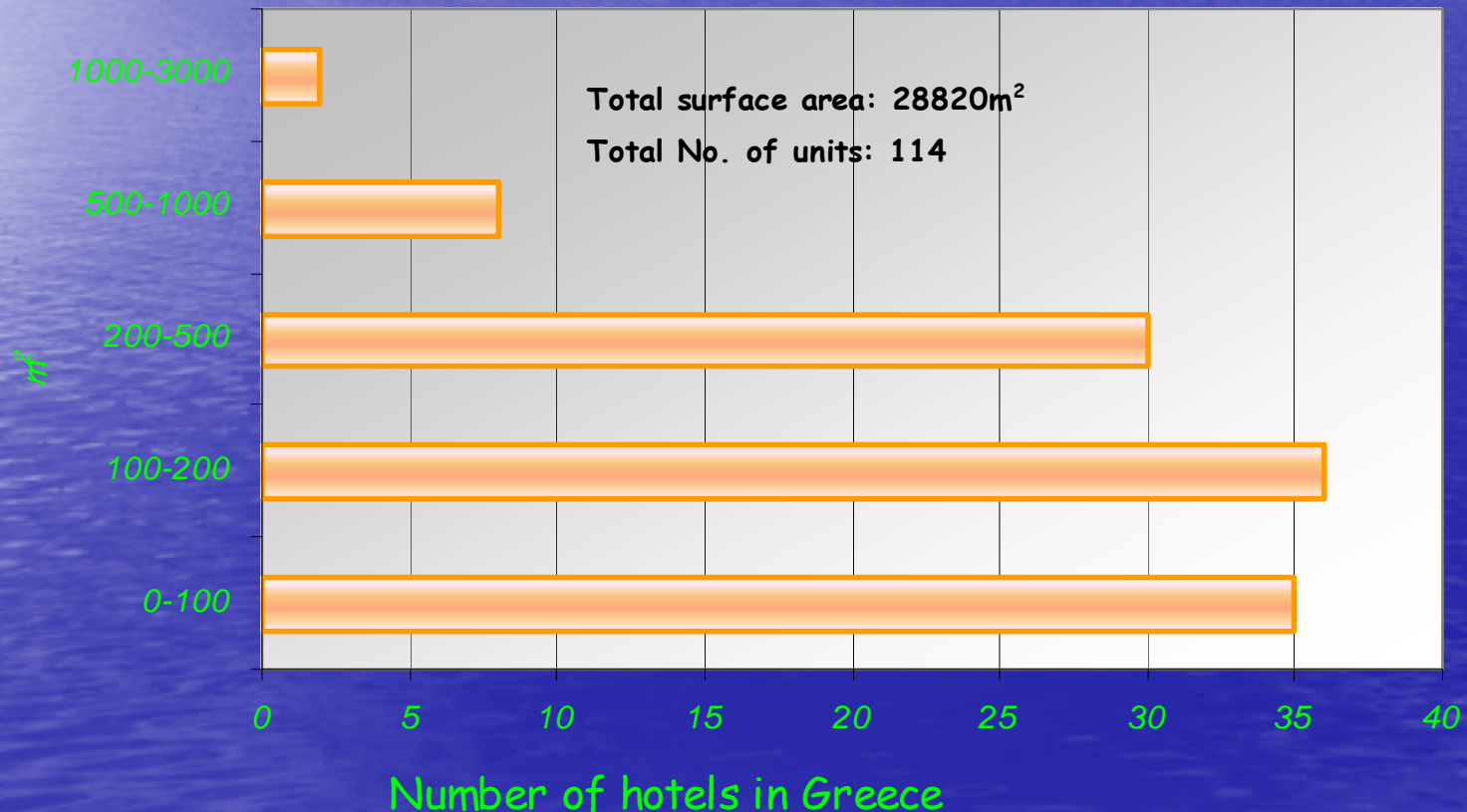
HOTEL BURLINGTON

(cogeneration unit 185kWe)

