



EIE-06-085 SOLPOOL

Intelligent Energy  Europe

Solar Energy Use in Outdoor Swimming Pools SOLPOOL

National Fact sheet Reports on the state of the Demand and Potential of Solar Heating of Outdoor Swimming Pools

2nd version

GREECE

D05 National fact sheets on boundary conditions

D06 Requirement sheet for solar thermal use

D07 Funding sheet on existing grant schemes and new approaches

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1 Introduction

The overall objective of the SOLPOOL-Project is to increase the number of outdoor swimming pools equipped with solar thermal installations by 10% in every partner region. Target groups of the campaign are the owners and operators of swimming pools as well as installers and as a secondary target group, the guests.

The project is coordinated by DGS (Deutsche Gesellschaft für Sonnenenergie). The remaining members of the consortium include TTZ (Germany), ALE (France), ApE (Slovenia), CZREA (Czech Republic), Lecce (Italy), SAVEREMA (Hungary) and CRES (Greece).

Main activities of the project carried out individually by all partners and in all regions are the following:

- Status quo analysis (List of swimming pools, installers, manufacturers, list of solar firms, grant schemes etc.)
- Organization and realization of campaigns that target owners and operators as well as installers of swimming pools – solar heating systems
- Establishment of regional information centres
- Development of the Impact advisor as a calculation tool
- Workshops for owners, operators and installers
- Information panel for guests of swimming pools

Data collection in Greece

This section refers to the methodology and strategy used for collecting the data that will be presented in the following paragraphs. A number of obstacles met during the survey for data collection have only been accounted to certain particularities of the country.

In specific, there has not been any official administrative body for land property registration in Greece until recently. This suggests that the volume of the private swimming pools (belonging to private buildings, houses, etc) cannot be extracted by any official source; moreover, there are no data concerning the existence or not of a pool heating system. A legitimate assumption towards the resolution of this lack of information would be that it is rather uncommon in Greece to use a heating system for pools at private buildings and houses, as they are mostly used only during the summer period.

The other segment of the swimming pool private sector in Greece refers to hotels and other resorts. A heating system for swimming pools operated by hotels and resorts is basically desirable, as it could extend the swimming pool usage period to approximately two months before and after summer. However, even under the assumption that most of the big hotels and resorts have indeed installed a heating system for their pools, it ended to be quite hard to consider and contact all of the owners, as well as extract the required technical data. This is a result either of their unawareness on technical and economical characteristics or a general distrust regarding releasing economical data of their enterprise.

What seems significant for this project are the swimming pools located at athletic or swimming centres, which mainly belong to the public sector and are characterized by high density

of attendance (large number of visitors, independent of weather conditions). This type of use makes it almost certain that a heating system is installed. Although the effort of retrieving information for a large number of swimming centres brought out reliable results, the owners or operators are not completely aware of all the technical characteristics concerning the heating of swimming pools. Through a number of interviews that were carried out during this research, several technical data were obtained, while in the cases that no such technical information could be retrieved, assumptions and estimations were made.

Important sources of information for the collection of data are the companies that manufacture and/or install either swimming pools or heating systems. Through an extensive survey focused in market observation studies referring to specific sectors, commercial catalogues obtained from these sectors and various internet sources a full list of such companies was compiled. Their main activities consist of:

- Manufacturing and maintenance of swimming pools
- Trading and installation of pre-manufactured swimming pools
- Design and installation of swimming pools' heating systems
- Design and installation of solar thermal heating systems
- Manufacturing and trading of solar thermal heating systems

However, not every company active in the aforementioned sectors is willing to give out technical and economical data, as they are considered confidential and vital for their welfare (in terms of competition). A number of interviews were held with companies that manufacture and/or install swimming pools and heating systems (both conventional and solar). By interviewing three major companies that share 70% of the Greek market, a general image of the market was established and an estimation of the situation was relatively easier accomplished. The survey with these companies included a questionnaire concerning the number of installations, technical and economical characteristics as well as market conditions. The minutes of an interview held with such a company can be seen under Appendix I.

In the following paragraphs, there will be a notation of the actual data collected, as well as the sources and means of estimations.

2 Environmental conditions for the use of Solar Thermal systems

The climate in Greece is typical of the Mediterranean climate and it is characterized by mild and rainy winters, relatively warm and dry summers with, generally, long sunshine duration almost all of the year. A great variety of climate subtypes, always in the Mediterranean climate frame, are encountered in several regions of Greece. This is due to the influence of topography (great mountain chains along the central part and other mountainous bodies) on the air coming from the moisture sources of the central Mediterranean Sea. Thus from the dry climate of Attiki (the great area of capital, Athens) and generally of East Greece, change over to the wet one of North and West Greece. In terms of climatology, the year can be broadly divided mainly into two seasons. The cold and rainy period, lasting from the mid of

October until the end of March, and the warm and non-rain season lasting from April until September. During the first period the coldest months are January and February, with mean minimum temperature ranging, on average, between 5 -10 degrees of Celsius near the coasts and 0 - 5 over mainland areas, with lower values (generally below freezing) over the northern part of the country. Rainfall in Greece even in the winter, does not last many days and the sky does not remain cloudy for several consecutive days, as it happens in other regions of the world. Winter bad weather days are often interrupted, during January and the first fortnight of February, with sunny days, well known as 'Alkion days' in ancient times. The winter is milder in islands of Aegean Sea and Ionian Sea than in the North and East of Greece. During the warm and non-rain period the weather is almost stable, the sky is clear, the sun is bright and generally there are no rainfalls. However there are scarce intervals with rapid rain or thunderstorms of small duration mainly in mainland areas. The warmest period is the last ten-day period of July and the first one of August, when the mean maximum temperature lies in the range of 29.0 and 35.0 degrees of Celsius. During the warm period, the high temperatures are dampened from the fresh sea breezes in the coastal areas of the country and from the north winds blowing mainly in Aegean, well known as 'Etesian'. (Source: HNMS).

The combination of both the geographical latitude and the high levels of sunlight in Greece results in an average solar energy intensity of 1570 kWh/m² every year (see Figure 1). In the largest part of Greece, the sunlight duration exceeds the 2700 hours per year. West Macedonia and Epirus are the areas with the lower average sunlight duration (2200 to 2300 hours), whereas on Rhodes and Crete sunlight lasts for over 3100 hours per year. This means that Greece has a large potential for an economical exploitation of solar radiation for heating reasons, what is amply demonstrated by the wide applicability of solar thermal systems designated for domestic water heating.

Yearly sum of global irradiation on a horizontal surface GREECE

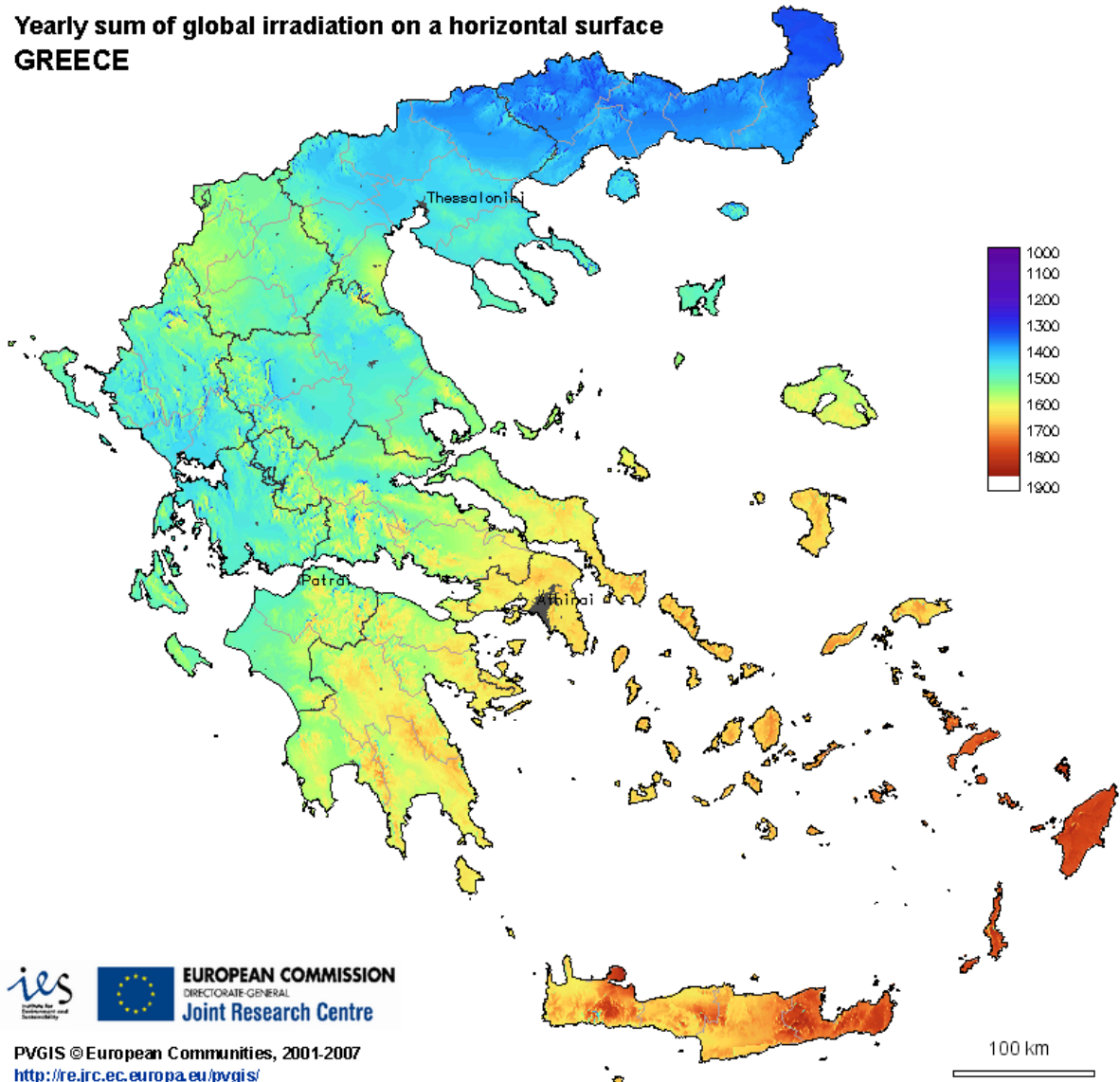


Figure 1 Solar radiation map in Greece

Source: JRC

All of the factors mentioned above imply that the outdoor swimming pool usage period in Greece is rather extended in the course of the year, compared with other European countries. However, because of the high variations in climate, sunlight and temperatures across the country, there is no uniform usage period for outdoor pools. The average usage period is from June until September and when the swimming pool is heated it is extended for 3 months, i.e. April to October. The average usage period is from June until September. During this period the temperature of the water in the swimming pool is above 20°C (due to the high solar radiation and external temperatures), thus no heating is required. When the swimming pool is heated, the swimming period is extended for about 3 months, from April to October. Since the external swimming pools are usually used only when the external temperatures are good, no further heating to cover the swimming pool needs after these months is required.

3 State of the Art of Solar Thermal Applications

Solar heating of open-air swimming pool water has some decisive advantages over other methods of using solar energy thermally:

- Temperature level: The required temperature level is comparatively low at 18°C to 25°C. This permits the use of inexpensive plastic absorbers.
- Solar radiation and time of use: The time of the highest solar radiation in many cases matches the time of use. Commonly at latitudes in Central Europe open-air pools are operated from beginning/middle of April until the middle of September. During this period approximately 65 – 75% of the annual solar radiation occurs.
- Simple system design: The pool water flows directly through the absorber. The storage tanks normally required for solar energy systems are not implemented since the pool itself takes over this function.

Solar heating for open-air swimming pools have been used for several decades now and are a well- established technology. However, this does not mean that this application of solar thermal energy has reached its limits yet.

According to statistics in Sun in Action II, about 3-4.000 m² of unglazed collectors have been placed yearly in the 90's. The estimated production and sales for 2000 and 2001 is 10.000 m² yearly.

If we look at the developments over recent years, heating of the pool is too costly for most swimming pool owners. Existing older conventional heating systems are however often replaced by absorber systems or the owners do without heating altogether.

3.1 Absorber Systems

3.1.1 Systems without auxiliary heating

Solar circuits in public open-air baths are normally operated with a separate solar circuit or absorber circuit pump. The hydraulic construction is much more complex than for private swimming pools because of the hygiene requirements.

A system in a large open-air pool functions according to the following principle:

The wastewater is led from the pool into a central water storage tank. This tank acts as a "water level display" for the whole swimming pool water circuit. Evaporated water is replaced here by fresh water. The water is pumped through the filter from the water tank. One or, according to the design of the filter system, several parallel-connected filter pumps are responsible for this. After this the water returns to the pool via the water treatment system.

