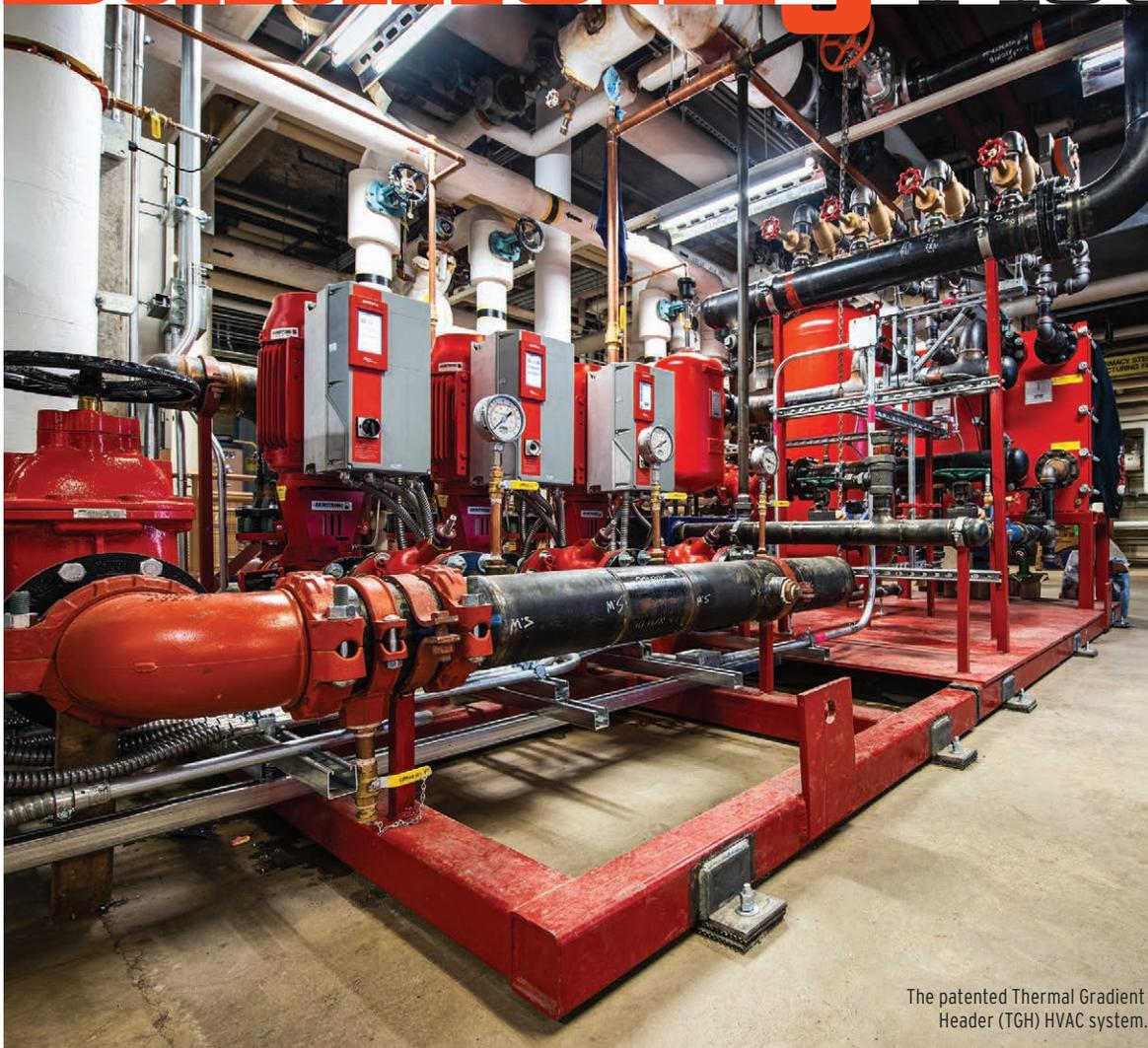


Balancing Act



The patented Thermal Gradient Header (TGH) HVAC system.



