Market analysis of ST-ESCOs

1 Introduction to the Solar Thermal and ST-ESCOs market

The Hellenic Solar Thermal Systems market after almost 20 years of development and fluctuations could be considered as a developed market, at least regarding the residential sector.

Regarding the use of solar systems, 99% of them are small scale systems for domestic hot water, 0.75% are large scale systems for hot water in the tertiary sector (hotels, hospitals and swimming pools) and 0.17 % (5,118 m^2) are large systems for hot water, air-conditioning space heating and desalination in industry ("Collection of statistical data on Solar Energy Applications in Greece", CRES 2001, Eurostat grand).

The most important reasons for the success of Solar Thermal Systems in Hellas are summarised below:

- High solar radiation, appropriate climatic conditions and morphology of the country.
- Successful marketing campaigns.
- Legislative support and incentives at early stage.
- Broad dissemination of the technology (advertisements, information brochures, demonstration projects, etc.).
- Public acceptance.
- Continuous effort from the manufacturers for better and cheaper products.
- Easy access to solar thermal products.

Despite the success of the solar thermal systems in the residential sector, there is still a large unexploited potential, especially in the industrial and tertiary sector where their penetration is negligible.

One of the main reasons is that end users (especially large ones) are still reluctant to face the high initial investment cost and doubtful for the reliability and durability of solar installations.

The **ST-ESCOs**, by **selling the solar energy (and not the solar plant)** at a competitive price and by carrying out the plant's operation and maintenance can remove completely the above mentioned barriers, thus opening the way for a rapid expansion of solar thermal installations throughout Europe in all potential sectors (residential, services and industry), both private and public.

However, the development of European ESCOs in general is still in its infancy and, to what concerns in particular the solar thermal sector, only sporadic (and not always successful) initiatives have been taken.

The pure ESCO industry in Hellas may be considered negligible and stable for the present. The proposal for a directive of the European Parliament and of the Council on energy end-use efficiency and services and a legal push in terms of integrated energy services and energy management specific legislation in combination with mandatory national and sectoral energy consumption reduction targets would possibly take-off the EPC (Energy Performance Contracting) market especially from utilities and big companies handling a

pool of potential clients. The issue of a law for ESCO business operation would clarify the operational environment.

2 Demand side

At the end of 2000 the surface area of the solar collectors in operation in Hellas amounts to 2.96 millions m^2, 61.8%, of which are located in Central Hellas, 27.6% in Northern Hellas and 10.6% in Crete which has the highest surface area per capita.

About 1.000.000 households are avoiding 1.800.000 ton CO2 each year by using a solar system which can provide up to 80% of the energy needed for hot water.

Although the above data show that in Hellas solar thermal technology is widely used, there is still a large potential. Less than 25% of the houses have already installed a solar system. The figure is very low compared with the potential, having in mind that in similar cases (Cyprus, Israel) the percentage is over 90%.

A wide market survey have shown that more than 90% of the owners of solar systems are satisfied and if they would replace the old solar system they would invest on a solar system again.

Main motivations to buy a solar system are the following:

- Savings (expected pay back period 4-6 years)
- Safety (compared with electric heaters) and trouble free operation
- Improved quality of life (availability of hot water)

To buy a solar system in Hellas is as easy as to buy an electric heater. As the most roofs are flat, the installation is also easy (reasonable access to the roof, simple selection of the appropriate position/direction).

Most of the collective (central) systems (about 150.000 m^2) were subsidised by 50% and they are installed mainly on hotels or industries. The low oil price results to payback periods longer than 5 years and make the central solar system solution less attractive for the end users. However the current oil prices (around 60$/barrel) and the sort term forecasts that show an increasing tendency can favour renewables and in particular STS.

The main reasons for potential STS users to choose the services of an ST-ESCO company are:

- Difficulty to face the initial investment.
- Uncertainty regarding economical results of a ST system.
- Unwillingness to face the technical risks with respect the installation, operation and maintenance of a ST system.