the existing solar thermal market in hotel sector

SOLAR THERMAL IN HOTELS. ADD 1400 UNITS WITH 37 000 M2 OF THERMOSHIPHONIC COLLECTORS

Size distribution of central thermal solar systems in Greek hotels



Economical issues in hotel sector of solar thermal systems

We are allowed to accept the results of the table in the hospital sector too

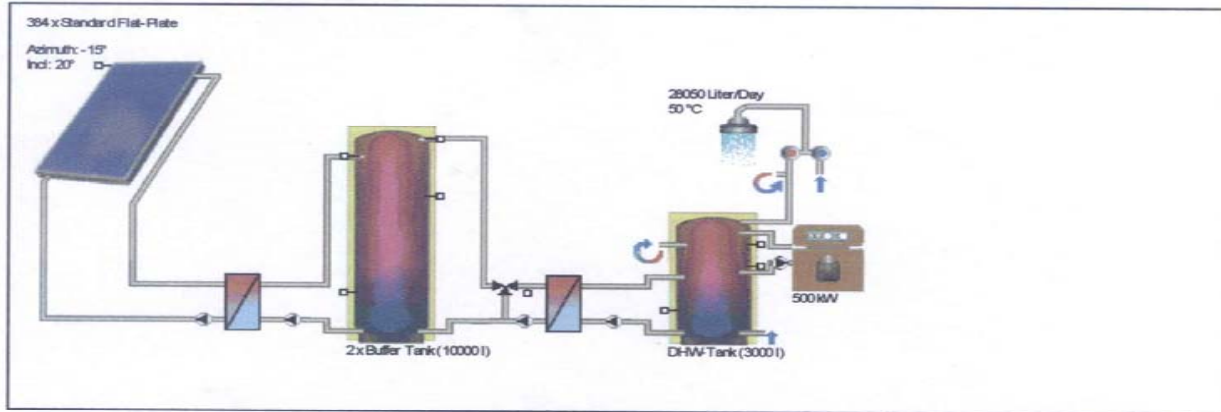
TECHNICAL ECONOMIC RESULTS FROM RES IN 14 GREEK HOTELS

Renewable Energy Technologies examined

<i>Name of hotel</i>	<i>Place</i>	<i>Biomass</i>	<i>Solar passive</i>	<i>Geo-thermal</i>	<i>Solar PV</i>	<i>Solar SHW</i>	<i>Solar cooling</i>	Number of pre-feasibility studies
Porto Valitsa	Chalkidiki			46 kW 3,9 years		30 m2 3.1 years		2
Metropolitan	Corfu				1,67kWp 43 years	600 m2 5.1 years		2
Lutania Beach	Rhodos			525 kW 4,3 years		600 m2 4.4 years	601 m2 8.0 years	3
Casino Rhodos	Rhodos			30 kW 4,6 years				1
Colossos Beach	Rhodos			1751 kW 4,7 years		200 m2 1.7 years		2
Kresten Palace	Rhodos			1050 kW 4,3 years		400 m2 3.3 years		2
Marie Hotel	Rhodos				1,38kWp 39 years	60 m2 2.2 years		2
TOTAL in CREECE				5	2	6	1	14

Design of STS 1/3

CRES
Solar Thermal Department
Hotel Chandris
Final Report



Results of Annual Simulation

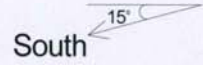
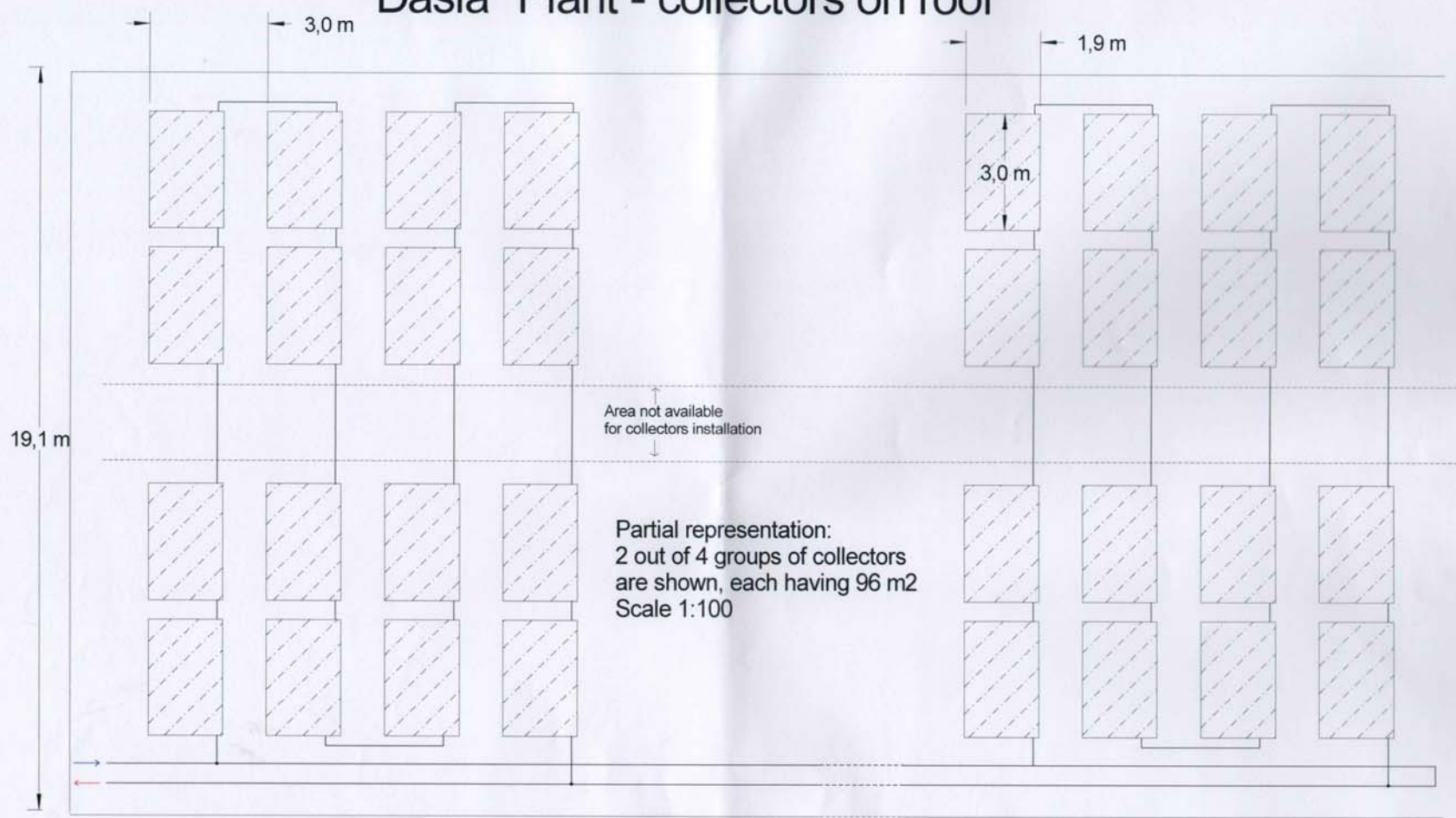
Collector Surface Area Irradiation:	559,67 MWh	1457,47 kWh/m ²
Energy Produced by Collectors:	198,31 MWh	516,43 kWh/m ²
Energy Produced by Collector Loop:	185,98 MWh	484,31 kWh/m ²
DHW Heating Energy Supply:	252,56 MWh	
Solar Contribution to Hot Water:	179,37 MWh	
Energy from Auxiliary Heating:	85,62 MWh	

