Solar Water Heating for Swimming Pools

From RVR

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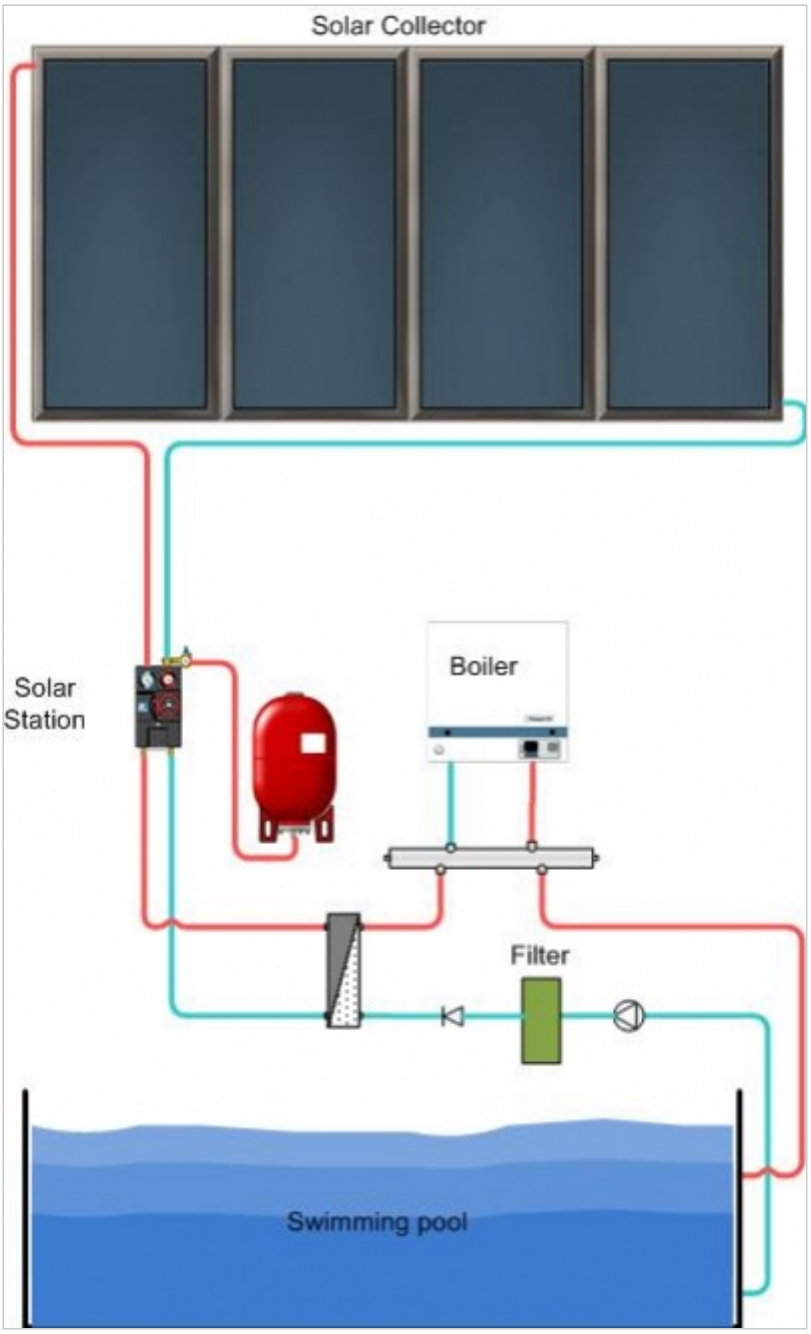
System Design