The most promising sectors in Hellas for an ESCO to invest on application of Solar Thermal Systems seem to be the tertiary (services) and the industrial sector. The residential sector presents a peculiarity because in most of the cases to the tendency is to install individual systems.

One of the reasons is that, even in the blocks of flats with central space heating, the DHW (domestic hot water) is not centrally distributed. In the future there might be a substantial market potential if certain legislative measures (metering, billing issues etc) will be taken towards the direction of central DHW systems.

The introduction of central ST systems in the multifamily building is a very important issue and could enhance substantially the solar thermal market. Efforts should be focused on new

constructions as well as on building renovation. ESCOs establishment could help in this direction.

Based on the data from the National Statistical Service of Hellas, for the year 2000, building stock in Hellas accounts 3.99 million buildings. From those, 2.756 million are households, 111 thousands are offices and commercial buildings (2.8 %), 414 thousands are mixed use buildings (10.4 %), 31 thousand are industrial buildings (0.8 %), 23 thousands are hotels (0.6 %), 17 thousands are educational buildings (0.4 %) and 2 thousands are hospital buildings (0.1 %). Other tertiary uses account 594 thousand buildings (14.9 %).

Regarding the tertiary sector the most promising sub-sectors for the application of Large Scale STS (and therefore of ESCOs contracts implementation) are:

1. Hotels
2. Hospitals
3. Care buildings
4. Sport Centers

Some market data for selected sectors are following.

Hotels Sector

The hotels sector is most probably the most promising one for the future implementation of Large Scale Solar Heating plants (and, therefore, ESCOs contracts). Apart from having a large potential, it presents an already developed market. Consequently, a new solar company has simply to participate in this existing market while in other sectors with similar potential the market is weak or has still to be created.

Over 100 hotels have at present large or medium size central solar thermal plants, manufactured by 15 different constructors [Karagiorgas, 2001]. The average size of the central solar plants for hotels is 257 m^2, the largest one is sized 2783 m^2, and the total size is 28820 m^2. Figure 1 shows a size distribution of the central solar systems in the Greek hotels.

Here follow some selected elements of the available material for the solar hotel sector that can be interesting for the purposes of this analysis:

- The most developed market exists in the island of Crete. In fact, 41.40% of the market is met in Crete, only 2.10% in Northern Hellas, while the remaining 56.5% (15,285m^2) is spread across the rest of the country.
- It is estimated that thermosyphonic solar thermal systems installed in hotel units cover surfaces of 35,000 m^2. We can, therefore, reach the conclusion that they hold an equally significant share in the market of solar thermal systems.
- Although only 10 (thus 10%) of the hotels have collectors surface of more than 500 m^2, these systems hold a market share of 30.17%.

