new EnergyGuard™

Selective Transmission

EnergyGuard™ Specific benefits:

- Increases water temperature by up to 7°C
- Algae growth is inhibited
- Reduces filtration times by up to 50%
- Reduces chemical consumption by up to 60%
- Reduces energy consumption by up to 60%
- Can be used as a winter cover

General cover benefits:

- Available with GeoBubble™ technology
- Eliminates water evaporation by 98% +
- Reduces debris contamination
- Saves money and shrinks your carbon footprint
- 6 year pro rata manufacturer's warranty

The new EnergyGuard™ selective transmission patent applied for* swimming pool material presents the highest possible savings in respect of reduced maintenance costs and offers solar gains without the threat of algae, all from a single pool cover, making it the most advanced and blanket/cover yet.

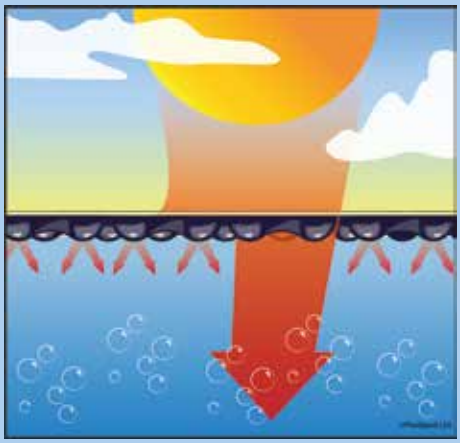
Swimming pool cover materials can be traditionally divided into three categories, each with different solar performance and benefits:

- Opaque materials absorb solar energy, blocking out light inhibiting algae growth and transferring this energy into the top surface of the pool water where it heats the water through conduction.

- High transmission materials allow the maximum amount of the sun's energy to penetrate, directly heating the water itself.

- Reflective materials redirect solar radiation away from the water to produce a cooling effect.

The midnight-blue colour of the New EnergyGuard™ selective transmission material absorbs the wavelengths that ordinarily promote algae's photosynthesis, instead converting these wavelengths into heat through conduction. The cover also directly transmits other wavelengths into the pool water where they heat the water directly. This means that all available wavelengths of solar energy are efficiently harnessed to heat the pool while keeping the pool algae free at the same time. This remarkable technical innovation creates a high performance material capable of raising water temperatures naturally by up to 5˚C in the UK and an estimated 7˚C in warmer climates, reducing both chemical consumption by 60% and energy consumption by 60%, all in an algae-free environment. As such, the new EnergyGuard™ selective transmission material marks a significant breakthrough and a new era in thermal pool covers / solar blankets.

