Continuous Optimization for Commercial Buildings Program

Retrocommissioning Investigation Report

March 22, 2013

Prepared for:

Thompson Rivers University

International Building

BC Hydro #:COP10-353

Prism Project #: 2012100

Prepared by:

Prism Engineering

saving you energy

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Introduction

Prism Engineering Ltd is pleased to present the results of the Investigation Phase that was conducted as part BC Hydro's Continuous Optimization for Commercial Buildings Program for the International Building of the Thompson Rivers University Kamloops Campus. The objective of an investigation is to identify deficiencies and improvements in the operation of a facility's mechanical equipment, lighting, and related controls, and determine opportunities for corrective action that reduce energy consumption and preserve the indoor environmental quality.

The measures selected for implementations are presented in the *Investigation Summary Table* (see Appendix A). To ensure each measure is implemented according to the C.Op Provider's specifications, the *Retrocommissioning Investigation Report* details the recommendations for implementation and the recommended verification method to show that each measure is implemented correctly. This information can be used by the owner to specify the corrective actions and what needs to be presented to show that the correction or improvement has been successfully implemented by those responsible (e.g. controls contractor) for the implementation.

While the investigation focuses on low-cost improvements with short paybacks, major capital improvement opportunities may also be identified. Major retrofit measures are beyond the scope of the Program but other BC Hydro programs provide a variety of incentives to complete the retrofits.

Seven retrofits were identified as a part of this investigation. The proposed measures were reviewed in a meeting with Thompson Rivers University, BC Hydro and Prism Engineering representatives to determine which measures will be implemented.

Retrofits approved for implementation include:

- Shutdown Heating Pumps at Night;
- Add Chiller Water Supply Water Temperature Setpoint and Pump Speed Reset;
- Optimize Boiler Firing Sequence;
- Optimize AHU's Static Pressure Setpoint;
- Correct AHU1 and AHU2 Economizer Operation;
- Add DDC Control to the Foyer Lighting;
- Add Programmable Timers to TV Monitors.

The following retrofits were not considered for implementation under the C Op program but are recommended for further analysis and implementation for addressing comfort or operational issues:

The following retrofits were not considered for implementation due to the long payback periods:

1.0 Project Overview

Project Information	
Project/Building Name	International Building
Building Owner	Thompson Rivers University
Building Location	Kamloops, BC
Project Start Date	3/13/2012
Project Completion Date	3/15/2013

Contact List	
C.Op Provider	Ken Holdren/Juan Mani
C.Op Firm	Prism Engineering
email	ken@prismengineering.com
phone	(604) 298 4858
Building Owner Representative	Jim Gudjonson
email	jgudjonson@tru.ca
phone	(250) 852-7253
Building Engineer	Tom O'Byrne
email	Tobyrne@tru.ca
phone	(250) 371-5866
BC Hydro Program Representative	Graham Henderson
email	Graham.Henderson@bchydro.bc.ca
phone	(604) 453-6471

Task	Date Completed
RCx investigation kickoff meeting	20/Jun/2012
EMIS installation date (Electricity)	11/Apr/2011
EMIS installation date (Fuel)	11/Apr/2011
Master List of Findings submitted	15/Mar/2012
Master List of Findings approved	
Master List of Findings meeting with owner	
Measures selected for implementation	
RCx Investigation Report submitted	

Estimated Project Implementation Start Date	August 1, 2013

Building Energy Usage Summary	
Building Size (gross sq. meters)	10,800
Building Size (conditioned sq. meters)	10,800
Annual Electric Consumption (kWh/yr)	765,644
Annual Electric Cost (with applicable taxes)	$51,010
Bulk cost per kWh (with demand charges)	$0.067
Utility Rate Tariff	1611
Fuel Type	Natural Gas
Annual Fuel Consumption (GJ)	1,541
Annual Fuel Cost (with applicable taxes)	$13,099
Fuel Cost per gigajoule	$8.50
Total Energy Cost (with applicable taxes)	$64,109
Electric Energy Use Intensity (EUI) (kWh/sq. meters)	71
Building Energy Use Intensity (EUI) (ekWh/sq. meters)	111

RCx Costs & Savings	
Implementation Cap	$12,343
Implementation Cost	$19,400
Annual Electric Usage Savings (kWh)	76,997
Annual Electric Usage Savings - Avg. of Year 1&2 ($)	$6,753
Savings as % of Total Electric Usage	10.1%
Annual Electric Demand Savings ($)	$0
Annual Fuel Savings (GJ)	23
Annual Fuel Savings ($)	$193
Savings as % of Total Fuel Usage	1.5%
Total Energy Cost Savings - Avg. of Year 1&2 ($)	$6,946
RCx Project Simple Payback	3.1
Savings as % of Total Energy Cost	10.8%

Implementation cost includes engineering and project management. It is our intent to provide accurate pricing; however, the measure implementation costs provided should be used as budgets only and not fixed prices. Pricing assumes that all measures will be implemented. Implementation costs for individual measures will likely increase if measures are excluded from the scope of contracted services.

1.1 Brief Description of Existing System

This section contains a brief description of the existing HVAC and Controls system. The information is intended to provide a general overview only.

Boilers

The heating plant consists of two (B1 and B2) 1,500 mBH forced draft Thermal Solutions boilers. The boilers have a rated efficiency of 88%. Each boiler has a dedicated ¾ hp boiler circulation pump (BP1 & BP2).

