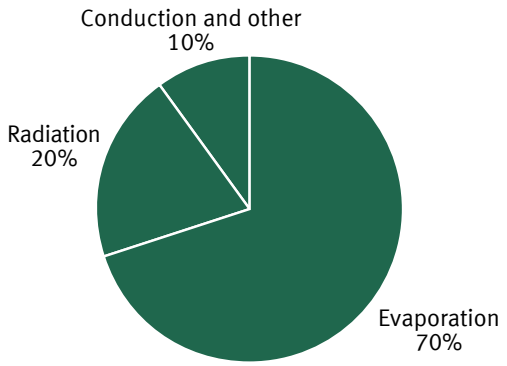
# Reducing swimming pool heat loss

**Q: What are the primary energy losses from swimming pools? Do you have any recommendations for eliminating those losses?**

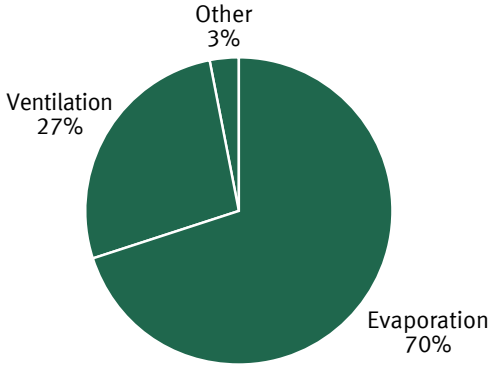
**A:** Evaporation is the primary mode of swimming pool heat loss, accounting for approximately 70% of the heat lost from both indoor and outdoor pools (Figure 1)[1]. The remaining heat losses are generally from radiant heat for outdoor pools and ventilation for indoor pools. Evaporation dominates pool heat losses because each gallon of water that evaporates removes 8,300 Btus of heat from the pool, whereas heating the gallon of replacement water to the temperature of the pool requires only 8.3 Btus per degree Fahrenheit of temperature rise—or between 80 and 200 Btus per gallon for the typical heat gain required. Evaporation from indoor pools generates an additional energy penalty because the ambient air must be dehumidified or replaced with fresh air.

**Figure 1: Causes of swimming pool heat loss.**
Most heat is lost from swimming pools—both outdoor (A) and indoor (B)—through evaporation.

**A. Causes of outdoor pool heat loss.**




**B. Causes of indoor pool heat loss.**






The best way to reduce evaporation losses is to cover the pool when it is not in use. Pool covers block evaporation as well as radiant losses, and they can provide some insulation from convective losses. Achievable savings from pool covers depend on how long the pool is covered and on local conditions that affect how evaporation is taking place, with reported savings of 50% or more compared to the energy required for heating uncovered pools.[2] Additional savings accrue because less makeup water is required, leading to an accompanying reduction in chemicals required to maintain proper pool chemistry.

For outdoor pools, evaporation losses are driven by the ambient temperature, humidity and average wind speed. Windy and arid environments cause faster evaporation and greater energy losses.

Estimating the energy savings of a pool cover in a specific application requires complex modeling to account for the pool's characteristics, its usage patterns and the local climate. The Washington State University Extension Energy Program provides a pool energy use calculator[3] that takes all of these variables into account and can help estimate energy losses and pool-cover savings. Table 1 (see next page) shows the heating costs that might be expected for outdoor pools under a certain set of assumptions, in different climate zones, with and without using physical pool covers, based on analysis by the U.S. Department of Energy.[4]

*(continued on reverse)*

**Table 1: Typical costs of heating outdoor pools, with and without covers.**

Regular use of a pool cover greatly reduces evaporative losses and provides significant savings on energy bills. This table shows savings estimates for locations across the United States.

| | | Seasonal pool-heating costs | |
|---|---|---|---|
| **City** | **Pool season** | **With cover** | **Without cover** |
| Atlanta | April - October | $424 | $2,248 |
| Boston | May - August | $328 | $2,096 |
| Chicago | May - September | $296 | $2,072 |
| Dallas | April - October | $280 | $1,920 |
| Denver | May - August | $168 | $2,120 |
| Kansas City | May - October | $416 | $1,872 |
| Los Angeles | May - October | $304 | $2,376 |
| Miami | Year-round | $584 | $2,848 |
| Minneapolis | June - September | $248 | $1,776 |
| Phoenix | March - October | $168 | $1,776 |
| Seattle | June - August | $424 | $1,784 |

Note: Based on a 1,000-square-foot pool heated with an 80% efficient gas heater at $0.50 per therm and a pool temperature of 80°F. Other parameters such as exposure to wind and sun and hours of cover use per day are not available.