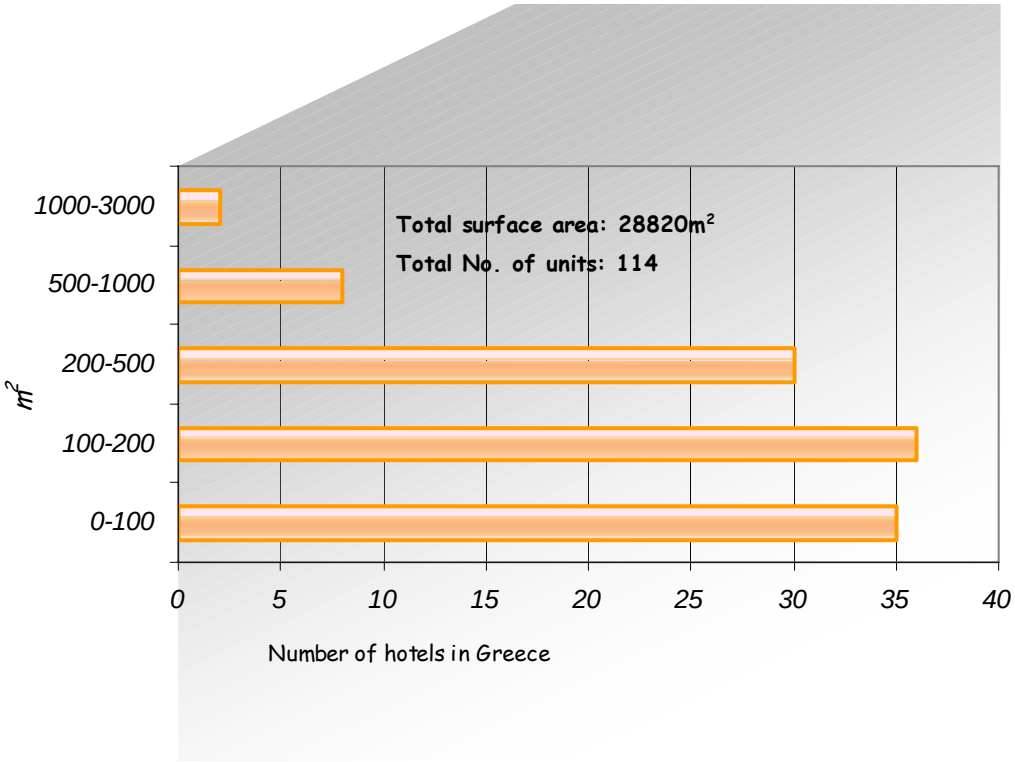

Figure 1: Size distribution of central thermal solar systems in Hellenic hotels

Industrial Sector

In the possible solar **industrial applications** for hot water, four main industrial sectors can be distinguished, promising a good acceptance of large solar thermal systems. These are industries with relatively low energy consumptions, where the fraction of energy provided by the solar thermal system to the industry's energy load is quite significant. Solar thermal systems are particularly effective in industries that require water temperatures in the range 40 – 80 ^{0}C.

The most promising industrial sub-sectors for the application of Large Scale STS are:

1. **Food industry** (Dairy products, cold cut and process meat factories, pastry and cake confectioneries, olive oil refineries, tinned goods, slaughter houses)
2. **Agro-indusries** (Solar drying, horticulture-nursery greenhouses, slaughterhouses, meat processing, livestock landings)
3. **Chemical industry** (Cosmetics, detergents, pharmaceuticals, wax, distilleries, breweries)
4. **Beverage industry** (Wineries, liquor and wine distilleries, breweries, soft drinks)

In an extended analysis for the promotion of solar heating systems in the industrial sector [Kanavos, 2001], the technical potential for solar water heating systems has been estimated. The results, divided by industrial sub-sector, are presented in table 1 and practically confirm the above declarations on “good potential applications”.

CODE	Industrial Sector	Surface of solar collectors substituting DIESEL (m^2)	Surface of solar collectors substituting LPG (m^2)	Surface of solar collectors substituting LSHFO (m^2)	Surface of solar collectors substituting HSHFO (m^2)	Surface of solar collectors substituting NG (m^2)	Total surface of solar collectors substituting PETROLEUM FUELS & NATURAL GAS (m^2)
1	Iron and Steel	0	0	0	0	0	0
2	Chemical and Petrochemical	21,226	155,921	238,992	0	805,156	1,221,295
3	Non-Ferrous Metals	0	0	0	0	0	0
4	Non-Metallic Minerals	0	0	0	0	0	0
5	Machinery + Construction + Transport Equip.	17,689	1,834	11,006	0	25,878	56,407
6	Mining and Quarrying	0	0	0	0	0	0
7	Food and Tobacco	235,847	99,056	707,541	0	815,507	1,857,951
8	Paper, Pulp and Printing	31,839	55,031	148,584	0	183,961	419,415
9	Textile and Leather	29,481	4,586	377,355	0	444,179	855,601
10	Other Industry	749,994	333,855	69,182	1,572	334,903	1,489,505
	Total Industry	**1,086,076**	**650,283**	**1,552,660**	**1,572**	**2,609,583**	**5,900,174**

Table 1: Technical potential for solar water heating systems by industrial sub-sector

Legend: LPG=Liquefied Propane Gas, LSHFO=Low Sulphur Heavy Fuel Oil, HSHFO=High Sulphur Heavy Fuel Oil, NG=Natural Gas.

