# A fresh approach to poolside energy performance

**INDOOR POOLS ARE** one of the most energy intensive building spaces with inherent health and safety risks, challenging architects, developers and building managers with questions of design, installation, operation and maintenance.

The lack of any outside air ventilation or air temperature control in heated pools can lead to surface condensation with subsequent building fabric degradation and poor indoor air quality, at the detriment of occupants' health and wellbeing.

In addition to the high operating costs of any heated pool environment, there is the hidden cost of building fabric degradation if the moisture in the air is allowed to condense. Hence, it is imperative to have high levels of outdoor 'fresh' air circulated through the pool hall to control the temperature and relative humidity for the comfort of pool patrons and reduce condensation from occurring.

Air Change has been designing and manufacturing swimming pool air heating systems for more than 15 years using air to air heat recovery, and now offers a single unit solution to heat both air and water in enclosed heated swimming pools. This has been particularly effective at the Galston Aquatic Centre, where there has been evidential improvement of indoor quality and energy cost savings since installation.

The Galston Aquatic and Leisure Centre is located in the Hills district of Sydney within the local government area of Hornsby. The centre features a 25m x 8m lane indoor pool and fully equipped gymnasium, offering 'Learn 2 Swim' classes, squad training and aqua aerobics. Hornsby Shire Council sought expressions of interest to provide a de-humidifier for the pool hall that would provide ventilation and heating and be subject to an Energy Performance Contract (EPC). The EPC was focused on improving air quality, improved system management processes and reducing heating, ventilation and maintenance costs over the long term.

"POOLPAC PLUS USES LESS THAN HALF THE ENERGY OF A TRADITIONAL WATER HEAT PUMP."

## DX HEAT PUMP

The PoolPac Plus system was created by Air Change to meet council's EPC requirements. The unit is a direct expansion (DX) heat pump system designed to control the air temperature, humidity and the pool water temperature in a single packaged unit.

The pre-existing system at Galston comprised of a direct exchange air handling unit with a typical pool water heat pump using outside air as the heat source for pool water heating, supplemented by a bottled gas water heater. It lacked any outside air ventilation or air temperature control.

Heated indoor pools lose water and heat from the pool water surface continuously because of evaporation leading to concentration of harmful airborne chemicals and humidity in the pool environment. In chlorinated pools, chloramines are produced when bodily proteins such as skin and sweat react with chlorine and evaporate into the pool air breathed by swimmers and workers.

These chloramines are a major cause of childhood asthma and cause lung damage equivalent to smoking, as well as skin and eye irritation. Fresh air is necessary to dilute the internal air and reduce the concentration of harmful chemicals.

The PoolPac Plus system ventilates the space by supplying fresh outside air into the pool hall, while simultaneously exhausting the moisture laden chlorinated indoor air. More importantly, it uses this hot moist air as an efficient heat source for a DX heat pump system to heat both the pool air and water. Air to air heat recovery is very efficient and can extract up to 75 per cent of the heat in the exhaust air with minimum energy consumption.

The DX heat pump recovers the remaining heat from the exhaust air and uses this energy to heat the pool water or air as required. By using this warm exhaust air as the heat source in the winter months, the PoolPac Plus can use less than half of the energy of the traditional water heat pump and performs effectively without the need to 'defrost'.

The Australian standard requires the Galston Aquatic Centre to extract and replace 4,000 litres per second of exhaust air. In addition, it is important to control the temperature and relative hu-

midity in the swimming pool hall for the comfort of the pool workers and non-swimmers. High relative humidity causes condensation to form on cold surfaces leaving a corrosive liquid which can cause major damage to the building fabric, pool plant and equipment, loudspeakers, pipe work, conduits, rod/bar supports for ventilation ducts and water slides.

Directing warm supply air from the pool air handling unit onto external windows and wall surfaces can also help to increase their temperature and reduce condensation. Finally, limiting the relative humidity of the indoor pool air and maintaining the air above its dewpoint (temperature/relative humidity) eliminates the risk of condensation occurring. Precise temperature and relative humidity control is essential to ensure a safe, efficient and comfortable environment.

## ENERGY MODELLING

The PoolPac Plus uses a sophisticated control system to prioritise heating during off-peak times and minimise energy use during peak network demand times at the aquatic centre. This load shedding can be quite easily achieved in swimming pools due to their inherently large thermal mass of water. The swimming pool temperature can be raised very slightly during times when power is inexpensive and heating can be reduced or completely turned off during peak periods.

Energy modelling showed in advance that this system would provide major energy savings while providing the necessary ventilation, superior indoor air quality and reduction of relative humidity to prevent corrosion and damage to the building structure. To establish the success of the PoolPac Plus installation it is important that the system be continually monitored for both energy and heating performance.

**The PoolPac Plus Unit at Galston Aquatic and Leisure Centre in Sydney.**

Over the past six months of monitoring, the system clearly meets the requirements of the Council. There is evidential improvement of air quality in the pool hall and a significant reduction in energy use and costs.