Fuel Oil Savings: 22 543,4 l
CO2 Emissions Avoided: 61 508,5 kg

DHW Solar Fraction: 67,7 %
System Efficiency: 32,0 %

Design of STS 2/3

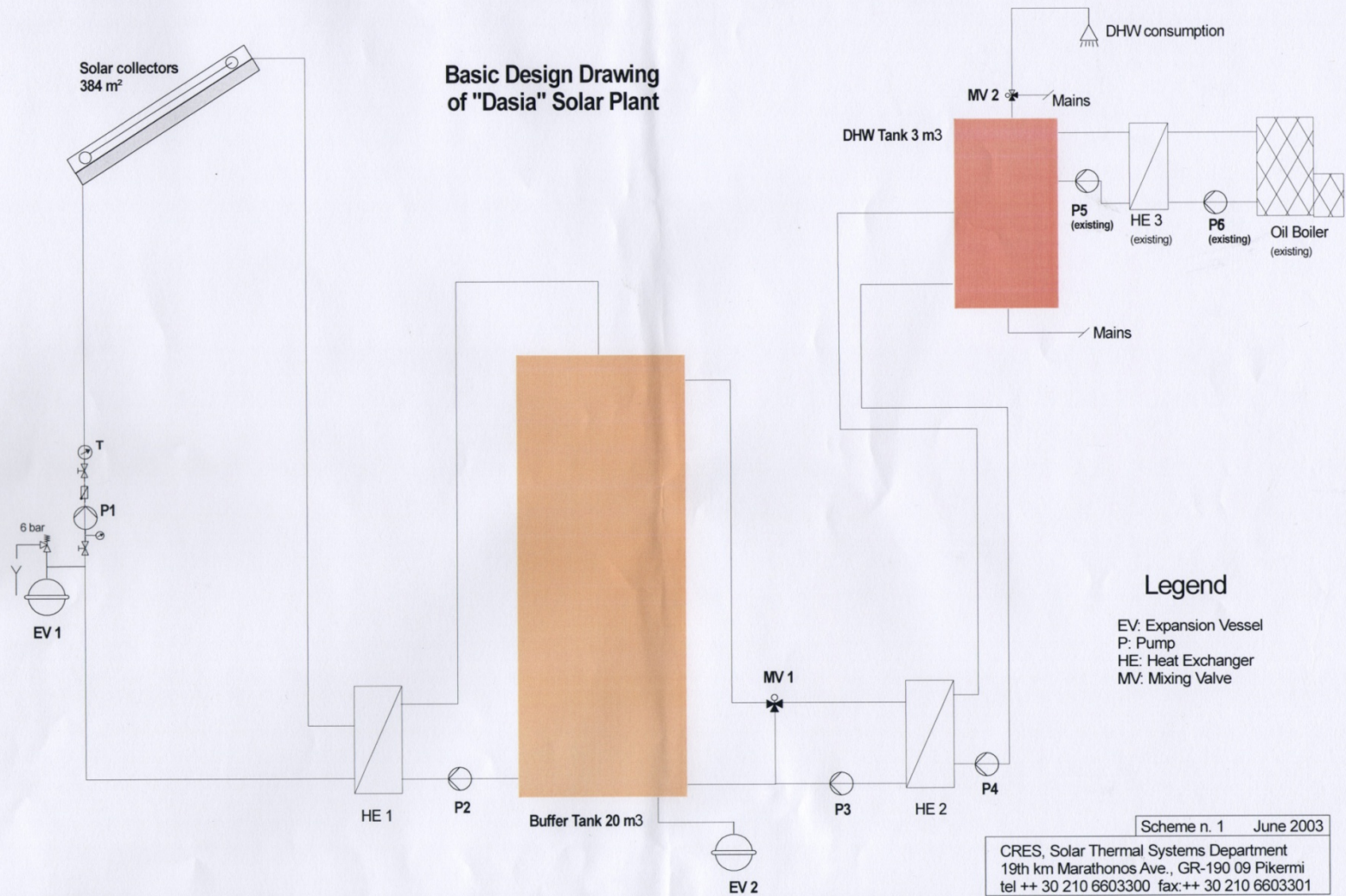
"Dasia" Plant - collectors on roof



Scheme n. 2 June 2003

CRES, Solar Thermal Systems Department
19th km Marathonos Ave., GR-190 09 Pikermi
tel ++ 30 210 6603300 fax:++ 30 210 6603301

Design of STS 3/3



Design of a solar cooling system: phase 1-software SACE

SACE Solar Cooling Evaluation Tool Light

File Calculate Help

Input data

Collector data:

Collector type	Vaccum tube collectot
Optical efficiency	0.820 [-]
Linear loss coefficient	3.520 W/(m ² K)
Quadratic loss coefficient	0.0300 W/(m ² K ²)
K50, long	0.95 [-]
K50, trans	0.95 [-]

Room:

Room area	250.00 m ²
-----------	-----------------------

Equipment:

Operation temperature heating	45.00 °C
Operation temperature cooling	75.0 °C
Efficiency heating system	0.85 [-]
COP thermal chiller	0.60 [-]

Reference File

Load and Meteo Data File	
Configuration	E:\Vassiliki\Ηθλιακός κλιματισμός\CLIMASOL\sace\ConfigFiles\Soc...
Results	E:\Vassiliki\Ηθλιακός κλιματισμός\CLIMASOL\sace\ResultFiles\12...

correlation method

building model

meteo data

collector model

heat load

solar gains

solar fractions for heating and cooling

COP, ϵ

start

21 2 A... S... D... EN 2:42 μμ

Views of the helio-geothermal heating

EUROPEAN PUBLIC LAW CENTER

MEDUCA BUILDING, LEGRAINATTICA

The unit has 2300 m² floor area and operation period, since 1990, around the year.