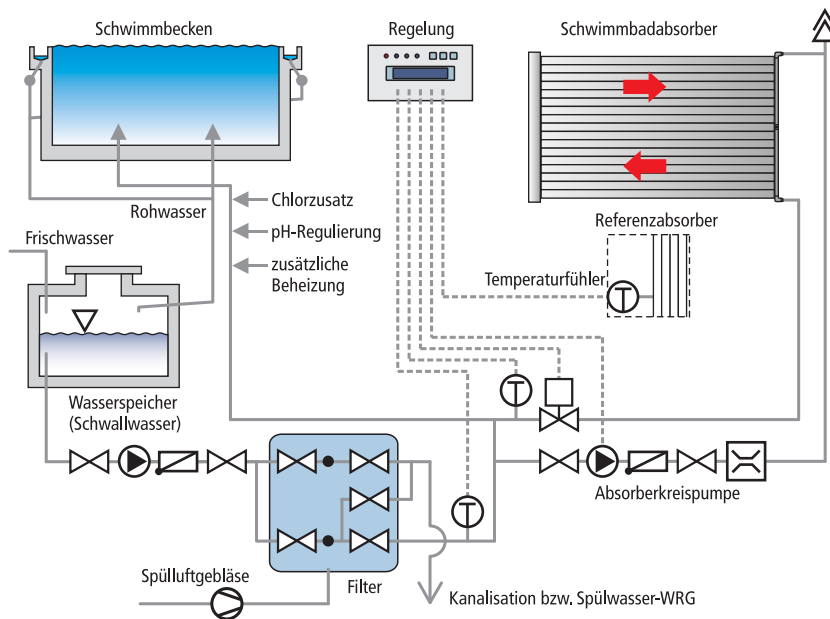


Figure 2 Circuit diagram of open-air swimming pool heating

In front of the water treatment system, the absorber field is connected to the circuit in a bypass system. The solar loop pump diverts part of the volumetric flow and pumps it through the absorber field. The size of the partial volumetric flow depends on the size of the absorber field. The solar heated water is led to the main flow again after the diversion and finally arrives back in the pool.

A motorized valve should be installed in the absorber circuit feed line and a non-return valve after the solar pump. These two fittings prevent the absorber field from running empty when the system is not in operation.

Before the water reaches the pool the hygiene parameters are set. Chlorine and chemicals are introduced to regulate the pH value as necessary. The chlorine injection point should always be integrated behind the absorber field diverter since the chlorine concentration in the absorber circuit must not exceed 0.6 mg/l. If there is a pulse of chlorine (under certain circumstances up to 10 mg/l) the absorber may be damaged.

When flat plate collectors are used instead of unglazed, then the water of the swimming pool does not pass directly through the collectors, but the collector circuit is separated from the swimming pool water with a heat exchanger.

In small scale systems (usually used for private swimming pools), the system construction is much simpler. In this case, only a single pump circuit is used. The excess water is fed to a central storage tank where the level of water is monitored and the evaporated water is refilled as with the large scale swimming pools. The water is taken from the central storage tank and is pumped to the water treatment unit (single unit). At this point the temperature level of the water is measured and if required, it is sent to the solar collectors for heating through a triode valve as in the previous case (but not with a separate pump).

3.1.2 Integration of auxiliary heating

Unglazed collectors are mainly used in small private swimming pools or in seasonal hotels. The dimensioning of the unglazed collectors is made in order to cover more than 90% of the heating demand, therefore a backup system is not used in combination with unglazed collectors.

In large professional pools, where a large collector field cannot be installed to cover 100% the swimming pool needs, conventionally operated auxiliary heating is installed to maintain a constant water temperature.

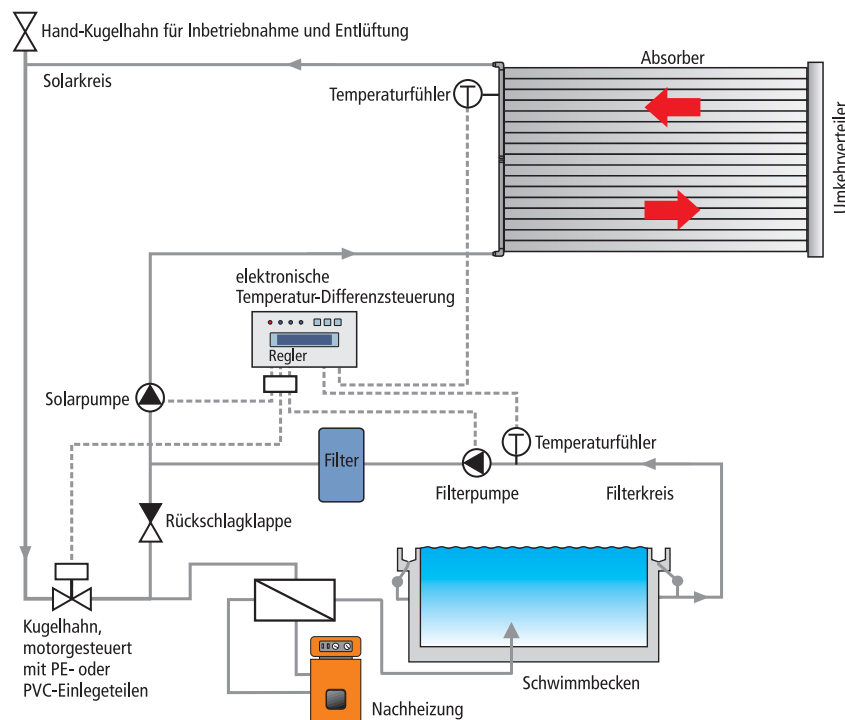


Figure 3 Circuit diagram of large absorber systems with additional heating

Auxiliary heating is operated by means of a conventional system (preferably gas heating systems) and an additional heat exchanger. In a dual-heated system, the auxiliary heating should always follow solar heating. If the water is not of the required temperature after recirculation to the filter circuit the auxiliary heating covers the residual heat requirement.

3.1.3 Unglazed absorbers

Solar open-air pool heating uses absorbers to collect the energy. The collector design is characterized by the lack of transparent cover and housing as well as thermal insulation. This simple construction is possible since the systems operate with low temperature differences between the absorber and the surroundings and with relatively uniform return temperatures (10°C – 18°C).

The swimming pool absorber is always made from plastic compound.

The use of unglazed and un-insulated absorbers for solar open-air pool water heating has some advantages due to the special operating conditions:

In the typical operating range, with a temperature difference $\Delta\theta$ between the outside temperature and the mean absorber temperature of 0-20 K, absorbers often operate with a higher efficiency than glazed collectors. This can be explained by the fact that the optical losses (normally about 10 to 15% with respect to the amount of solar radiation) through a transparent cover do not arise and that the thermal losses are not so significant because of the low temperature difference $\Delta\theta$. These thermal losses increase with operating temperatures, which however rarely occur due to the moderate absorber temperatures found under normal operating conditions. The wind speed is the decisive factor, which causes losses and

hence has a negative effect on the absorber efficiency. This was established in an investigation of absorber testing and test results of solar open-air pool heating.

Apart from a few special designs plastic absorbers can be subdivided into two groups:

- Tube absorbers (small tube absorbers)
- Flat absorbers

The tube absorber is the simplest design. A number of smooth or ribbed tubes (small tubes) are arranged in parallel and according to the design are connected together with intermediate webs or by retainers at a given spacing. Absorber lengths of up to 100 m can be achieved and obstructions like chimneys or rooflights can easily be circumvented.

In the case of flat absorbers, sometimes also called plate or cushion absorbers, the channels are linked together structurally. This produces plates of different dimensions with a smooth surface. This has the advantage that there are no grooves in which dirt or leaves can accumulate and solidify.

The influence of the design form on the conversion factor with different inclination angles can be measured but it is minimal. Variations of the angle of incidence lead to small differences in the conversion factor only for flat collectors. In the case of ribbed tube absorbers they lead to larger variations than with normal tube absorbers.

All absorbers are very easy to handle (see also the installation chapter), thus for example all common types can be walked on.

The following figures show a summary of the absorbers available on the market and the different methods of connecting the absorber to the collecting and distributing pipes.



Figure 4 Unglazed absorber field

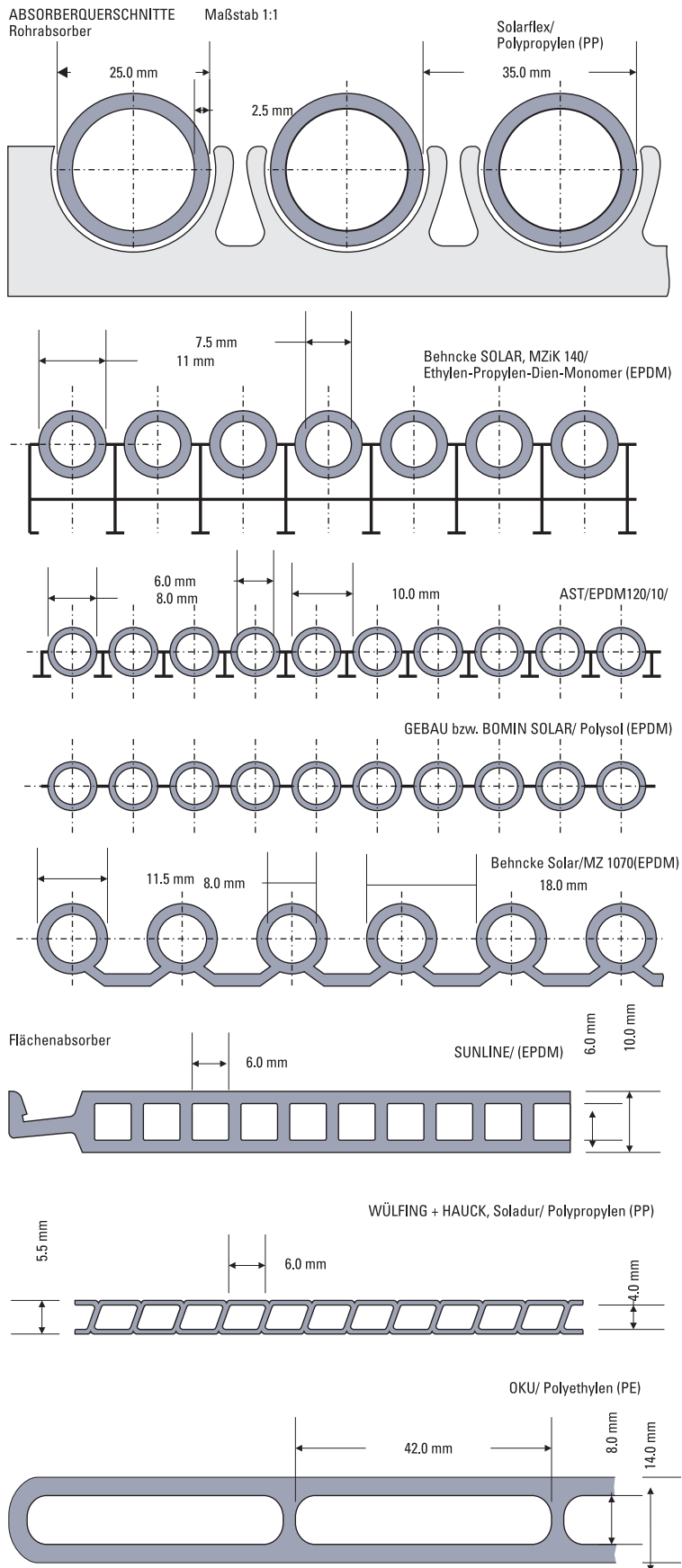


Figure 5 Different designs of absorber in cross-section

Solar absorbers are exclusively made from plastic. They can be hard and rigid or soft and flexible according to the plastic mixture. The use of plastic permits operation of the solar system with chlorinated swimming pool water. It is however necessary to consider the chlorine content. A high dose (from about 5 mg/l) can damage the absorber. The exact limits, from which damage can occur, depend on the plastic composition.

Plastics are also used for pipelines. These are however made from rigid materials.

The main plastic compounds used in unglazed absorbers are:

EPDM	Ethyl Propylene Diene Monomer
PP	Polypropylene
PE	Polyethylene
ABS	Acrylonitrile Butadiene Styrene copolymer
PVC	Polyvinyl Chloride (hard or soft)

3.2 Flat plate collectors

In open air swimming pools flat plate collectors may be installed if also a solar heating of domestic hot water for showers is required. Almost all glazed flat-plate collectors currently available on the market consist of a metal absorber in a flat rectangular housing. The collector is thermally insulated on its back and edges and is provided with a transparent cover on the upper surface. Two pipe connections for the supply and return of the heat transfer medium are fitted, usually to the side of the collector.

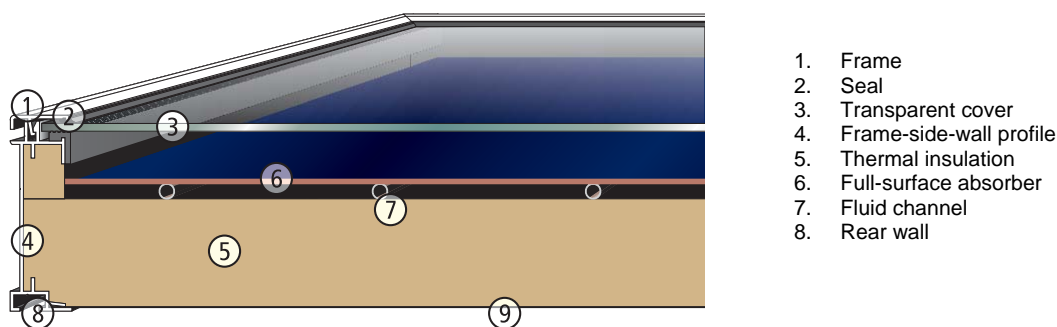


Figure 6 Section through a glazed flat-plate collector

Because of the risk of corrosion of thermal collectors with copper absorbers, these can only be operated in solar systems for swimming pool heating if a separate solar loop is installed (i.e. indirect) including an external heat exchanger.

3.3 Vacuum tube collectors

Vacuum tube collectors are not used in Greece for swimming pool heating due to their high efficiency that can result in temperatures of more than 170°C in summer in Greece and their high cost that is almost double of that of the flat plate collectors

3.4 Existing norms and standards

In the following there will be a reference to all existing standards and norms for the installation and use of solar thermal heating devices, as well as any additional outdoor swimming pool norms and standards concerning solar thermal heating systems. A list of all important standards, which impact the installation and usage of a solar thermal system cited here, will be furthermore considered during the development of the campaign strategies.

