

HVAC&R Nation

AN AIRAH PUBLICATION



**Sweet
job!**

Ammonia
the magic
ingredient
for Haigh's
Chocolates

Skills

WORKSHOP

Silver brazing

Future *focus*

8 *trends set to transform our industry*



FUTURE FOCUS

From the eternal push for energy efficiency to refrigerant phase-downs, our industry has shown an appetite and an ability to embrace change. With this month's ARBS exhibition showcasing the latest innovations, **Sean McGowan** picks out eight trends set to transform the world of HVAC&R.

PREDICTIVE MAINTENANCE

Following in the footsteps of other sectors, predictive maintenance in the HVAC&R sector is quickly replacing traditional schedule-based maintenance regimes.

According to leading mechanical contractor Airmaster, predictive maintenance improves the effectiveness of maintenance by evaluating the condition of the HVAC plant through periodic and continuous condition monitoring.

This "smart" monitoring dictates and directs maintenance activities to ensure a building's HVAC&R systems achieve peak performance on a continual basis.

As one of the first sites to have a predictive maintenance program applied, 222 Exhibition Street in Melbourne has seen a reduction in asset failure, improved tenant comfort and significant energy savings resulting in an improved NABERS energy rating.

“

Tenant complaints reduced by 68 per cent as a direct result of the predictive maintenance

”

Within one year, and despite a 13 per cent increase in occupancy rate, electrical energy consumption at 222 Exhibition Street fell by 11.5 per cent. Tenant complaints reduced by 68 per cent as a direct result of the predictive maintenance regime.

Among the technologies used in predictive maintenance are innovative building management and controls systems, sensors, and even thermal imaging tools, which can be used to identify minor electrical faults before they develop into major failures that could cause critical equipment breakdowns. ■



Cooltech's scalable MRS solution uses a glycol/water coolant instead of refrigerant gases.

Source: Magnetic Refrigeration – Proof of concept – over 20kW machine.

MAGNETIC REFRIGERATION

Magnetic cooling (or refrigeration) is based on a principal almost as old as James Harrison's fluid-based refrigeration discovery.

According to Cooltech Applications, a leader in the field, the magnetocaloric effect (MCE) causes the temperature of magnetocaloric materials (MCM) to rise when they are exposed to a magnetic field and fall when they are removed from it.

"The temperature with the strongest effect (the Curie temperature) depends on the properties of each material," says Cooltech. "The power generated by the system depends on the type of materials and their characteristics (mass and shape)."

In a magnetic refrigeration system, a controlled magnetic field applies a series of magnetisation-demagnetisation cycles to the magnetocaloric alloys. Each cycle creates a temperature gradient in the material, with a rapid succession of cycles producing the final, stabilised hot and cold temperatures in the refrigeration system.

An environmentally friendly fluid such as a glycol/water mix is then used to create an efficient heat transfer, thereby reducing energy consumption and carbon emissions.

Magnetic refrigeration is already being used in a range of refrigerators and display cabinets and is sure to grow further as the technology develops. ■

THERMOACOUSTIC REFRIGERATION

Thermoacoustic refrigeration works by using soundwaves and a blend of gases such as helium and argon in a "resonator" to produce a cooling effect.

The main components of a thermoacoustic refrigeration unit are a closed cylinder, an acoustic driver, a porous "stack" and two heat exchangers – one hot and one cold.

Acoustic waves created by the driver (for example, a loud speaker) make the gas resonate. As it oscillates back and forth, it creates a temperature difference along the length of the stack. This change in temperature is created from the compression and expansion of the gas by sound pressure.

Sound too cool to be true?

Over 10 years ago, American ice-cream icon Ben & Jerry's funded the development of a working prototype by Penn State University.

This was interfaced into a standard retail ice-cream freezer cabinet that had its compressor and condenser removed. The evaporator tubing carried a single-phase liquid that was circulated through a heat exchanger in the thermoacoustic unit, to create environmentally friendly, energy efficient cooling of the cabinet's ice-cream. ■



Could thermoacoustic refrigeration become flavour of the month?



FAULT DETECTION AND DIAGNOSIS (FDD)

An estimated 40 to 50 per cent of Australia's commercial building energy consumption is attributed to HVAC systems. So just imagine how much energy could be reduced if inefficient or poorly operating HVAC equipment could be identified and rectified more easily.

No wonder the CSIRO believes the emergence of automated fault detection and diagnostics (FDD) tools could be a game-changer. Some tools are already available, and the technology is poised to facilitate huge energy savings and emissions reductions from commercial HVAC systems.

Some FDD tools are designed to be able to pinpoint tens, if not hundreds, of proven faults in HVAC equipment. Pre-programmed algorithms alert building management staff to potential issues, and help them identify the cause and even suggest preventative solutions.

Recently, the CSIRO participated in an industry trial of FDD tools, including the deployment of a FDD tool at its Phytotron building at the Black Mountain Science Innovation Precinct in Canberra.

This saved 660 Megawatt hours (MWh), which equates to 630 tonnes in carbon emissions and a reduction in energy-related costs of \$90,000. ■

INNOVATION ON SHOW AT ARBS



At this month's ARBS exhibition in Sydney, the popular Speaker Series will feature a number of topics that explore the future trends to impact the HVAC&R industry.

Among them will be a presentation from CSIRO researcher Dr Josh Wall, M.AIRAH, on the latest findings from a range of real-world FDD case studies in commercial buildings. Dr Wall will look at six different FDD solutions from Australian service providers that were implemented, and review the results.

The session is on Tuesday, May 8 at 8.30am and costs \$45 to attend.