Needs for:

- Space heating (with solar) and space cooling (with geothermal)
- sanitary hot water (with solar)

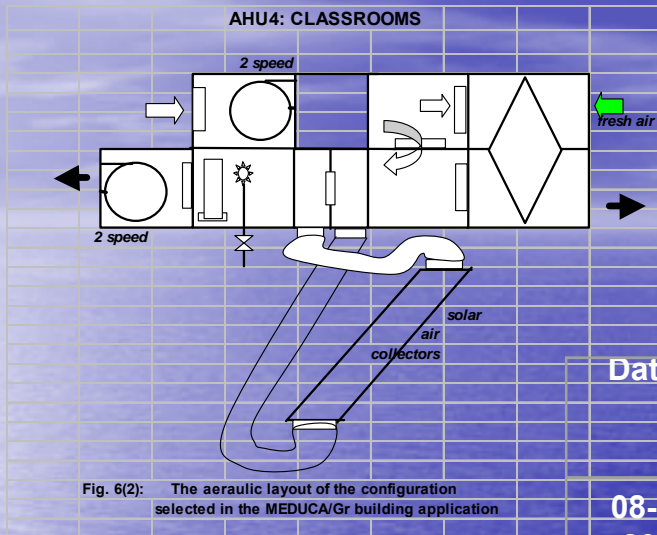


Two geothermal water to water the heat pumps (80kW και 130kW)

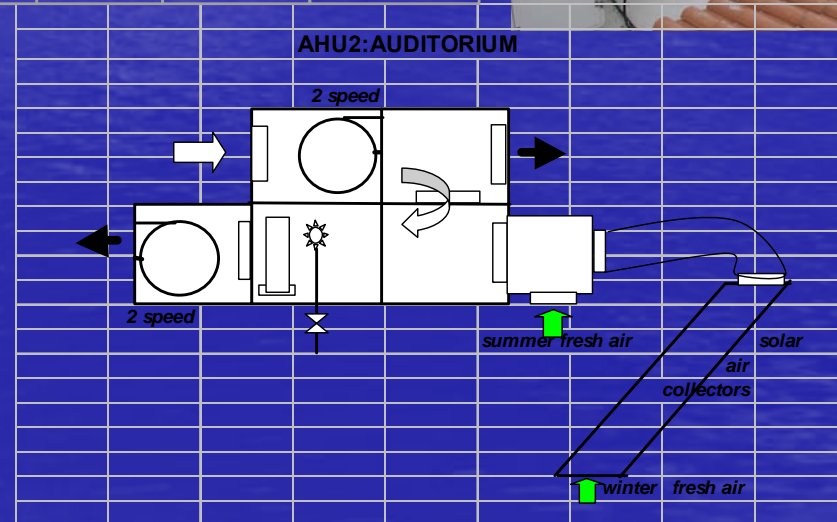
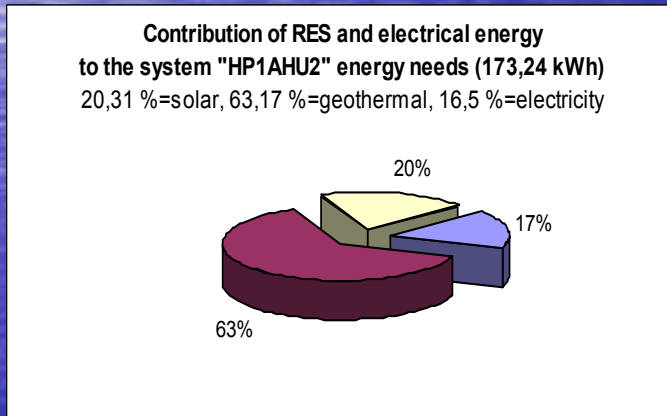
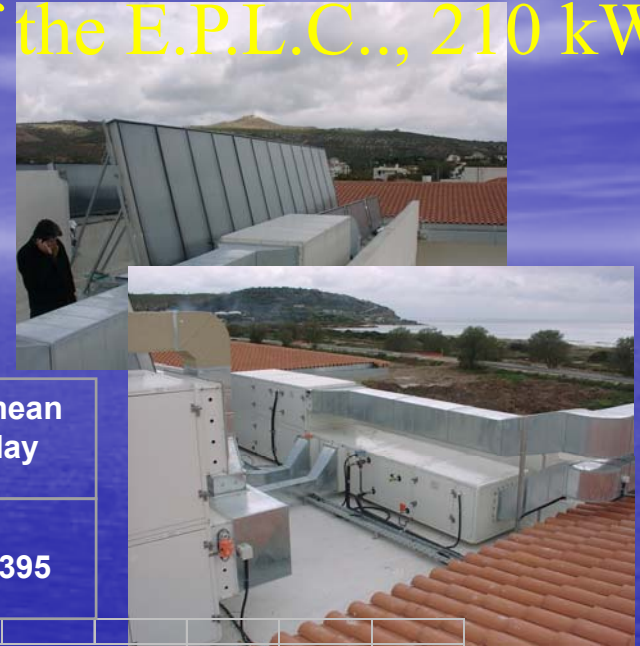


The solar air collector field for recirculation air heating (100 m²)