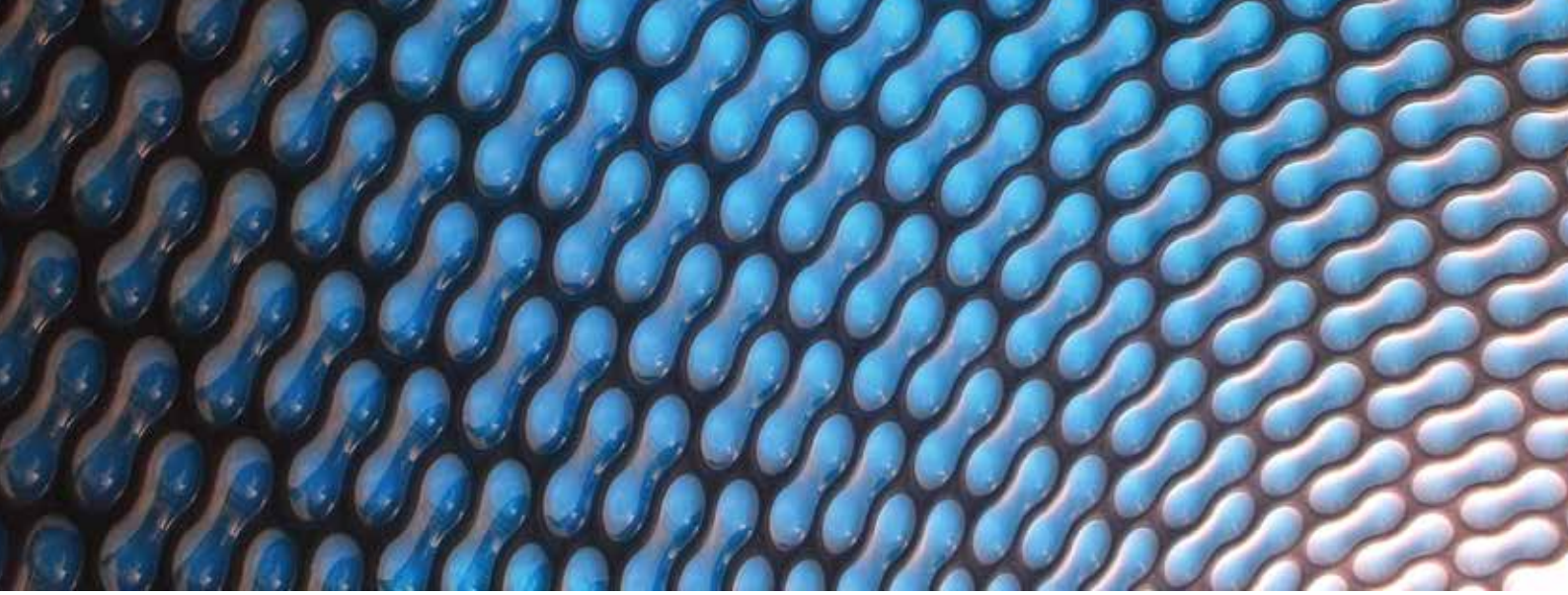


What is GeoBubble™ technology?

The GeoBubble™ material has a geometric bubble shape developed specifically for swimming pool covers, increasing the material's longevity and boosting overall performance.
Traditional bubble designs exhibit excessive thinning at the corners resulting in a far more vulnerable mateiral susceptible to premature degradation.
The smoother shape of the patented* GeoBubble™ technology eliminates these weak points with a material 50% thicker at its thinnest point than those using the traditional bubble designs. With the inclusion of a larger air cell profile and addition of a structural arch to withstand air expansion and prevent bubble collapse, combined with Plastipack's UV anti-oxidising additive packages, the material's lifespan has been increased by over 25%

*Patent applied for No: GB1509903.9

*Patent No: PCT/2010/001851



In July 2013, a pool covered with the new EnergyGuard™ selective transmission material was compared simultaneously with:

1. an uncovered control pool
2. a pool covered with Plastipack's high transmission Sol+Guard™ material
3. a pool covered with the previous iteration of the opaque high absorption EnergyGuard™ swimming pool cover material.

The four test pools were unheated outdoor pools, all 3.66m in diameter with a water depth of 0.565m, situated in the South East of the United Kingdom.

Temperature gain

The purpose of the test was to record temperature variances in each pool, from the build-up to the point at which the temperature differences were constant. Figure 1 below represents a day to night reading at the midpoint of testing.

Figure 1 shows that the new EnergyGuard™ selective transmission cover had a dramatically increased heating performance compared to the test pool covered with the previous iteration of the EnergyGuard™ material. These increase of heating efficiency reaches levels close to that of the high transmission Sol+Guard™ material, a translucent material designed for maximum heat gain.

The new EnergyGuard™ increased performance can be explained by the selective transmission properties of the material filtering light to heat the water. By absorbing the wavelengths responsible for photosynthesis, both the new and previous iteration of the EnergyGuard™ material pass the associated heat to the rest of the pool. However the new EnergyGuard™ material has the further ability to transmit infrared wavelengths non-essential to photosynthesis and very efficiently absorbed by the water to contribute to a direct heat gain.

