

**Ημερίδα Ενημέρωσης για τις Εταιρίες Παροχής Ενεργειακών Υπηρεσιών –
Θερμικών Ηλιακών Συστημάτων (ΕΠΕΥ - ΘΗΣ)**

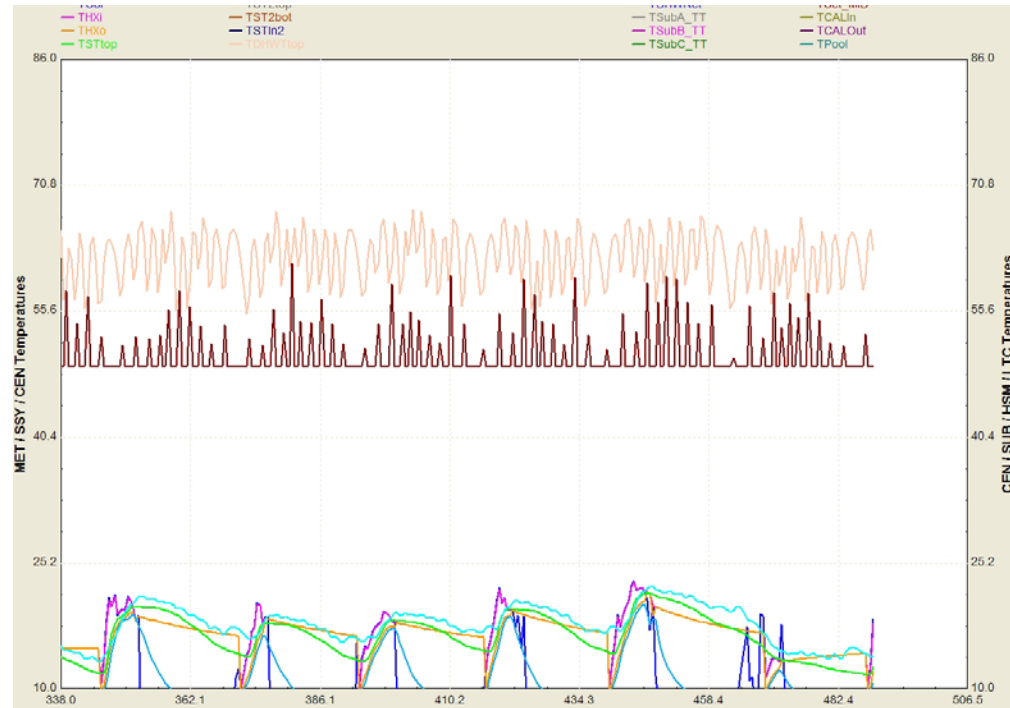
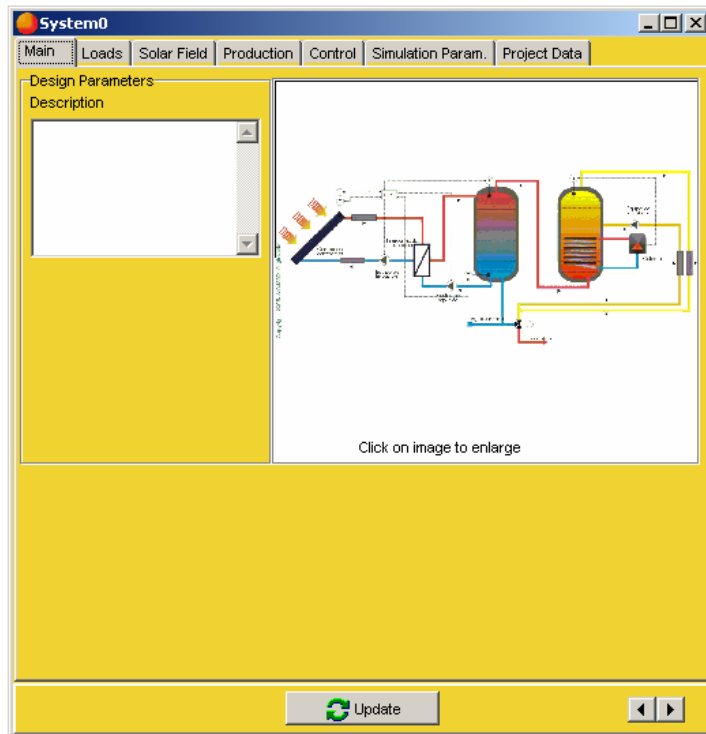
6 Ιουνίου 2007, Ξενοδοχείο Athens Imperial