Residential Sector

Only sporadic applications on central solar heating systems exist in the residential sector. The common practice is the use of thermosyphonic systems, even in multi-floor buildings. However, recently some of the active solar companies have expressed their interest in the application of forced circulation systems, mainly of small scale.

In fact, some changes are expected on this sector and some opportunities may arise in the short and mid term future. One important change is related to the new Regulation for Rational Use of Energy and Energy Conservation in accordance with the Energy Performance Building Directive (EPBD). This Regulation refers to the entire building sector and will change the Energy Concept of both existing and new buildings. Some aspects that may affect the utilisation of solar thermal systems especially in the residential sector are listed bellow:

- The Energy Design of any new building will be compulsory.
- The results of the Energy Design will be recorded on a special document, the **Energy Identification Sheet** of the building.

It is certain that the **Energy Identification Sheet** will affect strongly the building value. Consequently, the application of solar thermal systems will become an appealing option for the constructors of new buildings as well as for the owners of existing ones that are willing to improve their commercial value.

3 Supply side

According to the EBHE (Hellenic Solar Industry Association) data, the total collectors' sales surface in Hellas has been more than 130 000 $m^2$for the last three years (up to 2004), while an additional 20 to 25 thousands of m^2 are exported (mainly to Germany and Austria).

Solar industry represents a well-developed manufacturing sector in Hellas. The Hellenic Solar Industry Association counts 18 members, which represent the larger manufacturers. Besides, about 50 smaller enterprises are active on a local or regional level. Hellas is the largest exporter of solar systems in Europe. The Hellenic production of the sector covers a substantial percentage of the European market.

Applied Technologies of Solar Thermal Systems

The great majority (more than 95 %) of solar sanitary hot water systems installed in Hellas regards compact thermosiphonic units, providing hot water to individual dwellings. A typical configuration of such a system comprises a simple flat plate collector (single- or double-glazed) and a storage tank attached above the collector. Usually, the heat is transferred from the collector to the storage through a closed circuit, filled with antifreeze fluid, and a heat exchanger. The storage tank is equipped with an electrical heating element.

The system sizing is based on the estimation of daily warm water consumption per person of about 50 Litre at 50°C. The average area installed per apartment is 2–2,5 m² with a tank of 150-200 litres and the average solar fraction for the generation of sanitary hot water of these thermosiphonic systems is about 70–85 %. Typical price is around 1000 €.

Figure 2 is a schematic representation of a typical thermosyphonic system.

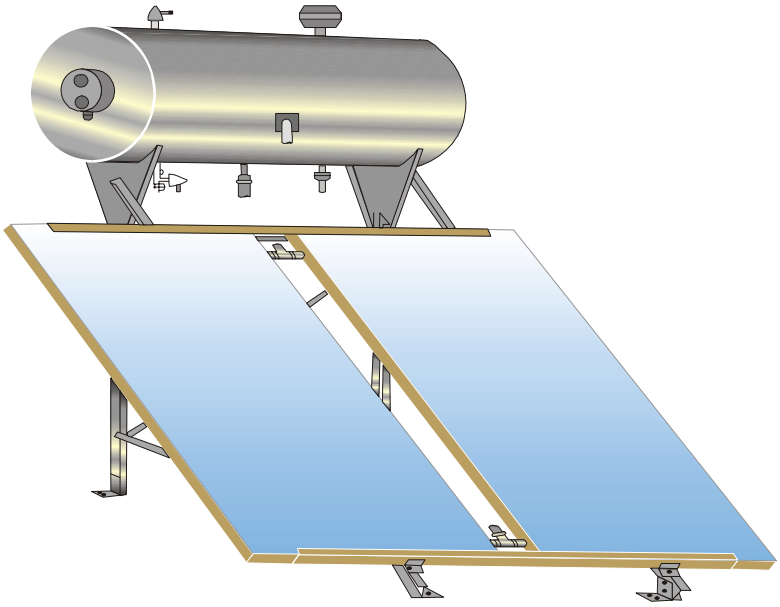

Figure 2: a schematic representation of a typical thermosyphonic system in Hellas.

