Swimming in savings

Rotary heat wheels provide a fresh air option without the expense of additional equipment, Bill Ellul explains and provides a long lasting example of the simple technology.

There has recently been an increase in research on the subject of fresh air quality and indoor environment associated with a reduction in energy usage.

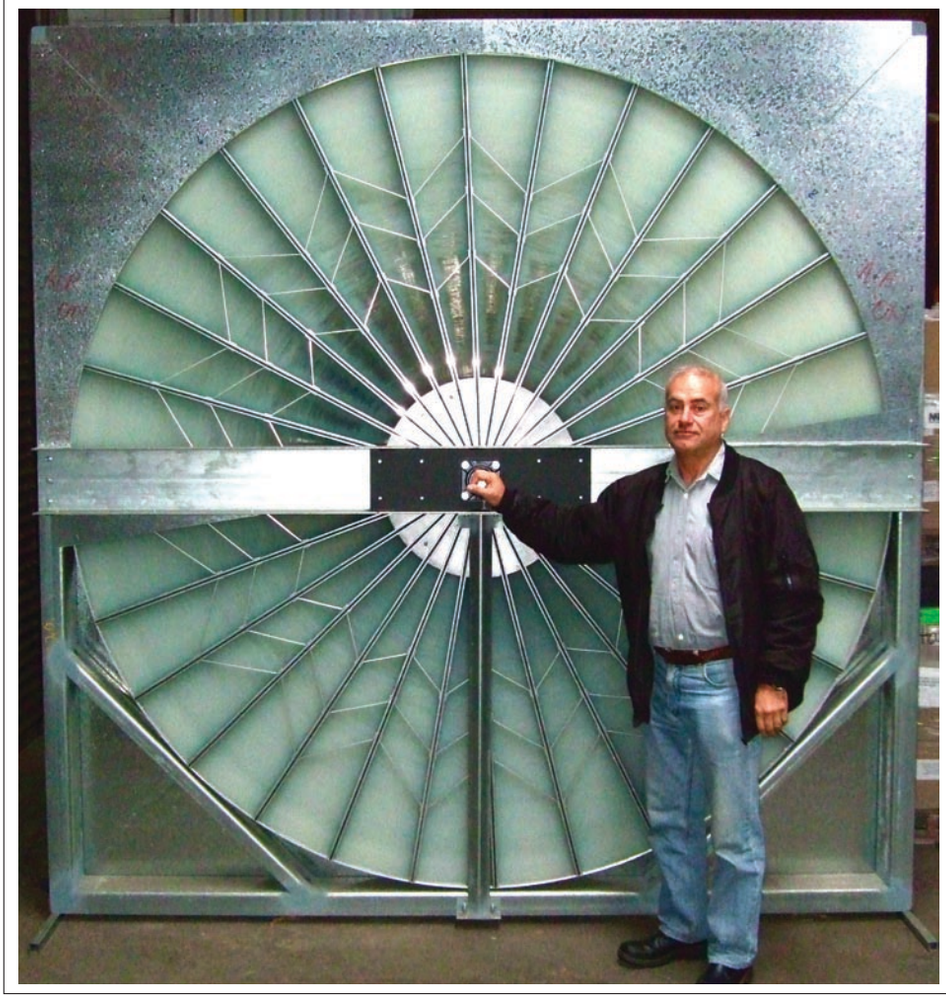
There is no doubt about the enormous benefits associated with introducing sufficient quantities of fresh air into our buildings. This obviously introduces, however, a high energy requirement to condition the incoming fresh air to produce comfort conditions, causing conflict with the desire to reduce energy usage in today's environmentally conscious world.

The common use of natural ventilation in buildings as a means of reducing fresh air flow and reducing energy consumption is what I would call a cave man approach to solve the problem and does not work. Simply put the aim of natural ventilation is to take advantage of what is commonly known in air conditioning circles as economy cycle.

It has always been understood that when outside conditions are better than inside then a simple ventilation mode is required of the air conditioning system without the operation of the air conditioning equipment. In other words all that is required is for the fresh air fan to bring fresh air into the building and the exhaust fan to exhaust the unwanted building air. In order to save energy many energy auditors recommended the use of economy cycle as a good option.