Micro-CHP installed system from Aqua-Tech.

Time to think about mechanical and HVAC systems differently

by NATALIE BRUCKNER

Mechanical and HVAC systems and energy efficiency go hand-in-hand. You can't talk about one without the other. Technology in these sectors has advanced at such a rapid rate that it is no longer a conversation about innovations, but which technologies available today will give your building the highest performance and exceed energy code demands, while offering the quickest payback.

"All the technology is there, it's just a matter of getting integrated solutions from a design team, not just a single discipline, and working toward that same goal. Getting the developers and contractors familiar in how we can address it is essential. We need to continue to build on the knowledge and awareness," says Mike Dixon, mechanical engineer at Williams Engineering.

"Our focus is on increasing thermal indoor comfort but limiting energy use, so we end up with more sophisticated mechanical systems to meet those needs," adds Dixon.

While just a few years ago the impacts of climate change were considered something we need to worry about in the future, the realities are that we are seeing the effects today. Dixon says that Williams' building simulations are now seeing the impacts of climate change in the weather data they use to punch

into their energy modelling. "We are at an inflexion point where most of B.C. won't be able to use the solutions we used in the past. We need to eek out every bit of energy we can," says Dixon.

Williams has been involved in a number of projects that showcase energy-efficient mechanical systems. One such project is 1400 Alberni in Vancouver, which, once complete, will be the tallest Passive House development in the world. "The energy modelling for this project is happening out of our office. It's very exciting," says Dixon.

Williams is also involved in a number of social housing projects and residential care homes that have turned their attention to sophisticated mechanical and HVAC systems to reduce their energy use. "The cost has come down to a point that we can do carbon dioxide demand control ventilation for a residential home and the cost is not significant. We are also seeing a trend in popularity in residential and smaller projects," he adds.

Another change Williams is seeing is the involvement of utility companies who are stepping up to help offset the capital costs of installing central heating and cooling systems. Operating a mini utility onsite allows the operator to sell thermal energy directly to the homeowners, while offsetting capital costs for the developer, and eliminating maintenance fees for the strata.

As the race to net zero continues, increasing focus is being placed on the top performers in the mechanical and HVAC systems sector. Aqua-Tech, the Canada-wide master distributor for Lochinvar Boilers and Water Heaters, is recognized as providing systems that will help us get there and the company continues to see impressive demand. Darryl Singleton, VP at Aqua-Tech also credits this demand on the drive for buildings to be carbon neutral by 2030, which he says is having "a significant amount of muscle flex" on helping build awareness.

However, Singleton highlights that the infrastructure costs are going to be astronomical when it comes to supporting a grid that works. "Mandating a change without supporting the grid is not the answer," he says. "It's going to be a challenge because by 2025 you better have all the systems ready to achieve that, but right now the government isn't putting money toward that infrastructure."

When it comes to Aqua-Tech's own technologies, Singleton says he is finding increasing interest being shown in alternative energy. "We introduced a new product called Micro-CHP [combined heat and power]; micro because it is under 50kW/hr," says Singleton. Using an internal combustion natural gas engine, Micro-CHP is designed to be an efficient and easily installed system ideal for light commercial use such as multi-family residences, hotels, hospitals, colleges, restaurants, car washes, and swimming pools. The XRG125 aims to meet the growing need for enhanced efficiency and reduced energy waste in North America.

In Canada and North America Aqua-Tech is also finding its 19kW and 25kW per unit systems are the most popular. Most systems payback in three to six years, depending on local grants and funding from government and utility incentives, wherever available.

Aqua-Tech has been involved in some interesting projects of late, including installing a smaller and a larger system in a Hutterite community in southern Alberta. "They are a great showcase of what it means to have a baseline demand that runs all year round. They are generating their own electricity and tying it into the grid network so anything they don't use they can sell back," says Singleton.

