Thermal Gradient Header technology, UBC Life Building, Vancouver, B.C.

Light At The End Of The Tunnel

Mechanical and HVAC professionals continue to demonstrate innovation and ingenuity

by ROBIN BRUNET

Sheldon Samborsky, team lead, mechanical for Williams Engineering Canada, echoes the sentiments of many of his colleagues in the engineering/HVAC profession when he says of 2021, "It's as if we're emerging from a long, dark winter. The number of work opportunities is huge, almost overwhelming, in fact."

Unsurprisingly, the focus of new builds and renovations moving beyond the pandemic is on superior HVAC systems, and this dovetails with the ongoing push to increase energy efficiency in a sector that has already achieved substantial gains in this regard.

Williams Engineering recently completed the design of the new HCMA/DUB Architects- designed Coronation Park Sports & Recreation Centre in Edmonton. When construction is completed in 2024, the facility will include a fitness centre, multipurpose rooms, a child play space, and a unique International Cycling Union-sanctioned indoor cycling track.

Samborsky says of this project, "Mechanically the design has lots of flexibility, and we focused on dehumidification as an objective. While this may seem strange for a city as dry as Edmonton, it was necessary given the amount of moisture that will be generated by guests working out – and it's imperative that the special cycling track is kept in good shape, no swelling or cracking. That's why we went with a dedicated outdoor air and dehumidification system consisting of wrap-around heat pipe technology. This was an elegant way to remove humidity: no motor, just a neatly packaged and very efficient system."

The wrap-around heat pipe is just that, a heat pipe wrapped around a cooling coil, with a pre-cool section placed before a cooling coil and a reheat section placed after the cooling coil. The cooling and reheating of incoming air is such that the relative humidity is lowered from nearly 100 percent leaving the cooling coil to approximately 70 percent leaving the second heat pipe section. This is in keeping with ASHRAE Standard 62, which warns that if duct relative humidity exceeds 70 percent, fungal contamination can occur. The wrap around system increases the dehumidifying capacity by as much as 91 percent, while using about 50 percent less energy than electric reheat systems and about 25 percent less energy than other types of reheat.

Accompanying the boom in business within engineering/HVAC circles are a variety of issues, one of which James Furlong, partner at MCW Hemisphere Ltd., touches upon while discussing a surge in demand for what used to be a niche service: robust and reliable wireless systems in residential towers such as the second Park Central series of apartments in Calgary, one of MCW's more recent projects.

Furlong says, "There's been a 300 percent increase for these systems. So many people over the past year have stayed at home and relied on Zoom and other communication platforms for business that it's clogging delivery systems, like an eight-lane highway suddenly merging into a two-lane road. Hence, we're designing system designs in residences similar to what we've been supplying for years to airports."

Such is the case with the second Park Central tower, and Furlong remarks, "When we designed the first Park Central tower, which opened just last year, none of this was on the radar."

MCW is also very much on the forefront of the push toward greater energy efficiency: last year MCW Custom Energy Solutions was chosen as the energy engineering partner for the second phase of the University of Calgary's Energy Efficiency and Heat Recovery Initiative. The initiative is a conservation project designed to help UCalgary make strides towards carbon-neutral campus operations through energy retrofits and greenhouse gas (GHG) emissions reductions strategies in existing buildings.

Specifically, a combination of mechanical and electrical system retrofits, HVAC system retro-commissioning, and building automation system controls upgrades in research, laboratory, and teaching spaces is being undertaken. Furlong says, "We're in construction for most of these projects, and so far we're at 10,000 tons of savings and under budget. COVID has aided us, as we have been able to get into spaces unencumbered by students and faculty." The university aims to achieve a 35 percent reduction in GHG emissions by 2025, 50 percent by 2030, and carbon neutrality by 2050. The total program is anticipated to be $18 million.

Echoing his colleagues, Darryl Singleton, VP and general manager of Aqua-Tech Sales and Marketing Inc. (the Canada-wide master distributor for Lochinvar Boilers and Water Heaters, save for Quebec), describes business in 2021 as "Almost crazy busy, with many new projects."

One project, says Singleton, is "providing industry stakeholder consultation to the Canadian Institute of Plumbing and Heating's Canadian Hydronics Council to support the development of a user friendly, best practices guide for owners, system designers, and installers that will address all the new appliance efficiency requirements mandated by the National Resources Canada (NRCan) … these requirements will come into effect in July of 2023 for residential products and January of 2025 for commercial products."

