

How Using a High-Performance Solar Cover Can Reduce the Energy Costs of Your Pool

Solar pool covers are a highly effective way of utilising free solar energy to heat your pool for free. In the UK it is possible to hold a domestic outdoor pool at 28°C without the need for supplementary heating. This solar heating effect can therefore be a highly useful tool in reducing the heating energy consumption of your pool. The benefits of this are twofold: lowering energy bills and reducing the environmental impact of your pool.

By simply covering your pool with a high-performance Sol+Guard™ GeoBubble™ cover it is possible to increase the temperature of your pool by up to 7°C. Our recent summer 2023 study showed that the impact of this sustained temperature increase can result in the energy consumption. Over the course of a 30-day study, it was found that a heated 8m x 4m pool covered with a Sol+Guard™ cover used 87% less energy than an identical uncovered pool. In addition to this the covered pool also consumed 24% less stabilised chlorine. As a result, it was determined that an 8m x 4m Sol+Guard™ cover can return the cost of purchase in savings within just 72 days and go on to save an additional £5,182.08 over the course of its 8-year warrantied lifespan.



Fig 1: Sol+Guard™ with GeoBubble™ Technology

General cover benefits:

- Eliminate water evaporation by 98% +
- With GeoBubble™ technology
- Reduce debris contamination
- Reduce the pool's carbon footprint

Sol+Guard™ specific benefits:

- Increase pool temperature by up to 8°C
- Reduce energy consumption by over 70%
- Reduce chemical consumption by up to 40%
- Pay back the cost of a cover within 1 year
- 8+ years expected lifespan
- 8 years manufacturer's pro rata warranty
- Available with reinforcing weave

What is Sol+Guard™?

Sol+Guard™ is the highest performing solar GeoBubble™ cover with respect to solar heating potential and is part of the high-performance GeoBubble™ guard range. It has been designed to be highly transparent to solar energy, which is free pass through and be absorbed by pool water and makes for a warmer swim. The solar heating performance of Sol+Guard™ is closely linked to ambient temperature and sunlight intensity, so to maximise solar heating a pool should have good sun exposure throughout the day. Sol+Guard™ also works to retain heat overnight thanks to the patented GeoBubble™ air cells which work to insulate and mitigate against heat loss. Some heat loss overnight is always inevitable but Sol+Guard™ works to rapidly raise the temperature of a pool during daylight hours thanks to its excellent solar energy transmission properties.

Sol+Guard™ is also designed for longevity, utilising a unique blend of UV stabilisers it is warrantied to last in the harshest UV environments for 8 years, as is true of all the high-performance guard product range. The initial cost of the cover is typically paid back within the first year of its life, thanks to the substantial savings in water and energy consumption.

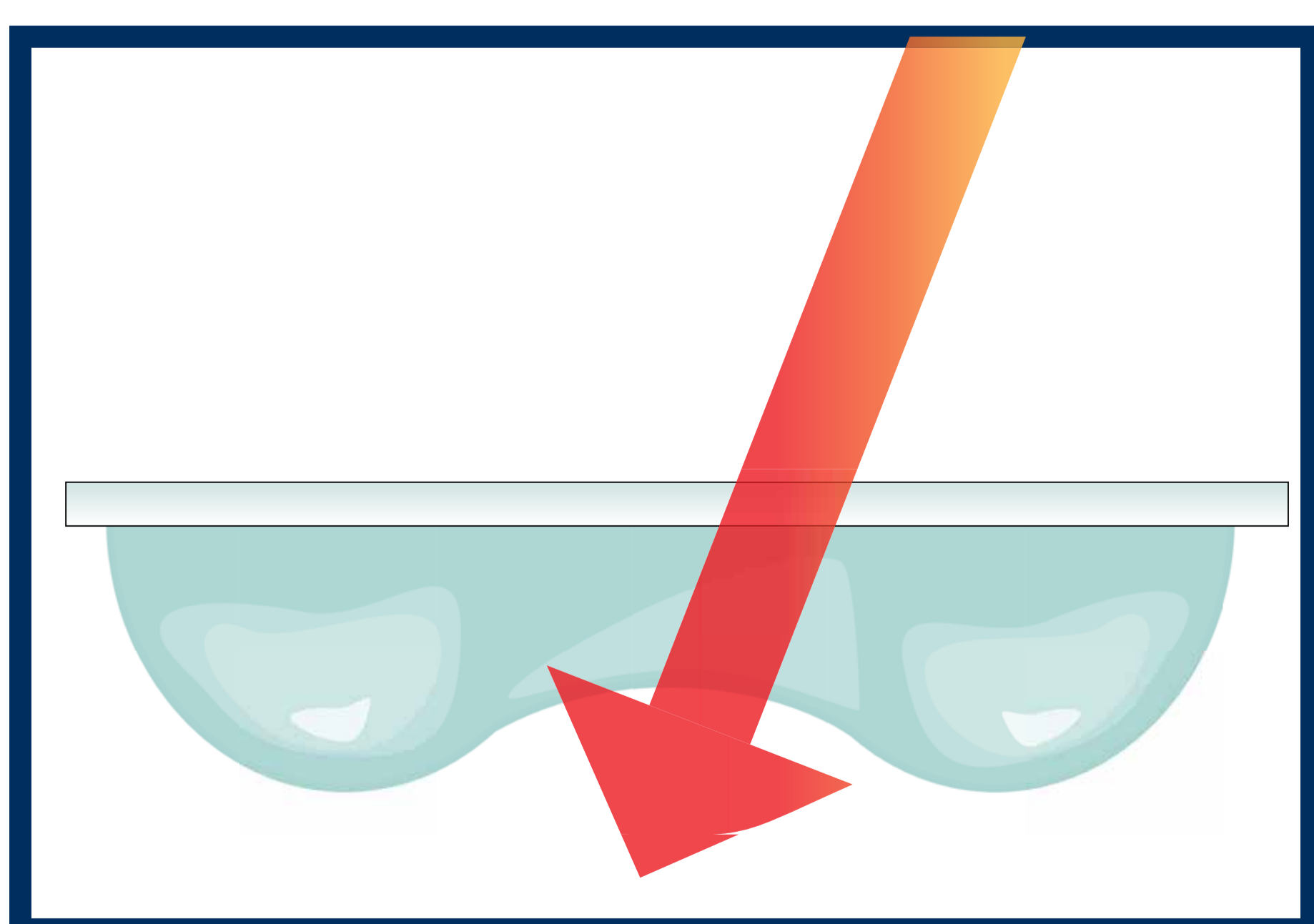


Fig 2: Illustration depicting the Solar Gains property of the material

This means that for the remainder of the cover's life it is actively working to save money whilst installed on a pool. Sol+Guard™ is so effective at reducing energy consumption as it can quickly raise and maintain the temperature of a pool above that of the heat pump thermostat set point, such that there is minimal requirement for additional heating energy.