Solar Thermal pool heating:

- ISO/TR 12596:1995

Solar thermals applications:

- Solar Key mark
- EN 12975-1:2006
- EN 12975-2:2006
- EN 12976-1:2006
- EN 12976-2:2006
- EN ISO 9488:1999
- ENV 12977-1:2001
- ENV 12977-2:2001
- ENV 12977-3:2001

Outdoor pool operation concerning solar thermal heating:

- Description of constructive issues, Ministerial Decree C1/443/1973
- Official gazette 120B/2006

Sources: CRES, ET

4 Market analysis

As mentioned in the introduction, the collection of data has been insufficient and consisted mostly of estimates that were done through generalization of the already collected information because of the various obstacles met in the Greek market.

Many of the data collected arose through interviews that were held with members of the Greek Solar Industry Association [EBHE]. The total number of EBHE's members is 38 and only two of them have designed, manufactured and installed solar thermal systems for out-

door swimming pools. One of the members participating in the interviews reported five installations of the aforementioned kind in 2008.

Nevertheless, manufacturers or installers of solar thermal systems imply that a number of their products are purchased by retailers who forward them to end customers. Trying to obtain a feedback from those retailers on sales and applications of solar thermal systems has not been proven successful. This highlights even more the difficulty of collecting the required data.

What has been suggested by many companies is that, because of the climate of Greece, the heating systems for outdoor swimming pools are not required during July and August. For that reason, when solar heating systems are installed, the produced heat during that period is employed exclusively for domestic water heating.

4.1 Public sector

As mentioned in the introduction, a complete list of data for outdoor swimming pools with installed heating system is hard to be obtained, as there is no reliable registration system. In specific, difficulties were met when trying to obtain information regarding the exact number of public outdoor swimming pools with an installed heating system, the various heating systems used, as well as O&M costs.

The inquiry was, therefore, based on online search of databases, as, for instance, the one found under the Hellenic Swimming Federation (HSF). The data concerning swimming pools gathered from such databases, in addition to the information collected by members of EBHE were merged together into a large and sufficient **list of public swimming pools** in Greece. A series of phone interviews that took place with the operators of the pools also contributed with some desirable results. During the second phase of the data collection procedure (October 2008 – completion of the action) a **questionnaire** [Appendix II] was sent to **public and private** professional pool owners/operators all over Greece. The total number of questionnaires sent were 52 [contact details see. Appendix III], out of which only 8 returned filled, containing details for 14 pools. In order to gather as much technical information as possible, CRES contacted by telephone, each one of the swimming pool owners who did not answer the questionnaire. At this point it should be mentioned that these questionnaire was also distributed to owners & operators who participated to WP3 workshops, but there has not been any feedback until today.

The list with all the information contained can be found under Appendix IV.

4.1.1 Number of pools

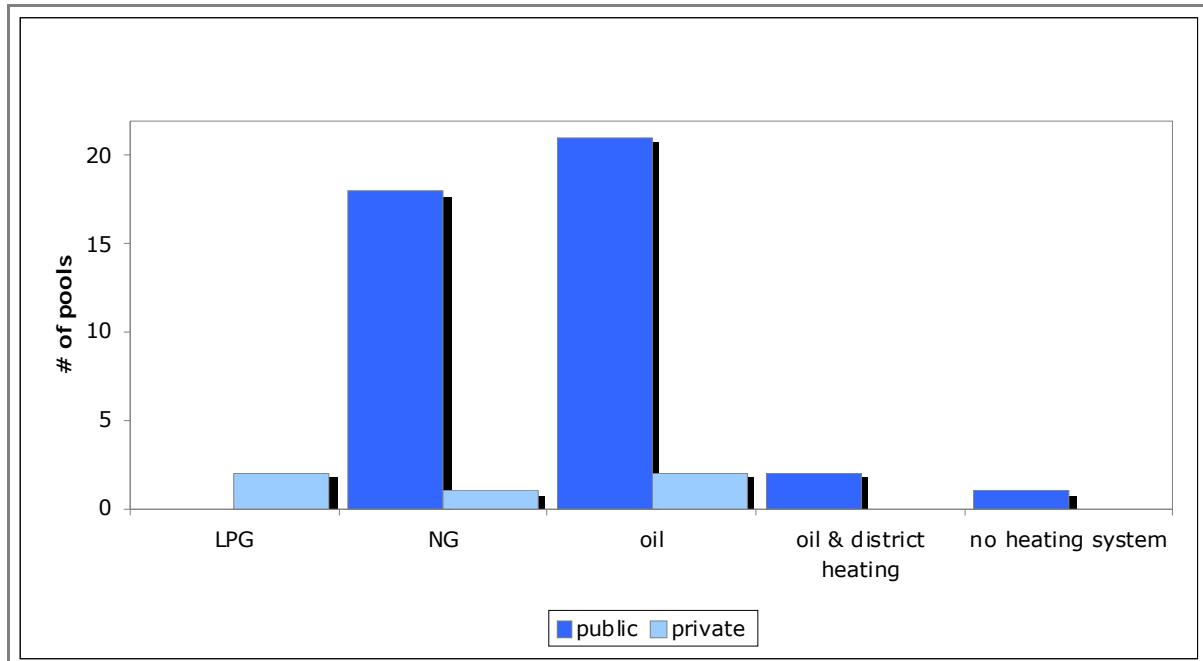
During the first phase of the data collection procedure, the total number of public pools belonging to swimming or athletic centres resulted to be 59; 44 of them accepted to provide details about the pool heating system according to the list established. Out of these, 25 are outdoor swimming pools and 24 of them have an installed heating system. During the whole project period 38 operators of public professional pools accepted to provide details for 75 pools, 40 of which are outdoor. 39 out of the outdoor swimming pools are heated.

The different types of the conventional fuels used for these pool heating systems are presented in Figure 7. The number of outdoor swimming pools belonging to both public and private sector identified during the data collection process is presented in the following table.

Table 1: Volume and type of pools (private and public sector)

Type of pool	Total Number of pools/outdoor pools	
Public pools	75	40
Private pools	13	4
Total	88	44

Details may be seen in Appendix IV, as mentioned earlier.



[source: Solpool]

Figure 7 Conventional fuel use for outdoor pool heating

4.1.2 Used heating systems

The technologies used for outdoor swimming pool heating in Greece are:

- boilers
- heat pumps
- flat plate solar thermal collectors
- unglazed solar thermal collectors

Boilers are the most commonly used technology; the water for the swimming pool is heated from the main house heating boiler through a heat exchanger, as shown in the next schematic diagram [Figure 8]. The main fuel used to supply these boilers is oil, with the exemption of very few gas burners installed in the last years that gas became available to the consumers.

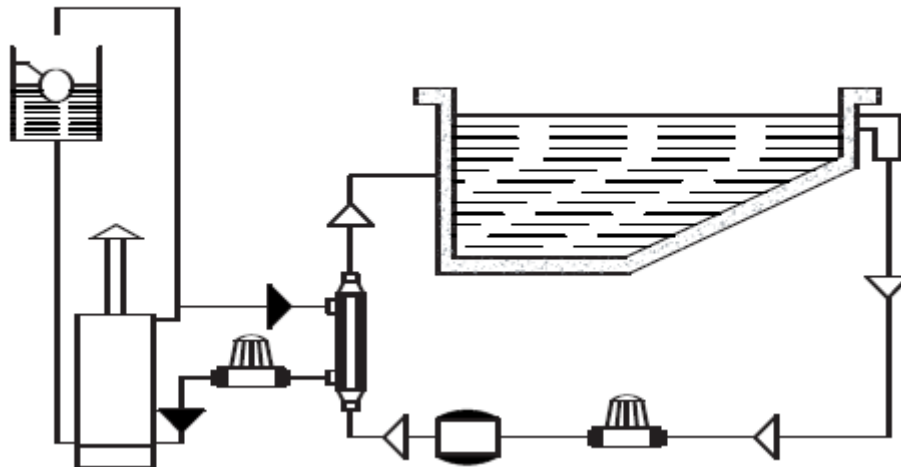


Figure 8: Swimming Pool Heating With Boiler and Heat Exchanger

Source: BOWMAN

The cost of installation of the heat exchanger is about 4000€ for an average of 80m²-100m² swimming pool. Despite the low capital cost, oil heating is very expensive in operation since the cost for the oil is 0,052€/kWh. Oil boilers are used at about 90% of the outdoor heated swimming pools (source: CRES, Solar Thermal Dpt).

The second most common technology that has been widely applicable during the last years is heat pumps. In this case, the usual compression-expansion cycle is used both for heating and cooling the water of the swimming pool - if required.

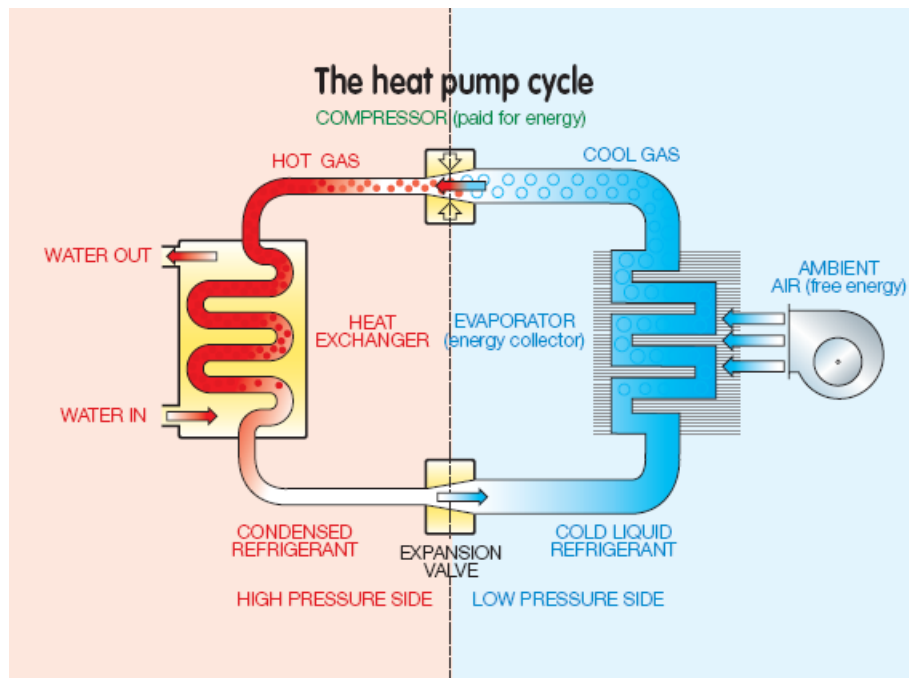


Figure 9: Swimming Pool Heating With Heat Pump

Source: CALOREX

The installation cost of the heat pumps is similar (4000€ -5000€ for 80m²-100m² swimming pool) to the installation cost of the boiler's solution. Heat pumps are installed at about 9% of the heated outdoor swimming pools (source: CRES, Solar Thermal Dpt).

The last method used is the solar heating. In this case, solar thermal collectors are used to heat the water for the swimming pool. This represents the smallest number of installations (about 1%). The cost of installation is more expensive than the cost of the other two technologies. More specifically, the system costs per collector m² including installation is

- for flat plate collector: 300€/m² (VAT excluded)
- for unglazed collector: 100€/m² (VAT excluded)

The unglazed collector field required to heat the swimming pool (for an extension of the swimming pool period of about 2 – 3 months before and after summer) is about 80%-100% of the swimming pool area. In specific, the ratio of collectors' surface by pool's surface for flat plate collectors is 0.7, whereas for unglazed collectors it equals 1 (source: EBHE).

The latter is mostly used for small-sized pools, mainly due to its low installation cost. On the other hand, flat plate collectors are used for higher heating levels, usually with the additional commitment of a heat exchanger.

4.1.3 Cost comparison of the different heating systems

From the above it is obvious that the installation costs for a solar heating system are significantly higher than those of conventional heating. For the heating purposes of a swimming pool of approximately 100 m² the installation of a conventional heat exchanger or a heat pump would cost 4 000 €, whereas the installation of an unglazed collectors system nearly 10 000 € and for a flat plate collectors system reaches the 21.000 €.

However the installation cost reflects only one fixed cost in the beginning of each project and does not consider the variable costs throughout the life cycle of a product (in this case the heating system). The most significant cost component in a long-term consideration is the fuel cost. For heat exchangers – boilers this accounts for the oil consumption, whereas the operating cost of heat pumps mainly consists of the electricity consumption cost. Solar heating systems do not use any fuel other than the solar energy, except for hybrid systems, or solar heating systems accompanied by an auxiliary conventional heating system. However, in the cases of outdoor pool heating this is seldom the case, as the thermal needs can be adequately covered solely by solar heating systems.

4.2 Private sector

As stated previously, the information collected for private outdoor swimming pools should be treated with some uncertainty and with some reservations concerning its accuracy. Particularly for swimming pools belonging to houses or private buildings, which are exclusively used by private individuals or just the pool owners; it was extremely difficult to obtain information, because of the lack of an official administrative body for land property registration. However, hotels and other kind of resorts that also belong to the private sector were easier to be approached. In specific, a research took place through the Greek National Tourism Organisation (GNTO) and a list with major hotels and resorts was established. Based on this list as well as the list of EBHE's members and through the process of interviewing, it was attempted to obtain as much information as possible. During this process four good practice examples were identified belonging to the private sector (see 5).

4.2.1 Number of pools

According to the interviews carried out with manufacturers – installers of swimming pools and heating systems in Greece, approximately 1500 swimming pools are installed every year, out of which only 5 -7% are outdoor pools with an installed heating system. Each of those companies installs 150 – 200 swimming pools per year and mostly for private customers.