In spite of the large unexploited potential, very few central solar systems are installed in Hellas. This is the case both for small size (single-family houses) as well as for large solar systems (building blocks, tertiary sector, industrial users etc.)

The main characteristics of the collectors' technology adopted in Hellas are listed bellow:

Collectors Surface 1.5 to 8 m^2

Absorber material:

Steel or stainless steel rollbond
Aluminium or copper bonded on copper or galvanised steel tubes
Copper bonded on copper tubes
Copper welded or soldered on copper tubes

Surface treatment:
- Black paint
- Selective paint
- Selective surface

Insulation:
- Many variations starting with Glasswool 30mm to combined hard PU-CFC free + rockwool totally 70mm.

Transparent cover:
- Normal window type glass 3-4 mm
- Solar tempered glass 3-4 mm
- Plastic

Casing:
- Aluminium extruded (anodised or polyester painted)
- Formed Aluminium or steel sheet
- ABS

ST-ESCO Market

Practically speaking, the ST-ESCO applications in Hellas are very few and there are no Energy Service Companies active in the market for the moment. Only a few ESCO attempts have been made in the past where Solar Thermal projects were involved. Apart from CRES, only two companies (SOLE LTD and SOL ENERGY HELLAS Inc.) have made efforts in order to act as ESCOs. Some companies have expressed their interest to play a role in this field. These were mainly construction companies and suppliers of systems (Solar, CHP, Automations, etc) and their interest was mainly expressed within the framework of other CRES's projects regarding the development of the ESCO market. These projects were focused on the public sector where several Energy Efficiency measures were under consideration (eventually including STS).

Regarding financing institutions the most appropriate, to be a part of ESCO schemes, are of course banks or other similar institutions such as insurance companies. In some cases utility companies could also play this role.

Up to now, since financing institutions are not yet actively involved on ESCO schemes and TPF projects, no specific financial schemes and requirements have been adopted.

The main reasons for the weak development of the ESCO market in Hellas are:

1. Lack of the appropriate legal and institutional framework
2. In particular for the public sector a serious barrier is still present: the existing law does not permit to a public institution to pay "alternative" energy bills like those from energy efficiency or solar thermal applications.
3. Fortunately, the second barrier is going to vanish, since a new law (that will permit such applications) is about to be implemented. The new proposal for law (under vote in the Parliament) facilitates joint projects between the public and the private sector that will boost the ESCOs market.

Some other barriers include:

- The legal consolidation of ESCOs
- The project financing, investment, design, construction and insurance mechanism
- Not direct economic benefits for the end-use service budget (re-allocation of public funds irrelevant to energy savings)
- Diffusion and confusion of responsibilities within public authorities for the procurement, services, works and maintenance regarding the building infrastructure

- Legal and tax problems arising from TPF implementation
- Lack of institutional regulations (e.g. where a public building owner is not its user) and warranties regarding the cooperation between TPF experts' actors.

During the last few years efforts have been made in order to determine ways to overcome these problems. The proposal for a directive of the European Parliament and of the Council on energy end-use efficiency and services and a legal push in terms of integrated energy services and energy management specific legislation in combination with mandatory national and sectoral energy consumption reduction targets would possibly take-off the ESCO market especially from utilities and big companies handling a pool of potential clients.

Nevertheless, the situation in the private sector is more flexible and interest on realising ESCO projects, both from the demand and the supply side, does exist.

With respect to the ST-ESCOs market there were some real projects in the past. Here it has to be emphasised that these projects regard a mixture of Energy Efficiency and Solar Systems that are more financially attractive.

In the study of [Kanavos, 2001], the feasibility of TPF schemes and of the creation of an ESCO are examined for the industrial sector. Some of the results are listed bellow and may be valid also for the services and the residential sector.

