GLACIEM CO_2 TECHNOLOGY

HEAT PUMP

GLACIEM COOLING TECHNOLOGIES

Retrofitting Air Exchange Units with Glaciem

You will have seen the energy rating stars that you see on household appliances. These rate the appliance with regard to how many times greater than 1 that appliance is for energy consumption. The more stars it has, the more efficient the appliance is. We use a more specific measure for energy efficiency with thermal systems and it is called a COP. The ***Coefficient of Performance***.

This is a measure of how much useful thermal work is done by a machine for a unit of electrical energy **1kW of power**. An electric water heater that you see in most houses has a COP of 1. A gas water heater will have a COP of about 0.85. But **a heat pump** for heating water can have a COP of >5. This means that for every 1kW of electricity that you use, the system will produce 5kW of heating. The heat pump is not 'making' the energy, it is simply transferring it from the air surrounding the machine to be used somewhere else, like a swimming pool.

The bad news about gas

While gas was cheap to buy many Aquatic Centres installed gas water heating systems as they cost less to run than electric systems. But these systems at the end of the day still have a COP of about 0.85. Now that gas has almost reached parity with electricity for price that party is over. Switching over to using an electric driven CO_2 heat pump can produce ***multiples*** of savings for pool owners.

The good news about heat pumps

Glaciem have been working to develop systems that can be **retrofitted** to your existing hot water and air handling systems, to provide the same functions, but at far higher efficiencies. And higher efficiencies convert to lower operating costs for pool owners.

Why we use CO2 heat pumps

The CO_2 in the heat pumps operates as a super critical fluid providing highly efficient heating and cooling rates in comparison to standard systems. For example:

A conventional reverse cycle air conditioning unit has a COP of 3.5

A well designed and integrated CO_2 heat pump has a minimum COP of >5

This difference in performance makes it worthwhile to decommission the existing compressors in Air Exchange units, as these units run 24/7 and are usually are the largest single user of electricity in an Aquatic Centre.

Can I displace my current gas pool heating and retrofit a reverse cycle air conditioning system for pool air heating with a CO_2 heat pump?

Yes you can. By installing a fully integrated CO2 heat pump in an air exchange system as well as providing heating for the swimming pool water the savings are a multiple of the existing system.

WHAT DOES ALL OF THIS MEAN?

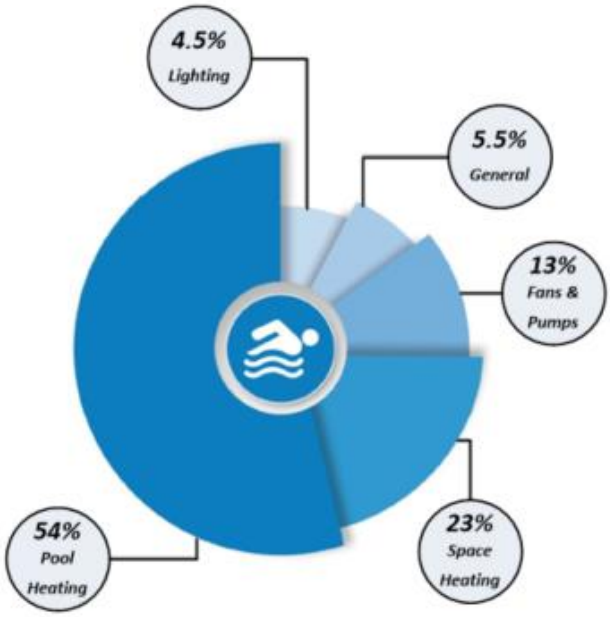
Let's step through the maths of this equation.

COP of Heating a swimming pool with gas = 0.85 meaning that 100kj of gas produces 85kj of heat

COP of Heating a swimming pool with a CO_2 heat pump = 5 to achieve the same 85kj of heat

0.17 of input energy is required (0.85/5 =0.17) =***83%*** saving

Figure 1 below represents the typical energy usage profile for a swimming pool. 54% of your energy goes to heating the pool the 83% saving above reduces your total cost by **45%** (0.83*0.54 =45%)



The same methodology can be applied to the pool space heating

COP of reverse cycle unit for heating a swimming pool space air = 3.5 meaning produce 100kW of heating 28.6kW of electrical energy is required

COP of Heating a swimming pool space air with a CO_2 heat pump = 5 to achieve the same 100kW of heat

20kW of electrical energy is required (20/28.6 =0.7) =***30%*** saving

From Figure 1 above space heating represents 23% of the total energy used in swimming pools 30% saving above reduces your total cost by **7%** (0.3*0.23 =7%).

The above combined savings represent a **52% reduction** in the total energy cost of operating a swimming pool.