As with all GeoBubble™ materials, a Sol+Guard™ cover can also reduce evaporation from a pool by up to 98%. Not only does this conserve water - an increasingly scarce and important resource - but it also helps to significantly reduce the rate at which heat is lost from the surface of swimming pool. The cooling effect of evaporation which can be responsible for as much as 70% of the heat loss, potentially more during heatwave conditions when the evaporation rates are higher. By covering a pool and essentially eliminating evaporation, the solar energy entering a pool is instead utilised for temperature gains.

Experimental Procedure

Between 14th June and 14th July 2023, a study was conducted on two identical outdoor test pools insulated to Part L building regulations, located at our state-of-the-art testing facility in the south-east of the United Kingdom. The scope of these tests was to determine the benefits of covering a heated outdoor pool with a Sol+Guard™ pool cover, with respect to energy savings and chemical consumption.

To achieve this one test pool was fitted with a Sol+Guard™ cover and another left uncovered to act as a control.

All test pools at our facility measure 8m x 4m, having been designed to be representative of an average sized, domestically owned pool. The pools have a volume of 41,600L and each contain an array of 6 type-T thermocouples at their centre, continually logging water temperature at incremental depths and calculating the average water temperature. Logging and compilation of the temperature data is completely autonomous, maximising accuracy and reproducibility of results. A bespoke computer programme was developed to achieve this and was coded using specialist LabView™ software. This programme was designed by Plastipack engineers in close collaboration with experts at the University of Surrey.

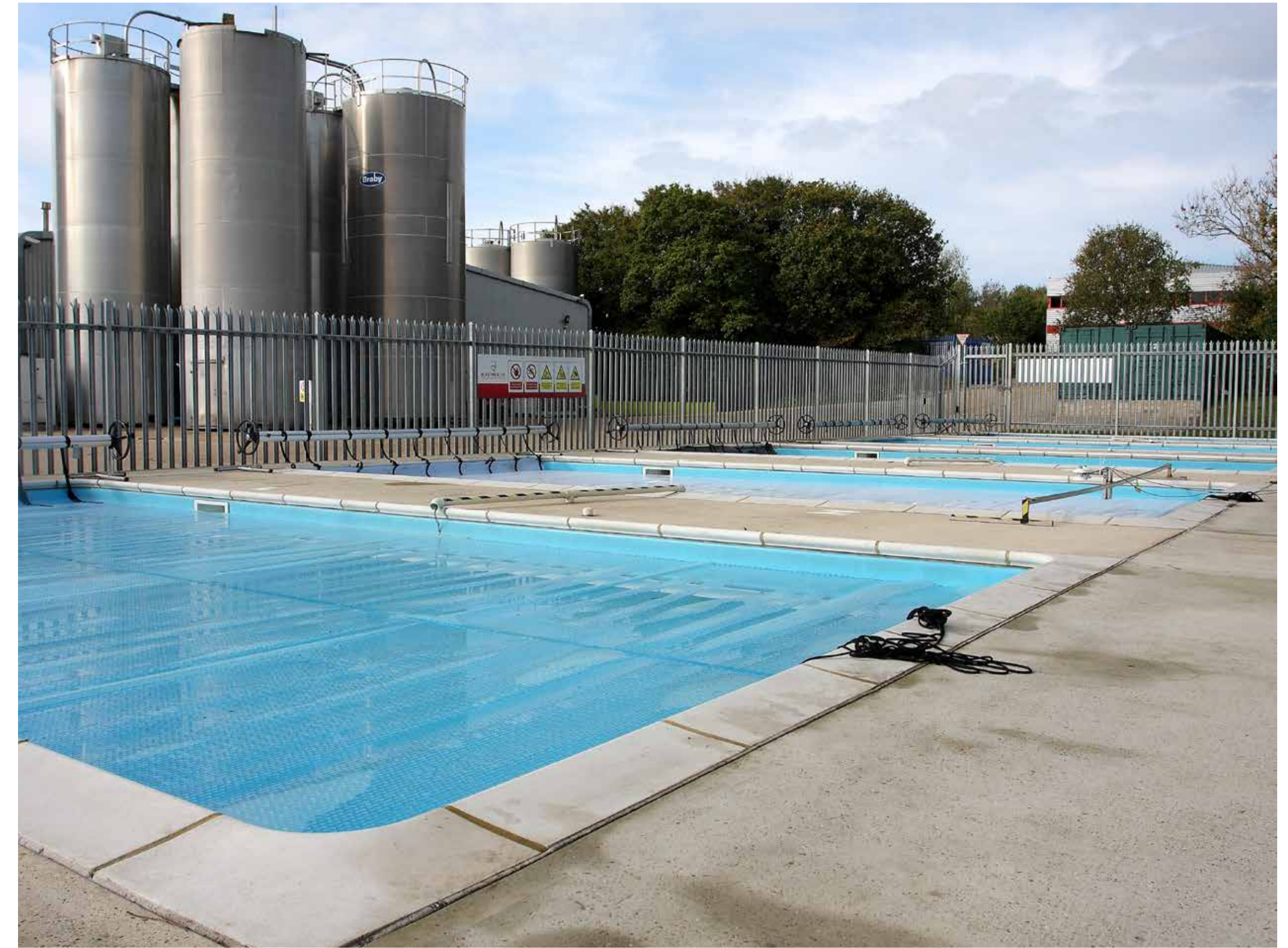


Fig 3: Test pools on the Plastipack premises

Each pool is serviced by its own 0.75kW filtration pump and heated using identical 1.25kWh heat pumps, which were on timers and set to 28°C. The filtration pumps were also set by timers to be running continuously between 07:00hr and 21:00hr, whilst the heat pumps ran between 08:00hr and 20:00hr. This filtration and heating pattern was selected as it most efficient for heating purposes. By ensuring that water is circulating sufficiently around the pool and through the filtration system prior to the heat pumps starting, heated water is quickly and efficiently distributed throughout the pool. The energy consumption of both the filtration pumps and heat pumps were recorded twice daily, at 08:00hr and 14:00hr. This data was then compiled to provide us with energy consumption data for both the test and control pools.