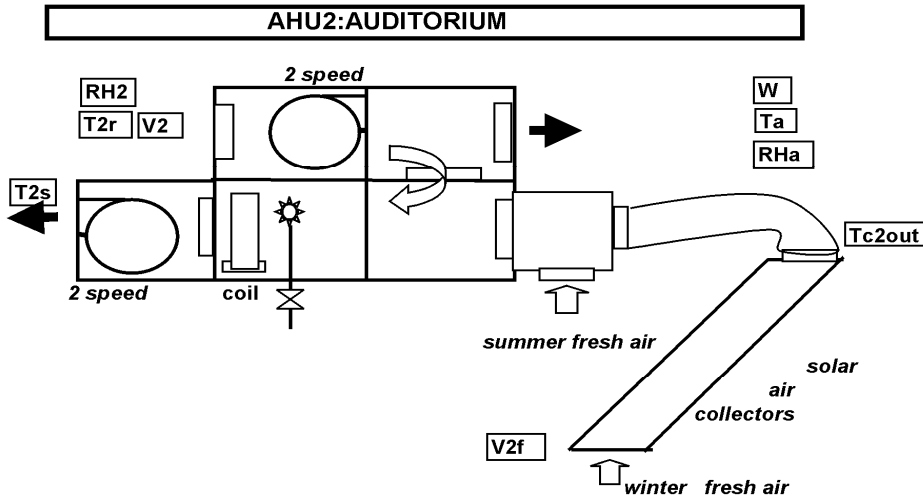
Project MEDUCA: Helio-geothermal heating and cooling Of the E.P.L.C., 210 kW



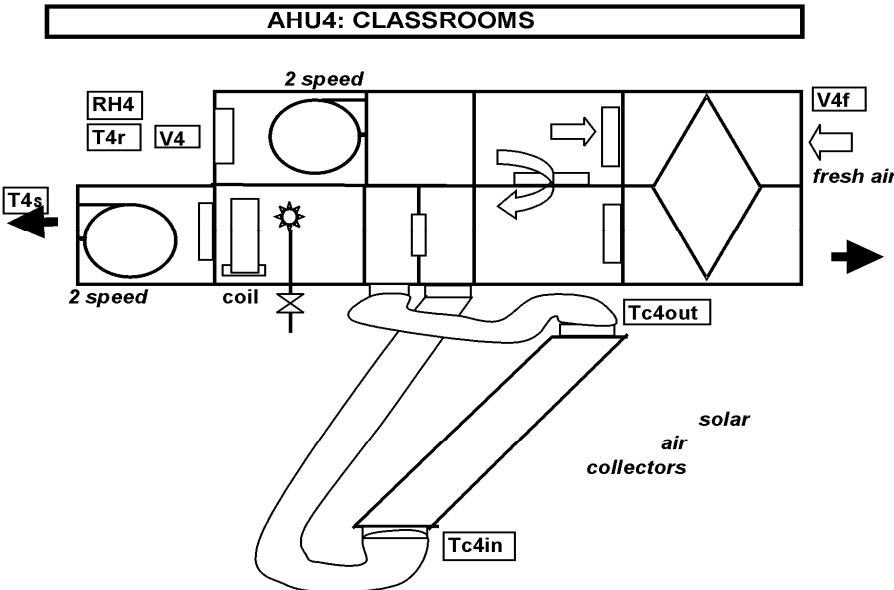
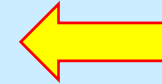
Date	CO HP 1	COP HP 2	η mean day
08-02-2001	3,91	4,3	0,395



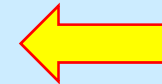
Two techniques are applied in the solar heating of the EPLC



Fresh air preheating with 25 m² of solar collectors



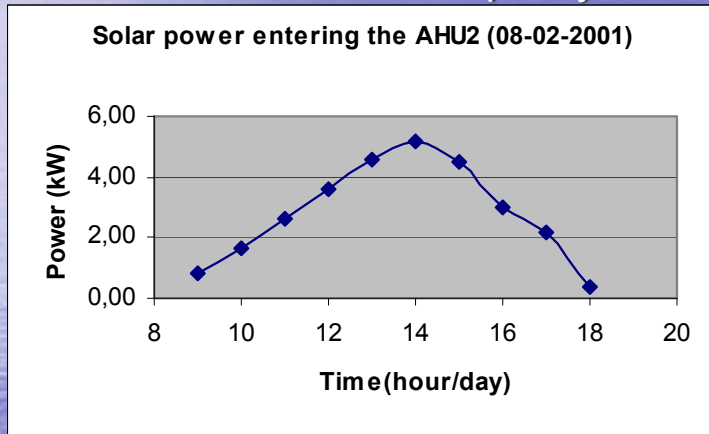
Recirculation air heating with 75 m² of solar collectors



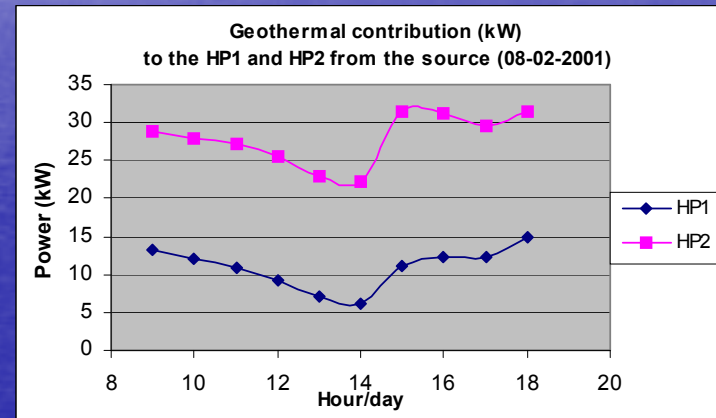
Measurement results of the project "MEDUCA"

CRES: Monitoring results from the helio-geothermal project "MEDUCA"

