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Solar Heating of Swimming Pools: A Question & Answer Primer

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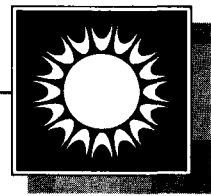
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Solar heating of swimming pools

A question & answer primer

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Solar pool heating is one of the most economically attractive solar technologies in Florida today. If you are interested in heating your pool, or can no longer afford heating it with fossil fuel alone, consider installing a solar pool heater.

The following information helps answer the most frequently asked questions concerning solar pool heating in Florida. Keep in mind that much of this information is "rule of thumb"; your individual situation, if analyzed in detail, may differ somewhat from the general application. A more detailed analysis of pool systems is provided by the publications listed in the bibliography.

Q: What would it cost to heat my pool with a standard fossil fuel heater?

There are approximately 800,000 swimming pools (including above-ground) in Florida, and most of them must be heated during the cooler months to maintain comfortable swimming conditions. An unheated pool will stay generally at about the average outdoor temperature, which may be as low as 53°F in north Florida in winter. For the typical user, comfortable pool water temperatures are 78°F to 82°F in spring and fall and 76°F to 78°F in winter.

Average yearly cost for heating a residential pool in Florida is \$1,450 using electrical resistance (electricity at \$0.09/kWh), \$500 using an electric heat pump and \$580 using natural gas. Liquid propane would cost the same as electrical resistance.

Q: How does solar compare with other forms of pool heating?

A typical solar heating system costs from \$2,000 to \$4,000 installed. Compared with average fossil fuel heating, a solar pool heater offers a most favorable payback of 1.5 to 7 years. In addition, the solar pool heating industry in Florida is mature. It has numerous distributors and contractors and a track-record of over 20 years of experience.

Please note that the actual cost of solar pool heating systems depends upon many factors — ease of installation, type of financing, location of pool in north or south, length of pool season desired and building code requirements. These variables cause price variations and the homeowner should talk to more than one dealer-installer when considering a purchase.

- A - Pool water in
- B - Pump
- C - Filter
- D - Check valve
- E - Gate valve 1
- F - Drain valve
- G - Solar collectors
- H - Vacuum breaker & auto air relief
- I - Gate valve
- J - Fossil fuel heater (if existing)
- K - Chlorinator (if existing)
- L - Warm water returns to pool
- M - Sensor
- N - Automatic control box
- O - Electric or constriction valve (collector bypass)
- P - Booster pump