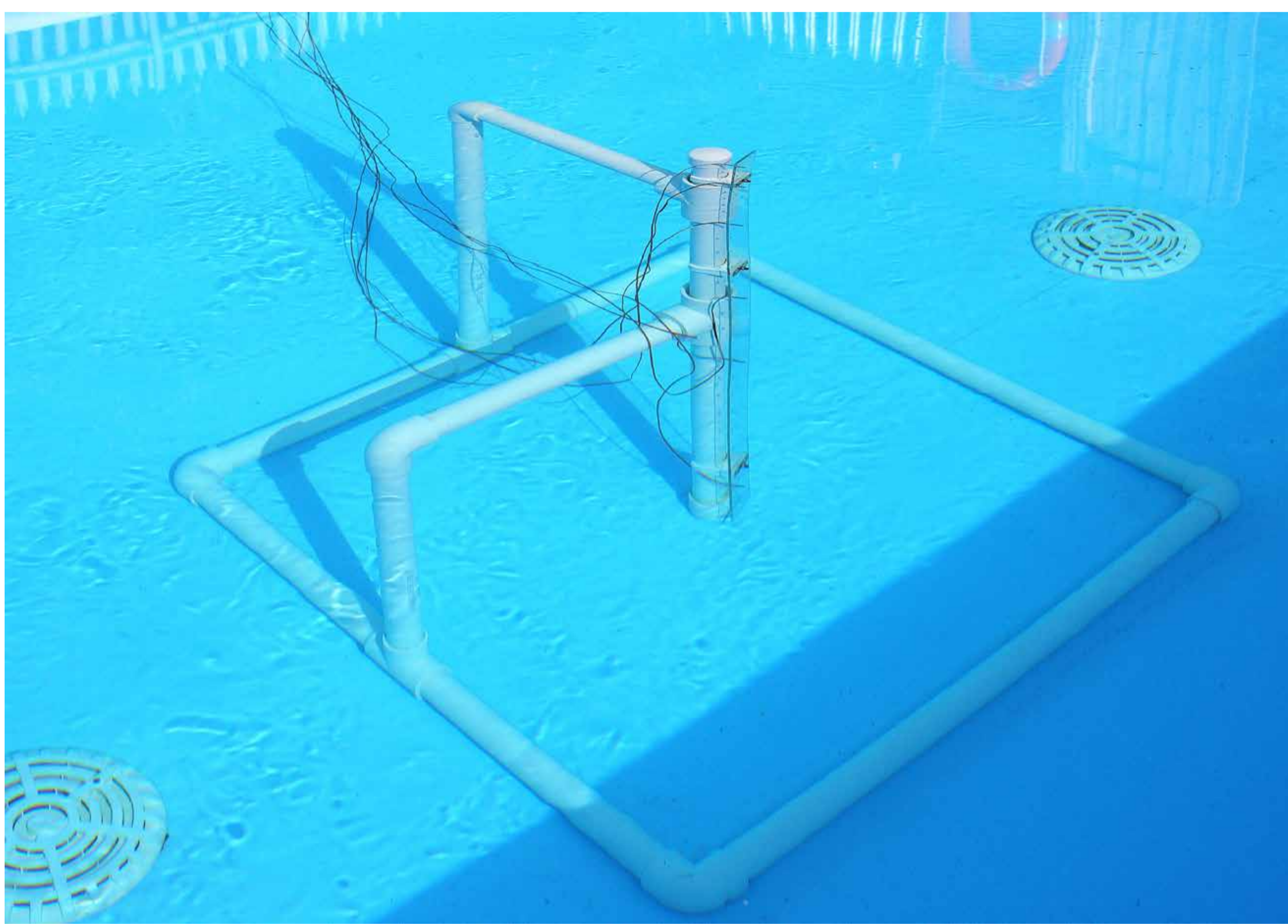
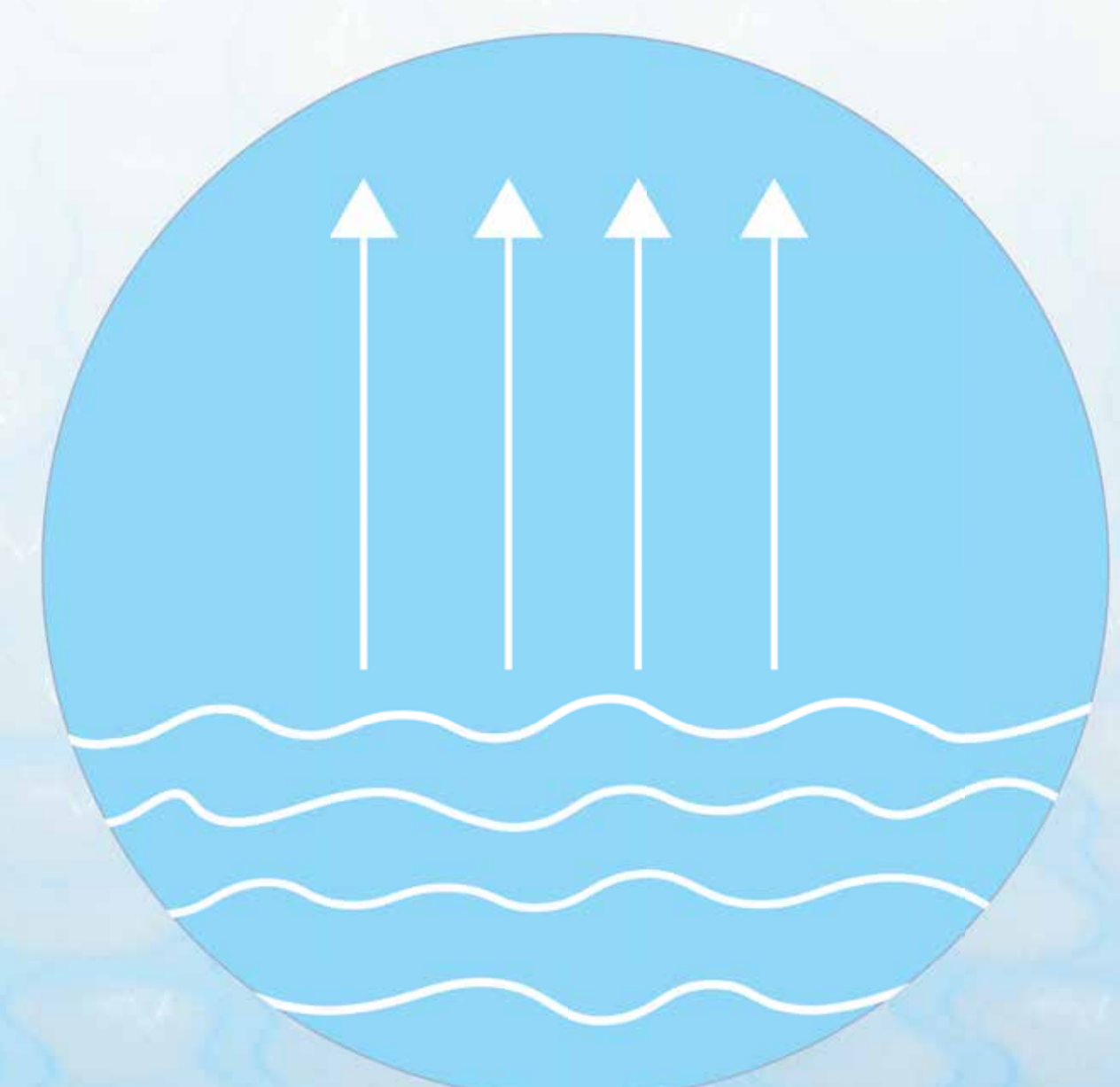