Unfortunately with conventional systems this mixed mode of operation necessitates a design which bypasses the air conditioning system in order to operate in purely fresh air mode, This will require bypass ducting and dampers or, in the cave man alternative, opening windows. Bypass ducting and dampers are expensive capital components and dampers are renowned for failure and leakages.

The cave man approach does not guarantee proper air flow and is bound to fail any air quality test. Furthermore, a leaking building will not have any waste energy recovery as it



would be impossible to provide it when there is no control over the lost opportunity escaping the building. Many consultants give the reason for not using forced ventilation systems with heat recovery because mixed mode operation is too complex.

The simple and elegant solution is to use a high efficiency low pressure drop rotary heat exchanger (RHE) which will simply switch from recovery mode to economy cycle ventilation mode simply by stopping the wheel's rotation. No bypass dampers and ducting required. This is because the RHE is a variable heat exchanger with heat exchange a function of the rotor speed. At zero speed there is no heat exchange so the system converts to just ventilation. All other fixed forms of energy recycling waste energy recovery such as plate heat exchangers will not give this simple flexibility; resulting in complex mixed mode operations which are unworkable and ineffective.

If we can recycle over 85 per cent of the energy in the building exhaust air with only a 100Pa fan penalty, without the use of expensive and inefficient bypass ducting and dampers, the problem is solved.

The Melbourne designed Mylar heat wheel was developed by CSIRO nearly fifty years ago to provide such a solution to the increasing energy crisis. Unfortunately most building air conditioning designers have not recognised that this type of energy recycling equipment is locally manufactured, commercially available and has a long and successful operating history.

The Perth Belmont Oasis Leisure Centre (BOLC) was originally built in 1993 by the City of Belmont and installed three 2.5m Mylar heat wheels manufactured by Rotary Heat Exchangers (RHE) of Melbourne.

They provided the waste heat recovery from the swimming pool exhaust to heat the incoming fresh air to the pool building. The total fresh air flow rate of 26,000 litres per second was designed to provide sufficient fresh air changes per hour to ensure comfort conditions for the pool occupants as well as prevent the damaging effect of moisture condensation on the internal building structure. The design efficiency of these wheels for this flow rate was given by the manufacturer to be 67 per cent at 150Pa.

Bill Ellul, chief executive officer of RHE, calculated "this has resulted in energy savings, under Perth conditions, of 8,000 gigajoules per annum and a greenhouse gas reduction of 500 tons of CO_2 per annum over the past 18 years; amounting to a energy cost savings of approximately one million dollars."

Just last year the Belmont Council, prior to tendering to refurbish the complete pool air conditioning plant equipment, contracted DB Mechanical Consultants to assess the condition of the installed heat wheels with the intent to replace. Daniel Belotti of DB found that the wheels continue to operate at their designed performance. It was decided not to replace the heat wheels in the refurbishment but maintain the current installation.

Above: Eighteen years old and still in suitable nick.
Left: Exhaust vents for the Belmont swimming pool.
Below: One of the wheels installed at Belmont Leisure Centre.

Ellul says "we have been in this business for 43 years and commonly see many of our wheels still operating after several decades of continuous operation. Our longest continuous operation installation is ten 2.5m wheels still operating at Queen Elizabeth Hospital in Perth, installed in 1968."

"Other notable examples of Mylar wheels still in operation are the Melbourne City Baths installed 982 and Geelong's Belmont Hospital in 1973."

Ellul claims these are not isolated cases. "it shows that this exceptionally high life expectancy results in an extremely low life cycle cost being a small fraction of any other alternative.

"For RHE this is not good for business as we don't have any inbuilt obsolescence.

"Furthermore we now offer to buy back the wheels to recycle many of the materials and components of the rotors making this a very attractive green proposition for the environment.

"A major benefit of our design, developed by CSIRO, is the unique small 100mm depth of all the rotors and smooth parallel passage low resistance matrix resulting in negligible carryover contamination of the fresh air. This avoids the detrimental use of purge air to decontaminate the rotor with fresh air as it rotates, which would reduce performance. Purging would be required in the case of much deeper rotors.

The latest versions of the RHE wheels are even more robust, "in the old days we used painted steel round frames but we now use galvanised square frames which are easier to install and are expected to have an even longer life in aggressive pool environments.

"We also now manufacture an even higher efficiency wheel by increasing the amount of heat transfer Mylar for the same size wheel. Generally consultants today select our high efficiency 80 per cent to 90 per cent wheels.