«Χρήση του λογισμικού “STESCO” για μελέτες σκοπιμότητας συμφωνιών ΕΠΕΥ – ΘΗΣ
Περίπτωση εφαρμογής»

Αριστοτέλης Αηδόνης

- Λογισμικό STESCO - EnMo Ενεργειακή προσομοίωση
 - Τεχνικές παράμετροι
 - Παράμετροι ελέγχου και προσομοίωσης
 - Υπολογισμοί με TRNSYS και αποτελέσματα
- Λογισμικό STESCO - EcMo - Οικονομικοί υπολογισμοί
 - Εισαγωγή Δεδομένων
 - Παράμετροι συμβολαίου
 - Οικονομικοί υπολογισμοί
 - Εκθέσεις αποτελεσμάτων
- Ενδιαφέρουσες εφαρμογές ΕΠΕΥ-ΘΗΣ

Λογισμικό STESCO: ΕηΜο (Ενεργειακό)



- Πρόγραμμα προσομοίωσης βασισμένο στο TRNSYS με φιλικό interface για εισαγωγή των τεχνικών παραμέτρων – δεδομένων (φορτίο, πεδίο συλλεκτών, έλεγχος κλπ)

Papageorgiou_FINAL.prj

Main Loads Solar Field Production Control Simulation Param. Project Data

Total Load

Daily consumption liters / day

Monthly Profile

January	<input type="text" value="1,000"/>	May	<input type="text" value="1,000"/>	September	<input type="text" value="1,000"/>
February	<input type="text" value="1,000"/>	June	<input type="text" value="1,000"/>	October	<input type="text" value="1,000"/>
March	<input type="text" value="1,000"/>	July	<input type="text" value="1,000"/>	November	<input type="text" value="1,000"/>
April	<input type="text" value="1,000"/>	August	<input type="text" value="1,000"/>	December	<input type="text" value="1,000"/>

Perfil diari

0-1	<input type="text" value="1,500"/>	6-7	<input type="text" value="2,000"/>	12-13	<input type="text" value="4,000"/>	18-19	<input type="text" value="2,000"/>
1-2	<input type="text" value="1,000"/>	7-8	<input type="text" value="2,000"/>	13-14	<input type="text" value="4,000"/>	19-20	<input type="text" value="3,000"/>
2-3	<input type="text" value="1,000"/>	8-9	<input type="text" value="2,000"/>	14-15	<input type="text" value="3,000"/>	20-21	<input type="text" value="3,000"/>
3-4	<input type="text" value="1,000"/>	9-10	<input type="text" value="3,000"/>	15-16	<input type="text" value="3,000"/>	21-22	<input type="text" value="2,000"/>
4-5	<input type="text" value="1,000"/>	10-11	<input type="text" value="3,000"/>	16-17	<input type="text" value="3,000"/>	22-23	<input type="text" value="2,000"/>
5-6	<input type="text" value="2,000"/>	11-12	<input type="text" value="3,000"/>	17-18	<input type="text" value="3,000"/>	23-24	<input type="text" value="2,000"/>

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Main | Loads | **Solar Field** | Production | Control | Simulation Param. | Project Data

Solar Collector

Absortion Surface	2,450	m ²
A0	0,800	
A1	3,960	W/m ² K
A2	0,011	W/m ² K ²
IAM	0,090	
Design Flowrate (test)	60,000	kg/hm ²
Collector Height	2,170	m

Solar Field

Number of collectors	500	
Total solar field surface	1225,000	m ²
Total solar field flowrate	40,000	kg / h m ²
Slope	25,000	°
Azimut (W+,E-)	-15,000	°
Distance (brut) between rows	5,000	m
Distance to storage	27,136	m

Update

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Main | Loads | Solar Field | Production | Control | Simulation Param. | Project Data

Solar Storage

Exchanger coefficient	768600,000	kJ/h K
Storage Volume	70,000	m ³
Tank Height	12,830	m
Insulation Thickness	0,150	m