- There is a remarkable theoretical techno-economic potential for solar water heating systems in the Hellenic industry.
- The "mutual benefit" TPF financing schemes are the optimum financing mechanisms that maximise the real potential.
- The establishment of an ESCO dealing with the promotion of solar water heating systems in industry is absolutely feasible and constitutes a real market opportunity for a profitable business.

An ideal ESCO should have the following characteristics:

- Excellent knowledge and wide expertise in solar water heating systems in order for the reliability of the relevant installations to be maximised.
- Good borrowing ability in order for low loan interest rates to be achieved.
- Deep knowledge of the mentality and other relevant characteristics of the Hellenic industrial sector.

Under the Third Party Financing scheme (TPF), a company, the third party, undertakes the risk of completely financing the investment, which is paid off by long-term energy saving and/or energy supply and a reduction in operating costs.

The contractor provides a wide range of different resources, including manpower, technical expertise, project finance, operating experience and all the associated management and commercial skills. Since the contractor is responsible for operation as well as project implementation, performance guarantees are inherent in the approach. If the contractor does not provide the service (defined in terms of specific standards such as room temperatures and volumes of domestic hot water) he does not get paid, and indeed may be required to provide an equivalent service using an alternative facility at his own expense.

4 ST-ESCOs Potential Estimation

As mentioned in Chapter 2, the most promising sectors for ST-ESCO projects are the tertiary and the industrial; mainly hotels and hospitals followed by sport centres (including pools). Regarding the residential sector there is also an interesting potential, mainly in what concerns central systems in multifamily houses.

The possibility, of course, on realising ESCO projects increases when a pool of measures (including energy efficiency) is implemented.
In the following text, each sector is examined and a potential for a 5 years period is estimated. In order to be as realistic as possible, we assume that this period may start from the year 2008 (after the completion of the EIE "ST-ESCOs" project); predictions may be valid only if by the year 2008 the solar thermal ESCOs will be appropriately promoted.

Industrial Sector

In the study of [Kanavos, 2001] the techno-economic potential for each industrial sub-sector in the case of the "TPF financing scenario" has been estimated. The results or this analysis are summarised in table 2.

Industrial Sector	Surface of solar collectors substituting DIESEL (m^2)	Surface of solar collectors substituting LPG (m^2)	Surface of solar collectors substituting LSHFO (m^2)	Surface of solar collectors substituting HSHFO (m^2)	Surface of solar collectors substituting NG (m^2)	Total surface of solar collectors substituting PETROLEUM FUELS + NATURAL GAS (m^2)
Iron and Steel	0	0	0	0	0	0
Chemical and Petrochemical	10,121	26,556	0	0	0	36,677
Non-Ferrous Metals	0	0	0	0	0	0
Non-Metallic Minerals	0	0	0	0	0	0
Machinery + Construction + Transport Equip.	8,434	312	0	0	0	8,747
Mining and Quarrying	0	0	0	0	0	0
Food and Tobacco	112,459	16,871	0	0	0	129,330
Paper, Pulp and Printing	15,182	9,373	0	0	0	24,555
Textile and Leather	14,057	781	0	0	0	14,838
Other Industry	357,620	56,860	0	0	0	414,480
Total Industry	**517,874**	**110,752**	**0**	**0**	**0**	**628,626**

Table 2: techno-economic potential for solar thermal TPF applications in industrial sub-sectors

We may assume that a realistic potential for ST-ESCOs applications in the ambit of the 5 years period is the 10% of the total potential presented on table 2, thus resulting to about 63,000 m^2.

Hotels Sector

Based on the data from the Hellenic Chamber of Hotels (2004), in Hellas there are 8,900 Hotels (all categories) with a capacity of 352,000 rooms and 668,000 beds. By making the hypothesis that there is a potential of 1m^2 of collector surface per each 2 rooms, it results that about 175,000 m^2 could be installed in the Hotel sector excluding the rooms for rent all over the country. This last category could double the above result, bringing the potential for the (enlarged) hotel sector to about 350,000 m^2.
For the moment, there have been installed about 29,000 m^2 without considering the systems installed in the rent rooms. The later could add up another 29,000 m^2.