Figure 1. Average pool temperatures 09/07/2013 to 10/07/2013

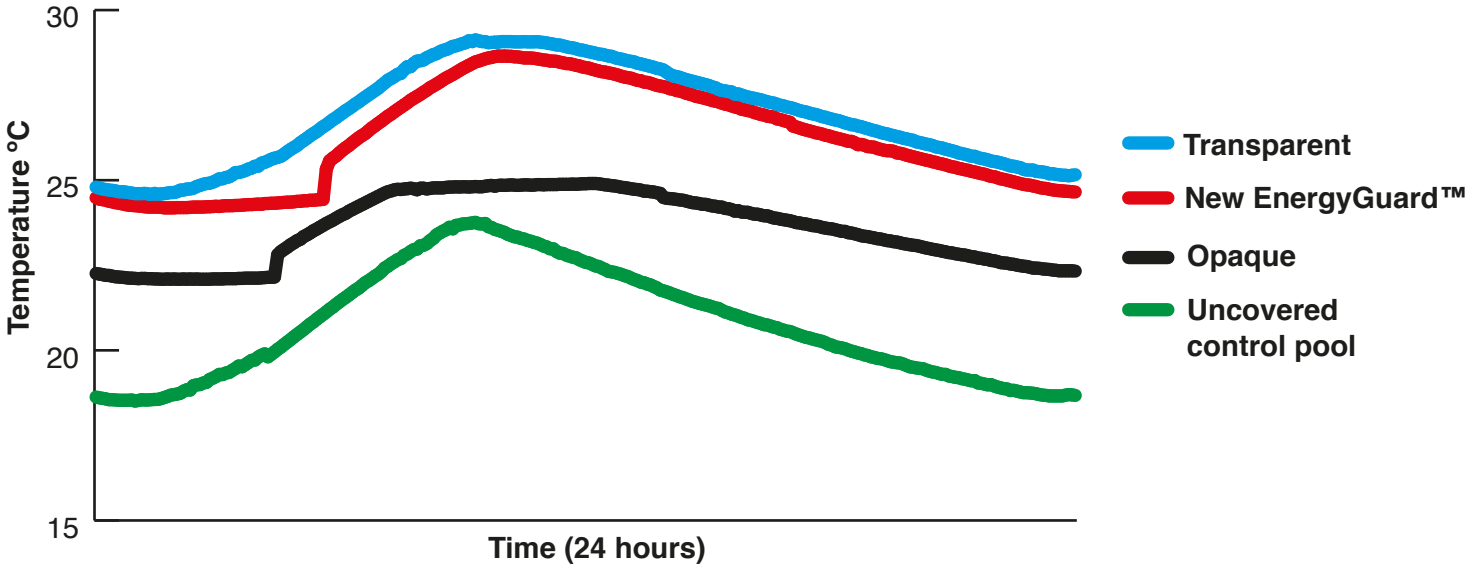
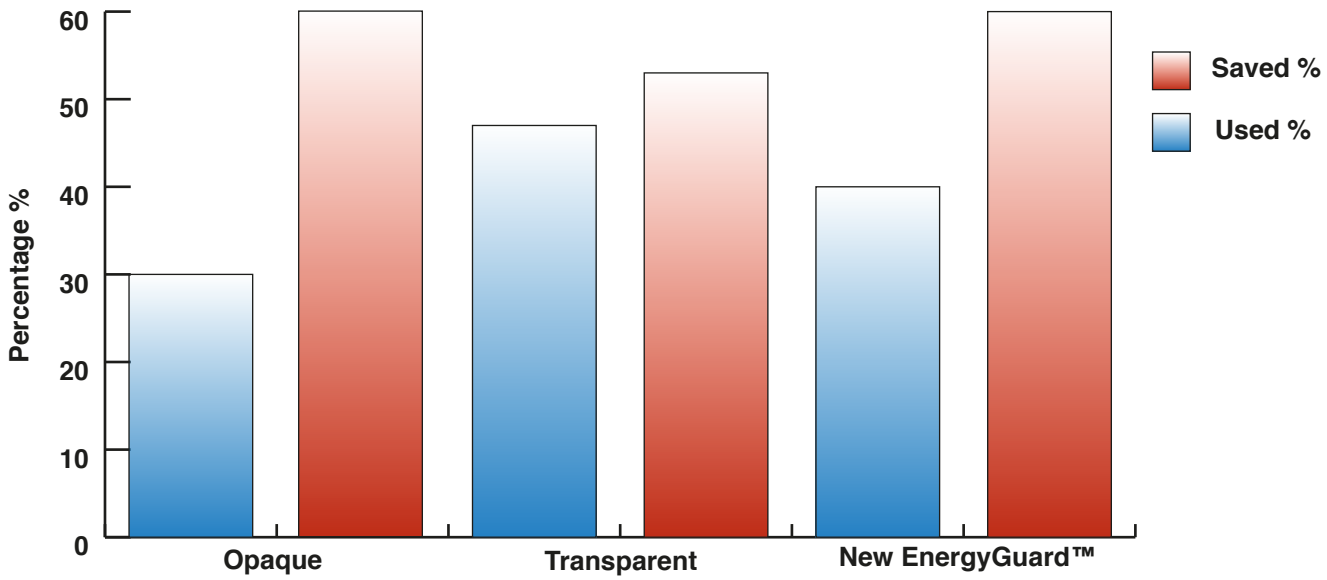


Figure 2: Chemical usage compared as a percentage to an uncovered pool



Chlorine consumption

Using the same four test pools described above, chlorine consumption tests were also conducted, taking daily water samples and adjusting chlorine balance to within industry standards i.e. between 2-4 parts per million (ppm) of free chlorine. The chemical consumption was monitored by the number of grams of chlorine each individual pool required to remain within the required range.

Figure 2 shows the chlorine consumption savings compared to the uncovered pool. All covers allow for at least 50% saving on chlorine consumption.

The test pool covered with the new EnergyGuard™ selective transmission material demonstrates a chemical saving of nearly 60% slightly lower than the previous iteration of the opaque high absorption EnergyGuard™ material, but still clearly outperforming the high transmission Sol+Guard™ material.

The difference observed between the Sol+Guard™ material and the new EnergyGuard™ selective transmission material can be explained by the latter's ability to inhibit biological growth by absorbing the wavelengths responsible for photosynthesis, whereas the reduction in chemical savings seen from the previous iteration of the EnergyGuard™ is most likely the result of the higher temperature that increases the chlorine's photolysis kinetics.