Auxiliary Storage

Storage Volume	12,000	m ³
Height	4,000	m
Insulation Thickness	0,100	m

Auxiliary System

Power	1000,000	kW
Performance	0,800	

Instalation

Distance to storage	40,000	m
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Update

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Main | Loads | Solar Field | Production | **Control** | Simulation Param. | Project Data

Solar Production

Primary Circuit ON Radiation	100,000	W/m2
Primary Circuit OFF Radiation	80,000	W/m2
Secondary Circuit ON Differential Temp.	2,500	°C
Secondary Circuit OFF Differential Temp.	0,500	°C
Maximum Temperature in Collectors	170,000	°C
Maximum Temperature in Storage	90,000	°C

Auxiliary Production

Storage Set Temperature	60,000	°C
Boiler OFF Differential Temperature	5,000	°C
Boiler Forward Temperature	80,000	°C

Process

Set Load Temperature	49,000	°C
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Update

Papageorgiou_FINAL.prj

Main | Loads | Solar Field | Production | Control | **Simulation Param.** | Project Data

Simulation Parameters

Start Time h

Final Time h

Calculation Step h

Integration Tolerance

Convergence Tolerance

ON-LINE PLOTter

Geographical parameters

Location

Water Temperature

January	<input type="text" value="8,200"/>	March	<input type="text" value="16,800"/>	September	<input type="text" value="22,100"/>
February	<input type="text" value="7,900"/>	June	<input type="text" value="20,200"/>	October	<input type="text" value="19,400"/>
March	<input type="text" value="9,200"/>	July	<input type="text" value="21,500"/>	November	<input type="text" value="15,700"/>
April	<input type="text" value="12,800"/>	August	<input type="text" value="22,800"/>	December	<input type="text" value="11,000"/>

 Update 

Input Data

Basic System Description

Conventional System Description

Economic Data

System Ongoing Cost

Solar System Savings

Plant size (m²)

1225,00

Plant net specific output (kWh/m²*year)

565,90

Decrease of solar plant energy output (%)

0,00

Net energy demand (kWh/year)

1356292,00

Net solar output (kWh/year)

693227,50

Calculation

Input Data

Basic System Description

Conventional System Description

Economic Data

System Ongoing Cost

Solar System Savings

Fuel of conventional system

Natural Gas

System efficiency (%)

80,00

Conventional energy price (€/kWh) (CEP)

0,036

Circulation losses (%)

5,00

Decrease in conventional boiler efficiency (%)

1,00

Input Data

Basic System Description

Conventional System Description

Economic Data

System Ongoing Cost

Solar System Savings

Total investment cost (€)	428750,00
ESCo contribution to investment (€)	107187,50
User contribution to investment (€)	21437,50
Subsidies (€)	171500,00
Total financing amount (€)	128625,00
Credit account period (years)	20,00
Interest (%)	6,00
Specific investment cost (€/m ²)	350,00

Input Data

Basic System Description

Conventional System Description

Economic Data

System Ongoing Cost

Solar System Savings

Monitoring costs (€/year)

400,00

Service and maintainance (€/year)

1200,00

Who pays the electricity?

User

Electricity consumption (%)

0,50

Electricity price (€/kWh)

0,090

Other costs (insurance,etc)(€/year)

1280,00

Total ongoing costs (€)

2880,00

Specific system ongoing costs (€/m²)

2,36

Input Data

Basic System Description

Conventional System Description

Economic Data

System Ongoing Cost

Solar System Savings

Reduction of ongoing costs for a conventional energy supply system due to solar plant (€/year)

0,00

Economic benefits due to increase of service life of conventional energy supply system (€/year)

0,00

Reduction of investment costs on the conventional energy system due to the solar plant (€)

0,00

Improvement on efficiency of the conventional system boiler (€)

0,00

Contract Definition

General Data

Increase in conventional energy price (%)	8,00
Increase in electricity price (%)	8,00
Increase of consumer price index (%)	3,00
Property of the plant after the end of the contract	User
Price of the solar plant for the end-user at the end of the contract (€)	1,00
Contract period (years)	20,00
Invoicing sections	1,00
Standard discount (%)	5,00