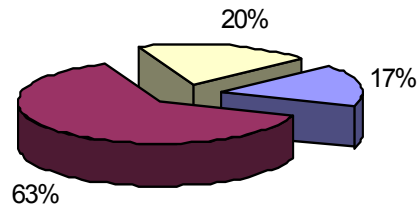
Solar driven thermal capacity



Geo driven thermal capacity



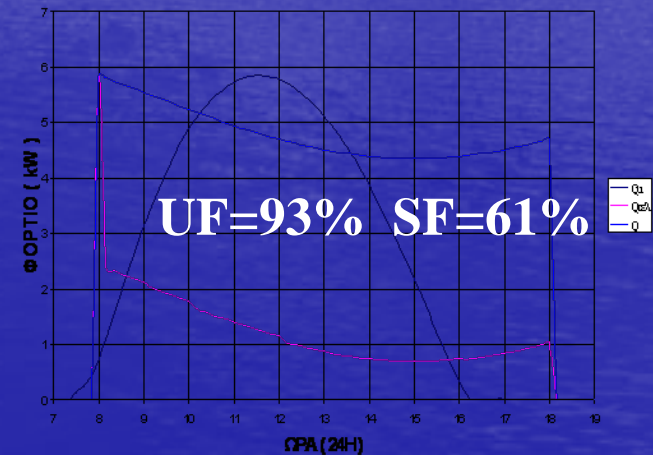
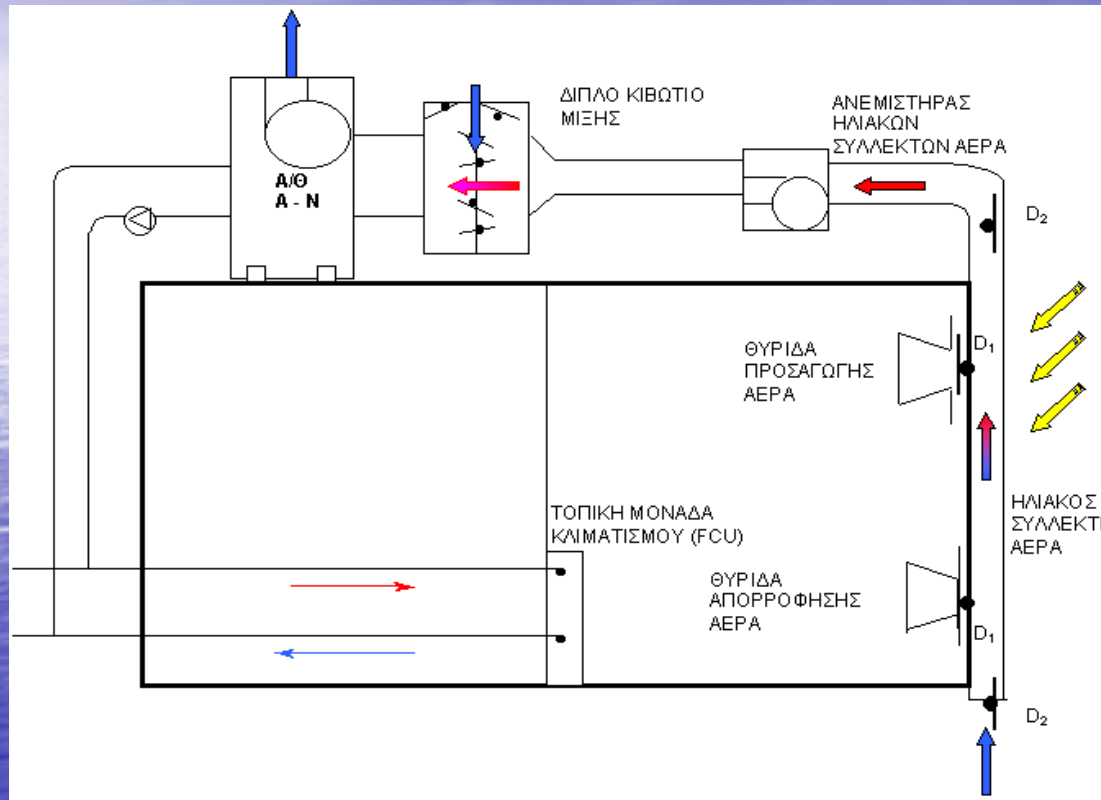
**Contribution of RES and electrical energy
to the system "HP1AHU2" energy needs (173,24 kWh)
20,31 %=solar, 63,17 %=geothermal, 16,5 %=electricity**



Project "PAVET 063": Solar air collectors (18m²) Coupled with air sourced heat pump (15 kW) at RES/CRES office building