Jeff Weston, president and CEO at Thermenex, who invented the patented Thermal Gradient Header (TGH) HVAC system that was holistically conceived

based on exergy preservation to reduce energy consumption and carbon emissions, understands that sharing information and education are essential in order to achieve a net zero future. And while he says high-performance solutions are different and therefore perceived as more complex, by simplifying the message it allows a greater understanding of how we can get there. First off, Weston reiterates that “fundamentally heating is cooling, and cooling is heating, and you can’t have one without the other, but this is not how we think about thermal energy.”

He adds that we need to start by understanding the value of resources and consume as much of the least valuable thermal resources before we consume the more valuable, non-thermal resources. “Once we start thinking differently, the clear objective is to optimize the utilization of all thermal resources and when you do that, you don’t inadvertently let thermal energy go to waste.”

Thermenex has changed the approach it takes to defining the solution. “We explain thermal energy like a fluid level. When it is maintained at the right level you feel comfortable in your space, and the key to keeping us comfortable is to ensure thermal energy entering the space, equals that which is exiting the space. Moving that energy around, to and from other spaces in the building, before dumping it outside or consuming non-thermal resources, is what matters,” says Weston.

Last year, the TGH solution was approved by B.C. health authorities to go into hospitals, and two systems are now being installed in the BC Children’s and Women’s Hospitals that will save substantial

amounts of carbon. Another system is going into the existing old St Paul’s hospital that is expected to save more than 800 tonnes of carbon a year, with a very short payback.

“Our application into dynamic buildings is proving its worth where it counts, at the meters. As a result of actual performance, we are now looking at several hospitals in B.C.’s Interior as well as cancer centres,” says Weston.

And there’s more exciting news ahead. Thermenex recently developed a new version of the TGH system that improves performance, while simplifying the application and lowering the cost so that it can be applied to a greater range of buildings.

Chi Zhang, sustainability manager at Norman Disney & Young (NDY), a Tetra Tech Company, agrees that our perceptions have changed when it comes to heat, and that it is no longer viewed a quantity to be added or extracted from a space to balance environmental and internal losses and gains. “Instead, excess heat from one space can now be surrounding spaces, used to heat service hot water, or even stored for later use.”

Zhang adds that what was once viewed as waste is now viewed as a source of heat recovery. “Technologies exist now that can both passively and actively reclaim heat from exhaust and sewage.”

Zhang’s colleague, Joseph Chow, associate at NDY, uses the Musqueam Capital Corporation (MCC) as an example of a group that is forward thinking. “With their in-construction Passive Energy Loop, a buried condenser water loop, they are demonstrating how taking the energy that would otherwise be

drained into the sanitary sewer or ejected into the atmosphere will be used for heating buildings. Their masterplanned community will share energy.”

Another example is Shannon Estates Utilities Ltd. that is leading the way in its Shannon Estates Thermal Energy System (SETES) utility. “It is one of the very few thermal energy utilities that directly bill residents for their energy usage,” says Chow. “As Wall invested in much more energy metering than others did and took on the effort to directly interact and be responsive to end users – instead of stratas who have diluted interests – residents can know their individual choices will affect their energy bills. Endpoint energy metering is allowing people to become much more responsible for their own energy consumption.”

It is now commonplace for property developers and managers, and not just specialized utility companies, to look to NDY for good, site-wide HVAC thinking. “The bottom line always includes how much it costs to purchase and construct, but now expands to so much more to include how costs are shared, whether the HVAC is a financial investment, how to reduce carbon dioxide emissions, long-term replacement, and how to make systems more resilient. One point that also keeps on coming up is how to make sure the system actually works and achieves its design intent. Complexity is the bane of HVAC and it’s up to us to not overcomplicate the design,” says Chow.

Looking ahead, both Chow and Zhang agree that the future lies in smarter systems and buildings that not only react to changing conditions, but can predictively prime or unload systems. **A**



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