Section1



New



Delete

Energy price increase



Rel. CEP



Absolute

Annual basic price (€)	1000,00
Energy under guarantee (kWh)	488000,00
Price of the energy under guarantee (€/kWh)	0,039
Price of the extra energy (€/kWh)	0,039
Annual increase in basic price (%)	3,000
Annual increase in energy under guarantee price (%)	8,000
Annual incr. extra energy price (%)	8,000
Period for the invoicing section (years)	20,00

OK

Variant	Mode	Plant size (m ²)	1225,00	1225,00
Plant net spec.output	565,90	565,90	Net solar output	693227,50 693227,50
Spec.system ongoing costs	2,36	2,36	Total ongoing costs	2880,00 2880,00
Spec.investment cost	350,00	350,00	Total investment costs	428750,00 428750,00
Final property of the plant	User	User	ESCo contribution	107187,50 107187,50
Final price of the plant	1,00	1,00	User contribution	21437,50 21437,50
Increase in energy price	8,00	8,00	Subsidies	171500,00 171500,00
Increase in electricity price	8,00	8,00	Financing amount	128625,00 128625,00
Increase of consumer price	3,00	3,00	Credit account period	20,00 20,00
Standard discount	5,00	5,00	Interest credit	6,00 6,00
			Contract duration	20,00 20,00
			Invoicing sections	1,00 1,00

Calculation Save variant Delete Variant Exit

Section1

Energy price increase Rel. CEP Absolut

Annual basic price (€) 1000,00 1000,00

Energy under guarantee (kWh) 488000,00 488000,00

Energy under guarantee price (€/kWh) 0,039 0,039

Extra energy price (€/kWh) 0,039 0,039

Annual increase in basic price (%) 3,000 3,000

Annual incr. in guarant.energy price (%) 8,000 8,000

Annual incr. extra energy price (%) 8,000 8,000

Period for the invoicing section (years) 20,00 20,00

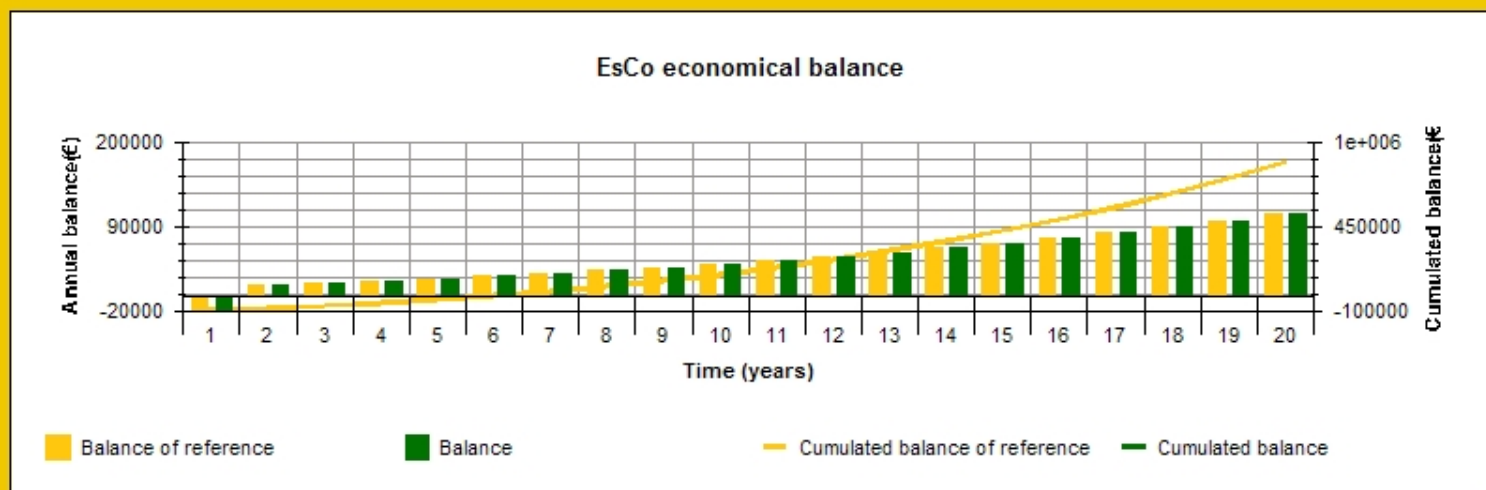
Energy in kWh; Surface in m²; Money in €; Increases in %; Time in years

Graphic Balance EsCO

Graphic Balance User


Table Balance EsCO

Table Balance User



Μελέτες ΕΠΕΥ – ΘΗΣ : Παπαγεωργίου



Intelligent Energy  Europe

Project no. EIE/04/059/S07.38622

“ST-ESCOs”

Development of pilot Solar Thermal Energy Service Companies (ST-ESCOs)
with high replication potential.