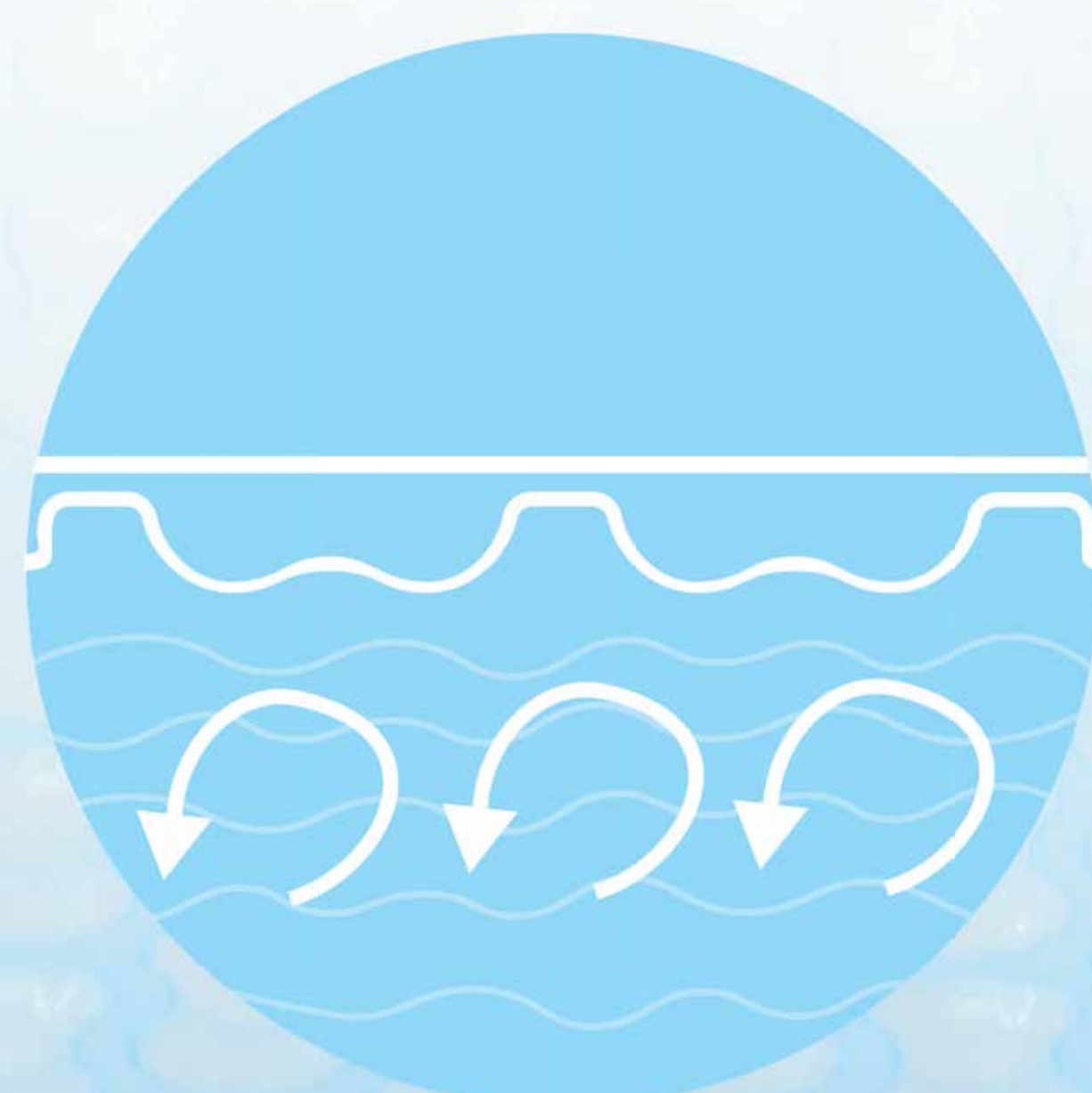
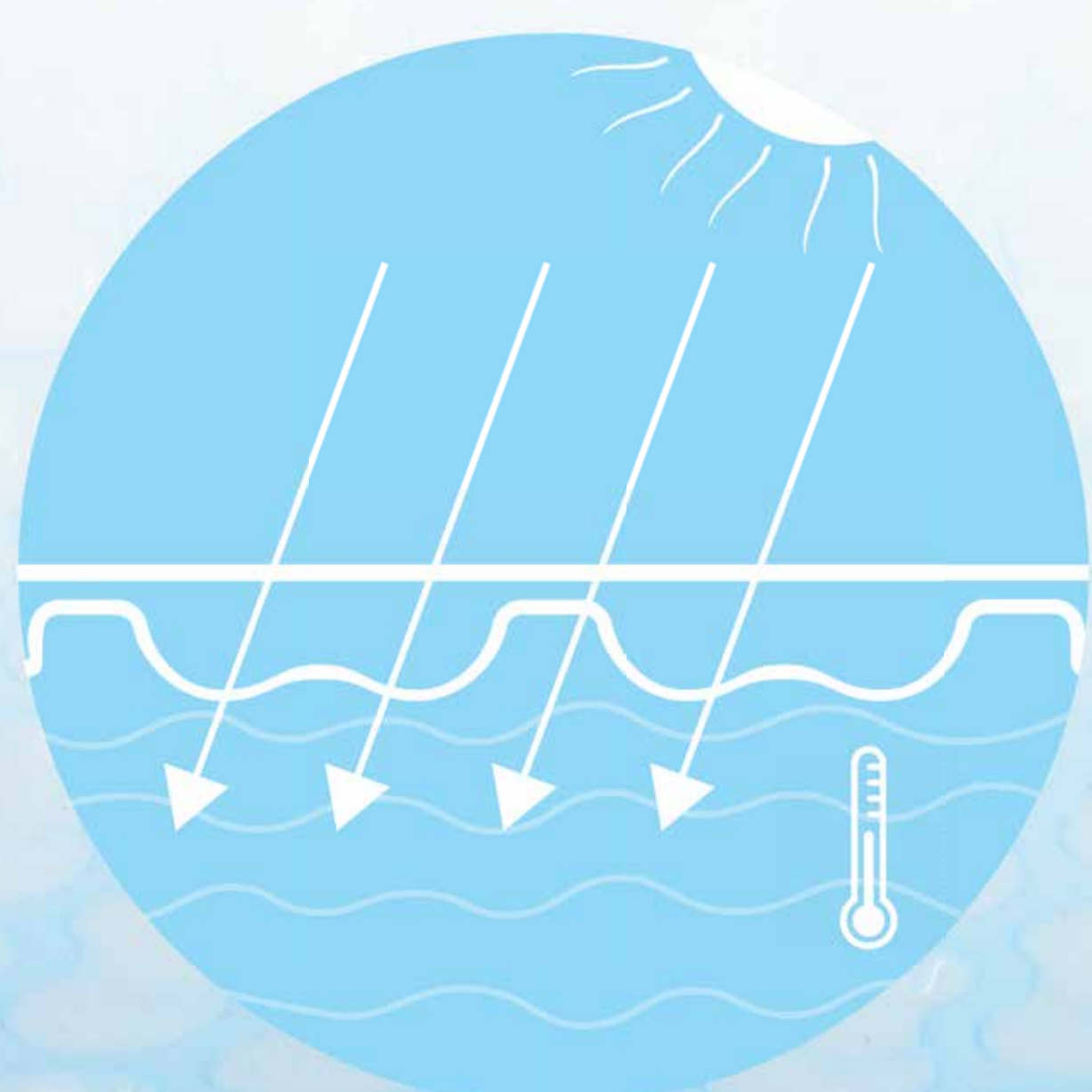


