

Solar Water Heating for Commercial Buildings

From RVR

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There are many commercial applications for solar energy ; hotels, public buildings, nursing homes, hospitals, schools, sports clubs and swimming pools. An investment in solar thermal energy can benefit a business in several ways:

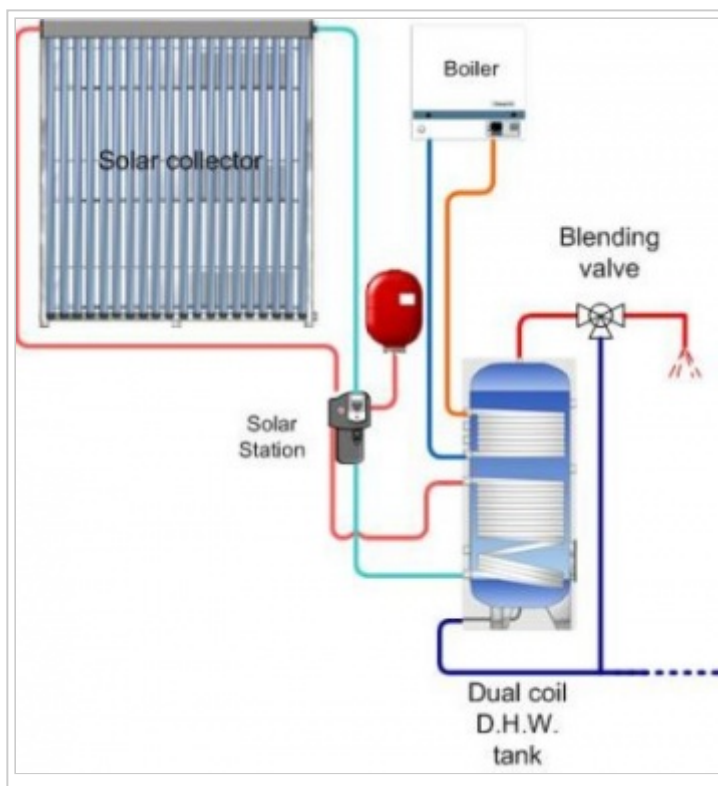
- Reduces consumption of expensive fossil fuels.
- Reduces CO₂ emissions
- A positive green image of the business is projected.

System Design

Many commercial buildings and sports clubs have high levels of domestic hot water usage. Domestic hot water is consumed year round and consumption is often at it's highest in summer when most solar energy is available. If the system is properly designed, high system efficiencies will be achieved resulting in a good return on investment.

Typical schematics are shown in the following diagrams.

Twin coil tank



This is the most common system design. Solar energy is transferred to the water through the lower coil of the tank and the back up boiler energy is put into the upper coil of the tank. It is simple, compact and inexpensive.

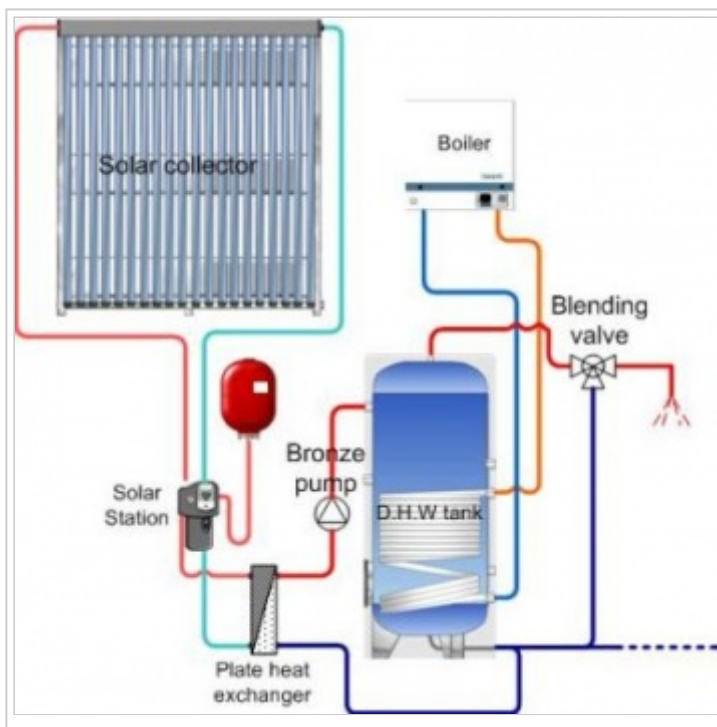
In a retrofit installation, it will normally be necessary to change the existing water heating tank for a twin coil model.

