



4342 Queen Street, Niagara Falls,
ON, Canada

Savvy building owners and managers know it can pay off to upgrade their property's heating and cooling systems to make them more effective and energy efficient. That's what the managers of a six-storey commercial office building in downtown Niagara Falls, Ontario knew, when they decided in 2016 to make the investment in a mechanical system upgrade in conjunction with the deployment of PlantPRO.

THE BUILDING

4342 Queen Street is a Class A commercial building, constructed in the late 1990s.

Managed by Avison Young Real Estate Management Services, the 150,000 square foot building was equipped with a central plant mechanical system —chilled and hot water plants with a central air handling system and floor VAV zone controls with hot water reheat coils air distribution. Government agencies, engineering firms and healthcare companies are its main tenants.

The mechanical system was controlled by a legacy Johnson Controls Metasys building automation system with N2 communication utilizing legacy software. The unique feature of the building was that the Absorption Chillers were used for both heating and chilled water.

This was an original design to reduce electricity demand on the building by using natural gas instead of electricity. But as the mechanical system ages, challenges arose in keeping up the building's cooling and heating. Repair and maintenance became more frequent.

In addition, over the past 10 years, it became harder to source the replacement parts and technical resources to repair the absorption chiller system. This drove up maintenance and overall energy costs.

CHALLENGES

Avison Young decided that the building needed a comprehensive solution — the managers wanted to maintain the property's Class A status. They wanted their mechanical system to meet the needs of today — and tomorrow. They wanted tenants to be comfortable and to meet new energy efficiency and sustainability objectives.

The building owners engaged Ambient Mechanical to conduct a design review of the mechanical system that resulted in a number of major upgrades being designed, engineered, installed and commissioned.

The project outlined a scope in order to replace the existing mechanical system with state-of-the-art high efficiency equipment. This included the replacement of an absorption chiller with two-200-ton Magnetic Chillers (Arctichill) as well as Condensing Boilers (RBI). Two existing cooling towers were also replaced with new Baltimore Air Coil (BAC) Cooling towers with VFD fan motor control.

In addition, all pumps (chilled water, condenser and heating) were upgraded with a high efficiency and VFD to adjust the speed of the motors.

During the design review, both the Ambient team and the client felt that there would be further opportunities utilizing chiller plant optimization. It was determined that PlantPRO was the best solution for this project. PlantPRO continuously optimizes the plant working conditions by promptly adjusting equipment staging and sequencing, managing operating set-points as well as water flows throughout the entire HVAC system to push the boundary of the performance of the new system and its energy efficiency.

HOW PLANTPRO HELPED SAVE ENERGY ON THIS BUILDING

The two 200 tons / 700 kW Water Cooled Chillers were configured in PlantPRO with control for digital isolation valves on the inlet of the evaporator vessels and a weekly sequence rotation to even out chiller runtime.

The three headed Primary Pumps were configured and fine-tuned to maintain a field differential pressure set point of 130 kPa to ensure that demand of the AHUs furthest away from the plant were satisfied.

The three headed Condenser Pumps were configured in a duty-standby configuration such that the third pump is operated as backup only in the event when the lead condenser pumps become faulty.

The Condenser Water Pumps were configured to maintain design flow through the chiller condenser vessel.

The Cooling Tower control loop was set up to maintain an optimized entering condenser temperature set point 3 degrees above the outside air wet bulb temperature, whilst remaining within the lower and upper temperature limits acceptable to the chiller.

The low ambient lockout temperature was set at 15 degrees Celsius, in a bid to ensure that, based on outside air conditions, the use of the building's economy cycle was maximized.



Return water based chilled water reset strategy was utilized to allow the plant to operate at the highest possible chilled water supply temperature for optimization whilst maintaining tenant comfort.

The two Boilers were configured to sequence on based on outside air temperature. Upon receipt of heating call, the smaller boiler was set to run when ambient temperature dropped below 14 degrees Celsius and the larger boiler when outside air temperature dropped below 9 degrees Celsius.

The headed boilers pumps are set to rotate on a weekly interval.