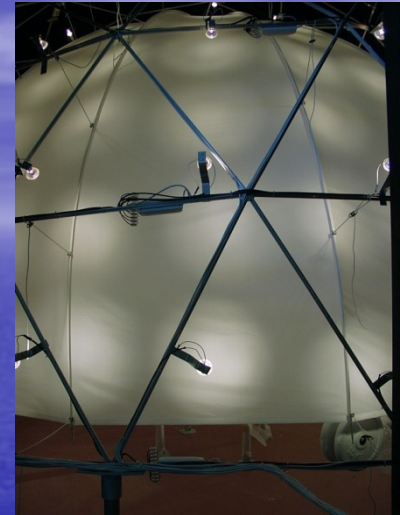


SOLAR FRACTION



COP = 3,1
COP_s = 4,7

Solar cooling in the CRES passive elements laboratory



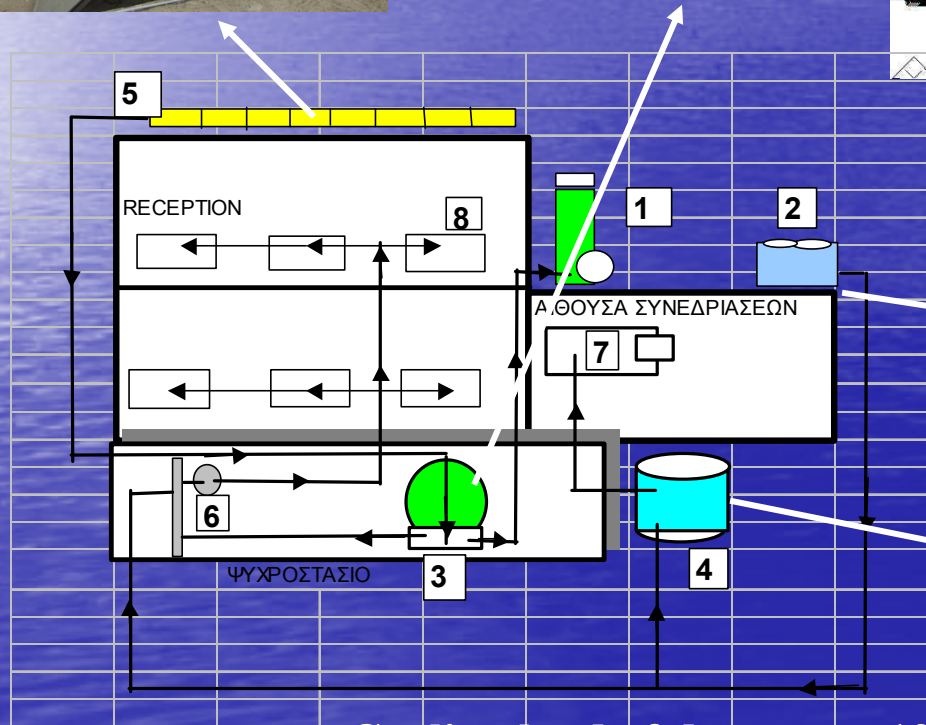
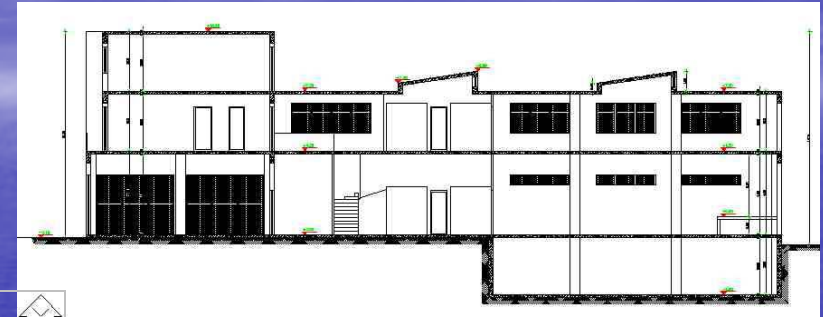
CRES, PIKERMI

The laboratory has 310 m² floor area and operation hours, since 1990, 8 hour a day.

Needs for:

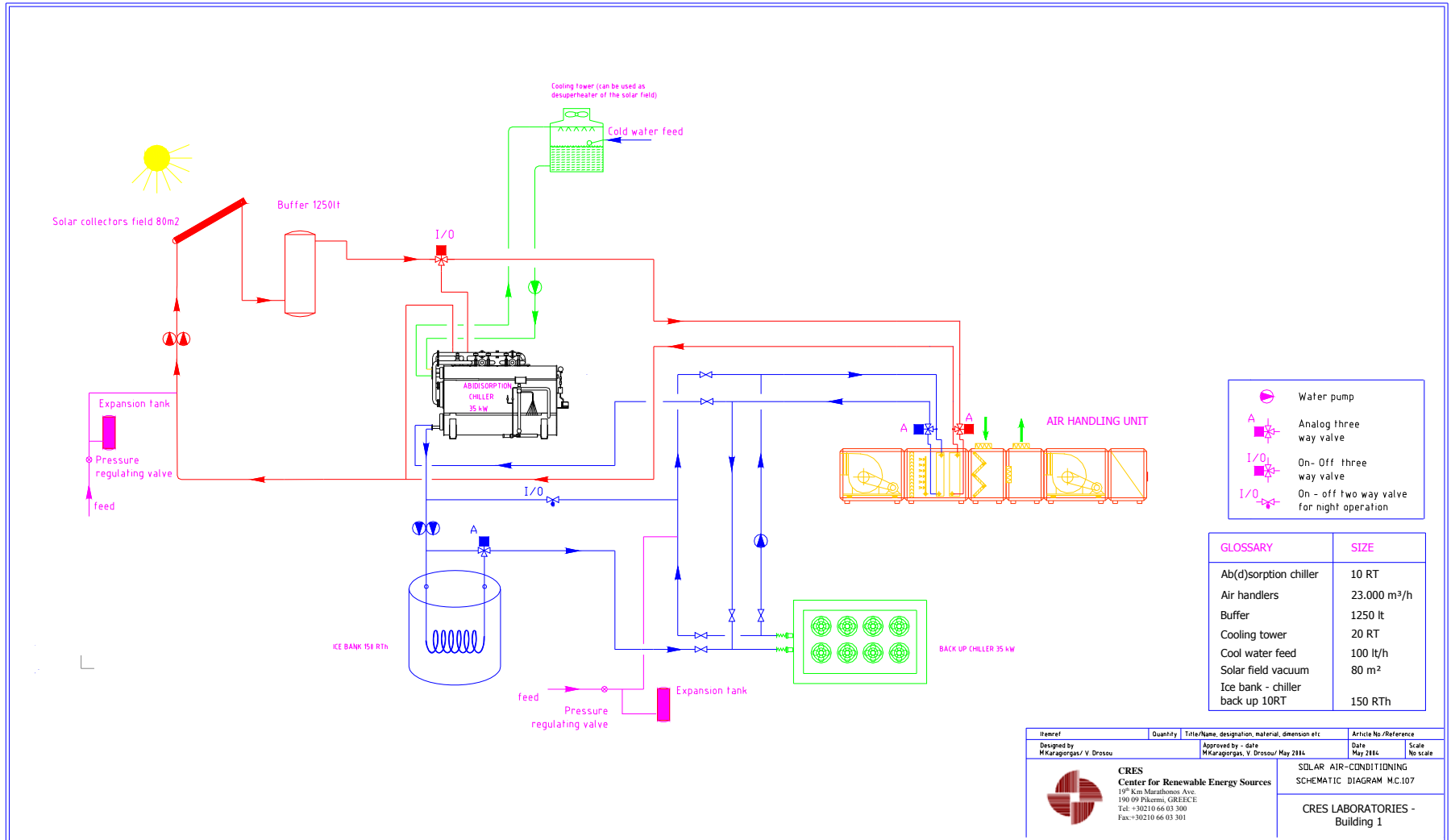
- Space cooling production for the process cooling loads (119 kW)
 - Electricity load shifting (in combination with cooling storage)
-