## Selecting a pool cover

The choice of an appropriate pool cover depends on the size and shape of the pool, the conditions in which the cover is used and available storage space. The most expensive covers are incorporated into the pool structure and include automated retraction and stowage systems. Less-expensive covers can be manually removed and stowed or rolled up onto a large trolley-mounted spool. In a typical application, a transparent insulating solar cover floats on the pool surface, blocking evaporation but allowing solar radiation to pass through to warm the water—a useful, fuel-saving benefit for most pools in North America.[5] Solar covers look like a lightweight sandwich of bubble wrap between thick layers of plastic coated with ultraviolet inhibitors to extend the lifetime of the material.

An alternative to a conventional pool cover is a chemical cover, which provides some evaporation protection without the hassle of moving the cover on and off the pool. In 2008, San Diego Gas & Electric funded a study of a chemical pool-cover product called Heatsavr[6], made by Flexible Solutions, which showed a 13% reduction in gas consumption over a 10-month period, saving 0.57 therms per square foot ($ft^2$) of pool surface at a large outdoor swimming pool in Oceanside, California.[7] Heatsavr's active ingredient is a long-chain fatty alcohol, which is a by-product of coconut and palm trees. Because it naturally degrades in swimming pools within 72 hours, the manufacturer recommends adding it to the pool daily in small doses (1 ounce per 400 $ft^2$ of pool surface) to maintain sufficient coverage.

Chemical covers are designed for use while the pool is occupied, but their effectiveness is diminished when the pool surface is disturbed by swimmers or wind. As wind and swimmer activity subsides, the alcohol molecules float back to the surface and reorganize into a single-molecule protective layer within 5 to 10 minutes, depending on the size of the pool.[8] Under the best placid-water conditions, savings from chemical pool covers will be less than what a physical solar cover would provide, but the low cost (approximately $0.12/day per 100 $ft^2$ of pool surface) and demonstrated effectiveness warrant testing this option alone or in conjunction with a physical cover to reduce losses when a physical cover is not in place. Salt River Project also tested Heatsavr as well as a similar, silicon-based product, and recommends these chemical covers primarily to reduce water evaporation.[9]

Pool covers provide the highest energy savings for pools when they are used regularly. Obviously, energy savings only accrue when the cover is on the pool. Deciding whether to invest in a conventional cover, chemical cover or both depends on the number of hours the pool is in use, the labor costs to move and store the cover, activity levels in the pool and ambient conditions.

*(continued on next page)*

## Additional energy-saving ideas

Pool owners are also encouraged to invest in other energy-saving measures to further reduce their pool-operating bills. For additional energy savings, here are some ideas for more efficient heating and circulation systems:

• Air-source heat pumps cost more than gas heaters, but with a reported coefficient of performance of 4.3, they can pay for themselves in 1.5 to 2.5 years. Read "Heat Pump Pool Heaters Deliver Energy Savings for Large Outdoor Pools"[11] for details.

• Condensing gas boiler pool heaters offer efficiencies above 90% compared to their conventional counterparts, which have efficiencies in the mid 80s.

• Solar thermal pool heaters are the most cost-effective use of solar energy in most climates. The U.S. Department of Energy's "Solar Swimming Pool Heaters"[12] page provides resources for site assessment, sizing and economics.

• Variable-speed drive control allows pool circulation pumps to be ramped up and down with demand to achieve pumping energy savings of up to 50%.

## Need more help?

Need help getting started? Contact an MGE account manager at (608) 252-7007. Find more operating tips and free equipment guides at mge.com/business/saving.

Financial incentives for selected energy efficiency improvements are available from **Focus on Energy**, Wisconsin's statewide program for energy efficiency and renewable energy. See focusonenergy.com/incentives for more details.



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### Notes


1 U.S. Department of Energy, "Swimming Pool Covers" (accessed May 2011) www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13140

2 U.S. Department of Energy [1].

3 Pool Energy Use Calculator, Washington State University Extension Energy Program www.energyexperts.org/CalculatorsTools/PoolEnergyUseCalculator.aspx

4 U.S. Department of Energy, "Estimating Swimming Pool Gas Heating Costs and Savings" (accessed May 2011) www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13180

5 U.S. Department of Energy [1].

6 Heatsavr™, liquid pool cover by Flexible Solutions www.flexiblesolutions.com/products/heatsavr

7 Emerging Technologies Coordinating Council, "Liquid Pool Cover Engineering and Measurement Study" (April 13, 2010) www.etcc-ca.com/images/stories/heatsavr_expr_workout_club_report_r2_4-12-10.pdf

8 Monique Nelson (June 2, 2011), Sales & Marketing Manager, Flexible Solutions, 760-674-9700 monique@flexiblesolutions.com

9 Salt River Project, "Reduce Evaporation from Your Pool" (accessed June 2011) www.srpnet.com/energy/powerwise/savewithsrp/Pooldrops.aspx

10 Colorado Gas Prescriptive Rebates Program www.blackhillsenergy.com/services/programs/business-prescriptive-rebate-co.php

11 E Source: "Heat Pump Pool Heaters Deliver Energy Savings for Large Outdoor Pools" www.esource.com/node/22854

12 U.S. Department of Energy, "Solar Swimming Pool Heaters" www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13230