Aqua-Tech Sales and Marketing is well positioned for this increase in minimum efficiency requirements, as Lochinvar has been an industry leader in introducing high-efficiency boilers, water heaters and pool heaters including condensing products from 55,000 Btuh to 6,000,000 Btuh.

PHOTOGRAPHY COURTESY THERMENEX

Singleton points out that in the overall push to implement condensing technologies in HVAC systems, "There are many challenges regarding appliance change-outs, especially in the commercial sector, and we need the industry to be prepared for them. One fear is that people will use unapproved venting materials when changing out non-condensing appliances with condensing appliances. Routing new systems is another task. These are the type of things that will be covered in our guide." The expectation is for this best practices guide to be published by NRCan this summer.

The regulatory push to increase energy efficiency does not detract from the fact that HVAC engineers by themselves continue to demonstrate innovation and ingenuity in a wide variety of projects, and Tempeff is an example. Tempeff's roots date back to the 1970s when the DualCore technology was pioneered in Europe, and building on that history it has been able to provide energy recovery equipment built in Canada with up to a 90 percent energy efficiency.

Tom Todoruk, national sales manager for Tempeff, says, "Our technology is remarkably simple, and as long as we get accurate and complete design information we can manufacture equipment that is capable of recovering up to 90 percent of the heat energy contained in the exhaust air and transfer that energy to the fresh outside air being drawn into the building, to meet required ventilation targets. Energy recovery itself has been around for a long time, but what is unique about our equipment is that the mechanical system design will not need to incorporate an energy robbing defrost strategy, ultimately leading to increased energy savings and the simplified system design will help reduce ongoing maintenance costs."

The Tempeff heat recovery technology has demonstrated success at extremely low temperatures without developing frost. Thousands of installations have been performed in North America with the majority of the installations being in the Northern U.S. and Canada. The Tempeff system relies on two heat exchangers (energy cores) and two recovery phases: one core adds energy to the supply air stream, heating up the air, and simultaneously the other core absorbs energy from the exhaust air stream. This cycle reverses in the second phase, with the second core adding energy to the supply air stream and heating up the air, while the first core absorbs energy from the exhaust air stream.

A recent example of Tempeff's contribution as part of a highly efficient mechanical system design is Montreal's renovated De Gaspe Complex with a gross area of 104,508 square metres spread over 11 floors in 5445 de Gaspe and 12 floors in 5455 de Gaspe. The HVAC infrastructure upgrade retained the existing hot water network but added control valves and larger fins on the radiators. The original boilers were replaced by condensing boilers, and a new thermal loop connects to packaged water source heat pumps in each suite. A new heat rejection system consisting of two dry coolers and two new cross flow open cooling towers with an isolating plate heat exchanger was installed on the roof to evacuate the extra heat of the thermal loop. The new boilers are connected to enable the injection of heat to the loop when necessary.

These and other upgrades resulted in a 36.12 percent natural gas savings and 14.7 percent electricity savings through the prioritization of heat recovery. De Gaspe's energy cost has been reduced from $18.94/m2 to $15.07/m2, despite an increase in occupancy rate from 58 to 98 percent. The project has also avoided the emission of over 952.4 tons of CO_2 per year, equivalent to removing 201 cars from the road.

Meanwhile, after spending years establishing Thermenex across Western Canada as a system that optimizes building thermal energy by using a thermal gradient header (TGH) – essentially a pipe with a warm end and a cold end that holistically integrates carefully arranged HVAC systems – Jeff Weston, principal at Thermenex, decided to rebrand the technology as TGH.

He explains, "TGH is the result of lessons learned on earlier Thermenex Systems and consists of a simplified piping arrangement. We decided to focus on one sector, health care, and we are helping Providence Health Care on their path to 80 percent GHG reduction by providing solutions to five of their six hospitals. Four of these facilities are already expanding their TGHs even though we just started them up in the 2021 spring season."

TGH provides all the benefits of the original Thermenex system for lower installation cost and simpler standardized control logic, and Weston says that in addition to health care, TGH will also be installed at Vancouver Port Authority's current expansion project. **A**