Johnson Controls – Applied Equipment
IDEA Innovation Award Submission
Reference: https://www.districtenergy.org/membership-services/awards-scholarships/annual-innovation-award

1. **Project Program Title**
   Pioneering Campus Decarbonization: Advancing Hybrid Steam-Electric Innovation at the University of Windsor

2. **Name and Location of District Energy System or Project**
   University of Windsor
   Windsor, Ontario, Canada

3. **Name of System Owner**
   Ryan Kenney
   Associate Vice-President, Operations
   Chrysler Hall Tower, Room 602
   401 Sunset Avenue
   Windsor, Ontario, Canada
   N9B 3P4
   Phone: (519) 253-3000 ext 2157
   rkenney@uwindsor.ca

4. **Name, relationship to the project/program, address, phone number & email of the person submitting the application**

   James Rosner
   Principal Advisor – Higher Education (North America)
   Johnson Controls
   5757 N Green Bay Avenue
   Milwaukee, WI 53209
   720-804-5954
   james.ward.rosner@jci.com

   Rob Tanner
   Product Marketing Director
   Applied Equipment, Americas – Johnson Controls
   5000 Renaissance Dr. New Freedom, PA 17349
   717-538-1071
   Robert.G.Tanner@jci.com

5. **Executive Summary – In 700 words or less, summarize the project /program, demonstrating the key aspects of what was done and the overall benefits.**

   At the University of Windsor, the campus' largest emission source is now a key driver in cutting carbon and operating costs.

   Across many higher education campuses, reducing emissions and lowering operating costs are often a part of the same story. Rising energy costs, aging infrastructure and decarbonization commitments are inspiring universities to rethink how campuses operate and how these strategies can fund long-term transformation. Increasingly, institutions are discovering that the fastest path forward often starts by improving building performance.

   The University of Windsor has become the first higher education institution in Canada to implement a dual drive hybrid steam electric turbine chiller. The system will transform the campus' waste heat into self-generated power allowing the institution to avoid costly peak energy demand events.

   Prior to installing the new hybrid chiller, the university was largely powered by an Energy Conversion Center (ECC) that provided approximately 40% of the campus' energy via a cogeneration system, including centrifugal and absorption chillers and gas fired boilers. The university's boiler system generated more than 200,000 pounds-per-hour of steam, supplying heat and hot water throughout the campus. This system also accounted for about 88% of the university's emissions, prompting Johnson Controls to reframe the challenge. Instead of simply engineering a solution that could optimize efficiency, the team sought to reimagine how the wasted stream could be captured as thermal energy and applied to further drive the university's sustainability and operational goals in tandem.

   In addition to the university's broader sustainability and decarbonization commitments – which included reducing greenhouse gas emissions by 45% within seven years and achieving net zero emissions by 2050 – they also faced stringent electric cost constraints. The university's electric rates were determined in conjunction with a Global Adjustment (GA) standard that supports the maintenance and future development of Ontario's electric infrastructure. The university has been designated as a Class A electricity customer, which means the GA rate is connected to the intensity of its electric load during the top five peak demand hours of the year. The methodology establishes the institution's Peak Demand Factor, which sets the GA rate for the entirety of the following year.[i] This makes load shedding during peak demand essential to not only drive decarbonization but manage operating costs.

   Johnson Controls developed a hybrid thermal strategy to optimize the existing cogeneration plant by recovering waste steam and utilizing it as a self-generated form of electricity during peak load events. By replacing the inefficient boilers within the university's ECC with a 1,200-ton YORK® YST Steam Turbine Centrifugal Chiller, the plant can efficiently switch between electricity or recovered steam as the energy source. A 24,000-lbs/hr Heat Recovery Steam Generator (HRSG) harvests steam that would be otherwise exhausted into the environment from the cogeneration plant.

This recovered steam powers the hybrid chiller during peak events, allowing the university to reduce their electric load by as much as 60%. Installation of the hybrid chiller is also projected to deliver 82% of the university's 2030 GHG emissions reduction target.

The hybrid chiller is expected to operate on waste steam for just 140 hours per year — a schedule optimized to provide strategic load shedding during the region's top five peak hours. For each one MW of electric demand the university avoids, it saves as much as $300,000–$400,000 per year in GA costs, providing a powerful expense reduction that can be reinvested in the university's future sustainability strategies.

6. **In 300 words or less, explain how the project/program is innovative and unique.**

   The university's electric costs are tied to a Global Adjustment (GA) standard that is determined by the intensity of their electric load during the top five peak demand hours of the year. This makes load shedding during peak demand events equally as important as year-round efficiency.