Fig 4: Thermocouple rig in one of the test pools on the Plastipack premises

Water chemistry samples were taken every other day to ensure that chemical balance of each pool remained within the accepted industry standards. pH, free chlorine, and combined chlorine concentrations of the pool water were logged digitally using a specialist photometry device. Any chemical additions required to restore and rebalance water chemistry to within the acceptable limits were recorded. These records were used to build a detailed dosing regimen for each test pool to allow for a comparison of chemical consumption.

Previous testing has been conducted to determine the effects of GeoBubble™ products with respect to controlling evaporation from the surface of a pool. A test was devised whereby two unheated tanks, with a surface area of 1m x 1.5m were each filled to a depth of 0.435m.

One tank was subsequently covered with a 400 Grade standard GeoBubble™ product, and the other left uncovered before being positioned outdoors in direct sunlight for 3 days during summertime. At conclusion of the test the water depths of both tanks were measured and used to calculate the water remaining in each tank. Percentage water lost by evaporation was subsequently calculated for comparison.



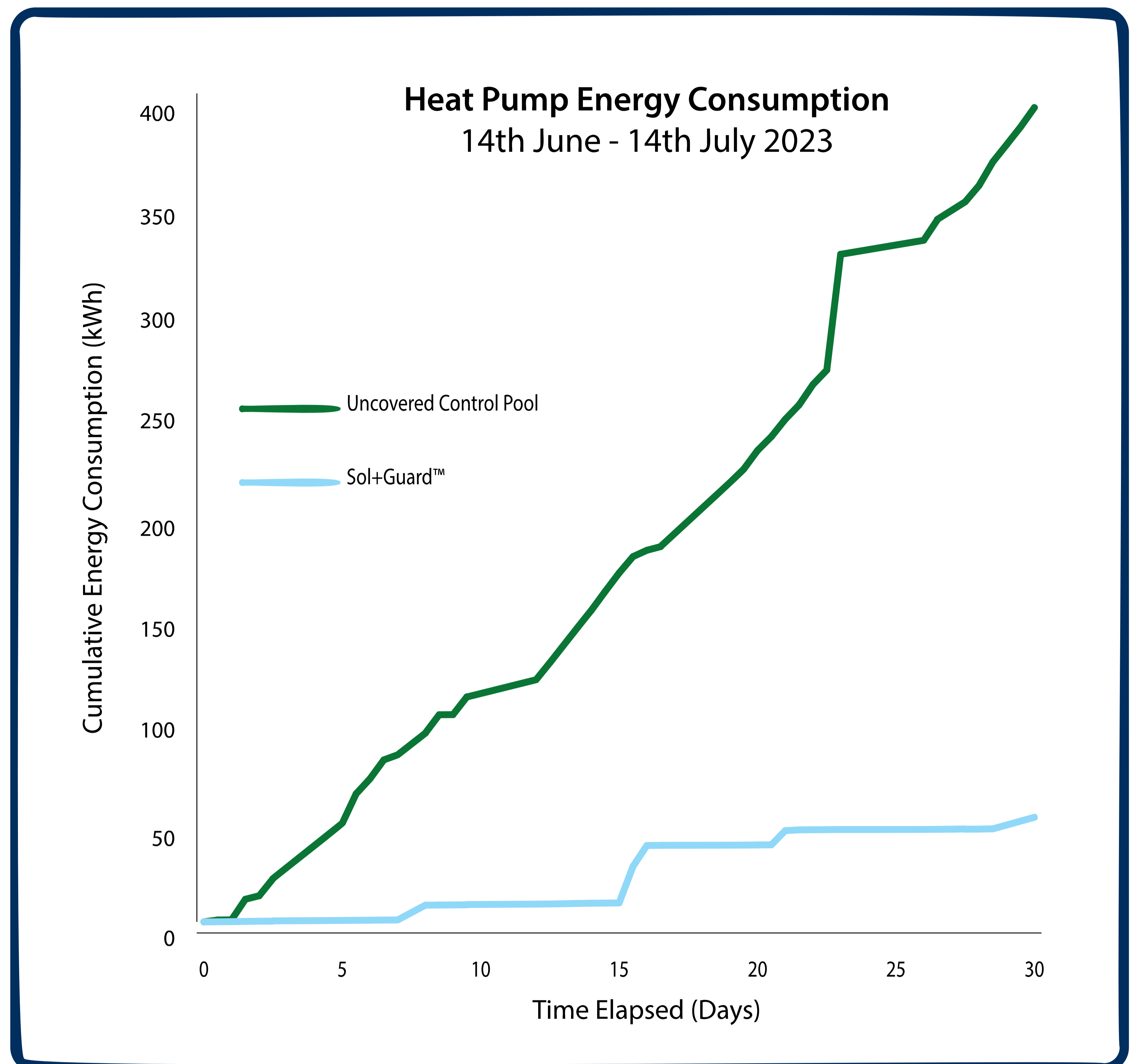
Energy Savings

Although a 3-4°C increase in temperature may sound modest, Figure 6. shows the how covering a pool with Sol+Guard™ can make a significant impact on the heating costs associated with running a heated outdoor pool.

It was found that the heat pump servicing the uncovered pool was in use far more than the heat pump servicing the pool covered by Sol+Guard™ cover. After 30 days the pool covered with Sol+Guard™ had consumed 50.5KWh of energy, whereas the uncovered pool consumed 393.3KWh. These results represent an energy saving of 87% for the pool covered with Sol+Guard™. This further shows the importance of retaining heat overnight, controlling evaporation and maximising solar gains during the day by covering a pool with a high-performance solar cover.

This enormous saving is explained by the fact that the pool covered by Sol+Guard™ had surpassed the heat pump thermostat set point of 28°C at the commencement of the study and maintained it until the weather turned less favourable after day 18. This meant that the heat pump had minimal work to do for most of the study's duration and is thanks to heat retention overnight and through evaporation control, as well as maximising solar gains throughout the day.

