

Building better controls

Technology has long been able to revolutionise the cost/benefits of tried and tested techniques – and heating and ventilating is no exception, as Dr Tom Shelley explains



Pointers

- Modern automation and control technologies are transforming ancient ideas into modern, energy-saving HVAC plant
- Wind catchers, evaporative cooling units and sun energy harvesting devices are now well worth investigation
- Total installed price and operational costs for many of these systems are well below those for conventional HVAC
- The devil is in the detail, which is mostly where intelligent sensors and automation plant score

Improved sensors, electronic controls, automation, modern materials – they're all great, but they're not only about developing radical, high-tech engineering solutions. Many can also give a huge boost to old, some very simple and efficient, techniques. And the major advantage: they're tried, tested and well understood, so all the new technology needs to do is get them working better.

Take the cooling of buildings: methods have existed for centuries, some consuming little or no energy and clearly ripe for renewal in these energy-conscious times. Houses in the south of Iran and the Persian Gulf, for example, have long relied on wind towers that catch even slight breezes.

There are several variants: some mounted on buildings and relying on heated air rising up one side to exit downwind, while cooler and denser air on the upwind side then descends into the building. In others, incoming air is directed through passages to be naturally chilled underground, or assisted with evaporative cooling by passing along an irrigation channel, over a fountain or similar, before re-entering the building.

Monodraught Windcatchers, made in High Wycombe, are among the modern equivalents – essentially wind towers with louvered sides, whose damping systems are no longer manual, but made

from recycled plastic and controlled by temperature and CO₂ sensors. The dampers can open fully for night time cooling during summer, while, at other times of year, they can provide trickle ventilation without draughts. Solar-driven fans are part of the equipment, introducing fresh air at up to 260 litres/sec on demand, while also extracting stale air.

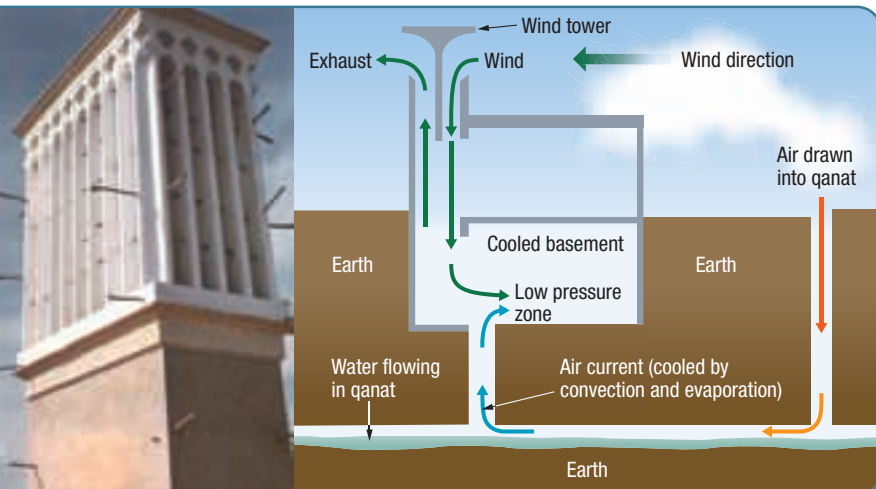
Turning to evaporative cooling (Plant Engineer, September/October 2007, page 8), which requires only a fraction of the energy consumed by conventional refrigeration cycle chillers, today's versions are available from companies such as Seeley and EcoCooling. Control systems on these now ensure that air input and extraction rates are balanced, according to internal and external temperatures; time clocks shut systems down for assigned periods, such as outside working hours; and automated water temperature controls prevent problems with Legionnaires Disease.

Well heeled

Shoe manufacturer Stylo Barratt is one user singing its praises. The company had a summer heat problem at its Yorkshire distribution warehouse, because the 6,400sqm picking area on its top floor had a single skin roof. Conventional air conditioning was ruled out on cost grounds, so group property manager Nigel Booth asked EcoCooling to come up with a proposal. Now, the company has 15 ECP07D down discharge coolers and six extraction fans, with air distributed down the main picking aisles and over the unpacking and discharge zones. Site facilities manager Keith Pemberton described conditions last summer as "beautiful".