Having a conservative approach, **for the 5 years** period, it could be estimated that **there is a potential** of ST-ESCOs implementations **equal to** the sum of the already installed systems, i.e. another **60,000 m^2** (this corresponds to about 17% of the total potential of the hotels sector).

Hospital Sector

Hospital sector counts almost 2000 buildings all over Hellas. Based on the data from the National Statistical Service of Hellas, in 1998 there have been 1.62 million of hospitalised people with almost 13.5 million man-days of hospitalisation (i.e. almost 8 days of hospital treatment per patient). Considering this figure as a typical annual value, and a mean hot water energy demand of 2.3 kWh per day and person, the resulting total demand for sanitary hot water is about 31 GWh/year. Considering a 70% coverage of this load by ST systems (~ 500kWh/m^2/year), then the theoretical potential for solar thermal installations collectors is about 43,000 m^2. If we assume that a 10% of this figure could be covered by ST-ESCOs contracts in the 5 years period, the resulting potential is about 4,300 m^2. Nevertheless, ST-ESCOs projects for the hospital sector are directly related with the resolution of the problems for the public sector and the successful implementation of the Public-Private Partnerships.

Other tertiary sectors

Since no data are readily available, it has been assumed that the potential for ST-ESCOs applications for the remaining sub-sectors of the tertiary sector is another 4,300 m^2 (equal to the hospitals sector potential).

Residential sector

The annual sales, as already mentioned, are about 150,000 m^2, directed mostly to the household sector.

With the right strategies it could be safely said that about 10% of that figure, i.e.15,000 m^2/year, could be added to the ST-ESCOs potential. Consequently, in the 5 years term the ST-ESCOs potential in the residential sector is about 75,000 m^2.

Table 3 summarises the above estimations of the ST-ESCOs potential for the various sectors.

Sector	ST-ESCOs potential (collectors m^2) for the 5 years period	Corresponding thermal capacity installed (MW$_{th}$)
Hotels	60,000	42
Hospitals	4,300	3
Rest of Services sector	4,300	3
Residential	75,000	53
Industry	63,000	44
TOTAL	206,600	145

Table 3: ST-ESCOs potential for various sectors.

5 Market prices for ST-ESCOs implementations

Usual terms for bank loans

Current (2005) interest rates for loans (for the order of magnitude of the solar applications) are about 6 to 6.5%. If we take out inflation, this interest rate becomes 3-4%.

CO2 Trade

The current (2005) conditions for CO_2 trade are at the moment not helpful for solar thermal systems applications. Only 139 Companies are included in the Hellenic National Allocation

Plan (their installed thermal capacity has to be over a certain limit i.e. 15MW). There are no concrete possibilities for smaller Companies to participate into the CO_2 market at present.

Energy prices

Table 4 is a collection of energy prices for the main fuels used in Hellas.

Type	Price (VAT is included)	Source
Diesel	0.674 € /litre	Hellenic Ministry of Development
Diesel Heat	295 €/m^3	Hellenic Ministry of Development
LPG (Liquid Propane Gas)	507 €/tn	Shell Gas
Heavy Oil No1 (1500) HS	266 €/tn	EKO
Heavy Oil No3 (3500) HS	223 €/tn	Shell Hellas
Heavy Oil No3 (3500) LS	275 €/tn	EKO
Natural Gas	37,3 € /MWh	Attica's Natural Gas Company: DHW use (2005)
Natural Gas	28,1 € /MWh	Attica's Natural Gas Company: mean value for industrial use (2005)

Table 4: Prices for main fuels in Hellas (2004 and 2005)

Note: In all fuels the applied VAT is 18% except for natural gas, where VAT is 8%. The natural gas price has an additional component that is related to the power requirements of the consumer, equal to 0,203 €/kW. All prices are approximated and may vary according to the level of consumption and to the region.
It has to be noticed that the price of "Diesel Heat" can be applied exclusively for space heating purposes.