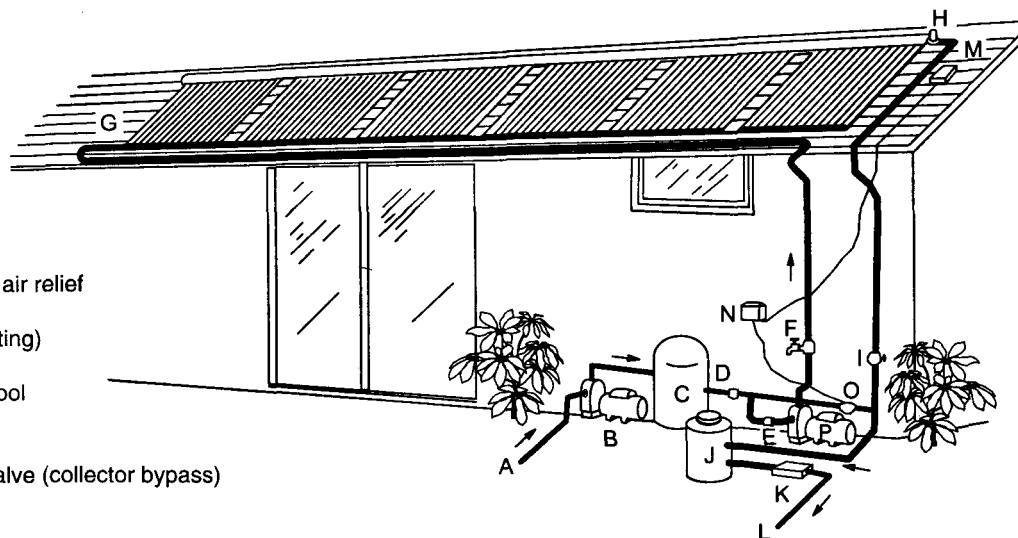


Figure 1. Typical solar pool heating system with automatic control

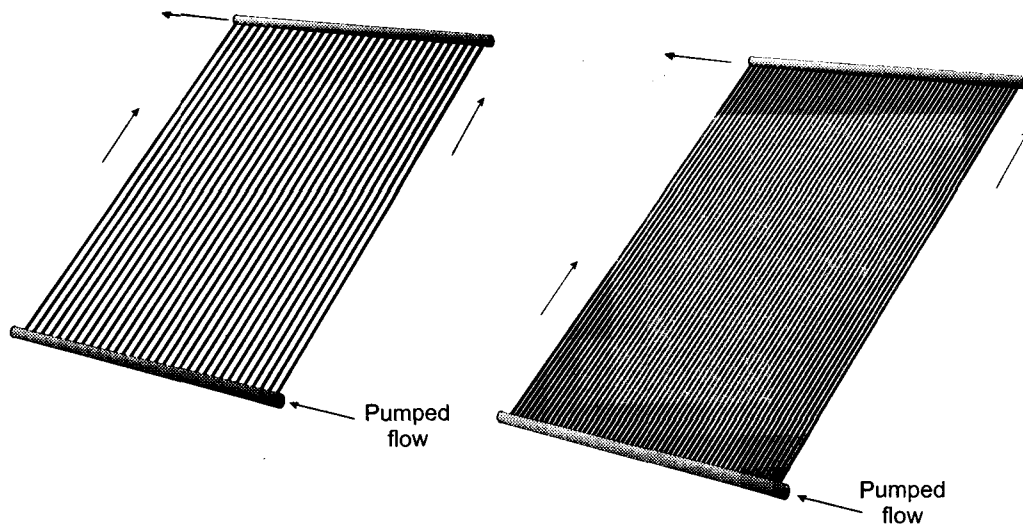


Figure 2. Black polypropylene plastic collectors

Q: How does a solar pool heater work?

Imagine a garden hose that has been lying in the sun. When you turn on the faucet, out comes hot water. That's solar heating. The sun's energy has been absorbed by the hose and transmitted as heat to the water inside it. The hose acts as a solar collector.

Comfortable swimming water temperature is relatively low compared to other uses of hot water. This allows the use of simple, efficient solar collectors (*see following question*). These systems require no separate storage tank, since the pool itself serves as the storage tank. In most cases, the pool's filtration pump is used to force the pool water through the solar panels. In some retrofit applications, a larger pump may be required to handle the needs of the solar system, or a small pump may be added to boost the pool water up to the solar collectors.

When adequate sunshine is available, the filtered pool water is circulated through the solar collectors, where it is heated by solar radiation and then returned to the pool. In this operation, the water goes from pool to pump, from pump to filter, from filter to collectors, from collectors to fossil-fueled backup heater (if there is one), from fossil-fueled heater to automatic chlorinator (if there is one), then back to the pool (*see Figure 1, on the front page*).

Automatic controls may be used to direct the flow of filtered water to the collectors when solar heat is available. This may be accomplished manually by the use of a manual "bypass valve" placed in location P of Figure 1. Normally solar systems are

designed to drain down into the pool when the pump is turned off. This provides the collectors with freeze protection. In central or southern Florida, water is sometimes circulated through collectors at night in summer to lose heat if the pool become too warm.

Q: What are the general types of swimming pool collectors used?

At the present time, the Florida solar industry is almost exclusively using black polypropylene plastic collectors. These panels may be either rigid or have individual pipes running lengthwise (*see Figure 2*). Individual collectors are normally 4'x10' or 4'x12'.

Other types of pool collectors are flexible rubber mat, arrays of black plastic pipe or tube-on-sheet panels made of copper or aluminum. Glass covered or glazed collectors, commonly used for domestic water heating, are not as cost effective for pool heating as unglazed collectors and are not used for pool heating in Florida.

Q: How do the different types of collectors vary in performance?

The performance of pool heating collectors does not vary significantly when comparing their energy delivered per day per square-foot of equivalent collector area (i.e., Btu/day-sq ft). Thermal performance ratings for all collector types are available from the Florida Solar Energy Center Public Information Office. (Request publication FSEC-GP-16.)

Q: How long will solar pool heaters last?

Most plastic collectors manufactured for swimming pool use contain ultraviolet screening materials called inhibitors. The actual mix of the inhibitors is generally a manufacturer's secret; but properly protected collectors should last 10 to 15 years.

Q: What is the proper orientation and tilt of the collector panels?

Ideally, solar collectors should face south. However, an orientation up to 45° east or west of due south will not significantly decrease performance as long as shading is avoided.

For optimum pool heating in winter, solar collectors should be tilted at latitude plus 15°. However, in Florida they are almost always mounted directly to the sloping roof. "Standoff" mounting to optimum tilt from a sloped roof usually will increase performance only 2 to 8 percent and is hardly worth the effort.