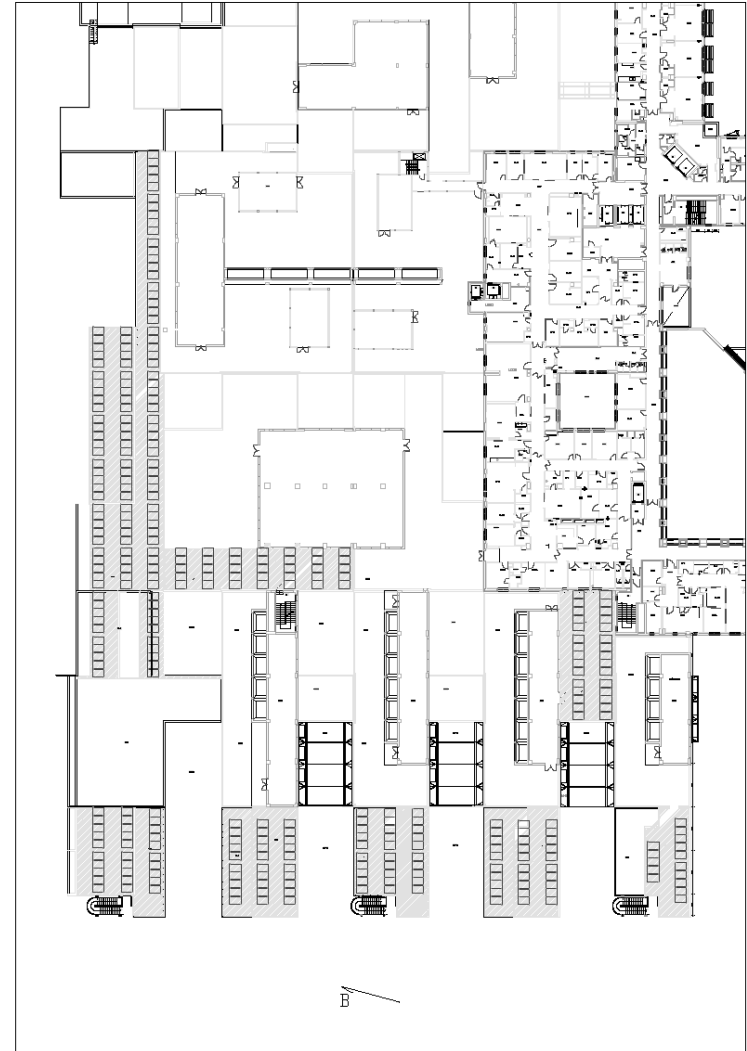


PAPAGEORGIU hospital
Detailed study
for a Solar Thermal plant with an
Energy Service Company (ESCO) agreement