An estimation based on the aforementioned online surveys and interviews with tourist organizations, hotel chambers and swimming pool installers reveals that there are about 150.000 outdoor swimming pools installed.

Moreover, as it is already mentioned in the public sector analysis (see 4.1 & 4.1.1), questionnaires were sent to professional swimming pools (public and private) and phone interviews were made. However the results of this process, concerning private sector, were insufficient, taking into account that only four of these swimming pools were proved to be outdoor.

The list with all the information contained can be found under Appendix IV

4.2.2 Used heating systems

The heating systems used in the private sector of Greece are identical with the ones used in the public sector (see 4.1.2). The diversification is probably only detected on the different sizes reflecting the different needs and usages of swimming pools. For instance, in athletic centres belonging to the public sector the swimming pools are typically quite large as they are commonly used for professional reasons and require, therefore, a more effective heating system (in the case of solar heating, flat plate collectors are preferred). It is rather uncommon in private sector to invest in a very effective heating system when the pool is infrequently used.

4.2.3 Cost comparison of the different heating systems

A cost comparison for the different heating systems was carried out in paragraph 4.1.3, since there is no diversification between public and private sector, as already mentioned before.

5 Best practices

In the following, four examples of outdoor swimming pools in Greece that are heated with solar thermal systems are selected as best practices of the current technology. The examples presented here are obtained solely by the private sector, mainly because of the difficulties met for extracting information from the public one. This should not, however, be misleading, as three examples refer to big hotels or holiday resorts in Greece with relatively large number of visitors and, therefore, high demand on swimming pool heating.

5.1 Pool 1 – Swimming pool at Hotel Lentzakis



Figure 10: Solar polypropylene collectors for swimming pool heating

Source: CRES

Table 2: Technical data of the absorber system of Hotel's Lentzakis pool

Tube Absorber surface area (for pool water)	152 m ²
Flat Absorber surface area (for sanitary water)	448 m ² for solar cooling (selective plat plate)
Pool surface area and volume	180 m ²
Year of installation	25/01/2002
Operator	Hotel "Lentzakis"
System Installer – Planning	SOLE S.A.
Type of collector(s)	Unglazed collectors (polypropylene)
Auxiliary heating system	None
Pool Operating Period	March-October
Specific yield	1.14 kWh/m ² per year (only from the unglazed collectors)
Energy savings	17 250 lit of oil per year
Environmental gain	322 tons / year of CO ₂ and 5.5 tons / year of SO ₂
Costs for the solar system	8.000 € (incl. planning and installation)
System costs in EUR/m ² of absorber area	52.6 €/ m ²

Source: SOLE S.A.

Short description of the system

The “LENTZAKIS S.A.” hotel is located in Rethimno Crete, in southern Greece. It caters mainly for tourism, with capacity of 150 beds and it is 100% occupied in the summer and 45% in the winter. The installed system which consists of 152 m² polypropylene collectors provides hot water for the heating of the outdoor swimming pool. The swimming pool heating needs between March and October are 173.611 kWh and they are equal to the total collectors output since there is no back up system available. This system was installed in the framework of a solar cooling project which was subsidized up to 50 % by National Operational Programme for Energy (of the Greek Ministry of Development).

Partners:

- Lentzakis S.A.

Contact Address

LENTZAKIS K. A.E.
42 Moatsou St., Rethimno,
Crete, 74100, Greece
Tel: +3028310 24761/24766, Fax: +30 28310 24900

5.2 Pool 2 – Swimming pool of Rethymno Village Hotel



Figure 11: Swimming pool of Rethymno Village hotel

Source: SOLE S.A.

Table 3: Technical data of the absorber system of Rethymno Village Hotel’s pool

Tube Absorber surface area (for pool water)	199 m ²
Flat Absorber surface area (for sanitary water)	448 selective flat plate for solar cooling
Pool surface area and volume	Not known
Year of installation	2000
Operator	Rethymno Village Hotel
System Installer – Planning	SOLE S.A.
Type of collector(s)	Unglazed polypropylene
Auxiliary heating system	None
Pool Operating Period	February – November
Specific yield	1247 kWh/m ² per season (only from the unglazed collectors)
Energy savings	24.67 tons of oil per year
Environmental gain	79 tons / year of CO ₂
Costs for the solar system	10.600 € (incl. planning and installation)

System costs in EUR/m ² of absorber area	53.26 €/m ²
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Source: SOLE S.A.

Short description of the system

The “Rethymno Village” hotel is located in Rethymno Crete in southern Greece. It caters mainly for tourism; with a bed capacity of 170 beds. In 2000, Rethymno Village installed a solar cooling and a swimming pool heating plant in the framework of the European project Climasol. The swimming pool heating installation is made out of 199m² unglazed collectors that heats a 250m² swimming pool from February till November. The heating requirements of the swimming pool are fully covered by the solar system.

Partners :

- Client: Rethymno Village
- Office study: SOLE S.A.
- Solar thermal system: SOLE S.A. SunStar unglazed collectors
- Installer: SOLE S.A.

Contact Address

KOUTROULIS BROS S.A. (Owner)
30 Imvrou St., Rethimno,
Crete, 74100, Greece
Tel: +30 28310 25523/22693, Fax: +30 28310 53862

5.3 Pool 3 – Swimming pool of Europa Hotel



Figure 12: Swimming pool of Europa hotel

Source: CRES.

Table 4: Technical data of the absorber system of the Europa Hotel’s pool

Tube Absorber surface area (for pool water)	32 m ²
Flat Absorber surface area (for sanitary water)	Not known
Pool surface area and volume	25 m ²
Year of installation	2001
Operator	Europa Hotel
System Installer – Planning	SOLE S.A.
Type of collector(s)	Unglazed polypropylene
Auxiliary heating system	None
Specific yield	1144 kWh/m ² per season (only from the unglazed collectors)

Energy savings	36 tons of oil per year
Environmental gain	11.6 tons / year of CO ₂
Costs for the solar system	1710 € (incl. planning and installation)
System costs in EUR/m ² absorber area	53.4 €/m ²

Source: SOLE S.A.

Short description of the system

The “Europa resort hotel” is located in Rethymno, Crete in southern Greece. It caters for tourism; with a capacity of 45 beds and 11 apartments. In 2001, SOLE S.A. installed a DHW solar thermal and a swimming pool heating plant. The swimming pool heating installation consist of 32m² unglazed collectors that heat a 25m² swimming pool. The heating requirements of the swimming pool are fully covered by the solar system.

Partners

- Client : Europa resort hotel
- Office study : SOLE S.A.
- Solar thermal system : SOLE S.A. SunStar unglazed collectors
- Installer : SOLE S.A.

Contact Address

Europa Resort Hotel
Panormo, Rethymno, Crete
Greece, 74 057.
Phone:+30.28340.20.200
Fax:+30.28340.51.100
e-mail: info@europahotel.gr

5.4 Pool 4 – Private Swimming Pool in Corfu Island



Figure 13: Private Pool in Corfu



Source: Helional S.A.

Table 5: Technical data of the Flat Plate ST system of the pool

Tube Absorber surface area (for pool water)	16 m ²
Flat Absorber surface area (for sanitary water)	Not known
Pool surface area and volume	40 m ²
Year of installation	2008
Operator	KOSKINAS NIKOS

System Installer – Planning	ALPHATECH Corfu (installation), HELIONAL (planning)
Type of collector(s)	Flat Plate (HELIONAL FPS 2.0)
Auxiliary heating system	Oil fuel boiler
Specific yield	1,14 kWh/m ² per year
Energy savings	548 m ³ , natural gas
Environmental gain	1.110 kg/year of CO ₂
Costs for the solar system	6.000 € (incl. planning and installation)
System costs in EUR/m² absorber area	375 €/m ²

Source: Helional S.A.

Short description of the system

This solar thermal system is installed in a private pool in Corfu Island, in the Northwestern-part of Greece. The owners of this outdoor swimming pool decided to use the solar thermal heating system in order to extend the typical 3 months swimming period (June-August) to 6 months (April – September). The volume of the pool is 50 m³ and the surface area is 40 m². The solar thermal system consists of 8 fl at plate solar collectors, oriented south at 35° to the horizontal. The net absorbing area of the collectors is 14,48 m². The owners cover the pool during the night (from 19.00 until 07.00) in order to minimize the thermal losses.

Partners

- Client/Owner: Koskinas Nikos
- Office study: HELIONAL S.A.
- Solar thermal system: HELIONAL S.A., HELIONAL FPS 2.0
- Installer: ALPHATECH Corfu

Contact Address

HELIONAL S.A.
Oreokastro, Industrial Park P.O.box 89, 57013 Greece
Tel: +30 2310 783691
Fax: +30 2310 783498
e-mail: info@helional.com

6 Finances

6.1 Specific System costs in Greece

Table 6: Specific costs of solar thermal heating systems for outdoor pools in Greece

	Small Pools surface: <100 m ²	Medium pools surface: 100 to 500 m ²	Large pools surface: >500 m ²
Absorber systems			
Investment cost range in EUR/m ² (incl. installation cost)	100	75	70
Operational costs ¹ in EUR/year	300	500	600
Flat plate collectors			
Investment cost range in EUR/m ² (incl. installation cost)	150	135	120
Operational costs in EUR/year	300	500	600

Source: EBHE

6.2 Funding and Financing schemes

6.2.1 Programme 1 – EPAN II

Programme Name	Operational Programme for Competitiveness & Innovation (EPAN II)
Organisation	Special Secretariat for Competitiveness Management Authority
Street	56 Mesogeion Av.
Postal code	11527
City	Athens
Email	Online contact form at http://en.antonistikotita.gr/epan/site/Forms/contact_form
Telephone	O.P. "Competitiveness" Information Desk Tel: 801 11 36300 - calling only from Greece Fax: +30 210 7450883
Type of Support	Subsidy Investment and tax deduction ²
Available Money	To be announced
Share of total budget	Up to 60% investment costs and 100% taxes (depending in the region) ²
Who can apply	Terrestrial sector
Requirements for application	To be announced
Targeted areas	Hotels, industries, enterprises, professionals ²
Short description	Renewable energy sources, energy saving, modernization of enterprises ²
Documents	To be announced
Source of information	Special Secretariat for Competitiveness Management Authority
Year of beginning	expected in 2009
Information website	www.antonistikotita.gr www.ypan.gr

¹ The operational costs presented here include filter clearance, heat exchangers' chlorination and system service.

² based on previous calls for investment schemes submission

6.2.2 Programme 2 – INVESTMENT INCENTIVES LAW

Programme Name	Investment incentives law 3299/2004 as was modified by law 3522/2006, Article 37, Government Gazette 276 A', December 22, 2006
Organisation	Greek Ministry for Economy & Finance
Street	5-7, Nikis Str.
Postal code	101 80
City	Athens
Email	Online contact form at http://en.antonistikotita.gr/epan/site/Forms/contact_form
Telephone	+30 210 333 2000
Type of Support	<ul style="list-style-type: none"> • Cash grant, which covers part of the expense for the investment project by the State <p>AND OR</p> <ul style="list-style-type: none"> • Leasing subsidy, which covers part of the payable installments by the State relating to a lease which has been entered into for the use of new mechanical and other equipment <p>OR</p> <ul style="list-style-type: none"> • Wage subsidy for employment created by the investment. <p>OR</p> <ul style="list-style-type: none"> • Tax allowance. This incentive allows income tax exemption on non-distributed gains. The allowance is effective upon completion of the investment for the first ten (10) years of operation. It is created through a tax exempted reserve. <p><i>The above incentives are offered under the terms and conditions set out in the Investment Incentives Law</i></p>
Available Money	-----
Share of total budget	Depending on the category of business activity and the climatic zone
Who can apply	See § <i>short description</i>
Requirements for application	See § <i>short description</i>
Targeted areas	<p>The investment incentives law is applicable to enterprises having business activities in the following sectors:</p> <ul style="list-style-type: none"> • Primary (e.g. greenhouses, animal farms, fisheries etc.). • Secondary (e.g. manufacturing, energy etc). • Tertiary: <ul style="list-style-type: none"> - tourism (hotel units, conference centres, marinas, thematic parks, golf courses, development of mineral springs, thalassotherapy centres, health tourism centres, centres for training-sports tourism etc). - other services (e.g. applied industrial research laboratories, commercial centers, software development, supply chain services, logistic centers etc.).
Short description	<p>The “ National Development Law ” (Law 3299/04), which was amended by the law 3522 /06 , Article 37, is the current investment incentives Law , that is applicable to enterprises, covering all sectors of economic activity in the regions of the country. Regions with high unemployment rates and low income per capita receive the highest investment subsidies from the State.</p> <p>More specifically, for the purpose of investment incentives, Greece is divided into 3 different zones for public subsidy levels.</p> <p>Investments in RES installations (both electricity- and heat-producing ones) keep their favoured status under this Law such as investments in</p>

	<p>high technology, environmental protection, tourism, etc. The funding concerns a subsidy for the total investment cost and can be 20%-60% depending on the region and the size of the company.</p> <p>The following categories in the energy sector are eligible for incentives under the Development Law:</p> <ul style="list-style-type: none"> * Power generation, in the form of warm water, steam. * Production of solid fuels from biomass. * Cogeneration of electricity and heat. * Energy production from renewables, and especially wind and solar, hydroelectric, geothermal energy and biomass. * Environmental protection and waste disposal projects. <p>For further info please visit the following links:</p> <ul style="list-style-type: none"> ▪ <u>BUSINESS ACTIVITIES FALLING UNDER THE PROVISIONS OF THE INVESTMENT INCENTIVES LAW</u> ▪ <u>DIVISION OF THE COUNTRY INTO ZONES</u> ▪ <u>INCENTIVES ON OFFER</u> ▪ <u>TERMS AND CONDITIONS FOR OBTAINING THE INCENTIVES SUBSIDIZED EXPENSES</u> ▪ <u>PROCEDURES AND APPLICATION OF THE INVESTMENT INCENTIVES LAW</u> ▪ <u>MONITORING AND CONTROL</u> ▪ <u>SPECIAL CASES UNDER THE PROVISION OF THE INVESTMENT INCENTIVES LAW CATEGORIES OF BUSINESS ACTIVITIES</u>
Documents	See § <i>short description</i>
Source of information	Invest in Greece Agency (Hellenic Agency for Investments)
Year of beginning	2006 (ongoing)
Information website	www.elke.gr , www.mnec.gr