Solar Pre-heat tank



Where there is continuous consumption of hot water, such as in nursing homes and hotels, a pre-heat configuration will work well. The solar energy is supplied into the pre-heat tank. A boiler will supply energy to 'top up' the temperature of the smaller main tank. The main tank will always contain hot water heated by either the solar collectors or the boiler.

Heat exchanger



Fitting a heat exchanger onto an existing cylinder may be a good option where the existing water heater is of an adequate size to store the solar energy and in good condition. RVR Energy Technology supplies a range of heat exchanger kits, which may easily be fitted to existing water heaters.

Typical situations where this solution would be appropriate are:

- Where the existing cylinder is of an adequate size to store the solar energy and in good condition, yet only has one coil. The solar energy may be supplied into the tank through a heat exchanger, eliminating the need to replace the tank and reducing the cost of installing a solar system.
- In situations where there is a high peak demand, such as one finds in sports clubs. The solar energy is supplied via the heat exchanger while the boiler will feed into the lower coil of the cylinder. This ensures that there is an adequate supply of hot water and fast recovery even when there is no solar gain.

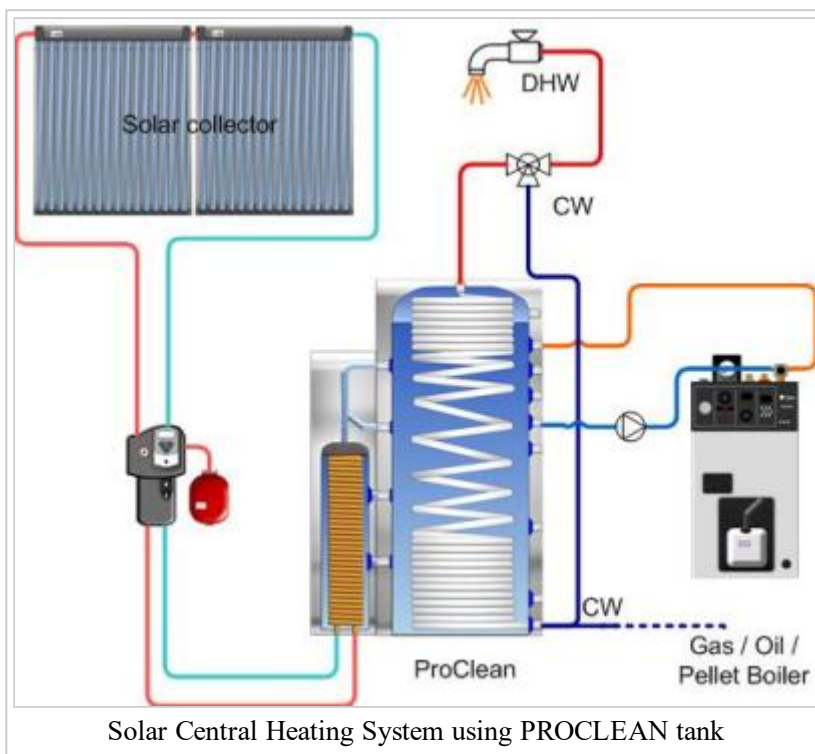
System based on TiSun PRO-CLEAN tank

The TiSun PRO-CLEAN tank uses a spherical heat exchanger to achieve stratified charging of the tank. This tank also heats the domestic hot water via a high surface area stainless steel coil. This coil contains the domestic hot water and a separate water heater is not needed.

The stratified charging system ensures that the warmest water is always available at the top of the tank in order to rapidly heat the domestic water.

This system is very hygienic as the volume of domestic hot water which is stored is minimised. The possibility of bacterial infections such as legionella are eliminated.

There is a choice of the standard PRO-CLEAN models or the PRO_CLEAN 2WR models for applications with high levels hot water flowrate.



Click here for information on the PRO-CLEAN product range. (<http://www.rvr.ie/default.aspx?subj=catalog/ProductsList&catI>)

Click here for information on the PRO-CLEAN 2WR product range. (http://www.rvr.ie/default.aspx?subj=catalog/ProductsList&catIdPath=0_42_68_257)

Solar Collector choice for commercial projects

The collector areas needed for commercial solar water heating applications are usually quite large. While any type of collector may be used, the large scale collectors from TiSun are particularly convenient to install. An aperture area of up to 18m² may be obtained using a single collector. This reduces the number of collectors needed and simplifies piping, control, bracketing, installation and commissioning.



Large TiSun FA collector being lifted into position

[Click here for more information on the large TiSun collectors. (http://www.rvr.ie/default.aspx?subj=catalog/ProductsList&catIdPath=0_70_75_81)]

Feasibility Study for solar water heating

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 is the water consumption level?
- What are the patterns of usage through out the day and year?
- What space is available for solar collectors?
- Details of the plant room space available for water heaters, expansion vessels and controls.
- 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 water heating 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 50% - 70% of the total energy requirements i.e. a solar fraction of 50% - 70%.