In another application, two Breezair evaporative coolers, installed by Clean Air Group, are greatly improving working conditions at London Taxis International in Coventry. Its 1,170sqm workshop is in a metal-framed building with corrugated iron roof, and that structure, combined with heat generated by welding equipment, was pushing temperatures up to around 40°C during the summer months. Tony Curtis, maintenance support engineer at London Taxis, says that even employees in the welding area no longer complain, and adds that its Breezair

Wind catcher systems, with new technology





Grants for microgeneration

The Department for Business Enterprise and Regulatory Reform (BERR) and BRE (Building Research Establishment) are hosting free events across the UK, promoting new grant funding available under Phase 2 of the Low Carbon Buildings Programme (LCBP2).

Grants of up to £1 million per site are available to public sector building owners and managers to help them gain the benefits of renewable energy technologies. Schools, hospitals, housing associations, local authorities and charitable bodies are amongst those eligible, and appropriate plant is any combination of microgeneration technologies, including solar photovoltaics, solar thermal hot water, wind turbines, ground source heat pumps, automated wood pellet stoves and wood-fuelled boiler systems.

For information on the grants, or to check your organisation's eligibility, go to: www.lowcarbonbuildingsphase2.org.uk/events or tel 08704 23 23 13, or email events@bre.co.uk

system has translated into greater productivity.

What about improvements in heating techniques? One of the oldest is harnessing heat from the sun – for example, by warming water. Many buildings in the Middle East are designed with glass fronts on the sunward side and overhanging balconies that shield them from the sun in summer, but reveal low angle sunlight in winter. Clearly, there are limits in a cooler climate, but the principle is enshrined in modern solar heating and heat recovery plant.

Heat recovery

Ashley Gardens Care Centre in Maidstone, an 89-bed care home, for example, was recently equipped with an Andrews Maxxflo CWH 120/300 condensing water heater and Solarflo heating package. The water heater stores 300 litres and outputs 26–122kW, with a recovery rate of 2,040 litres per hour through a temperature rise of 50°C. The solar system has a 900litre duplex tank, equipped with stainless steel solar and primary heating coils, storing water heated by seven 2.55sqm solar collectors, mounted on a flat roof adjacent to the boiler room. These are glazed, with flat plate aluminium tray collectors and stainless steel water chambers, and have 95% absorption efficiency.

There are refinements, though. Back in the late '70s, research at the Montana College of Mineral Science and Technology showed that, to be cost effective, solar hot water heating panels should be made part of the roof, replacing tiles, rather than resting on them – a fact that has been rediscovered by Viridian Solar, near Cambridge, which now offers such products commercially. That company has also teamed up with Dwell-Vent, based in London, but working closely with Cambridge University, which has developed a way of harnessing excess solar heat in summer to cool buildings.


Dwell-Vent has also updated another old idea – that of supply air windows, which warm air by passing it between panes of double glazing. Such units have been around since the 1940s in Finland, saving energy by warming incoming air – both by

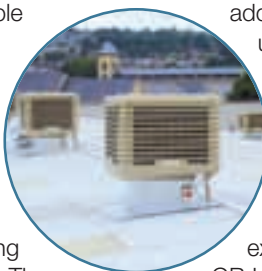
absorbing heat lost via radiation through windows and by capturing heat induced through solar gain. Air flow is driven by natural convection, exhaust air leaving through what the company calls 'passive stacks' (chimneys), but Dwell-Vent has also added 'smart' vents to optimise air flow under sensor-based automatic control.

Yet again, intelligence and automatic controls probably represent the two biggest steps forward – typically, only running pumps and fans when required, and at speeds designed for optimum results. One of the best examples is at process automation firm GB Innomech's new headquarters near Ely, which is managed by a PLC responding to 150 digital and 50 analogue environmental sensors. Actuators automatically control heat, light and ventilation to 15 offices and meeting rooms, 10 communal rooms and 300sqm of workshops. Touch screens allow users to set preferences and these also display status, as well as trends of monitored and controlled devices – connection being via a digital CC-Link network.

Beyond all that, its south-facing front windows have automatically controlled blinds that track the sun. Underfloor heating is fed by a ground source heat pump. Hot tap water comes from a solar vacuum water heater. Low-energy lighting systems turn themselves off when no one is detected and ventilation fans are driven by inverter drives.

In closing, however, it's worth noting a couple of important new pieces of kit. First, the latest firm to announce variable speed drives for ventilation systems is Lenze. Product manager Michael Bannister says that its 8400 series, launched at the Hannover Fair, is registered with the Carbon Trust.

Second, an alternative to ground source heat pumps is Space Air Solutions' Daikin Altherma air source heat pumps, which mean no more burying of pipes – and, according to the company, result in energy savings of 46%. 



Above, centre and below: installing evaporative cooling is low cost and very effective