Combined production and storage of ice by solar energy to supply air conditioning at the Headquarters Building of CRES



Cooling load of day type= 1250 kWh
Solar field=150 m², solar chiller=10 RT,
Electric chiller=24 RT, Ice banks= 200 RTh

Combine solar cooling and ice storage in CRES



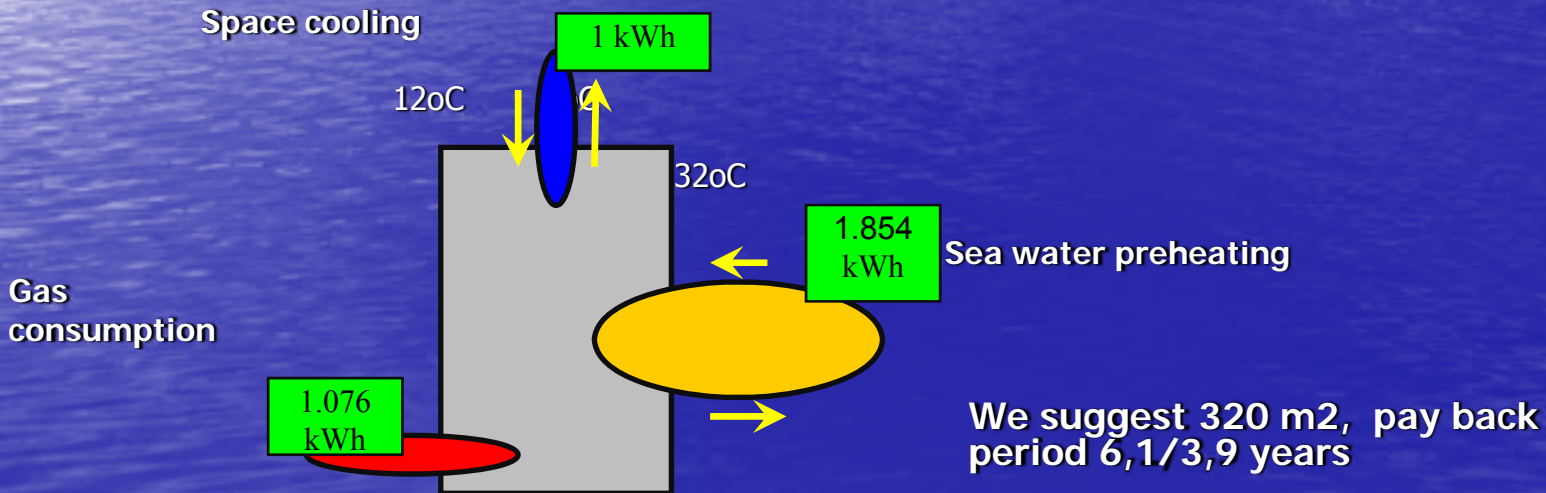
Possibilities to combine STS with RES technologies

TECHNICAL STUDY OF SOLAR THERMAL IN COMBINATION WITH ABSORPTION

MARE NOSTRUM HOTEL,
Thalassotherapy Center, VRAVRONA ATTICA
(hot water needs: 18 m³/h at 35-40 oC)



SUMMER OPERATION OF THE GAS FIRED ABSORPTION CHILLER WITH HEAT RECOVERY TO THE THALASSO WATER INTAKE



PROCESOL I&II – Solar Thermal Process Heating in Industrial Applications Coupled with Heat Recovery Technologies

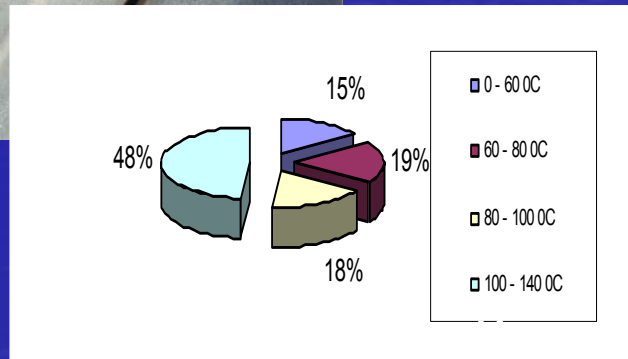
Οινοποιεία



Βαφεία-Φινιριστήριο



Γάλα-Τυρί



σε περιοχές οC

PROJECT "SOLAR OLYMPICS 2004"

Basic Design of Solar Heating and cooling
of 1100 kWcool capacities



“Innovative technologies of solar cooling
in Athens Olympic Games Settlements”

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mkara@bonair.gr