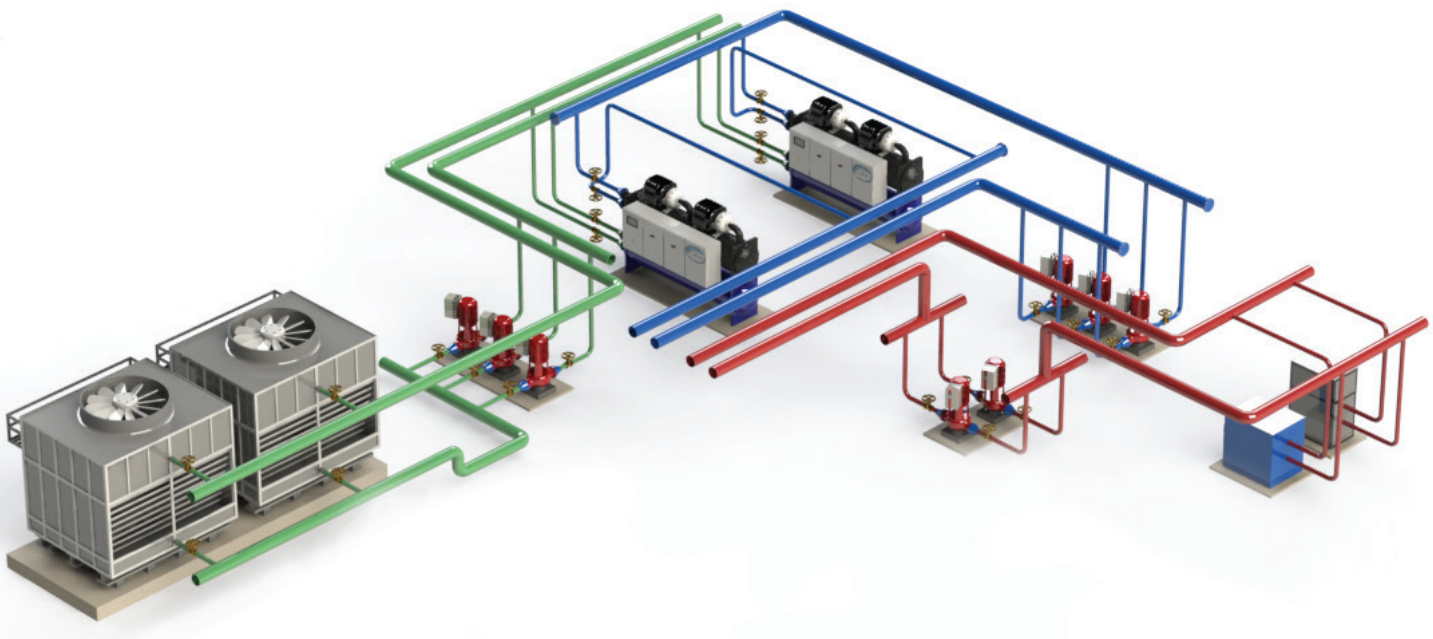
Table 2: Energy Consumption Comparison (kWh/year)

	Chillers 1&2	Cooling Towers	Chilled Water Pumps	Condenser Pumps	System Total
Base Case*	175,745	5,392	77,383	52,575	311,095
With PlantPRO*	143,773	5,150	41,154	10,363	200,440
Energy Savings*	31,972	242	36,229	42,212	110,655
Savings (%)	18.2%	4.5%	46.8%	80.3%	35.6%
Cost Savings**	\$4,735.25	\$35.88	\$5,365.62	\$6,251.80	\$16,388.54

*Annual energy consumption based on outdoor temperature regression and bin analysis. Expected cooling period of May 1st to October 31st was used.

**Cost savings based on average blended rate of \$0.148/kWh from last 12 months of building electricity cost.

Base Case Period is June 23rd 2016 to September 6th 2016 (75 Days)
PlantPRO Period was May 28th 2017 to October 21st 2017 (146 Days)



RESULTS

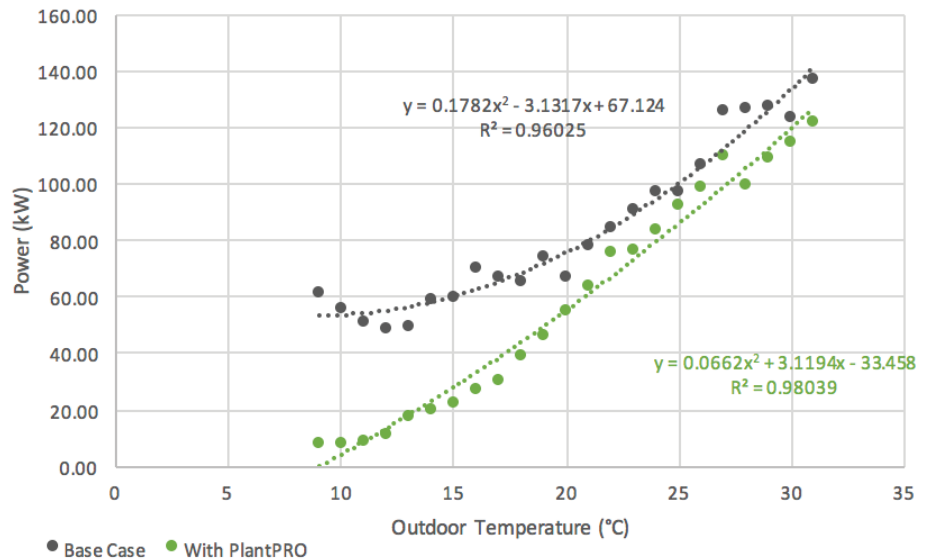
Electricity consumption, following the deployment of PlantPRO in September 2016, has reduced significantly compared with the system operating under the control of the Building Automation System.

Energy Meter data has been normalized vs. outdoor temperature to create an accurate comparison of the system with and without the PlantPRO.

Chiller energy consumption has been reduced by nearly 25 per cent, with much of the savings coming under part load operation. Even greater energy savings are being seen on the pumps and cooling towers due to optimization of the VFDs and reduction in runtime from improved sequencing.

With a combined design of high efficiency equipment and upgraded BAS control over the system using the latest technology from Johnson Control and Plant Pro, the building was able to maintain the same energy use level even with the higher cooling requirement due to the heatwave this year.

Figure 1: Total System Power (Chillers + Pumps + Cooling Towers)



ABOUT US

Conserve It is an international leader in building automation and HVAC solutions, having designed the award-winning plant room optimisation solution PlantPRO.

Based in Melbourne, Australia, the Conserve It team has a wealth of knowledge and vast experience in control and optimisation solutions that ensure central plant equipment runs efficiently, minimises energy consumption and maximises cost saving opportunities.

Conserve It comprises a team of certified and fully trained engineers and technicians and have an ever growing International presence, with solutions deployed around the world in over 20 countries.

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