6.2.3 Programme 3 – TAX DEDUCTION

Programme Name	TAX DEDUCTION (Law 3522/06)
Organisation	Greek Ministry for Economy & Finance Local Tax Office/ Local Public Fiscal Service
Street	-----
Postal code	-----
City	-----
Email	-----
Telephone	Ministry for Economy & Finance (Income DPT) +30 2103332000 +30 2103375000
Type of Support	Tax Deduction
Available Money	-----
Share of total budget	Depending on the category of business activity and the climatic zone
Who can apply	End user
Requirements for application	See § <i>short description</i>
Targeted areas	End user/household sector
Short description	Within the law 3522/06 there is an article that refers to a 20% tax deduction for a series of equipment including off-grid RES systems, thermal solar heating & natural gas systems, thermal insulation retrofits with a maximum absolute deduction of 700€, mainly targeting to private individu-

	als for the installation of such systems in the household sector.
Documents	Invoice of the equipment
Source of information	CRES
Year of beginning	2006 (ongoing)
Information website	http://www.cres.gr/kape/epixeiriseis_ependites_uk.htm

6.3 Cost Benefit Analysis

Since most of the swimming pools are not monitored and there is no data of the energy cost breakdown, a cost benefit analysis for the existing swimming pools is not feasible. To overcome the lack of data, 9 representative cases of the vast majority of the installed systems in Greece were selected, assumed and analysed. The geographical areas selection was based on the different climate conditions and the different sized pools scattered all over the country (i.e. small sized pools in private sector and small islands). These cases were simulated using the T*SOL software and the results were used for the cost benefit analysis. In order to have a better comparison between different climatic zones in Greece, identical swimming pools with identical solar thermal systems were compared. This comparison clearly shows the effect of the location of installation on the use of back up heating and the amortisation periods.

6.3.1 Small Pools

Small size (up to 100m²) outdoor swimming pools are very common in Greece. Private swimming pools with sizes from 30 to 80m² are usually constructed in newly developed areas especially around major cities in Greece and islands. In most cases, there is no heating system installed, or the pool heating system is connected to the main house heating distribution network, heated by oil boilers. In this case, 3 small size swimming pools (60m²) are considered in 3 different geographical areas of Greece, heated by oil.

Amortisation of a absorber system for outdoor pools with 60 m² pool surface in Athens

Heating system	Oil	Absorber	Unit
Investment costs	1000	6000	€
Capital costs			
Net Energy	16.93	16.93	MWh
Auxiliary energy	0	0	
Fuel demand	1682		Lt
Oil- and Electricity costs	1184	5	€
Maintenance	300	300	€
Total yearly costs	1484	305	€
Heat price			
Amortisation time		7	Years
Calculation assumptions:			
Electricity costs:	0.1	0.1	€
Oil costs	0.7	0.7	€
Absorber surface		60	m ²

Time frame	20	20	Years
Interest rates	5	5	%

Amortisation of a absorber system for outdoor pools with 60 m² pool surface in Naxos Island

Heating system	Oil	Absorber	Unit
Investment costs	1000	6000	€
Capital costs			
Net Energy	23.99	23.99	MWh
Auxiliary energy		0	
Fuel demand	2384		Lt
Oil- and Electricity costs	1674	6	€
Maintenance	300	300	€
Total yearly costs	1974	306	€
Heat price			
Amortisation time		5	Years
Calculation assumptions:			
Electricity costs:	0.1	0.1	€
Oil costs	0.7	0.7	€
Absorber surface		60	m ²
Time frame	20	20	Years
Interest rates	5	5	%

Amortisation of a absorber system for outdoor pools with 60 m² pool surface in Crete Island

Heating system	Oil	Absorber	Unit
Investment costs	1000	6000	€
Capital costs			
Net Energy	13.64	13.64	MWh
Auxiliary energy	0	0	
Fuel demand	1355		Lt
Oil- and Electricity costs	952	4	€
Maintenance	300	300	€
Total yearly costs	1252	304	€
Heat price			
Amortisation time		8	Years
Calculation assumptions:			
Electricity costs:	0.1	0.1	€
Oil costs	0.7	0.7	€
Absorber surface		60	m ²
Time frame	20	20	Years
Interest rates	5	5	%

6.3.2 Medium Pools

The vast majority of medium size (up to 500 m²) swimming pools are constructed in the tourist sector (hotels, thalassotherapy centers, luxurious bungalows complexes) in Greece. Since most of the hotels have seasonal occupancy and/or operation, these swimming pools are heated to extent operating period. The heating medium varies, but the most common is oil boilers.

Amortisation of a 150m² absorber system for outdoor pools with 200 m² pool surface in Athens

Heating system	Oil	Absorber	Unit
----------------	-----	----------	------

Investment costs	1500	15000	€
Capital costs			
Net Energy	37.45	37.45	MWh
Auxiliary energy	0	0	
Fuel demand	3720		Lt
Oil- and Electricity costs	2616	11	€
Maintenance	500	500	€
Total yearly costs	3116	511	€
Heat price			
Amortisation time		7	Years
Calculation assumptions:			
Electricity costs:	0.1	0.1	€
Oil costs	0.7	0.7	€
Absorber surface		150	m ²
Time frame	20	20	Years
Interest rates	5	5	%

Amortisation of a 150m² absorber system for outdoor pools with 200 m² pool surface in Naxos Island

Heating system	Oil	Absorber	Unit
Investment costs	1500	15000	€
Capital costs			
Net Energy	55.63	55.63	MWh
Auxiliary energy		0	
Fuel demand	5528		Lt
Oil- and Electricity costs	3885	16	€
Maintenance	500	500	€
Total yearly costs	4385	516	€
Heat price			
Amortisation time		5	Years
Calculation assumptions:			
Electricity costs:	0.1	0.1	€
Oil costs	0.7	0.7	€
Absorber surface		150	m ²
Time frame	20	20	Years
Interest rates	5	5	%

Amortisation of a 150m² absorber system for outdoor pools with 200 m² pool surface in Crete Island

Heating system	Oil	Absorber	Unit
Investment costs	1500	15000	€
Capital costs			
Net Energy	28.52	28.52	MWh
Auxiliary energy	0	0	
Fuel demand	2834		Lt
Oil- and Electricity costs	1993	9	€
Maintenance	500	500	€
Total yearly costs	2492	509	€
Heat price			
Amortisation time		9	Years
Calculation assumptions:			
Electricity costs:	0.1	0.1	€
Oil costs	0.7	0.7	€
Absorber surface		150	m ²
Time frame	20	20	Years
Interest rates	5	5	%

6.3.3 Large Pools

Large size swimming pools are usually used for professional purposes (public or private athletic and swimming centres). These swimming pools are all heated using oil boilers except those in Athens where the gas supply network was recently established. Since these swimming pools are designed for a professional use (28 °C), flat plate collectors are used with 40% co-funding.

Amortisation of a 250m² flat plate system for outdoor pools with 500 m² pool surface in Athens

Heating system	Oil	Flat plate	Unit
Investment costs	3000	18000	€
Capital costs		30000	€
Net Energy	98.85	98.85	MWh
Auxiliary energy	0	0	
Fuel demand	9823		Lt
Oil- and Electricity costs	6909	33	€
Maintenance	600	600	€
Total yearly costs	7509	633	€
Heat price			
Amortisation time		4	Years
Calculation assumptions:			
Electricity costs:	0.1	0.1	€
Oil costs	0.7	0.7	€
Absorber surface		250	m ²
Time frame	20	20	Years
Interest rates	5	5	%

Amortisation of a 250m² flat plate system for outdoor pools with 500 m² pool surface in Thessaloniki

Heating system	Oil	Flat plate	Unit
Investment costs	3000	18000	€
Capital costs		30000	€
Net Energy	96.05	78.64	MWh
Auxiliary energy		17.41	
Fuel demand	9545	1730	Lt
Oil- and Electricity costs	6708	1238	€
Maintenance	600	600	€
Total yearly costs	7308	1838	€
Heat price			
Amortisation time		4	Years
Calculation assumptions:			
Electricity costs:	0.1	0.1	€
Oil costs	0.7	0.7	€
Absorber surface		250	m ²
Time frame	20	20	Years
Interest rates	5	5	%

Amortisation of a 250m² flat plate system for outdoor pools with 500 m² pool surface in Crete Island

Heating system	Oil	Flat plate	Unit
Investment costs	3000	18000	€
Capital costs		30000	€
Net Energy	86.54	86.54	MWh
Auxiliary energy	0	0	
Fuel demand	8599		Lt

Oil- and Electricity costs	6046	26	€
Maintenance	600	600	€
Total yearly costs	6646	626	€
Heat price			
Amortisation time		4	Years
Calculation assumptions:			
Electricity costs:	0.1	0.1	€
Oil costs	0.7	0.7	€
Absorber surface		250	m ²
Time frame	20	20	Years
Interest rates	5	5	%

6.3.4 Overview

Parameter	Small pools			Medium pools			Large pools		
	Pool1	Pool2	Pool3	Pool1	Pool2	Pool3	Pool1	Pool2	Pool3
Specific System costs (EUR/m ²)	100	100	100	75	75	75	120	120	120
Specific Yield (kWh/m ² season)	282.2	399	227.3	249.7	370.8	190.2	395.4	314.5	346
Heat price (EUR/kWh)	0.018	0.012	0.02	0.013	0.009	0.018	0.006	0.023	0.007
Amortisation time (static)	7	5	8	7	5	9	4	4	4

6.3.5 Conclusion

The investment cost for solar heating systems for outdoor pools is higher than the cost of conventional systems, as it is presented in the above table. However the operating cost of the solar heating is very low, resulting in an amortisation time of about 7 years. This period might be considered very long compared to other countries, but this is mainly due to the limited usage of solar energy in summer (where in most cases no heating is required). This amortisation time can be significantly reduced (up to 50%) for cases such as professional swimming pools and hotels where the cost of solar heating system for swimming pools is eligible in existing funding schemes.

7 Summary

The current report serves as the national fact sheet for Greece on the state of the demand and potential of solar heating of outdoor swimming pools. It was established through the collection of all available information that has been gathered since the beginning of the Solpool project. It furthermore contains three deliverables of the project:

- D05: National fact sheet on boundary conditions (see 7.1)
- D06: Requirement sheet for solar thermal use (Five Steps Guide to get good pool absorber system) (see 7.2) and
- D07: Funding sheet on existing grant schemes and new approaches (see 6.2)

In addition to the aforementioned deliverables this report starts with a short introduction which mainly focuses on the data collection process. In specific, a description is done in reference to the difficulties and obstacles met as well as the means for generalizations, estimations and assumptions that took place. At this point, the dynamic nature of the data enquiry should be mentioned, meaning that when new information became available it was immediately integrated to the report and the whole data collection was constantly updated.

Moreover, a brief paragraph refers to the climate of Greece and particularly to information related to solar radiation and sunlight.

The main part of the report consists of a market analysis. The state of the art of solar thermal applications is demonstrated and it is followed by a market observation in reference with the public as well as the private sector. Some selected examples are, also, presented here and serve as best practices for solar thermal heating of outdoor swimming pools.

Finally, the economical aspect of the market is represented with a number of references concerning specific system costs and funding schemes, whereas it concludes with a cost benefit analysis.

7.1 Boundaries for the implementation of solar heating systems for outdoor swimming pools

The following list shows the national and regional barriers, which should be surpassed to succeed in the implementation of solar thermal heating systems and subsequently to improve the awareness of the end users. This includes technical or climatic as well as governmental, financial and social barriers.

Technical or climatic barriers:

- The area required for the installation of unglazed collectors should be large and in a close distance to the swimming pool.

Financial barriers:

- Cost of flat plate collectors is higher than a heat pump
- No funding schemes for private users
- Lack of knowledge or information on funding schemes for professionals (hotels etc) when available

Governmental barriers:

- The height of collectors when installed should not exceed a specific maximum height according to the building's licence.

Social barriers:

- Lack of knowledge and awareness about solar thermal systems and funding schemes
- Limited interest on behalf of swimming pool installing companies to promote solar thermal systems
- Visual impact
- Architects negative approach to solar thermal collectors' implementation

7.2 Five Steps Guide to get good pool absorber system

First Step – Collecting basic information

Within the frame of the SOLPOOL project a variety information material has been developed. The brochures provide basic information on the technique, dimensioning, mounting, costs and benefits of solar thermal systems. The fact sheets show good practice examples and offer the opportunity to contact the owner / operator of a swimming pool for exchanging experiences. At least information help desks have been set up to provide everyone who is interested with helpful information. In addition information has been uploaded to the project web site like the presentations of the experts during the several information seminars and workshops (for further details: www.solpool.info/2015.0.html).

Second Step – Using the Check list

For a more concrete understanding, one may use the checklist provided with this document (see Appendix V). The basic parameters will be collected not only for getting information about the energy consumption of the swimming pool but also being later used as input data for the Impact Advisor. This Excel-based tool calculates the necessary collector area for a desired water temperature as well as the energy savings and CO₂ emissions achieved reduction.