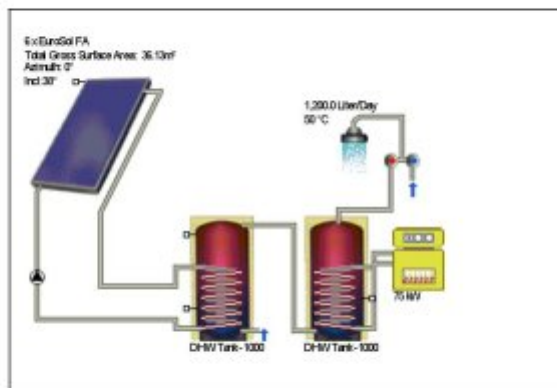
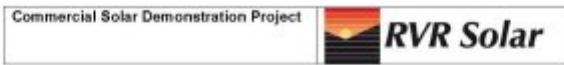
The T*SOL software simulation below has been carried out for a hotel project. The system proposed consists of several large TiSun collectors giving 33m² of aperture area. The projected output is as follows:

- Annual energy yield of 13.75 Mwh.
- DHW Solar Fraction of 63.4%.
- CO₂ savings of 3101.26 kg per annum

Solar Hydraulic Layout Example




Solar Simulation Example



Results of Annual Simulation

Collector Surface Area Irradiation:	35.83 MWh	1,090.14 kWh/m²
Energy Produced by Collectors:	14.46 MWh	442.25 kWh/m²
Energy Produced by Collector Loop:	14.09 MWh	431.16 kWh/m²
DHW Heating Energy Supply:	20.28 MWh	
Solar Contribution to DHW:	13.7 MWh	
Energy from Auxiliary Heating:	7.92 MWh	

Natural Gas Savings: 1,367.0 m³
 CO2 Emissions Avoided: 3101.26 kg
 DHW Solar Fraction: 63.4 %
 System Efficiency: 38.4 %

Commercial Solar Demonstration Project	
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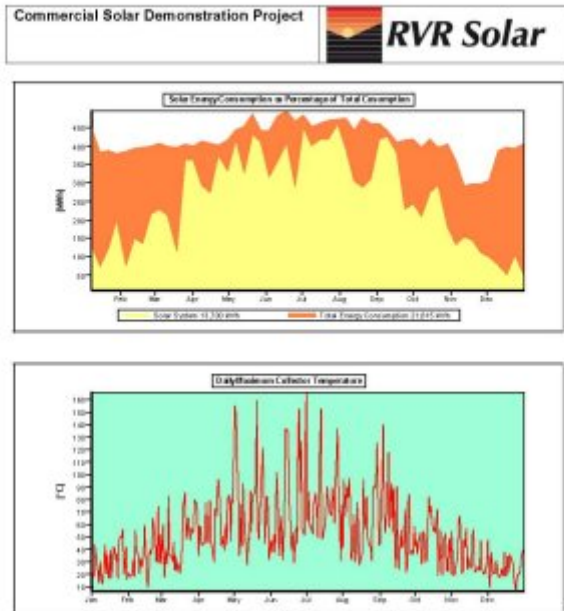
Project Data	
Location:	Dublin
Weather Data Record:	"Dublin"
Global Radiation Annual Total:	948.71 kWh
Latitude:	53.43 °

Basic Data	
Domestic Hot Water	
Average Daily Consumption:	1200 l
Desired Temperature:	50 °C
Load Profile:	Hotel
Cold Water Temperature:	8 °C
	12 °C

System Components	
Collector Loop	
Manufacturer:	Teufel & Schwarz GmbH
Type:	EuroSol FA
Number:	6.00
Total Gross Surface Area:	36.125 m ²
Total Active Solar Surface Area:	32.688 m ²
Inclination (Tilt Angle):	38 °
Azimuth:	0 °
DHW Standby Tank	
Manufacturer:	T*SOL Database
Type:	DHW Tank -1000
Volume:	1000 l
Solar Preheating Tank (S)	
Manufacturer:	T*SOL Database
Type:	DHW Tank -1000
Volume:	1000 l
Auxiliary Heating	
Manufacturer:	T*SOL Database
Type:	Gas Condensing Boiler - 9
Output:	75 kW

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

T*SOL Pro 4.3 17/04/2008



These calculations were carried out by TTSOL Pro 4.3 - 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.

TTSOL Pro 4.3

17/04/2008

Financial Analysis

A detailed financial analysis would also form part of the feasibility study. This would provide a calculation of the rate of return on the investment.

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