CASE STUDY

ENERGY OPTIMIZATION OF A HEAT EXCHANGER AT THE LONGUEUIL COURTHOUSE, QC, CANADA

The Longueuil Courthouse opened its doors in 1987 and brought together all the jurisdictions of the Superior Court and the Court of Québec. With a total area of 169,500 sq. ft, the building houses hearing rooms and administrative offices on 2 floors. The building is managed by Société Immobilière du Québec (SIQ).

The building's mechanical systems were designed to allow optimum equipment use and maximum heat transfer recovery. The system is composed of a group of 9 air conditioners with a unit capacity of 240,000 Btuh (70kW), which serve the indoor zones and 20 heat pumps of 126,000 Btuh (37 kW), which supply the perimeter zones. These heat pumps are operated in cooling mode in summer and in heating mode in winter, depending on the demand.

The closed loop equipment is connected on one side of the plate-frame heat exchanger to a water tank and the heating system . The cooling towers are on the open loop side of the heat exchanger. The energy is dissipated by 2 cooling towers of 150 tons for a total capacity of 300 tons, with recirculation flow of 450 gpm per tower. The towers operate year round down to an outdoor temperature of approximately – 10˚C

In a heating period corresponding to outdoor temperatures below –10˚C, if the contribution of the internal zones and the energy stored in the water tank is insufficient, it is then necessary to provide an energy contribution through auxiliary gas boilers. This period only represents about 400-500 hours per year.

PROBLEM

A gradual reduction of the plate-frame heat exchanger's energy efficiency resulting from clogging the surfaces was observed, endangering the building due to the water temperature rise. The necessary cleaning operations were also increasingly long and frequent, with use of acids. This added to the buildings operating cost along with higher energy consumption.

SOLUTION

A Vortisand® side stream water filter, Model AWT1-20-SP with 60 gpm filtration capacity was installed on the condenser water loop, making it possible to optimize the plate-frame heat exchanger's energy performance.

More loss of pressure on the mixed water side and a lower temperature differential (3˚C instead of 4.5˚C) were observed. The plate-frame heat exchanger has operated continuously according to its original design & performance, without the need for cleaning. Optimal performance has been maintained since the Vortisand® was installed.

An overall saving of 11.5 kW has been calculated for an annual savings of $5,240, i.e.:

1) Power saving: $1,650

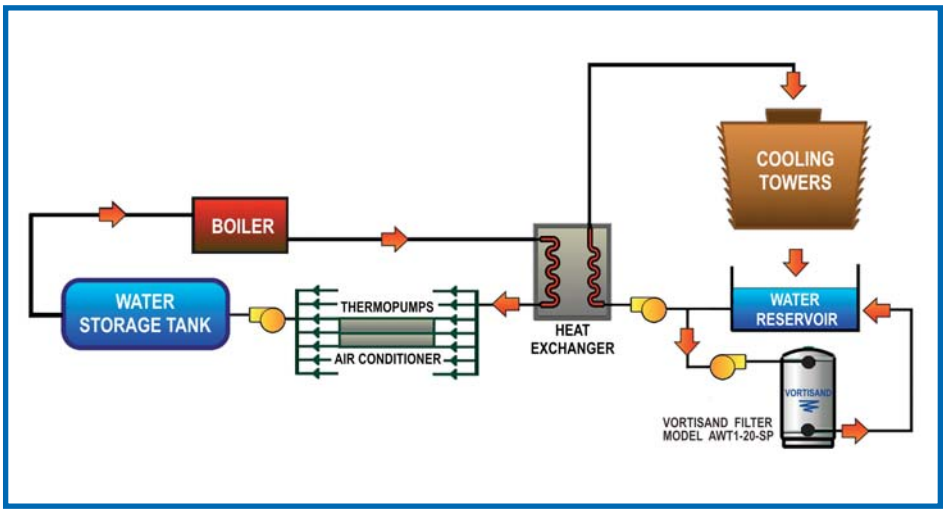
2) Saving of kWh: 8 400 hrs x 11.5 kW: $3,590

Mr. Christian Gagnon, SIQ technician

The total building optimization program reduced the chemical treatment usage, labor and downtime to clean the plate-frame heat exchanger and the entire condenser water system. Proper side-stream filtration allowed the building to operate more efficiently by removing all the suspended solids down to 0.45 sub-micron size range. Payback period is less than 2 years.

SPECIFICATIONS
Model AWC1-20-SP

- **Filtration Flow :** 60 gpm
- **Vessel :** 20" diameter stainless steel 304, 175 psi ASME, Sec.III, Div.1.
- **Pump:** Centrifugal with ODP 1 HP motor.
- **Control panel:** Nema 12 with PLC including differential pressure switch, stager, backwash counter, pump starter and main disconnect switch.



LONGUEUIL COURTHOUSE
Vortisand® Filter Application Energy Analysis - Results

Parameter	Units	Before Filter	After Filter
Chilled Water Loop			
Systems Chilling Power	kW	640.1	640.1
Average Efficiency Coefficient		3.70	3.93
Compressor Motor Consumption	kW	192.2	180.9
Chilled Water Temperature (outlet)	deg. C	29.0	27.4
Chilled Water Temperature (inlet)	deg. C	33.5	30.4
Thermal Load supplied to chilled water	kW	813.1	802.9
Energy Saving	**kW**		**11.4**
	%		**5.9%**
Plate Heat Exchanger			
Thermal Load	kW	813.1	802.9
Differential temperature	deg. C	2.62	1.20
Heat Exchange Coefficient	W/m2-K	3598	7773
Nominal Heat Exchange Coefficient	W/m2-K	5565	5565
Increased Exchange Capacity	%		116%
Cooling Tower Water Loop			
Water Temperature (cooling tower inlet)	deg. C	32.1	29.3
Water Temperature (cooling tower outlet)	deg. C	24.6	26.1
Cooling Towers Average Energy Consumption	kW	8.2	8.1

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