Third step – Calculation with the Impact Advisor

The Impact Advisor is a neutral decision tool for the application of solar heating of outdoor swimming pools. It offers owner/operators as well as installers the main information for preparing the realization of a project. Based on the results of the impact advisor calculation one can decide whether the investment in a solar thermal system makes sense or not. The parameters investment costs and amortisation time give clear information about the most important economical facts.

The Impact Advisor can be downloaded under: <http://www.solpool.info/2104.0.html>

Fourth step – Ordering an offer

Based on the results of the Impact Advisor the owner / operator of a swimming pool may order an offer from a solar company skilled in planning and installing of solar thermal systems for open air swimming pools. For this purpose the SOLPOOL database may be used (<http://www.solpool.info/2017.0.html>).

Fifth step – The decision

After comparing the offers from the solar companies the owner/operator may use the service of the help desks to perform a last proof from independent site. This check will lead to a recommendation for a specific solution. In addition possible financial subsidies can be checked (see 6.2). Finally the decision will be made and the solar system will be ready to be installed.

8 References

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Interviews

11. Interview with Hydrocosmo (2007) URL: <http://www.hydrocosmo.com/>
12. Interview with LANSE pool A.E. (2007) URL: <http://www.lanse.com/>

APPENDIX I: Summary of Interview

Minutes from meeting with company concerning project SOLPPOL on 04/04/2007

Summary:

Company	Hydrocosmo
Address	Chanion 15-17, 123 51, Aghia Varvara tel: +30 210 5444546, +30 210 5620885, fax: +30 210 5699474 WebSite: www.pool.gr E-Mail : hydrocosmo@hellasnet.gr
Activities	<ul style="list-style-type: none"> • Pool manufacture from cement and tiling – tessera - painting • Premanufactured pools with conventional or compact engine room • Over ground garden swimming pools • Pool equipment (filters, pumps, lighting, stairs, etc) • Pool covers (isothermal – safety – automatic – folding arbors) • Automatic control systems for PH Redox • Pool chemical products (chlorine, etc) • Water fumigation with salts – ozone – ionization • Pool heating • Biological cleaning
Person in charge	Dimitrios Lamarinis

Customers	<ul style="list-style-type: none"> • Private sector (almost exclusively)
Swimming Pools Heating Systems	<ul style="list-style-type: none"> • Oil • Heat pumps (air) • Solar systems (tubes) • Electric heat exchangers

Information:

Market situation	Approximately 1500 pools per year, 5% -7% are outdoor with installed heating systems. The company installs approximately 150-200 per year
Experience in solar thermal systems	4-5 installations of solar heating systems (tubes) in total
Used heating systems	Oil with a 90% market share, small-sized electric heat exchanger and recent peak in heat pumps (with air) usage (also promoted by the company itself)
Cost (referring to 100m ³ , for 24h heating and ΔT=7°C)	Oil and heat pump: app. 4000-5000€ and solar thermal systems:+10% to 15%
Common heating needs	40 m ³ ⇒ 45000 cal 100 m ³ ⇒ 65000 cal 150 m ³ ⇒ 100000 cal
Common heating system / pool with a large market share	During the last years small swimming pools (cost: 10000€ and size: 3m x 7m) have demonstrated a wide approval, while the most common heating system selected is electric heat exchanger because of its low cost
Crucial parameters for solar thermal systems	<ul style="list-style-type: none"> • The most significant parameter refers not to the installation cost rather than the large area required, which, firstly demands the availability of a free large surface and most importantly the architectural integration and the visual impact acceptance • The usage of crystalline systems and a heating share for space heating could help • A funding or financial support alone could not offer much;

APPENDIX II: Questionnaire of the 2nd phase of data collection



Πληροφορίες: Πικέρμι, 3 Φεβρουάριου 2009
Ε. Κορμά
 Τμήμα Ανάπτυξης Αγοράς
 Τηλ.: 2106603319
 Fax: 2106603308
 e-mail: elkorpa@kassa.gr

Το Κέντρο Ανανεώσιμων Πηγών και Εξοικονόμησης Ενέργειας (ΚΑΠΕ) είναι ο εθνικός φορέας για την προώθηση των Ανανεώσιμων Πηγών (ΑΠΕ), της Ορθολογικής Χρήσης (ΟΧΕ) και της Εξοικονόμησης Ενέργειας (ΕΞΕ). Ιδρύθηκε το 1987, είναι Ν.Π.Ι.Δ. και εποπτεύεται από το ΥΠ.ΑΝ - Γ.Γ.Ε.Τ.

Κύριος σκοπός του είναι η προώθηση των εφαρμογών ΑΠΕ/ΟΧΕ/ΕΕ σε εθνικό και διεθνές επίπεδο, καθώς και η κάθε είδους υποστήριξη δραστηριοτήτων στους παραπάνω τομείς συνυπολογίζοντας τις περιβαλλοντικές επιπτώσεις.

Το ΚΑΠΕ στο πλαίσιο ευρωπαϊκού έργου που υλοποιεί, με αντικείμενο τη χρήση *Ηλιακής Ενέργειας για Θέρμανση Κολυμβητικών Δεξαμενών*, διενεργεί έρευνα προκειμένου να καταγραφούν οι ανάγκες και τα συστήματα θέρμανσης των κολυμβητικών δεξαμενών υψηλής επισκεψιμότητας που λειτουργούν στην Ελλάδα.

Θεωρώντας ότι η συνεργασία σας στην έρευνά μας θα έχει ιδιαίτερη βαρύτητα παρακαλούμε όπως συμπληρώσετε το συνημμένο πίνακα.

Τα στοιχεία που θα συλλεχθούν θα συμπεριληφθούν στην εθνική έκθεση, της οποίας η πρώτη έκδοση βρίσκεται ανηρτημένη στην ιστοσελίδα: <http://www.solpool.info/2146.0.html#c6940>.

Είμαστε στη διάθεσή σας για οποιαδήποτε επιπρόσθετη πληροφορία ή διευκρίνιση.

Αναμένοντας σε θετική ανταπόκρισή σας,

Έφη Κορμά,
 Τμήμα Ανάπτυξης Αγοράς - Marketing
 Δ/νση Ενεργειακής Πολιτικής & Σχεδιασμού

Συνημμένα: Πίνακας στοιχείων κολυμβητικών δεξαμενών

Κέντρο Ανανεώσιμων Πηγών Ενέργειας & Εξοικονόμησης Ενέργειας
 19ο χλμ Λαση. Μαρθώνος, 19009 Πικέρμι
 τηλ: 210 6603300, website: <http://www.kassa.gr>, email: cas@kassa.gr

Solar Energy Use in Outdoor Swimming Pools
 EIE-06-085 SOLPOOL



Γενικά Στοιχεία
 Κολυμβητική δεξαμενή _____
 Διαχειριστής/ιδιοκτήτης _____
 Οδός, αριθμός, τκ _____
 Τηλέφωνο _____
 Fax _____
 e-mail _____ ιστοσελίδα _____

Στοιχεία Κολυμβητικής Εγκατάστασης

Αριθμός κολυβ. δεξαμενών			
Περίοδος λειτουργίας		Ημερομηνία λήξης	
Ημερομηνία έναρξης			
Όρες λειτουργίας ημερησίως			

Δεξαμενή 1

Μήκος	m	Πλάτος	m
Επιθυμητή θερμοκρασία νερού	°C		°C

Δεξαμενή 2

Μήκος	m	Πλάτος	m
Επιθυμητή θερμοκρασία νερού	°C		°C

Δεξαμενή 3

Μήκος	m	Πλάτος	m
Επιθυμητή θερμοκρασία νερού	°C		°C

Στοιχεία υφιστάμενου συστήματος θέρμανσης

Δεν υπάρχει σύστημα θέρμανσης

Σύστημα θέρμανσης

Ηλεκτρισμός	Αντλία θερμότητας (αέρα)	Γεωθερμική Αντλία Θερμότητας	
Αντλία θερμότητας (νερού)	Υγραέριο (LPG)	Φυσικό Αέριο	
Πετρέλαιο	Θερμακό Ηλιακό Σύστημα	Τηλεθέρμανση	
Άλλο			

Κατανάλωση Ενέργειας για θέρμανση

Μέση κατανάλωση ηλεκτρικής ενέργειας ή καυσίμου ανά έτος		kWh, m ³ , litres
Κόστος Καταναλωόμενης Ενέργειας ανά έτος		€/έτος

Σχόλια-Παρατηρήσεις

Θα σας ενδιέφερε να ενημερωθείτε για τη χρήση της ηλιακής ενέργειας για τη θέρμανση κολυμβητικών δεξαμενών; ΝΑΙ ΟΧΙ

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APPENDIX III: Contact details of public & private pools (questionnaire distribution)

A/A	Name of the pool/town	Address	Postal code	City	email	url	Telephone Number (+30)	Fax Number (+30)
1	Athlitikos Nautikos Omilos Glufadas	Diadoxou Paulou 42, Glufada	16601	Athina	info@anog.gr	www.anog.gr	210 8944913	210 8944914
2	Ellinikos Nautikos Omilos Aiguption	Xersonisos Agiou Kosma	70214	Athina	enoa@otenet.gr	www.enoa.gr	210 9818525	210 9820729
3	Athlitiki Enosi Xaidariou	Athinon avenue and Agoniston Stratopedou	12461	Athina	aehaidariou@yahoo.gr	www.aehaidariou.blogspot.com	210 5324225	210 5821668
4	Athlitiki Enosi Keratsiniou	Kuprou and Spetson, Keratsini	18755		info@aekeratsiniou.gr	www.aekeratsiniou.gr	210 4962300	210 4962300
5	Athlitiko Somateio Almpatros Ano Liosion	Agiou Pelagous 1, Keratsini	18755	Athina	swimanoliosia@yahoo.gr	-	210 2470666	210 2470666
6	Athlitikos Nautikos Omilos Argyroupolis	Militou 2, Argyroupoli	16451	Athina	anoaswim@gmail.com	-	210 9623333	211 9623333
7	Athlitikos Nautikos Omilos Zakunthou	Kruoneri Zakunthou	29100	Zakunthos	anozak@yahoo.gr	www.zakynthos.com.gr/anoz	26950 44097	269850 26856
8	Athlitikos Omilos Palaiau Falirou	Marina Floisvou		Athina	savek@hol.gr	-	210 9889333	211 9889333
9	Athlitikos Nautikos Omilos Proteas Lamias	Erythrou Stavrou 1	35100	Lamia	postmaster@proteaslamias.gr	www.proteaslamias.gr	22310 23637	22310 23637
10	Athlitikos Omilos Olympiada Petroupolis	Eleutheriou Venizelou 5, Petroupoli	13232	Athina	olpet96@yahoo.gr	www.olympiada.org.gr	210 5050000	211 5050000
11	Athlitikos Omilos Nireas Geraka	Garitou and Miltiadou	15344	Athina	info@swimmers.gr	www.swimmers.gr	210 6615645	210 6654160
12	Athlitikos Omilos Olumpiadas 73	Dimarxeiou 56, Aigaleo	12242	Athina	iliasgiarenis@ath.forthnet.gr	-	210 5910157	210 5910157
13	Athlitikos Omilos Nireas Chalandriou	Pentelis Avenue 150	15234	Athina	nireas@nireaspatras.com	www.nireashal.com	210 6827722	210 6853263
14	Athlitikos Omilos Kolonou	Leandrou 37-39	10443	Athina	aokolonou@yahoo.gr	-	210 5148601	210 5148601

A/A	Name of the pool/town	Address	Postal code	City	email	url	Telephone Number (+30)	Fax Number (+30)
15	Athlitikos Omilos Aigaiou	Ritsou Gianni 1	82100	Xios	aoa@aoaclub.gr	www.aoaclub.gr	22710 42897	22710 42019
16	Athlitiki Akadimia Kolumvisis "Nireas 89", Alexandroupoli	Ainou 48	68100	Alexandroupoli	saki.sf@hotmail.com	-	25510 80980	25510 80980
17	Akadimia Kolumvisis "Nireas", Patras	Ypsilantou 125	26225	Patras	nireas@nireas-patras.com	www.nireas-patras.com	2610 465180	2610 223520
18	Akadimia Kolumvisis Kavallas	Aristotelous 19	65302	Kavala	stagidis@yahoo.gr	www.akka.gr	2510 231200	250 836384
19	Aiolos Petroupolis	Elaion and K.Varnali 1, Petroupoli	13231	Athina	aiolospetroupolis@yahoo.gr	-	210 5063930	210 5063930
20	A.K.O Chalkidas	Alonaki	34100	Chalkida	akoxalkidas@yahoo.gr	-	22210 88311	22210 88311
21	Athlitiki Enosi Kalamatas	Irodou 12	24100	Kalamata	info@argis.gr	www.argis.gr	27210 63354	27211 63034
22	Athlitikos Sullogos Grevenon	Fassa and Anonimou 51	51100	Grevena	info@megalexandros.gr	www.megalexandros.gr		
23	Gumnastikos Nautikos Omilos Aris Nikaias	Petrou Ralli 131	18545	Athina	info@arisnikeas.com	www.arisnikeas.com	210 4920820	210 4915528
24	Gumnastikos Sullogos Kifissias	Kifissias Avenue 192	14562	Athina	info@gskifissias.gr	www.gskifissias.gr	210 8018460	210 8018460
25	Delfinia Metamorfosis	Ploutonos 2A, Metamorfosi	14451	Athina	delfmet@gmail.com	-	210 2583427	210 2827974
26	Doxa Artas	Maximou Graikou 16	47100	Arta	aodoxa@yahoo.gr	http://aodoxa.gr	26810 78150	
27	Ethnikos Kozanis	Vaileiou Fori 1	50100	Kozani	info@ethnikoskozanis.gr	www.ethnikoskozanis.gr/	24610 02995	24610 029995
28	Omilos Naupliou	Martiou 25 Street 6, Pronoia	21100	Nauplio	eurosnafpliou@otenet.gr	-	27520 25880	27520 25880
29	Gumnastikos Athlitikos Sullogos Iasonas	Karaoli and Dimitriou 175, Nikaia	18453	Athina	info@iasonas.gr	www.iasonas.gr	210 4910620	