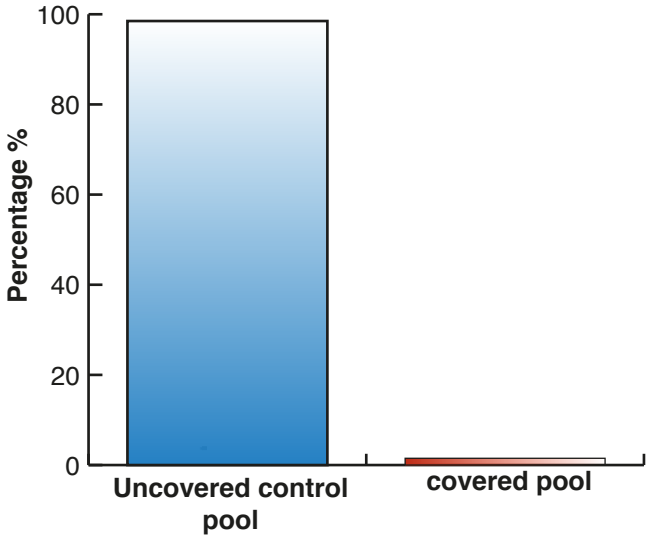
Evaporation prevention

To test a pool cover's ability to curb evaporation, Plastipack conducted tests using two unheated outdoor tanks each measuring 1 x 1.5 x 0.435m. One tank was covered, the other left uncovered. This test was done in July 2009 in the South East of the United Kingdom.

The covered tank showed a 98% reduction in water losses. This equates to a saving of approximately 32,000 litres per year for an average sized pool of 4m x 8m. This saving would be considerably higher in hotter climates and in areas subject to high winds.

A swimming pool cover or solar blanket eliminates almost all water evaporation, saving water resources and enabling a more sustainable pool with a lighter water footprint. Without the natural cooling effect that occurs when water is converted to vapour and released into the atmosphere, higher and more stable water temperatures are achieved.

Figure 3. Evaporative water losses

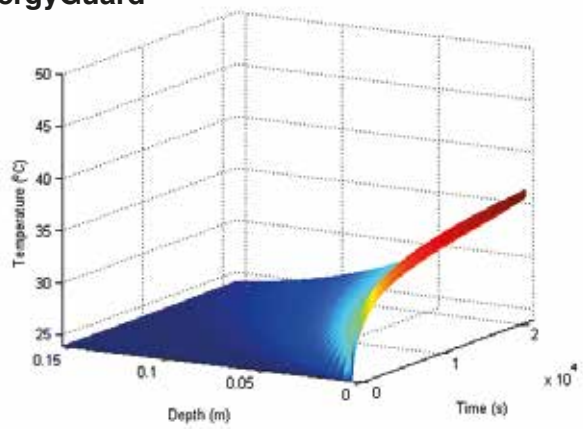


Laboratory testing and development

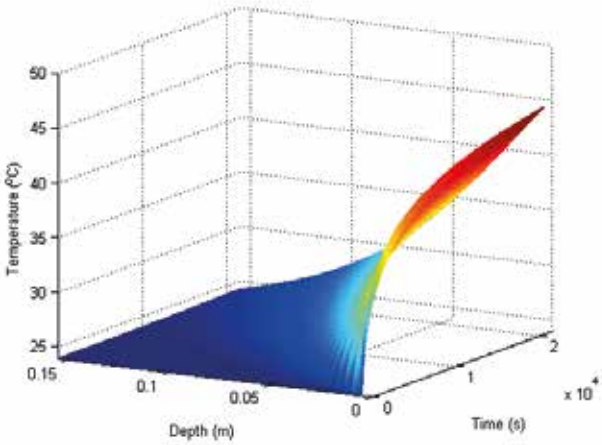
Plastipack produced sample films with different pigments, exhibiting unique optical properties absorbing the light required for photosynthesis but transmitting the wavelengths key to heating water. The heating potential of the covers were then investigated through FEA (finite element analysis) as shown in figure 4, laboratory experiments using a solar simulator and product field testing as shown on figure 1.

Figure 4. Finite element anaylsis of swimming pool cover material

Old EnergyGuard™



New EnergyGuard™ Selective Transmission



Algae inhibition

Plastipack tested the films on their ability to inhibit algae growth. Beakers containing gelatine balls of algae (Chlorophyta Scenedesmus Quadruicauda) were covered with the sample materials and exposed to a controlled light source. The algae's respiration was then monitored by analysing the pH of the water in which they were suspended.
The material's ability to inhibit algae growth was later confirmed at field test facility where the controls were repeated and the water was tested in a natural environment during the UK's spring season.

Increases pool temperatures

Inhibits algae growth

Retains heat

Prevents evaporation