

Solar Pool Heating Design:

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For pool heating systems, the maximum suggested solar collector gross area is limited within the software to equal the pool area. This is a rule-of-thumb used in the industry. The solar collector area of the most economical solar pool installation in mid latitudes will be about one third to one half of the pool surface area. This document outlines how to decide on the number of panels with more precision.

To design a solar pool heater system using Seabird Solar evacuated tubes, use the RETScreen program available at www.RETScreen.net and the collector performance information available on www.seabirdsolar.com . The performance figures for the 20-tube panels maybe be copied from the solar pool example on the website and the location and size of pool changed to suit the local installation.

Nearly all pool installations may make use of the existing pool circulation pump. Simple manual control of the valves to circulate water through the collectors is most economical and reliable, while a fully automated electronic system using magnetic valves is the most convenient.

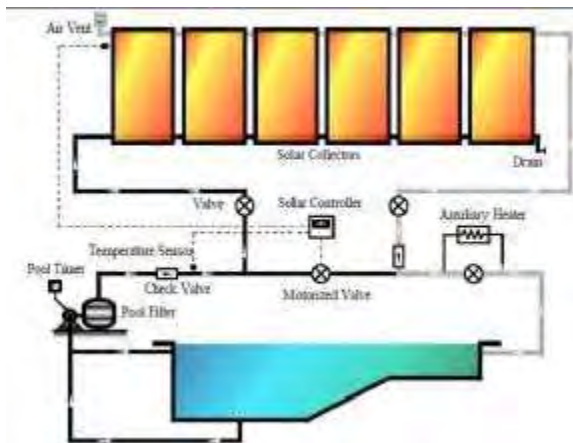


Figure 1: typical large scale pool setup.



Fill in the location and pool information as required in the program spreadsheet. Observe the recommended number of panels the program calculates. Calculate if your site and budget allow for the recommended number of panels, then adjust the number of panels as required. Observe the payback time and cumulative financial analysis changing as the number of collector panels input is changed-most likely the most economical installation will be close to the recommended number of panels, but space or budget constraints may dictate a smaller number of panels.

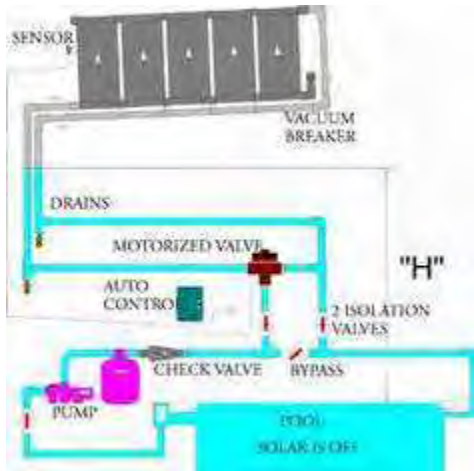


Figure 2: Simpler pool schematic

The help section of the RETScreen program gives information on each cell input. Select examples are copied below to give the user who receives a completed analysis an idea of the inputs.

RETScreen Program inputs:

Temperature

The user enters the desired minimum temperature of the pool. This is the temperature set point of the pool heater. 5 degrees of temperature difference can double the number of solar collector panels required.

Typical values range from 22°C for competitive swimming, to 27°C for recreational swimming, to 35°C for therapeutic pools, whirlpools and spas

Cover use

The user enters the number of hours per day (h/d) a cover (blanket) is put on the pool. The model assumes that the cover is on predominantly at night, and that 90% of the pool is covered by the blanket.



The user should enter 0 if no cover is used. If the pool is open n hours per day and a cover is used whenever the pool is closed, the user should enter $24-n$; for example if a community pool is open 8 hours a day, the user should enter 16.

Makeup Water

The user enters the percentage of pool water renewed **every week, not including** the addition of water to compensate for evaporation. This amount is representative of pool activity level. It includes compensation for water lost when swimmers exit the pool and periodic water renewal done for hygienic reasons (backwash: cleaning of filtration system using reverse water flows). This value is typically between 5 and 10%. Generally, the lower value will be used for a residential pool with low activity level, and the higher value for public pools with high activity level.

Note that the model can accept higher ratio values: for example, more than 25% if the user wants to represent the case of a municipal pool where water is completely renewed every month for hygienic reasons, or even higher than 100% in the case of a therapeutic center with non-chlorinated ocean or spring water where water is renewed continuously. However, in this latter case, it is recommended to validate the results by comparing the results with those obtained when the model is set for "Hot water" application type with aquaculture as the "Load type."

Wind sheltering - season of use

The user enters a coefficient characterizing the attenuation of wind speed near the pool due to obstacles such as buildings, trees, and fences.

The wind speed values entered in the [Start](#) worksheet are multiplied by the wind sheltering coefficient prior to evaluating evaporative losses from the pool. Typical values are between 10% for a very sheltered pool to 30% for an open-air pool. Higher values of the wind sheltering coefficient can be considered only for very exposed locations.

Note that the wind sheltering coefficient has a significant influence on the estimated energy requirement for heating the pool. Evaporation losses are strongly dependent on wind speed at the pool surface, and can represent up to 60% of all energy losses of the pool. It is usually safer to consider a larger wind shelter coefficient (30%) than a smaller one (10%) to estimate the amount of energy displaced by the solar heating system, because smaller values will tend to under-estimate the energy requirements of the pool. Pool covers are used primarily for this reason.

Solar shading - season of use



The user enters a coefficient characterising the average shading of direct solar radiation on the pool itself over the season of use of the solar water heater. This is used by the model to reduce direct passive gains of a standard pool.

Typical values range from 0% for a pool without any obstacles, to 50% for a pool surrounded by trees and buildings. **No shading factor shall be considered for the use of a pool blanket, even opaque.**

Supply temperature method

The user selects the type of method used to specify cold (mains) water temperature. The options from the drop-down list are: "Formula" and "User-defined."

If "Formula" is selected, the model automatically calculates the temperature of the supply water from temperature data specified in the "Site reference conditions" section of the [Start](#) worksheet. The corresponding yearly minimum and maximum are shown in the next two lines.

If "User-defined" is selected, the minimum and maximum supply water temperature values are entered by the user. In the Northern Hemisphere the model assumes that the minimum temperature occurs in February and the maximum in August; a sinusoidal temperature profile is used for other months. The situation is reversed in the Southern Hemisphere.

If mains water comes from a deep well, of which the temperature is nearly constant throughout the year, the user should set the calculation method to "User-defined" and set the minimum and the maximum values equal to the well temperature.

Number of collectors

The user enters the actual number of collectors for the solar water heating system. As a first pass, the user should use the suggested number of collectors calculated by the model in the cell to the right of the input cell, then vary the value of the number until a financial optimum is found. Every time the number of panels is changed, of course the total system cost, which was entered earlier in the spreadsheet, must also be changed.

The most economical system is the one that will use solar to save the most amount of money over the system lifetime. The most ecologically friendly installation, in terms of impact to the environment, is most likely just a few panels more than the most economic installation, once the impact of manufacturing a larger system is included. Trying to use a 100% solar heated pool throughout the year in a location with large temperature changes between summer and winter will result in a system that is hugely expensive and so over sized that the water will be just about boiling in the summer. A more economical



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approach is to use solar to heat the water when there is plenty of sun, then either accepting that water temperature will vary on cold, dark and cloudy days, or using some form of backup heat.