Financial Analysis for ST-ESCOs investments

In tables 5 and 6 some of the main economic parameters for possible ST-ESCOs investments are presented. Two types of solar thermal systems (medium and large) are considered. The following practical requirement has been adopted for the analysis: the price of the solar energy had to be (at maximum) equal to the lowest conventional price (that is here realistically represented by the natural gas prices of 2005 for domestic and for industrial users). Consequently the IRR (Internal Rate of Return) of the ST-ESCOs investment has been calculated for various contract durations.

System type	**Cost per m^2 (without support)**	**Subsidy**	**Typical Range**	**Typical energy production to final use (kWh/m^2)**	**Annualised price of solar thermal MWh**	**Conventional price of MWh (for natural gas)**	**Years of contract**	**IRR: Internal Rate of Return (over inflation)**
Medium size ST system	320 €	50%	50-200 **m^2**	600	41,3 €	41,4 €	8	5 %
							10	**9 %**
							15	13 %
							20	14 %
Large ST system	280 €		500 to thousands of **m^2**	650	31,1 €	31,2 €	8	3 %
							10	**7 %**
							15	12 %
							20	13 %

Table 5: Main economic parameters for ST-ESCOs applications (50% subsidy)

System type	Cost per m^2 (without support)	Subsidy	Typical Range	Typical energy production to final use (kWh/m^2)	Annualised price of solar thermal MWh	Conventional price of MWh (for natural gas)	Years of contract	IRR: Internal Rate of Return (over inflation)
Medium size ST system	320 €	30%	50-200 m^2	600	41,3 €	41,4 €	8	-
							10	2 %
							15	7 %
							20	9 %
Large ST system	280 €		500 to thousands of m^2	650	31,1 €	31,2 €	8	-
							10	1 %
							15	6 %
							20	8 %

Table 6: Main economic parameters for ST-ESCOs applications (30% subsidy)

The main hypothesis for the calculations are listed bellow:

- Maintenance costs are supposed to be included (for simplicity) to the initial (investment) cost[1].
- In all IRR the inflation is not included.
- A combustion efficiency of the natural gas boilers equal to 90% has been assumed. This is the reason for the higher prices in tables 5 and 6 compared with table 4.
- For table 5 a financial support of 50% has been assumed for the ST-ESCO: this is the current -2005- situation under the "Development Law".
- The Natural Gas prices have been assumed to follow the inflation rate for the duration of the contract. The charging of power supply from the natural gas distributor has been ignored.

Comments on the results of Tables 5 and 6

From the comparison of the annualised prices between the "solar" and the "conventional" MWh, it is clear that the investment is attractive in the first case (table 5 - subsidy of 50%). In this case, a 10 years contract gives an IRR that is 7 to 9% over the inflation rate.

On the other hand, table 6 (with 30% support) shows that the ST-ESCOs investment is hardly attractive with a 10 years contract.

It is worth mentioning that, apart from the subsidy percentages, most of the other hypotheses done are on the "safe side". For example, the 90% of the gas boilers efficiency (based on the upper calorific value of the natural gas) is particularly high; lower values may occur in practice. Moreover, natural gas is the cheapest conventional fuel at the moment. Diesel oil, for example, is by 20% more expensive if compared with natural gas thus making an ST-ESCO application more attractive in economic terms.

The above analyses have shown that long contract duration is a necessary condition for the success of an ST-ESCO agreement. Moreover, the importance of subsidies is evident.

6 Best practice examples

Best practice examples are included in the deliverable "Info-sheets".

[1] In fact, the "cost" numbers used correspond to market prices (applied when the end-user purchases the solar plant). It is obvious that the real cost of the plant for the ST-ESCO will be lower.

7 References

Kanavos John, CRES:*"Promotion of solar water heating systems in Industry trough trans-associational agreements and joint projects between user and manufacturer associations"*, in the framework of PROCESOL ALTENER Program 98-205, 2001.

Karagiorgas M., Palamara A.: CRES: "Market development of Thermal Solar Systems in the Hotel Sector in Greece", 2001.