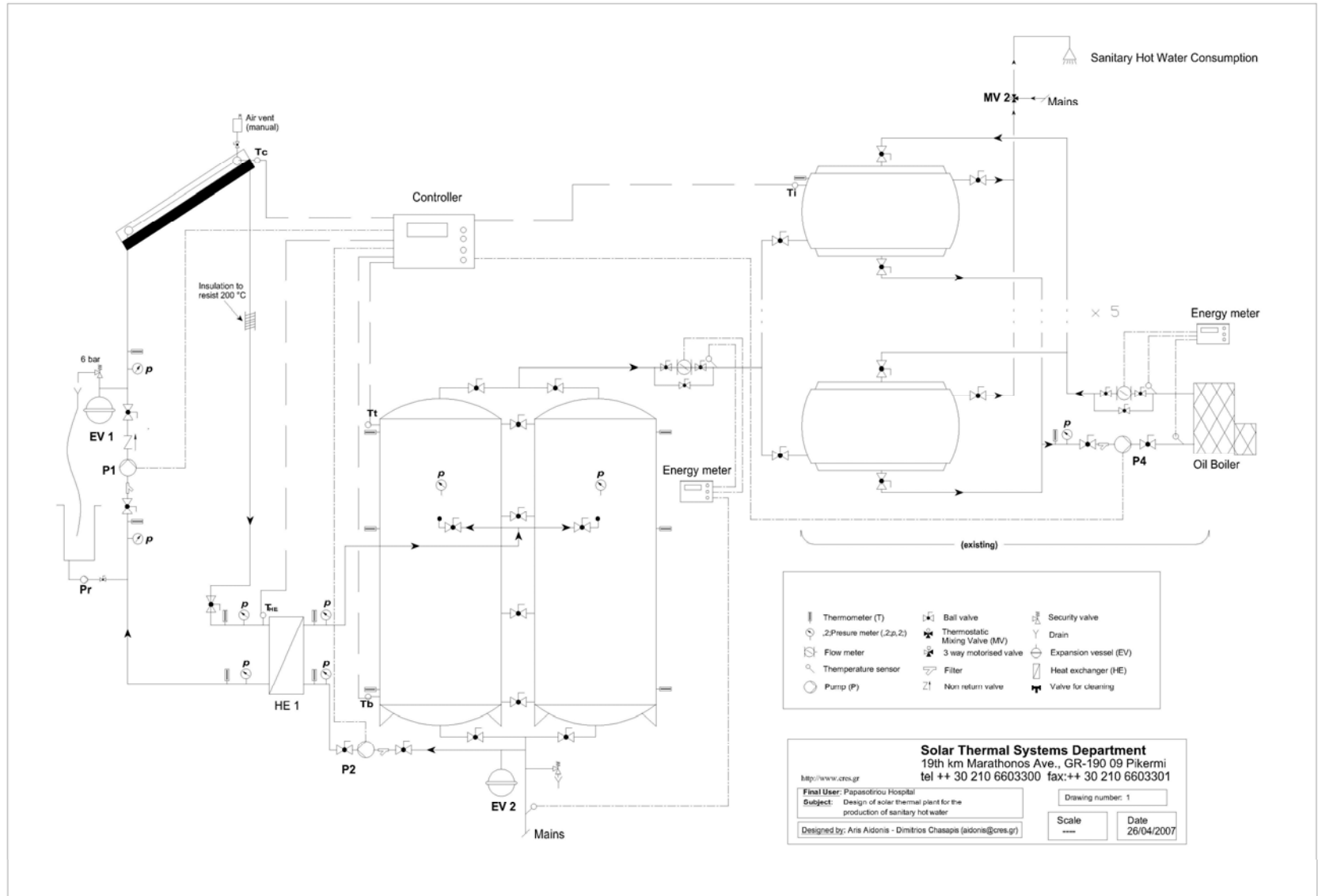
Project coordinator
Centre for Renewable Energy Sources (CRES)

Vassiliki Drosou, drosou@cres.gr tel. ++30 210 6603381
George Markogiannakis, gmarko@cres.gr tel. ++ 30 210 6603286
Aristotelis Aidonis, aidonis@cres.gr, tel. ++ 30 210 6603284