For more information or to register visit www.arbs.com.au

PREFABRICATED CONSTRUCTION



A different kind of “drop-in” solution.

Buildings are one of the few remaining products created largely in situ and bespoke. But this is changing.

Thanks to digitisation and the ongoing desire to reduce costs, lessen construction time and improve on-site safety, prefabricated offsite construction techniques are becoming more popular. And they are already revolutionising how we design and create our buildings.

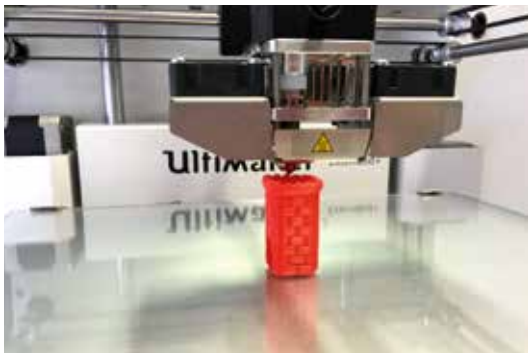
“If you put this emerging trend together with the potential for additive manufacturing techniques (see 3D printing below) and robotic construction and installation methods, you really do have an exciting vision of construction in the not too distant future,” says Bryon Price, F.AIRAH, business development manager for A.G. Coombs.

So far, prefabricated construction has largely been applied to replace conventional construction of items such as ductwork, vertical and horizontal risers, and plant room components. The move to full modular construction will see the majority of the building form constructed offsite.

“This will significantly change how building services are incorporated into the built form,” says Price.

He says multiple modular “technology paths” are being tracked by a number of organisations around Australia, all applying various approaches and materials. ■

3D PRINTING



From spare parts to sausages – 3D printers can produce them.

While manufacturers like Danfoss are already utilising 3D printing to have prototypes and components additively manufactured (the scientific term for 3D printing), it is no longer just the domain of multinational corporations. The technology also promises much for individual technicians and small businesses.

With the price of technology continuing to fall, an industrial micro-revolution is taking place as each home, business and community becomes a potential manufacturer.

According to Murray Hogarth, senior advisor for Green Capital, 3D printing represents a redistribution of power away from big business – a democratisation of manufacturing if you like.

With 3D printers now available at the likes of Officeworks and even Aldi, the days of waiting for a spare part to arrive from a far-off warehouse are theoretically over. Simply print it overnight, and install it the next day.

Additive manufacturing is also being applied to construction, where large-scale concrete “printers” can form buildings within hours. A Chinese materials company showed it was possible to “print” 10 houses in just 24 hours using a custom-built machine that outputs layers of construction waste mixed with cement. Each building features 3D-printed walls and structure. The only section not produced by the 3D printer was the roof of the buildings.

While such construction techniques create relatively basic structures in fast time, another Chinese construction firm has more recently “printed” an impressive 400m², two-storey concrete villa in just a month and a half. And at the South by Southwest festival in March, a US charity and a robotics company teamed up to unveil a 3D-printed house measuring 75m² that was fully up to code and permitted for people to inhabit. While the prototype cost around \$13,000, that price is expected to come down to just over \$5,000.

Not bad going! ■

DEMAND RESPONSE



Demand response projects will have a big impact on HVAC&R systems.

A \$35.7 million pilot project was recently announced by ARENA (Australian Renewable Energy Agency) and the Australian Energy Market Operator (AEMO) to manage electrical supply during extreme peaks. This means you’ll be hearing more about demand response in the coming months.

Demand response involves paying an incentive to energy users to reduce their power consumption, switch to back-up generation, or dispatch their energy storage for short periods when electricity reserves reach critically low levels.

The demand response pilot will be trialled over the next three years in Victoria, South Australia and New South Wales to free up temporary supply of electricity during extreme weather – such as prolonged summer heatwaves – and unplanned outages.

“We’re hopeful this will create the proof of concept for a new market mechanism that will ultimately be to the benefit of Australian consumers,” said AEMO managing director and CEO Audrey Zibelman. ■



85 per cent of Australians surveyed were willing to turn down their thermostat by 2°C



According to a poll commissioned by the Australia Institute, more than 64 per cent of Australians support the idea of incentivising energy users to curb their energy use. The poll also found that 85 per cent of Australians surveyed were willing to turn down their thermostat by 2°C.

Among the successful funding recipients of the demand response trial are energy retailers, a demand response aggregator, and Victorian-based smart thermostat developer.

Zen Ecosystems’ innovative thermostat is expected to be rolled out to more than 10,000 homes and businesses. The thermostats will be networked to a centralised control platform and remotely controlled when a demand response event is called by AEMO.

The same technology has been used successfully in California across a range of markets including retail and hotels. ■

AUGMENTED REALITY (AR)



Call of Duty – HVAC&R!

The term augmented reality (AR) refers to a direct or indirect live view of a physical, real-world environment whose elements are augmented by computer-generated perceptual information that is both visual and auditory.

You may have seen it used before by architects who often have iPads with AR software to bring their design to life onsite. Any number of AR video games are also currently available.

In the HVAC&R industry, Daikin in the Netherlands has trialled high-tech “smart glasses” to help its service engineers in the field.

The AR spectacles support onsite engineers by providing access to technical information such as databases and error codes. The glasses also enable video conferencing with helpdesk staff and colleagues around the world – all hands-free so the technician can follow instructions immediately.

The glasses feature voice recognition and can even recognise objects and codes. A GPS function on the glasses shows the service desk where the technician is, and also allows the service desk employee to see exactly what the engineer sees. ■