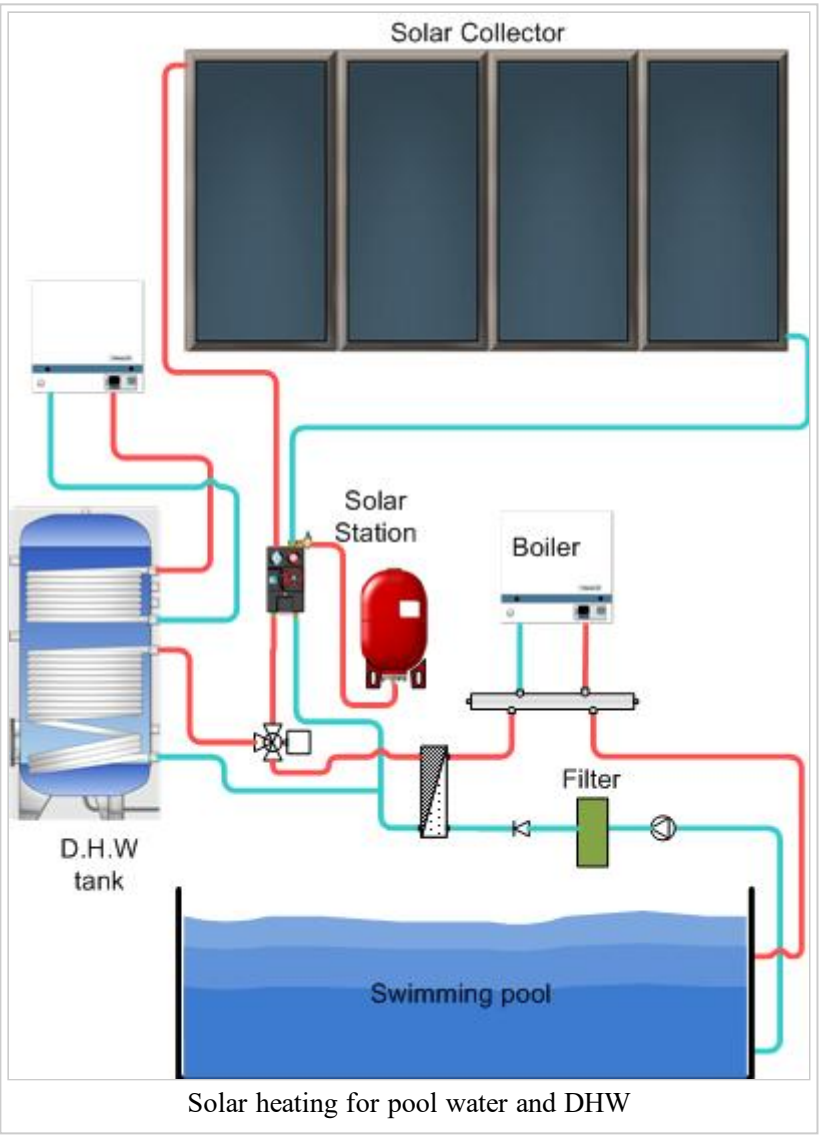
Swimming pools (both commercial and private / garden) are an ideal use of solar energy. As the swimming pool requires energy at low temperatures (typical pool water temperature 28°C - 30°C), the collectors operate efficiently. The pool also provides a large thermal store which can absorb all of the energy collected. Collector stagnation is rarely a problem in swimming pool applications. This results in high system efficiency and results in a good return on investment.

The installation of solar heating for a swimming pool is one of the best investments in renewable energy that can be made by a hotel or similar business.

Typical schematics are shown in the following diagrams.



Solar heating for pool water



Solar heating for pool water and DHW

The solar system is at it's most efficient when heating pool water and this should always be prioritised in order to maximise the return on investment.

In situations where there is also a demand for hot water, the priority should be always given to the pool. When the pool demand is satisfied, then the solar collectors can be used to heat the hot water also.

Solar can also be used in domestic pools, offering substantial savings on fuel bills. Should you require any advice on using solar energy on a awimming pool project, please contact RVR for further guidance.

Feasibility Study for Swimming pool applications

Using specialised solar simulation software, RVR can evaluate a project and calculate the rate of return on the investment. A feasibility study will contain the following:

- Plant description and schematics
- A solar simulation showing the energy in kWh which can be gained from using solar.
- Financial analysis with the projected rate of return for the investment.