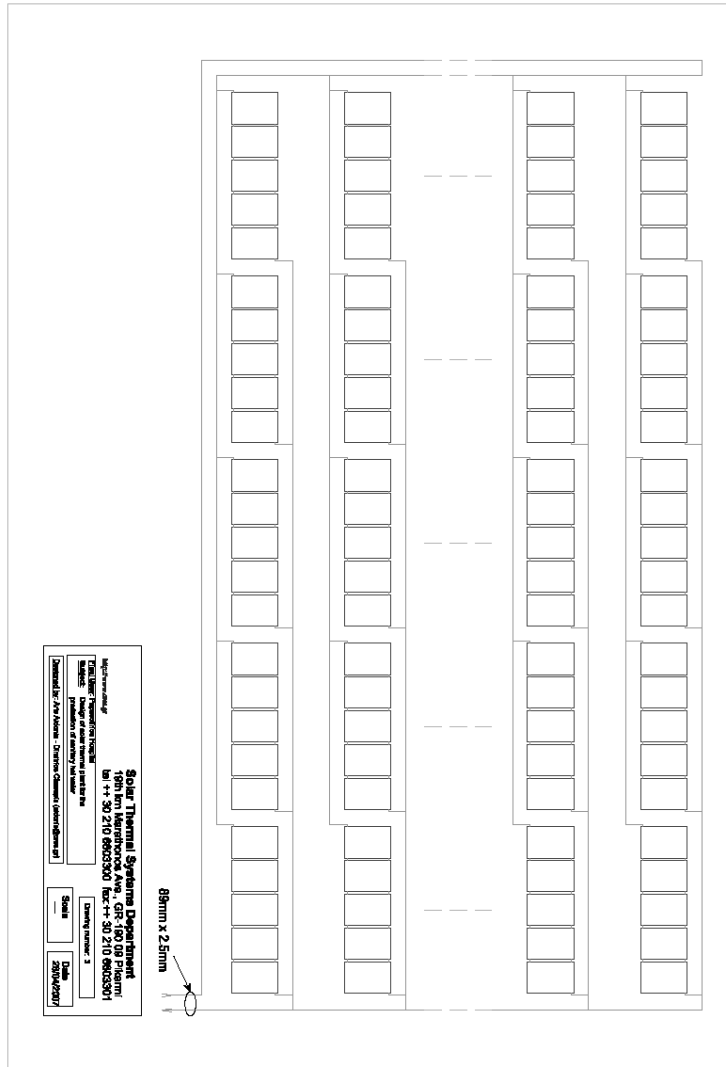
Project website: www.stescos.org



Μελέτες ΕΠΕΥ – ΘΗΣ : Παπαγεωργίου



Μελέτες ΕΠΕΥ – ΘΗΣ : Παπαγεωργίου



Solar collectors total surface proposed (absorbers' area)	1225 m ²
Total (roof) surface needed for the collectors field	about 3000 m ²
Total storage volume of solar plant	70 m ³
Annual solar yield delivered to the user	693 MWh
Overall benefit (NPV) of the User	107950 €
Total cost of the plant for the ST-ESCO	428750 € (350 €/m ²)
Bank loan	128625 (30%) €
Subsidies	171500 € (40%)
Contribution of the ST-ESCO to the initial investment	107188 € (25%)
Net Present Value of the total economic benefit for the ESCO	411500 (20y)
IRR of ESCO	26,4 %
Payback time	≈ 6-7 years
Bank loan interest rate	6 %

Δανία: ηλιακό σύστημα τηλεθέρμανσης !



- Marstal - Aeroe, 1316 κτίρια
- Τηλεθέρμανση, 46-72° C (ARCON)
- 18 365 m² - συλλέκτες 12,6 m²
- Ecol: > 450 kWh/ m²,έτος
- f= 30 % ηλιακό, 100% με την καύση των μεταχειρισμένων λιπαντικών
- Βέλτιστος συνδυασμός με μέτρα εξοικονόμησης ενέργειας στα κτίρια (μόνωση, βάνες θερμοανάμιξης, ρυθμίσεις..)
- Καθολική αποδοχή από την τοπική κοινότητα

ST-ESCO: SOLID



Placed on the Stadium of Graz

- collector field : 1407 m²
- output: 560 MWh/a
- ESCO project
- solar rate equal to gas heating costs
- contract with utility “District Heating Graz” for 15+5 years
- in operation since 2002

ST-ESCO: SOLID



Solar Energy fed into the
District Heating Network
of Lienz:

- biomass-solar combination
- ESCo Contract
- Collector Field: 640 m²
- Storage: 0 l
- Commissioning: 2001

Olympic Sailing Village (SOLID)



- Olympic Village for 2008 Olympic Summer Games in China
- Solar air conditioning plant for Logistics Center
 - 4,000 m² AC area
 - 900 kW peak load
 - according to Chinese standard
 - 500 kW Sanyo chiller
 - 631 m² collectors
- System start up: August 2006



Thank you
Thank you

www.stescos.org

www.aiguasol.com

www.cres.gr

cres@cres.gr



ΚΑΠΕ
CREZ

Κέντρο Ανανεώσιμων Πηγών Ενέργειας - Τμήμα Θερμικών Ηλιακών
Συστημάτων