*Right: Fig. 6 Heat Pump Energy Consumption
14th June – 14th July 2023*



For the 30 days that the test was running the cost of heating the uncovered pool was calculated to be £117.99, whereas the cost for the pool covered by Sol+Guard™ was found to be just £15.15. It can therefore be determined that during the course of a single 6-month swimming pool season, covering an outdoor 8m x 4m heated pool with Sol+Guard™ has the potential to save 2,056.8KWh of electrical energy, with a cost equivalent to £617.04. Over its 8-year warrantied lifespan a single Sol+Guard™ cover would therefore save 16,454.4KWh of power, offering a financial saving of £4,936.32.

NB: These prices were calculated in accordance with Ofgem's Energy Price Cap in the UK, which was set at 30.0p/kWh at the time of publication (August 2023) <https://www.ofgem.gov.uk/information-consumers/energy-advice-households/energy-price-cap>

What is GeoBubble™ technology?



GeoBubble™ is the geometric bubble design, developed specifically to improve the performance and lifespan of floating swimming pool covers.

Traditional bubble covers have offered little design innovation since first being introduced to the swimming pool market. It is common for a traditional bubble cover to exhibit excessive thinning in the bubble profile, resulting in a material that is susceptible to premature degradation and with a significantly reduced useful lifespan.

The unique shape of our patented GeoBubble Technology™ eliminates these weak points, presenting a bubble profile that is 50% thicker at its thinnest point vs conventional bubble covers. Inclusion of a larger air cell and supporting structural arch allows GeoBubble™ products to better withstand bubble collapse and allow greater room for internal air expansion. This means that the expected lifespan of GeoBubble™ products are up to 25% longer than any existing equivalent material incorporating a traditional bubble design.

Chemical Consumption

Chemical additions to the test pools were closely monitored during the study period. This allowed the performance of the Sol+Guard™ cover to be assessed with respect to chemical savings. Pool water samples were taken on alternating days and stabilised chlorine was added accordingly to balance the water concentration to within industry standards (2-4 parts per million). The 'chemical consumption' of each pool was assessed by recording the additions of stabilised chlorine each pool required to remain within this range. During this study, stabilised granulated chlorine was added to a test pool if water concentration of free chlorine dropped below 4 PPM. Ordinarily the test pools would have been maintained at 3 PPM, however the regimen was increased to account for the heatwave conditions – warmer water will significantly increase the rate which free chlorine is depleted from a pool.

Figure 7. shows that over the duration of the study, 1842g of stabilised chlorine granules was added to the pool covered by Sol+Guard™, whilst 2598g was added to the uncovered pool. These results represent a 24% reduction in chlorine additions for the pool covered by Sol+Guard™.

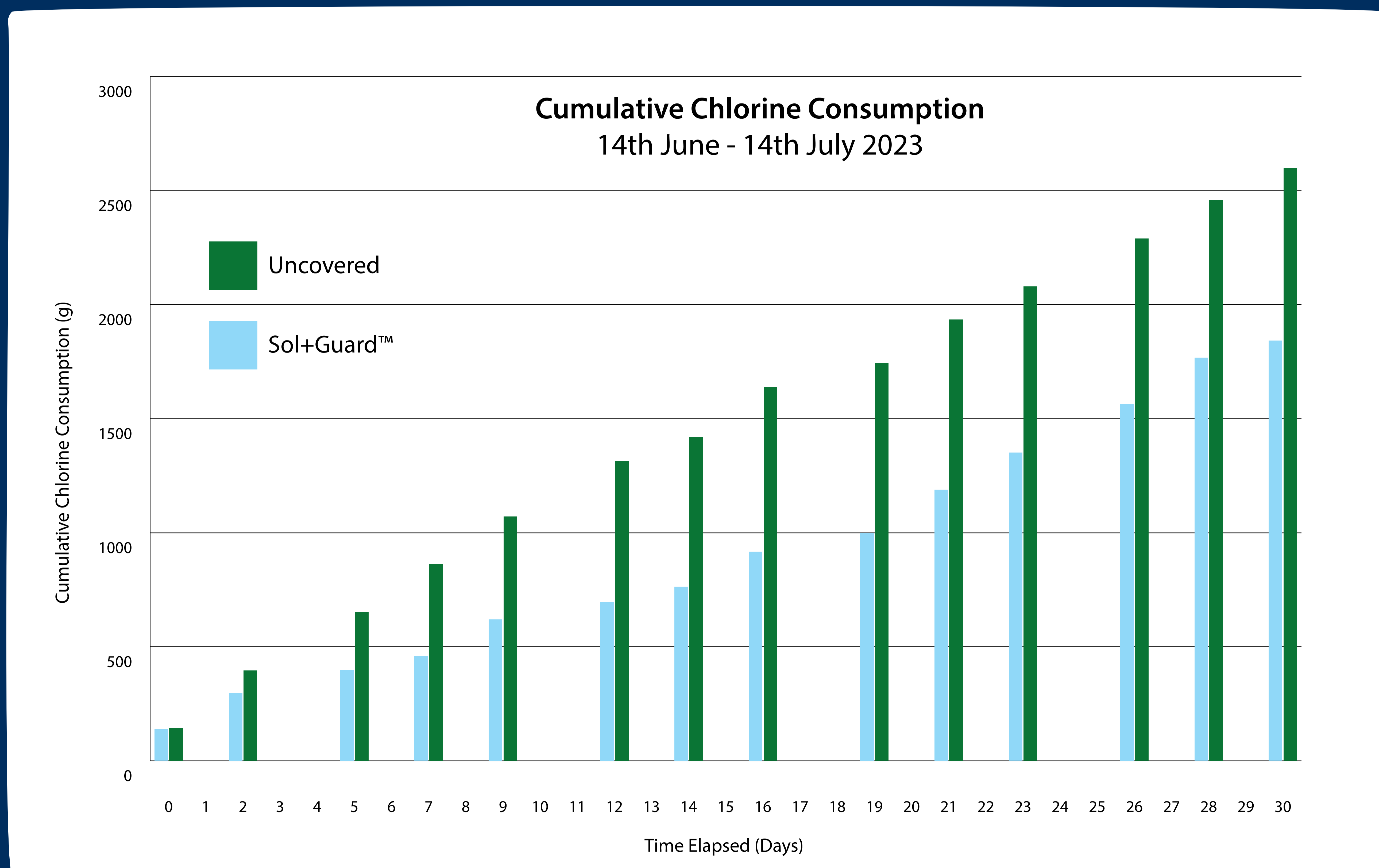


Fig. 7 Cumulative Chlorine Energy Consumption, 14th June – 14th July 2023

The reduction in chemical consumption is due to the Sol+Guard™ cover preventing dirt, debris and algae spores from entering the pool. A swimming pool is particularly susceptible to dirt and algae ingress following rainfall. By acting as a physical barrier, covering a pool with Sol+Guard™ helps to defend against contamination and helps to reduce the amount of free chlorine which is consumed for the purposes of eliminating algae and maintaining balanced water chemistry.

