

Calculating Pool Heating Cost Savings from Reducing Evaporative Losses

Pool Disk Team, July 2009

Swimming pools lose the majority of their heat through evaporation (and also smaller amounts from radiative and convective effects). Evaporation cools a pool in much the same way as sweat cools skin. However, in a swimming pool, evaporative loss means both that more energy is needed for heating, and that water must be added to replace what is lost.

Pool Disks reduce evaporative losses, thus saving on pool heating bills. The disk materials block evaporation, preventing heat loss, and the black disks absorb solar energy, contributing another warming effect.

In more detail:

In a typical pool, 50% to 70% of a pool's heat loss comes from evaporation.

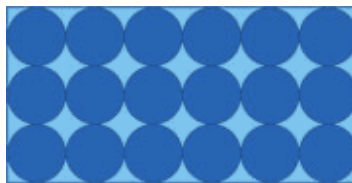
From a publication by the US Department of Energy (1),

"Evaporating water requires tremendous amounts of energy. It only takes 1 Btu (British thermal unit) to raise 1 pound of water 1 degree, but each pound of 80°F water that evaporates takes a whopping 1,048 Btu of heat out of the pool."

A given pool's evaporation rate will vary depending on average water and air temperatures, relative humidity, and wind speed. Various estimates of pool water loss can be made, some more theoretical and some more empirical in nature.

As an example of an empirical estimate, using data from the GROW library (2):

- Pools located in many areas of California typically have an evaporative water loss from 50 - 80" per year.
- For a 12' x 24' swimming pool with 65" of water loss/year, there is an evaporative loss of 11,670 gallons of water volume per year.



Approximately 75% Coverage

For a swimming pool with Pool Disks covering 3/4 of its surface, this leads to water savings of:

- 8,640 gallons of water volume saved per year.

Taking into account the energy needed to evaporate the water calculated above:

- The latent heat of vaporization of the water in this example is 20,600 kW-hrs per year.
- At California residential energy costs of \$0.14 per kW-hr (3), this much energy would cost \$2,890 per year.

Even in a small swimming pool, Pool Disks can lead to savings of thousands of dollars per year.

References for further reading:

1. The US Department of Energy has a useful page on reducing swimming pool heating losses with pool covers:
http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13140
2. The Geotechnical, Rock and Water Resources (GROW) Library has regional information to estimate a swimming pool's evaporative loss:
<http://www.grow.arizona.edu/Grow--GrowResources.php?ResourceId=208>
3. The Energy Information Administration has a page tabulating electricity costs:
http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html
4. "Evaporation Rate of Water in a Vessel", Kazuo Hisatake, Satoko Tanaka, and Youko Aizawaa, *J. Appl. Phys.* Vol. 73, No. 11, 1 June 1993, pp. 7395 - 7401.
5. "Apparatus for Measuring the Evaporation Rate of Water Across an Air/Water Interface", Yoshikiyo Moroi, Takaharu Yamabe, Osamu Shibata, and Yutaka Abe, *Langmuir* 2000, 16, pp. 9697-9698.