In order to prepare a feasibility study the following information is needed:

- What size is the pool and what is the usage pattern?
- What space is available for solar collectors?
- Details of the plant room space available for water heaters, expansion vessels and controls.

- Consumption of domestic hot water; litres used per day, patterns of usage through out the day and year.
- If the building is existing, detail on any heating equipment on site.
- Backup heating and the price paid for fuel.

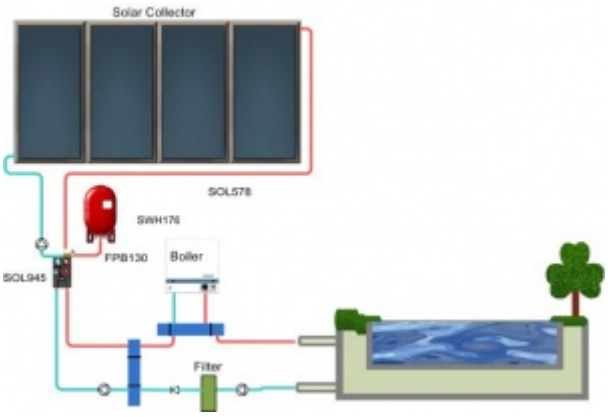
Feasibility Study Example

The rationale behind the design of solar thermal systems is to achieve close to 100% of the summertime heat requirement. The solar yield during the other months will be lower. Over the course of a year the system will contribute in the region of 60% - 70% of the total energy requirements i.e. a solar fraction of 60% - 70%.

The T*SOL software simulation below has been carried out for a hotel project. The system proposed consists of fifteen FA 2/6 commercial flat plate collectors giving 162.9m^2 of aperture area. The projected output is as follows:

- Annual energy yield of 89.75 Mwh.
- DHW Solar Fraction of 63.5%.
- CO_2 savings of 18936.318 kg per annum

Solar Hydraulic Layout Example



Solar Simulation Example

Sample Commercial Project
Hotel Project Swimming Pool

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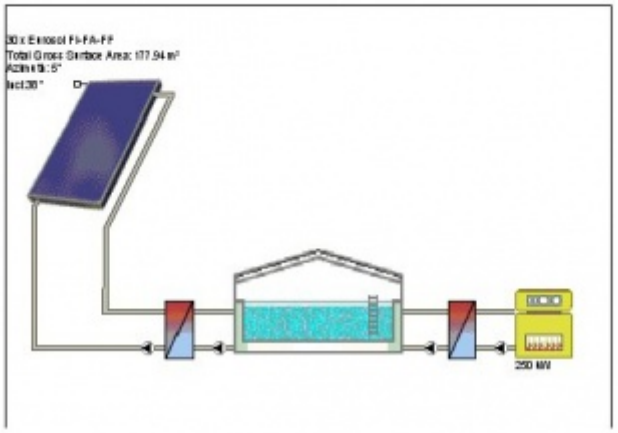

Results of Annual Simulation

Collector Surface Area Irradiation:	180.18 MWh	1,106.10 kWh/m²
Energy Produced by Collectors:	92.77 MWh	569.49 kWh/m²
Energy Produced by Collector Loop:	89.75 MWh	550.95 kWh/m²
Solar Contribution to Swimming Pool:	89.75 MWh	
Energy from Auxiliary Heating:	51.53 MWh	

Natural Gas Savings: 8,954.9 m³
CO2 Emissions Avoided: 18936.318 kg

Swimming Pool Solar Fraction: 63.5 %
System Efficiency: 49.8 %

Sample Commercial Project
Hotel Project Swimming Pool

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Project Data

Location:	Ireland
Weather Data Record:	"Valentia"
Global Radiation Annual Total:	983.22 kWh
Latitude:	51.93 °
Longitude:	10.25 °