During the 30-day study period the uncovered pool had consumed £36.11 in chlorine granules whereas the pool covered with EnergyGuard™ consumed just £25.60. Over a full 6-month swimming pool season this saving equates to £63.60, or £508.80 over the duration of a Sol+Guard™ cover's 8-year warranted lifespan.

NB: These prices were calculated based on a UK RRP of £69.50 for 5kg of stabilised chlorine at the time of publication (August 2023) <https://www.poolwarehouse.uk.com/index.php/product/chlorine-granules-5kg/>

Results and Discussion

Solar Gains and Temperature Regulation

For the duration of the 30-day study the pool covered with a Sol+Guard™ cover remained on average 3.5°C warmer than the uncovered control pool. Over the course of the study the maximum temperature for the Sol+Guard™ covered pool was 33°C, achieving an increase in temperature of 6°C over the uncovered control. Figure 5. details the average pool temperature of the test pools during the study.

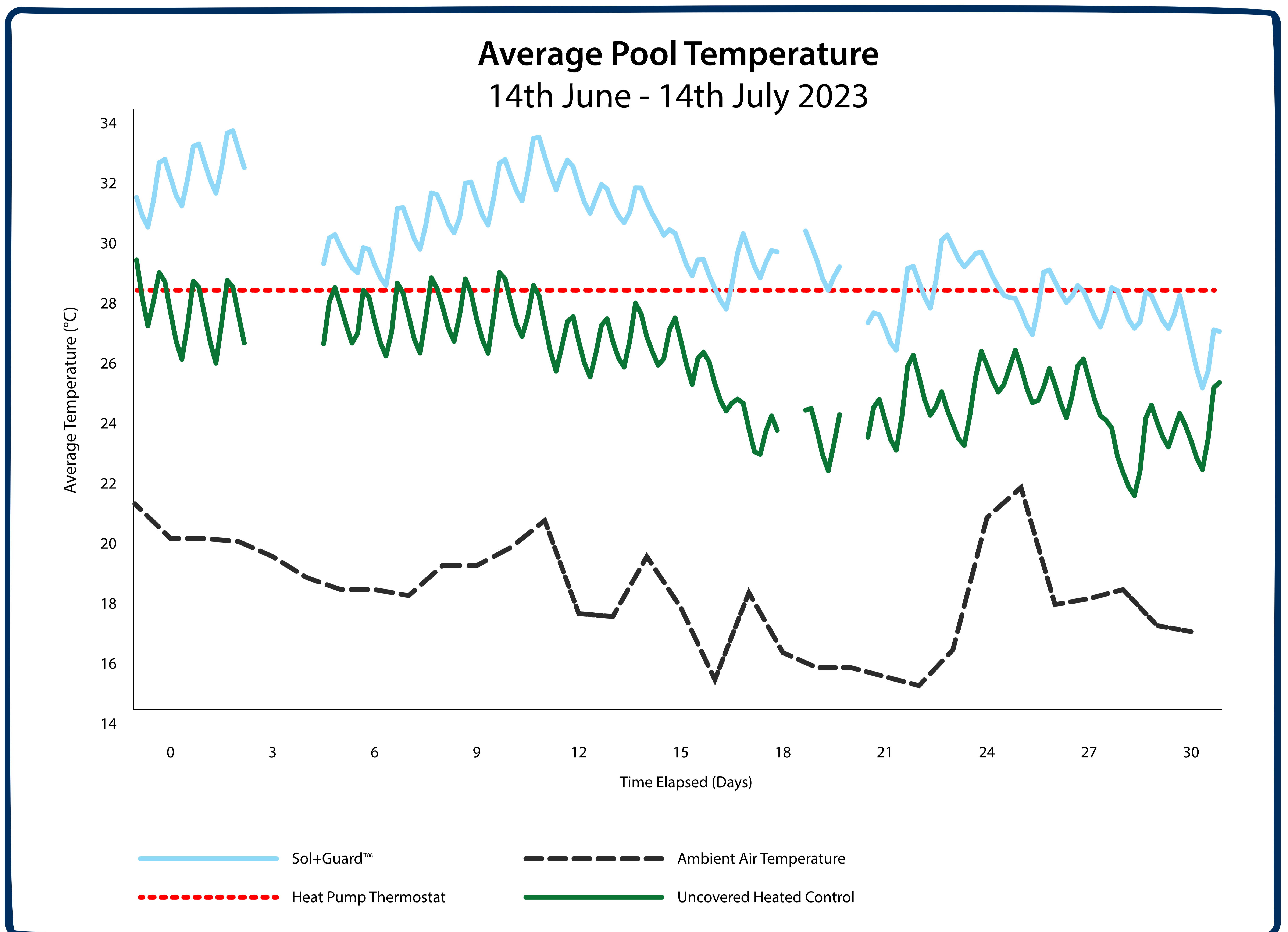


Fig. 5 Average Pool Temperature, 14th June – 14th July 2023

It was found that during the day both pools saw an increase in average temperature, thanks to a combination of solar gains and electrical heating from the heat pumps servicing each pool. Similarly, both pools saw a reduction in temperature overnight when the heat pumps were not running. The uncovered pool consistently lost almost all the heat it gains during the day when the heat pump was running, whereas the pool covered by Sol+Guard™ retained its heat overnight. This allowed the pool covered by Sol+Guard™ to increase its average temperature over the course of several consecutive days. Naturally both pools also saw periods when the average pool temperature gradually reduced over the course of several days, this was due to extended periods of cooler and cloudy days or rainfall. To highlight this the average daytime ambient temperature has also been plotted on Figure 5. It can be seen that the rise and fall of the temperature of both pools closely follows the same pattern as that of ambient air temperature.

Heat retention and the elimination of evaporation meant that the pool covered with Sol+Guard™ reached its maximum temperature of 33°C, whereas the uncovered pool was only able to reach a maximum temperature of 28.5°C (after dropping from 31°C - the temperature at which the pool started the study, having previously been covered for maintenance) The uncovered pool was unable to utilise solar gains effectively to increase water temperature above that of the thermostat set temperature. This is an excellent example of the consequences of leaving a pool uncovered whilst not in use and why it is always best to cover a pool when looking to eliminate the effects of evaporation and maximise water temperature.

Evaporation Control

It has been found during previous testing that a tank covered with GeoBubble™ materials exhibited a 98% reduction in water loss, when compared to an identical uncovered tank. This means that for an average sized pool of 4m x 8m in the UK, covering it with GeoBubble™ products equates to a water saving of approximately 32,000 litres per year versus leaving it uncovered. This saving will be greater in hotter, dryer climates or regions subject to high winds.