   The HRSG and YORK® YST Steam Turbine Centrifugal Chiller allows the institution to harvest waste steam from their existing system and generate thermal energy during peak demand events, effectively reducing its electric load, minimizing grid draw and reducing emissions. As the first university in Canada to implement a multi-power system of this kind, the University of Windsor is leading the future of strategic and efficient energy management.

7. **With supporting data, demonstrate the improved energy efficiency benefit offered by the project/program, in 250 words or less.**

   The university's Energy Conversion Center operates continuously to provide approximately 40% of the campus' total energy. Approximately 88% of emissions were generated by the legacy boiler-steam system.[ii] By recovering steam to power the new hybrid chiller, the university was able to generate their own power using captured thermal energy that would otherwise be exhausted as waste heat. This configuration is estimated to provide 82% of the university's 2030 GHG emissions reduction target through the ability to remove an aging and inefficient gas-fired boiler. The ability to choose between steam and electrical driven cooling provides the best of both worlds, reduced on-site combustion when energy is cheaper and use of steam to drive the chiller when electricity is expensive.

8. **With supporting data and graphics, explain the financial advantages of this project / program in 250 words or less.**

- Utilization of the hybrid chiller has been strategically optimized to achieve load shedding during hours of peak electric demand. As part of the university's Global Adjustment (GA) billing standards, each one MW of electric demand they avoid during peak hours translates to as much as $300,000–$400,000 per year in avoided GA costs. Additionally, the project benefited from incentives of $200,000 through the Enbridge Gas Energy Efficiency Program.

9. **In 250 words or less, please provide any additional information about the project/program (What challenges did you face?)**

   Founded in 1857, the University of Windsor is one of the oldest institutions in the country. As with many legacy universities, the campus is comprised of both modern and historic buildings. At the Energy Conversion Center (ECC), the utility tunnel had tight load constraints that limited how the 1,200-ton hybrid chiller could be installed. To overcome this challenge, the chiller was assembled piece-by-piece onsite and wheeled into place. Additionally, the hybrid drive chiller had to fit in the same space as an old gas-fired boiler. So the drives needed to be arranged in-line instead of parallel to fit within the footprint of the plant. Finally, the plant is located adjacent to one of the busiest border crossing between the United State and Canada. The Ambassador Bridge connecting Detroit, MI to Windsor, ON lies directly adjacent to the ECC. Close cooperation and traffic coordination between the Canada Border Service Agency was necessary to conduct crane operations to lift the chiller components into place.

10. **What plans do you have for the future? How did your customer base or community react?, etc.)**
    The University of Windsor's next phase of its sustainability plan will place a strong emphasis on building energy efficiency and system optimization as foundational strategies to achieve its target of a 45% reduction in GHG emissions by 2030 and carbon neutrality by 2050 [iii]. This includes scaling conservation measures such as recommissioning buildings, upgrading HVAC systems, improving building envelopes, and expanding building automation systems (BAS) and advanced metering infrastructure to enable continuous, data-driven optimization of energy use. Given that approximately 88% of campus emissions are driven by steam-based heating and distribution systems, efforts will also focus on reducing steam demand through system optimization, transitioning to low-temperature hot water systems, and improving central plant operations. At the building level, targeted retrofits—such as LED lighting upgrades, controls optimization, and improved ventilation strategies—will enhance performance while improving occupant comfort and reducing operating costs. These initiatives align with the University's broader sustainability framework, which prioritizes reducing environmental impact through energy efficiency, low-carbon capital renewal, and sustainable building standards.

From a community standpoint, initiatives to date have generally been well received, with students, faculty, and local stakeholders increasingly supporting visible climate action, sustainability reporting, and opportunities for academic integration and research. Moving forward, the University will continue leveraging its campus as a living laboratory, integrating smart technologies, performance tracking, and capital planning to ensure continuous improvement in building efficiency, while positioning facilities for future electrification and integration of renewable energy systems.

11. **Please provide 3 to 5 attachments as images, diagrams or photographs in jpeg format with identifying captions.**

Images to come *(from Wes Schmidt at Godfrey)*

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[i] Independent Electricity System Operator (IESO), (2026), "Peak demand factory and capacity based recovery amount for class A" https://www.ieso.ca/Sector-Participants/Settlements/Capacity-Based-Recovery-Amount-for-Class-A

[ii] Stantec in collaboration with University of Windsor (November 2023), "University of Windsor, Carbon neutrality plan" https://www.uwindsor.ca/sustainability/sites/uwindsor.ca.sustainability/files/12_01_23_carbon_neutral_masterplan_final_summary.pdf

iii **Sustainability Framework (2024 - 2029)** https://www.uwindsor.ca/sustainability/sites/uwindsor.ca.sustainability/files/university_of_windsor_sustainability_framework_2024-2029.pdf