A/A	Name of the pool/town	Address	Postal code	City	email	url	Telephone Number (+30)	Fax Number (+30)
30	Kolumvtikos Athlitikos Omilos Ilion	Ioulianou 31, Ilion	13121	Athina	chkalokiris@in.gr	-	210 2622398	210 2386286
31	Kolumvitikos Omilos Peristeriou Glaukos	Peukon and Eukalupton, Peristeri	12137	Athina	delgas@hol.gr	www.glafkos.com.gr	210 5055077	210 5055077
32	Kolumvitikos Omilos Tripolis	Ouasigton and Dimitsanis 1	22100	Tripoli	info@koat.gr	www.koat.gr	2710 224114	2710 242773
33	Kolumvitikos Omilos Dramas	Armen 33	66100	Drama	kodramas@otenet.gr	-	25210 26158	2521020161
34	Kolumvitikos Omilos Komotinis	Marasli 15	69100	Komotini	kokomotinis@gmail.com	-	25310 21512	25310 21512
35	Kolumvitikos Omilos Ilision	Tsirka 8, Ilisia	11745	Athina	kopi1981@in.gr	-	210 7757231	210 7757231
36	Kolumvitikos Omilos Irakleiou	Sprou Moutsakli	71500	Irakleio	info@koh.com.gr	http://www.koh.com.gr/	2810 250666	2811 250666
37	Makedonikos	Neapoli	56728	Thessaloniki	info@makedonikowim.gr	www.makedonikowim.gr		
38	Nautikos Athlitikos Omilos Kerkiras	Dimokratias avenue	49100	Kerkira	naokswim@yahoo.gr	-	2310 636368	2311 636368
39	Nautikos Athlitikos Omilos Volou	Anauros	38110	Voloas	nova@novaswim.gr	www.novaswim.gr	24210 20376	24210 20376
40	Nautikos Athlitikos Omilos Vouliagmenis	Laimos Vouliagmenis	16671	Athina	nov@nov.gr	www.nov.gr	210 8962416	210 8964022
41	Nautikos Athlitikos Omilos Korinthou	Argous avenue	20100	Korinthos	info@nokorinthou.gr	www.nokorinthou.gr	27410 28630	27410 28630
42	Nautikos Athlitikos Kalamatas	Akti Dimaion Ptr	26333	Patra	nop.acadies@gmail.com	www.nop.org.gr	2610 317766	2610 424908
43	Nautikos Athlitikos Omilos Chanion	Akti Kanari	73131	Crete	nektaria@nox.gr	nox@cha.forthnet.gr	28210 96078	28210 96077
44	Nautikos Athlitikos Omilos Kavalas				info@nokavalas.gr	www.nokavalas.gr	2510 222897	2511 222897

A/A	Name of the pool/town	Address	Postal code	City	email	url	Telephone Number (+30)	Fax Number (+30)
45	Chalandti Tennis Club	Garoutou 13, Chalandri	15232	Athina	info@tennis-club.gr	www.halandritennisc lub.gr	210 6398336	210 6007830
46	Aquadome	2° km Varis - Koropiou	19003	Athina	aqua-dome@otenet.gr	www.aquadome.gr	210 8975222	210 8975222
47	Family Sports Club	Mitropoulou and Kalianiou, Vrilisia	15235	Athina	info@sportsclub.gr	www.familysportsclub.gr	210 8104862	210 8104694
48	Aqua Life	Agiou Athanasiou and Souliou 17	14569		info@swimandspa.gr	http://www.aqualifecenter.gr/	210 8004438	
49	Hellenic Aquatic Club	Tsitsani 38, Glufada	16675	Athina	dimos@hac.co.gr	www.hac.co.gr	210 8955905	
50	Life up	Athinon avenue 314	12462	Athina	-	www.lifeup.gr	210 5320555	210 5322900
51	Petagon Sports Management	Kerasountos 68, Kalamaria	55131	Thessaloniki	info@pentagon.gr	www.pentagon.gr	2310 427282	2310 427279
52	Sportcamp	Katounistra area	20300	Loutraki	sport-camp@sportcamp.gr	www.sportcamp.gr	27440 23999	2744026930

Appendix IV: Contact details and data of public & private pools (filled questionnaires & telephone interviews)

SOLPOOL

List of Professional Pool Owners and Operators -(public private sector)

# of pools	Name of the pool/town	Address	City	email	url	Telephone Number (+30)	Fax Number (+30)	Operator	Pool Type	Length * Width	Temperature	Pool Heating Period	Time schedule	Existing Heating System	Fuel	Fuel consumption	Fuel Cost	Filled Questionnaires
1	Athlitiko Kentro Dimou Grevenon (1)	Oktovriou 13 street, 85	Grevana			24620 80020	24620 23980	Municipality	Indoor	25X33	27o c	September-July (6/7)	15:00 - 21:30	Boiler	Oil	80.000 lt / year	50.000 € / year	√
2	Athlitiko Kentro Dimou Grevenon (2)	Oktovriou 13 street, 85	Grevana			24620 80020	24620 23980	Municipality	Indoor	10X10	27o c	September-July (6/7)	15:00 - 21:30	Boiler	Oil			√
3	Nautikos Omilos Vouliagmenis	Laimos Vouliagmenis	Athina	nov@nov.gr	www.nov.gr	210 8962416	210 8964022	Municipality	Outdoor	50X20	26 o c	January - December (7/7)	17 h	Boiler	Oil	165.000 lt / year	136.000 € / year	√
4	SportCamp (1)	Katounistra area	Loutraki	sportcamp@sportcamp.gr	www.sportcamp.gr	27440 23999	27440 26930	Private Body	Outdoor	25X12.5	26 o c	January - December (7/7)	24 h	Boiler	Liquid Gas		50.000 € / year	√
5	SportCamp (2)	Katounistra area	Loutraki	sportcamp@sportcamp.gr	www.sportcamp.gr	27440 23999	27440 26930	Private Body	Outdoor	12X6	24 o c	January - December (7/7)	24 h	Boiler	Liquid Gas			√
6	Aquadome (1)	2o km Varis - Koropiou	Athina	aquadome@otenet.gr	www.aquadome.gr	210 8975222	210 8975222	Private Body	Indoor	25X12.5	27.5 o c	October-May (7/7)	08:00 - 22:00	Boiler	Oil	94.000 lt / year		√
7	Aquadome (2)	2o km Varis - Koropiou	Athina	aquadome@otenet.gr	www.aquadome.gr	210 8975222	210 8975222	Private Body	Indoor	16X8	27.5 o c	October-May (7/7)	08:00 - 22:00	Boiler	Oil			√
8	Nautikos Omilos Patron (1)	Akti Dimaion Patra	Patra	nop.acadies@gmail.com	www.nop.org.gr	2610 317766	2610 424908	Municipality	Outdoor	33X25	27o c	January - December (7/7)	12 h	Boiler	Natural Gas			√
9	Nautikos Omilos Patron (2)	Akti Dimaion Patra	Patra	nop.acadies@gmail.com	www.nop.org.gr	2610 317766	2610 424908	Municipality	Outdoor	17X10	28o c	January - December (7/7)	12 h	Boiler	Natural Gas			√
10	Dimos Kozanis (1)	Pandoras 2	Kozani	info@gskozanis.gr	www.gskozanis.gr	24610 34311	24610 22123	Municipality	Outdoor	25X10	25o c	August - July (7/7)	10 h	Boiler	Oil and District Heating			√
11	Dimos Kozanis (2)	Pandoras 2	Kozani	info@gskozanis.gr	www.gskozanis.gr	24610 34311	24610 22123	Municipality	Outdoor	10X6	25o c	August - July (7/7)	10 h	Boiler	Oil and District Heating			√
12	Dimos Kalamatas (1)	Filelinon and Omirou	Kalamata	klmnc@otenet.gr		27210 29717	27210 22367	Municipality	Outdoor	50X25	26.6o c	September-July (6/7)	12 h	Boiler	Oil	120.000 lt / year		√
13	Dimos Kalamatas (2)	Filelinon and Omirou	Kalamata	klmnc@otenet.gr		27210 29717	27210 22367	Municipality	Outdoor	10X12	29o c	September-July (6/7)	12 h	Boiler	Oil			√
14	Family Sports Club	Mitropoulou and Kalianiou, Vrilisia	Athina	info@sportsclub.gr	www.familysportsclub.gr	210 8104862	210 8104694	Private Body	Outdoor	20X10	28o c	January - December (7/7)	10:00 - 20:00	Boiler	Oil			√
																		Phone Interviews
1	Athlitikos Nautikos Omilos Glufadas (1)	Diadoxou Paulou 42, Glufada	Athina	info@anog.gr	www.anog.gr	210 8944913	210 8944914	Private Body	Outdoor	50X25		September-May	12:00 - 20:30	Boiler	Oil			√
2	Athlitikos Nautikos Omilos Glufadas (2)	Diadoxou Paulou 42, Glufada	Athina	info@anog.gr	www.anog.gr	210 8944913	210 8944914	Private Body	Indoor	15X10		September-May	14:00 - 20:30	Boiler	Oil			√
3	Athitikos Omilos Nireas Geraka	Garitou and Miltiadou	Athina	info@swimmers.gr	www.swimmers.gr	210 6615645	210 6654160	Municipality	Outdoor	50X25		January-December	07:00 - 21:00	Boiler	Oil			√
4	Athlitikos Omilos Ionikos Nikaias (1)	Petrou Ralli 133	Athina			210 4972003	210 4962942	Municipality	Outdoor	50X25		September-July	07:00 - 22:30	Boiler	Natural Gas			√
5	Athlitikos Omilos Ionikos Nikaias (2)	Petrou Ralli 133	Athina			210 4972003	210 4962942	Municipality	Outdoor	10X8		September-July	07:00 - 22:31	Boiler	Natural Gas			√
6	Athlitiki Akadimia Nireas 89 Alexandroupolis	Ainou 47	Alexandroupoli	saki.sf@hotmail.com	http://gonow.to/nireas89	25510 80980	25510 80980	Municipality	Indoor	25X12		September-May	08:00 - 22:00	Boiler	Oil		45.000 € / year	√
7	Aiolos Petroupolis (1)	Elaion and K.Varnali, Petroupoli	Athina	aiolospetroupolis@yahoo.gr		210 5063930	210 5063930	Municipality	Outdoor	25X15		January-December	08:00 - 22:00	Boiler	Natural Gas			√
8	Aiolos Petroupolis (2)	Elaion and K.Varnali 1, Petroupoli	Athina	aiolospetroupolis@yahoo.gr		210 5063930	210 5063930	Municipality	Outdoor	8X8		January-December	13:00 - 21:00	Boiler	Natural Gas			√
9	A.K.O Chalkidas	Alonaki	Chalkida	akoxalkidas@yahoo.gr		22210 88311	22210 88311	Municipality	Outdoor	50		September-July	11:30 - 22:00	Boiler	Oil			√

SOLPOOL

List of Professional Pool Owners and Operators -(public private sector)