Q: Can I use one solar system to heat both my pool and domestic water supply?

No. Swimming pool heaters used in Florida do not have covers (glazing) and are designed to heat a large volume of water (thousands of gallons) to relatively low temperatures (around 80°F), while hot water systems raise less than a hundred gallons to about 130°F. The energy used to heat 100 gallons of water to 130°F daily is a "drop in the bucket" compared to that needed to heat a pool. To do so, a similar collector area of glazed hot water-type collectors would be needed; but the additional cost of the higher temperature collectors would be unnecessary. In fact, pool heating collectors are generally more efficient at low temperature than the hot water type.

Q: Can I install a solar pool heater myself?

Generally speaking, yes. But only a person who is very handy at plumbing and electrical wiring should consider installing a solar pool heating system. The first time around, you and a friend can expect to spend two days putting in a system that would take an experienced crew six hours. This is hard work on a hot roof; but you can usually save at least one-third of what you would otherwise pay a solar contractor for the installed system.

If you plan to install your own system, thoroughly read the manufacturer's installation manual. Most collector manufacturers have an installation video in addition to the installation manual. View it carefully. Also, you may wish to purchase a copy of the Florida Solar Energy Center's "Solar Water and

Pool Heating: Design and Installation Manual," and carefully study Section 7 (Swimming Pool Heating).

Q: How can I find a solar pool heating installer-contractor?

FSEC publishes a directory of solar contractors, which may be obtained from the Public Information Office. Also the telephone company Yellow Pages lists solar contractors under solar.

Q: How do I go about choosing a solar installer-contractor?

Ask whether they have a Florida solar contractors license and are members of their professional association (FlaSEIA).

As with any purchase be sure to ask about a contractor's experience, the collector warranty and maintenance. It is also a good idea to ask more than one contractor for a cost estimate. When comparing different contractors the most important item to compare is the amount of collector area specified by each contractor.

Q: How big a collector do I need?

Heating a swimming pool requires a large amount of energy. As a result, a large collector area (typically 350-500 square feet) is necessary to collect the solar energy needed, regardless of the type of collector used. Thus, from 7 to 12 black plastic panels will be required for typical residential pools.

The collector area is usually about the same size as the pool surface area in northern Florida, about 80 percent of the pool area in central Florida and about 65 percent in southern Florida; but these numbers may vary significantly depending on the requirements of the pool. For more detailed information about sizing collectors, see FSEC publication GP-13.

Q: What about maintenance?

A properly installed solar pool heating system should require very little, or no maintenance. However, regular maintenance of the pool and its filtration system is crucial. Pool pH and chlorine levels must be maintained within the limits specified by the pool water test kits. Chemicals should be added to the pool water far from the collector intake pipes. The filter should be cleaned as frequently as recommended by the manufacturer to ensure that adequate flow is supplied to the collectors. Check the solar heating system for proper operation at the beginning of each swimming season, particularly if

it has an automatic control. Remember, a properly operating solar collector feels cool to the touch. The temperature rise of the water going through the collectors should be from 3°F to 5°F for most efficient operation.

Q: What about pool covers?

The greatest loss of heat from a pool occurs from its surface because of evaporation. By reducing this evaporation loss, pool covers are very effective in lengthening the swimming season. They also keep the pool clean, thereby lowering the cost of chemicals and filter maintenance. Depending on materials and the number of hours of use, temperature increases of 5°F to 10°F may be expected from a pool cover. A 5°F increase is reasonable when the cover is used 12 hours a day; 10°F when it is used 20 hours a day.

Transparent or lightly translucent covers work best because they allow solar energy to pass through and be absorbed by the pool water, and they also prevent heat loss at night. Opaque covers are best used in Florida at night to prevent heat loss. A roller is a good investment to help you move the cover on and off the pool. Motorized rollers are also available.

Pool covers will last from three to five years, depending on care in handling and storage. Nevertheless, they are your best buy for an extended swimming season. From the standpoint of energy conservation, a pool cover should be used.

Selected References

Solar Swimming-Pool Heating in Florida, Collector Sizing and Economics. Florida Solar Energy Center, July 1981, FSEC GP-13.

Solar Water and Pool Heating: Design and Installation Manual, Florida Solar Energy Center, Revised August 1993, FSEC-IN-21-82.

Thermal Performance Rating (Pool Collectors), Florida Solar Energy Center, FSEC-GP-16.

FSEC Approved Solar Energy Systems: Domestic Hot Water and Pool Heating, Florida Solar Energy Center, FSEC-GP-15.

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