Basic Data

Indoor Pool

Pool Area:	375 m²
Auxiliary Heating:	Yes

System Components

Collector Loop

Manufacturer:	Teufel & Schwarz GmbH
Type	Eurosol FI-FA-FF
Number:	29.55
Total Gross Surface Area:	177.943 m²
Total Active Solar Surface Area:	162.9 m²
Inclination (Tilt Angle):	38 °
Azimuth:	5 °

Auxiliary Heating

Manufacturer:	T*SOL Database
Type	Gas Condensing Boiler -250
Nominal Output:	250 kW

Original T*SOL Database With Test Report Proof of Conformity Available

Sample Commercial Project
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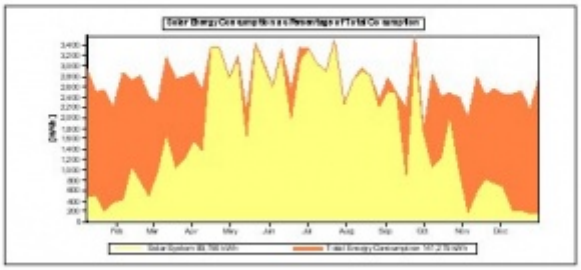

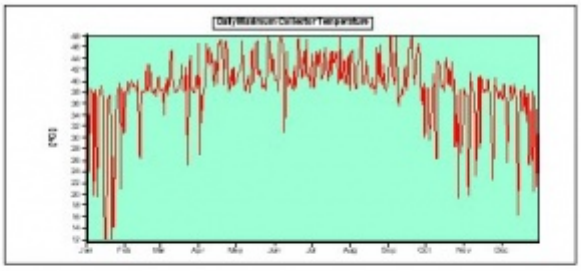

These calculations were carried out by T*SOL Expert 4.0 - the Simulation Programme for Solar Thermal Heating Systems. The results are determined by a mathematical model calculation with variable time steps of up to 6 minutes. Actual yields can deviate from these values due to fluctuations in the weather, consumption and other factors. The Schematic System Diagram above does not represent and cannot replace a full technical drawing of the solar system.

Financial Analysis Example

The detailed financial analysis below illustrates the financial performance of the system over its lifetime.

The following are the key points:

Gas price - 6.21 cent per kwh (2008 figures).

The estimated project cost after grant €70,000 (€30,000 SEI grant).

The estimated cost of solar energy 2.81 cent per kWh (fixed for 25 years).

Taking energy annual inflation at 15%:

Lifetime savings €1,421,519

Annual ROI 12.8%

Taking energy annual inflation at 20%:

Lifetime savings €3,211,685

Annual ROI 16.54%

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Projection of Rate of Return on Solar Heating Investment		
Nursing Home	**Scenario 1**	**Scenario 2**
Assumptions		
Oil cost per kWh (SEI, Oct 08)	€0.0621	€0.0621
Electricity Cost per kwh	€0.2159	€0.2159
Boiler System Efficiency	90.00%	90.00%
Conventional Energy Cost Inflation Rate	15.00%	20.00%
Solar System Life Span	25	25
Interest On Capital	2.00%	2.00%
Annual Solar Heating System Performance in kWh		
Electricity Consumption	77.72	77.72
Delivered Thermal Energy Yield (TSOL Simulation)	89750	89750
Conventional Fuel Saving	99722	99722
Investment		
Project Cost	€100,000	€100,000
Grant Aid	€30,000	€30,000
Project Cost after Grant	**€70,000**	**€70,000**
Net additional project cost (including Solar)	**€70,000**	**€70,000**
Results		
Fixed Solar Thermal Energy Cost per Kwh	€0.0281	€0.0281
Total Savings Over System Life	€1,421,519	€3,211,685
Net Present Value	€981,779	€2,161,840
Annual Rate of Return on Investment	**12.80%**	**16.54%**
Note: These projections have been prepared in accordance with best accounting practices. They do not represent a guarantee of future performance of the investment.		

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