# of pools	Name of the pool/town	Address	City	email	url	Telephone Number (+30)	Fax Number (+30)	Operator	Pool Type	Length * Width	Temperature	Pool Heating Period	Time schedule	Existing Heating System	Fuel	Fuel consumption	Fuel Cost	Filled Questionnaires
10	Gumnastikos Nautikos Omilos Aris Nikaias (1)	Petrou Ralli 131	Athina	info@arisnikeas.com	www.arisnikeas.com	210 4920820	210 4915528	Municipality	Indoor	50X25		September-July	06:00 - 23:00	Boiler	Oil	1.000 lt / Day		√
11	Gumnastikos Nautikos Omilos Aris Nikaias (2)	Petrou Ralli 131	Athina	info@arisnikeas.com	www.arisnikeas.com	210 4920820	210 4915528	Municipality	Indoor	12X12		September-July	06:00 - 21:00	Boiler	Oil			√
12	Gumnastikos Sillogos Peristeriou (1)	Tzon Kenenti and Giannitson 81 A, Peristeri	Athina		www.peristerigs.gr	210 5055125	210 5055125	Private Body	Indoor	50		September-July	06:00 - 23:30	Boiler	Oil			√
13	Gumnastikos Sillogos Peristeriou (2)	Tzon Kenenti and Giannitson 81 A, Peristeri	Athina		www.peristerigs.gr	210 5055125	210 5055125	Private Body	Indoor	22		September-July	06:00 - 23:30	Boiler	Oil			√
14	Kolumvitikos Omilos Tripolis (1)	Ouasikton and Dimitsanis 1	Tripoli	info@koat.gr	www.koat.gr	2710 224114	2710 24773	Municipality	Indoor	50X25		September-July	16:00 - 21:00	Boiler	Oil			√
15	Kolumvitikos Omilos Tripolis (2)	Ouasikton and Dimitsanis 1	Tripoli	info@koat.gr	www.koat.gr	2710 224114	2710 24773	Municipality	Indoor	25X15		September-July	16:00 - 21:00	Boiler	Oil			√
16	Kolumvitikos Omilos Dramas (1)	Armen 33	Drama	kodamas@otenet.gr		25210 26158	25210 20161	Municipality	Indoor	25X12		August-May	12:30 - 22:00	Boiler	Oil			√
17	Kolumvitikos Omilos Dramas (2)	Armen 33	Drama	kodamas@otenet.gr		25210 26158	25210 20161	Municipality	Indoor	10X8		August-May	12:30 - 22:01	Boiler	Oil			√
18	Athlitikos Omilos Xiou	Ritsou Gianni 1	Xios	aoa@oaclub.gr	www.oaclub.gr	22710 42897	22710 42019	Private Body	Indoor	50X25		September-July	07:00 - 22:30	Boiler	Oil			√
19	OAKA (1)	Kifisias 37	Athina		www.oaka.com.gr	210 6850200	210 6834021	Municipality	Indoor	50X21		January-December	06:00 - 22:00	Boiler	Natural Gas			√
20	OAKA (1.1)	Kifisias 37	Athina		www.oaka.com.gr	210 6850200	210 6834021	Municipality	Indoor	25X12.5		January-December	06:00 - 22:00	Boiler	Natural Gas			√
21	OAKA (1.2)	Kifisias 37	Athina		www.oaka.com.gr	210 6850200	210 6834021	Municipality	Indoor	25X12.5		January-December	06:00 - 22:00	Boiler	Natural Gas			√
22	OAKA (1.3)	Kifisias 37	Athina		www.oaka.com.gr	210 6850200	210 6834021	Municipality	Indoor	50X21		January-December	06:00 - 22:00	Boiler	Natural Gas			√
23	OAKA (1.4)	Kifisias 37	Athina		www.oaka.com.gr	210 6850200	210 6834021	Municipality	Indoor	10X10		January-December	06:00 - 22:00	Boiler	Natural Gas			√
24	OAKA (1.5)	Kifisias 37	Athina		www.oaka.com.gr	210 6850200	210 6834021	Municipality	Indoor	25X33		January-December	06:00 - 22:00	Boiler	Natural Gas			√
25	OAKA (2)	Kifisias 37	Athina		www.oaka.com.gr	210 6850200	210 6834021	Municipality	Outdoor	50X25		January-December	06:00 - 22:00	Boiler	Natural Gas			√
26	OAKA (2.1)	Kifisias 37	Athina		www.oaka.com.gr	210 6850200	210 6834021	Municipality	Outdoor	25X21		January-December	06:00 - 22:00	Boiler	Natural Gas			√
27	Athlitikos Silogos Oduseas Thessalonikis	Gamveta 11	Thessaloniki		http://odysseas-swim.gr	2310 837739		Secretariat General of sports	Outdoor	25X12		September-July	06:00 - 22:00	Boiler	Natural Gas			√
28	Kolumvitirio Panathinaikou	Alexandras avenue 160	Athina	pao1908@otenet.gr	www.panathinaikos1908.gr	210 6464448	210 6424753	Private Body	Indoor	28X8		January-December	08:00 - 23:00	Heat Exchangers	Oil			√
29	Kolumvitirio Goudi	Georgiou Papandreou and Kanelopoulou	Athina			210 7771990		Municipality	Outdoor	50X30		September-July	09:00 - 23:00	Boiler	Natural Gas			√
30	Ethniko kolumvitirio Glufadas (1)	Foivis and Metaxa	Athina			210 8943807		Secretariat General of sports	Indoor	25X12		January-December	06:00 - 22:00	Boiler	Oil			√
31	Ethniko kolumvitirio Glufadas (2)	Foivis and Metaxa	Athina			210 8943807		Secretariat General of sports	Indoor	10X15		January-December	06:00 - 22:00	Boiler	Oil			√
32	Kerkira (1)	Kerkiras	Kerkira			26610 22594		Municipality	Indoor	50X25		September - May (7/7)	09:00 - 22:00	Boiler	Oil		120.000 € / year	√
33	Kerkira (2)	Kerkiras	Kerkira			26610 22594		Municipality	Indoor	15X15		September - May (7/7)	09:00 - 22:00	Boiler	Oil			√
34	Mytilini					22510 26477		Municipality	Outdoor	25X12		January - December (5/7)	07:00 - 22:30	Boiler	Oil			√
35	Chios (1)	Kontari Leukonias	Chios			22710 41300		Municipality	Indoor	50X25		November-July (7/7)	06:00 - 22:00	Boiler	Oil		140.000 € / year	√

SOLPOOL

List of Professional Pool Owners and Operators -(public private sector)

# of pools	Name of the pool/town	Address	City	email	url	Telephone Number (+30)	Fax Number (+30)	Operator	Pool Type	Length * Width	Temperature	Pool Heating Period	Time schedule	Existing Heating System	Fuel	Fuel consumption	Fuel Cost	Filled Questionnaires
36	Chios (2)	Kontari Leukonias	Chios			22710 41300		Municipality	Outdoor	33X21		November-July (7/7)	06:00 - 22:00	Boiler	Oil			√
37	Heraklio	Moutsakli Sp.				2810 250788		Secretariat General of sports	Outdoor	50X25		January - December (5/7)	06:00 - 23:30	Boiler	Oil		240.000 € / year	√
38	Chania (1)					28210 80710		Secretariat General of sports	Outdoor	50		October-April (7/7)	08:30 - 22:00	Boiler	Oil			√
39	Chania (2)					28210 80710		Secretariat General of sports	Indoor	25		October-April (7/7)	08:30 - 22:00	Boiler	Oil			√
40	Chania (3)					28210 80710		Secretariat General of sports	Indoor	15		October-April (7/7)	08:30 - 22:00	Boiler	Oil			√
41	Rethimno	Priskosoridi 1	Crete			28310 29881		Private Body	Indoor	25X12,5		October-Mayl (7/7)	24 h	Boiler	Oil		70.000 € / year	√
42	Agios Nikolaos	Agios Nikolaos Lasithiou	Crete			28410 22519		Secretariat General of sports	Outdoor	25X12		January - December (7/7)	07:30 - 22:30	Boiler	Oil			√
43	Sparti	Mataleika area	Sparti			27310 23300		Municipality	Outdoor	25X15		N/A	07:00 - 20:30	Heat Exchangers	Oil			√
44	Korinthos		Korinthos			27410 23240		Municipality	Outdoor	25X13		January-December (6/7)	13:30 - 22:30	Boiler	Oil		60.000 €/year	√
45	Pirgos (1)	Patron	Pirgos			26210 22774		Municipality	Outdoor	10X12		-----	only summer		Oil			√
46	Pirgos (2)	Patron				26210 22774		Municipality	Outdoor	10X13		January-December (7/7)	15:00 - 22:00	Boiler & Heat Exchangers	Oil	4.000 lt / 5 days		√
47	Volos (1)	Stadiou 1	Volos			24210 55390		Municipality	Outdoor	50X25		September-June (6/7)	06:00 - 00:00	Boiler	Natural Gas		221.055 € / year	√
48	Volos (2)	Stadiou 1	Volos			24210 55390		Municipality	Indoor	30X25		September-June (6/7)	06:00 - 00:00	Boiler	Natural Gas			√
49	Volos (3)	Stadiou 1	Volos			24210 55390		Municipality	Indoor	5X10		September-June (6/7)	06:00 - 00:00	Boiler	Natural Gas			√
50	Karditsa					24410 29820		Municipality	Indoor	25X15		September-July (6/7)	07:00 - 22:00	Boiler	Oil		120.000 € / year	√
51	Agrinio (1)		Agrinio			26410 28570		Municipality	Indoor	25X20		September-June (7/7)	07:00 - 22:00	Boiler	Oil	12.000 lt / month		√
52	Agrinio (2)		Agrinio			26410 28570		Municipality	Indoor	10X10		September-June (7/7)	07:00 - 22:00	Boiler	Oil			√
53	Ioannina (1)	8th Merarxias 24	Ioannina			26510 35603		Secretariat General of sports	Indoor	50X20		September-July (7/7)	11:00 - 23:00	Boiler	Oil	10.000 lt / 15 days		√
54	Ioannina (2)	8th Merarxias 24	Ioannina			26510 35603		Secretariat General of sports	Indoor	15X10		July-August (7/7)	11:00 - 23:00	Boiler	Oil			√
55	Preveza (1)	Kuani akti Prevezis	Preveza			26820 27693		Municipality	Outdoor	25X12		January-December (5/7)	14:00 - 21:00	Boiler	Oil	2.000 lt / 4 days		√
56	Preveza (2)	Kuani akti Prevezis	Preveza			26820 27693		Municipality	Outdoor	8X8		January-December (5/7)	14:00 - 21:00	Boiler	Oil			√
57	Edessa	Kostantinoupoleos 76	Edessa			23810 28040		Municipality	Indoor	25X15		September- July (7/7)	08:00 - 21:00	Boiler	Oil		50.000 € / year	√
58	Drama	M.Alexandrou 106	Drama			25210 24280		Municipality	Indoor	50X20		September- July (7/7)	12:30 - 22:00	Boiler	Oil	400 lt / DAY		√

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List of Professional Pool Owners and Operators -(public private sector)

# of pools	Name of the pool/town	Address	City	email	url	Telephone Number (+30)	Fax Number (+30)	Operator	Pool Type	Length * Width	Temperature	Pool Heating Period	Time schedule	Existing Heating System	Fuel	Fuel consumption	Fuel Cost	Filled Questionnaires
59	Kavala	Amerikanou Erithrou Stavrou 283	Kavala			2510 600105		Municipality	Outdoor	21X50		January-December (6/7)	06:00 - 22:30	Boiler & Heat Exchangers	Oil		150.000 € / year	√
60	Aleksandroupoli (1)	Vasileos Georgiou	Aleksandroupoli			25510 21122		Municipality	Indoor	50X12		October-May (7/7)	08:00 - 23:30	Boiler	Oil			√
61	Aleksandroupoli (2)	Vasileos Georgiou	Aleksandroupoli			25510 21122		Municipality	Indoor	8X8		October-May (7/7)	08:00 - 23:30	Boiler	Oil			√
62	Ksanthi		Ksanthi			25410 25533		Municipality	Outdoor	50X23		January-December (7/7)	07:30 - 22:30	Boiler	Oil		150.000 € / year	√
63	Ilisio	Taxilou 42	Athina			210 7797247		Municipality	Outdoor	50X25		November - April (7/7)	06:00 - 22:00	Boiler	Natural Gas			√
64	Aigaleo (1)	Dimarxeia 6	Athina			210 5903110		Municipality	Outdoor	50X24		September-April (7/7)	07:00 - 22:15	Boiler	Natural Gas			√
65	Aigaleo (2)	Dimarxeia 6	Athina			210 5903110		Municipality	Outdoor	10X12		September-April (7/7)	07:00 - 22:16	Boiler	Natural Gas			√
66	Rafina	Terma Nireas Proteos	Rafina			22940 26315		Municipality	Outdoor	25X12		September-July (7/7)	08:30 - 22:00	Boiler	Oil			√
67	Nea Smirni (1)	Trapezountos & Artakis	Athina			210 9333667		Municipality	Indoor	50X25		October- July (except Sundays)	06:00 - 23:00	Boiler	Natural Gas		150.000 € / year	√
68	Nea Smirni (2)	Trapezountos & Artakis	Athina			210 9333667		Municipality	Indoor	15X5		October- July (except Sundays)	06:00 - 23:00	Boiler	Natural Gas			√
69	Panellinios	Mauromataion 26	Athina	michas@panellinios-ac.gr	www.panellinios-ac.gr	210 8834408		Private Body	Indoor & Outdoor	33X20		January-December (7/7)	06:00 - 21:00		Natural Gas			√
70	EAK P.Falirou (1)	Marina Floisvou -parko Trokadero	Athina			210 9825917		Municipality	Outdoor	25X33		September-July (7/7)	09:00 - 23:30	Boiler	Natural Gas		60.000 € / year	√
71	EAK P.Falirou (2)	Marina Floisvou -parko Trokadero	Athina			210 9825918		Municipality	Outdoor	8X12		September-July (7/7)	09:00 - 23:31	Boiler	Natural Gas			√
72	Chaidari	Agonistos Stratopedou & Kavalas avenue	Athina			210 5819601		Municipality	Outdoor	50X25		January-December (7/7)	06:00 - 00:00		Natural Gas			√
73	Chalandri	Pentelis avenue 150	Athina			210 6819350		Municipality	Outdoor	25X33		September-May (7/7)	07:30 - 20:30		Oil			√
74	Grava	Passon 10, Galatsi	Athina			210 2282714		Municipality	Outdoor	25X13		September-June (7/7)	08:00 - 23:00	Boiler & Heat Exchangers	Natural Gas			√

Appendix V: Checklist

Name of the swimming pool _____

Owner: Surname, name _____

Postal code, place _____

Street name and number _____

Phone _____

Fax _____

E-Mail _____

Homepage _____

Operation period starts _____ and ends _____

Closed period in summer _____

Data of swimming pool

Number of pools _____

Pool 1

Pool length _____ m Pool width _____ m

Mean targeted pool temperature _____

Pool 2

Pool length _____ m Pool width _____ m

Mean targeted pool temperature _____

Pool 3

Pool length _____ m Pool width _____ m

Mean targeted pool temperature _____

Building 1

Usable floor of the roof _____

Building 2

Usable floor of the roof _____

Data of the heating system

No heating system

Heating system

Electric	<input type="checkbox"/>	Heat pump air	<input type="checkbox"/>	Heat pump soil	<input type="checkbox"/>
Heat pump water	<input type="checkbox"/>	LPG	<input type="checkbox"/>	Gas	<input type="checkbox"/>
Oil	<input type="checkbox"/>	Solar thermal	<input type="checkbox"/>	District heating	<input type="checkbox"/>

Energy consumption

Mean fuel consumption per year _____ kWh/m³/bottles/litres

Energy costs per year _____ €/a

Remarks