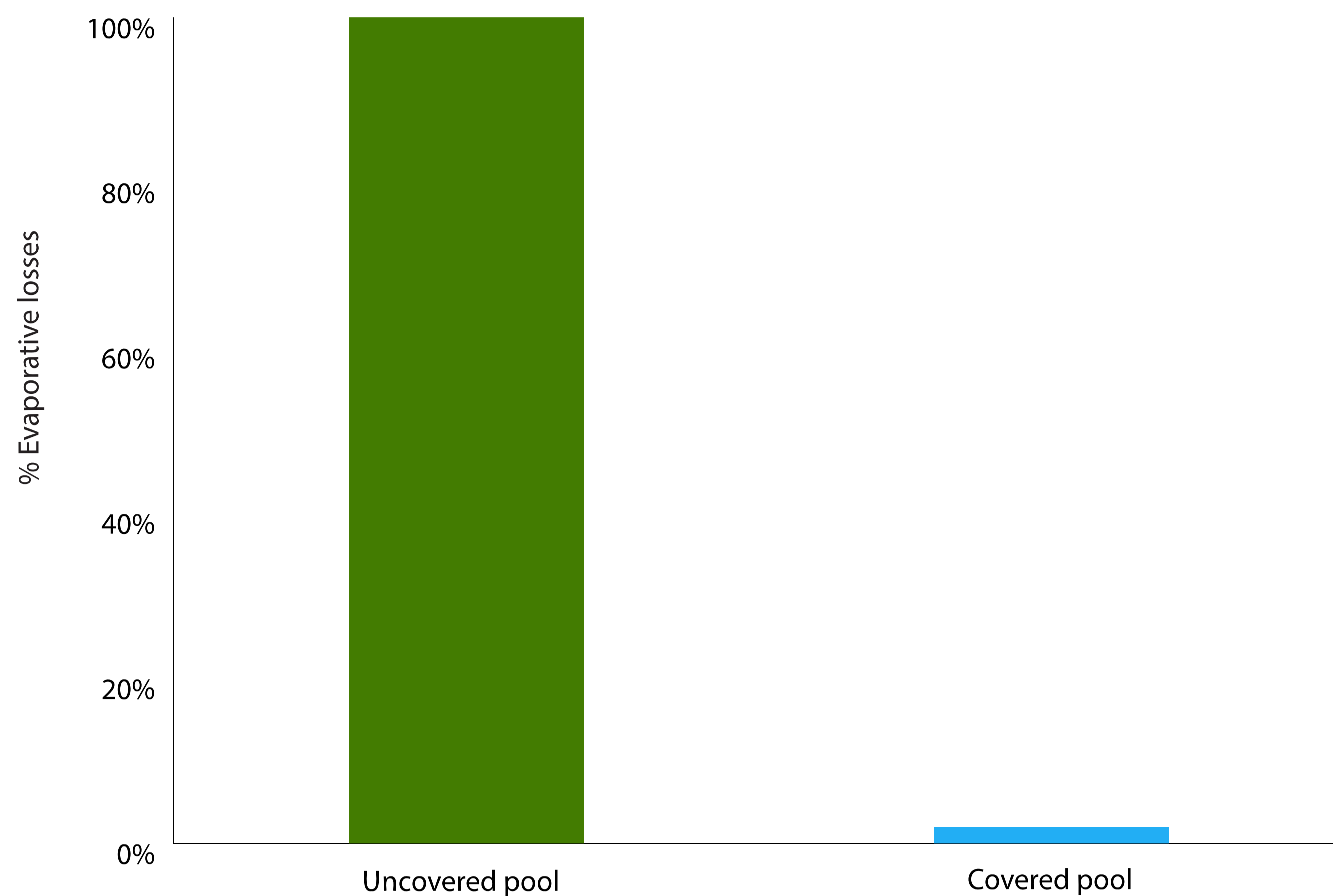


Fig. 8 Percentage evaporative losses from uncovered vs. covered pool

It is important to state however that evaporation is only prevented when the cover is in situ. A study by California Polytechnic State University [1] has shown that the degree to which a cover prevents evaporation, is directly proportional to the proportion of the water surface which is physically covered. A GeoBubble™ pool cover eliminates almost all evaporation by acting as an impermeable physical barrier. This prevents water being needlessly wasted and eases demand in regions where water supply is limited. Preventing evaporation from a pool's surface will also result in a warmer pool as it will significantly reduce the effects of evaporative cooling, the mechanism responsible for up to 70% of heat loss from a pool. Without the natural cooling that occurs when water is vaporised and released into the atmosphere, surface energy is retained as heat promoting a more stable water temperature.

[1] Effectiveness of Pool Covers to Reduce Evaporation from Swimming Pools: Misgana Muleta, Department of Civil and Environmental Engineering, California Polytechnic State University, Jan 2016

Summary

During this summer 2023 study it was found that the Sol+Guard™ covered pool had a reduced energy consumption when compared to the uncovered pool. The reduction in energy consumption was achieved by reducing heat loss and evaporative cooling effect whilst simultaneously increasing solar gains significantly. Sol+Guard™ achieves high transmission of solar energy through careful selection of pigments and additives which maximises the total IR energy entering the pool. This IR energy is subsequently absorbed by the pool water beneath and brings about a greater increase in temperature in the covered pool. Covering a pool Sol+Guard™ can reduce heating costs by up to 87%. It was found that the Sol+Guard™ cover promoted an average temperature increase of 3.5°C above that of the uncovered control and a maximum temperature increase of 6°C. By preventing dirt and debris from entering the pool, the Sol+Guard™ cover also reduced the stabilised chlorine consumption of the covered pool by 24%, further promoting cost savings when running and maintaining a pool.

At the end of a Sol+Guard™ cover's warranted lifespan it has the potential to save £5,440.80 in combined energy and chemical costs. An 8m x 4m cover currently retails for £257.92 in the UK meaning that an end user would be £5,182.08 better off after 8 years, when taking into consideration the initial cost of buying the Sol+Guard™ cover. According to this data, the cost of the cover is paid back after just 72 days thanks to these savings, well within the first year of the cover's life.

NB- The RRP price of an 8m x 4m Sol+Guard™ cover in the UK was determined to be £257.92, available from an online retailer at the time of publication (September 2023)

<https://www.poolwarehouse.uk.com/index.php/product/rectangle-solar-covers/>

Find out more at www.geobubblepoolcovers.com/solguard/



Sol+Guard™ material uses scientifically proven techniques and innovations like the GeoBubble™ to make the product a resource saving material. All testing was carried out using strict scientific methods, to ensure the findings of this report are accurate. To see more information about Sol+Guard™ covers please visit <https://www.geobubblepoolcovers.com/solguard/>

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