Hot Water Distribution

The piping configuration is primary-only; there are no secondary loops or 3-way valves. Hot water circulation is achieved by two (P-1 & P-2) 7 ½ hp Bell & Gosset pumps piped in parallel. The pumps are equipped with VFDs.

All the air handling units serving the building are equipped with heating coils controlled by 3-way valves. The heating loop also serves terminal reheat coils and forced flow heaters controlled by two-way valves. A three zone radiant floor system is installed in the foyer; circulation is achieved by a 1/6 hp pump (P-5).

Cooling Systems

The building is cooled by an air cooled chiller located outside the building, on the South wing. The chiller is a 130-TON Trane model RTAC155, rated at 1.23 kW/TON.

Chilled water from the chiller is circulated by two (P-3 & P-4) 10 hp pumps, arranged in parallel. Both pumps are equipped with VFDs. Chilled water is pumped through a chilled water piping system to the mechanical rooms in each of the buildings where the air handling units are located.

The computer and language laboratories, located in the second floor, are equipped with dedicated split cooling systems. The outdoor units are two McQuay model ALC 40 condensing units, mounted on the roof. The indoor units are ACSON model ALC 40 installed one in the language lab and one in the computer lab. The units are rated at 3 ½ ton each and are locally controlled.

Ventilation Systems

Air Handling Units

Ventilation is provided by three air handling units. All units are equipped with a mixing section, heating and cooling coils and VFDs. Units AHU-1 and AHU-2 supply to a VAV system with terminal reheat. Some VAV boxes are fan powered. All units are interfaced with the DDC System. A summary of the units is provided in Table 1.

Table 1: Summary of IB Air Handling Units

Tag	Location	Service	HP Supply/Return	CFM
AHU-1	3rd floor North mechanical room	Building North zone	30/10	21,000
AHU-2	3rd floor South mechanical room	Building South zone	30/10	20,00
AHU-3	Mechanical room 132	Foyer	10/None	7,000

Exhaust

Exhaust from washrooms, mechanical, janitorial, photocopy and other rooms is provided by 17 ceiling mounted fractional exhaust fans. General exhaust for the foyer is provided by a 1 ½ hp exhaust fan (EF-401) with a rated capacity of 7,200 CFM.

Building Management/Automation System (BAS)

The mechanical systems in the building are controlled from a BAS controlled with Direct Digital Control (DDC). The system is a SIEMENS Insight, version 3.11.

2.0 Measures Selected for Implementation (Under C.Op Program)

This section provides an overview of each measure, recommendations for implementation, and the most suitable method for providing evidence of implementation. For each measure, costs, payback calculations and incentive amounts can be referenced in the *Investigation Summary Table* (see **Appendix A).**

2.1 Measure 1: Shutdown Heating Pumps at Night

Overview

Hot water circulation is achieved by two 7 ½ hp Bell & Gosset pumps(P-1 & P-2) piped in parallel. The pumps run in a duty/standby fashion and are equipped with VFDs.

The heating plant is enabled as the outdoor temperature falls below 15 °C and disabled when it rises above 17 °C. The pumps speed is modulated to maintain a differential pressure setpoint of 220 Pa.

Based on the existing outdoor temperature control, the heating pumps are continuously enabled from November to March, according to Kamloops hourly weather data, regardless of occupancy.

Recommendations for Implementation

We recommend shutting down the heating pumps at the end of the building's occupancy. The heating pumps would be enabled if at least three temperature sensors read below 15°C and disabled when all temperature sensors are above 17 °C. Pumps will run continuously if the outdoor temperature is 3°C or lower.

Evidence of Proper Implementation

The recommended method for verifying that this measure is implemented properly is by setting trends showing the heating pump status and the building's minimum room temperature.

2.2 Measure 2: Add Chiller Water Supply Water Temperature Setpoint and Pump Speed Reset

Overview

Chilled water circulation is achieved by two pumps (P-3 & P4) arranged in parallel. The pumps operate in duty/standby fashion and are equipped with a VSD although all the air handling cooling valves are 3-way. The pump speed is modulated by the DDC system through a control loop to keep a differential pressure setpoint of 225 kPa but, according to the shop drawings, the pumps were selected for 180 kPa,. Observations of the DDC system showed that the pump speed was constant at 100%.

Chilled water supply temperature is currently set at the chiller controller. No reset is provided by the DDC system.

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Recommendations for Implementation

We recommend resetting the pump speed and the chilled water supply temperature in sequence to maintain at least one cooling valve 90% open.

The pump speed would ramp down from 100% to a speed that would assure minimum flow through the chiller. Once the pump is at the minimum allowable speed, the chiller setpoint would be raised from 6°C to 11°C.

Evidence of Proper Implementation

The recommended method for verifying that this measure is implemented properly is by setting trends for the chilled water pump speed and supply chilled water temperature and setpoint.

2.3 Measure 3: Optimize Boiler Firing Sequence

Overview

Heating boilers are sequenced in lead/lag fashion with a control loop using split range control. The supply water temperature (SWT) setpoint is reset with an outdoor temperature schedule and the control loop uses the SWT temperature as input to maintain the setpoint. The DDC sends a reset to the boilers (0-100%) in sequence calculated from the loop output. This control strategy is effective but it has the problem that when the loop is in the range just above the first boiler capacity, i.e. the lead boiler at 100% and the lag boiler less than 20% output, the lag boiler will cycle at low fire.

Figure 1 shows a DDC graphic screen capture of the boiler plant taken on February 14th. During the time this screen was captured the lead boiler was B-2. Since the loop output is more that 100 (104.6), the lag boiler is enabled and was cycling on low fire.

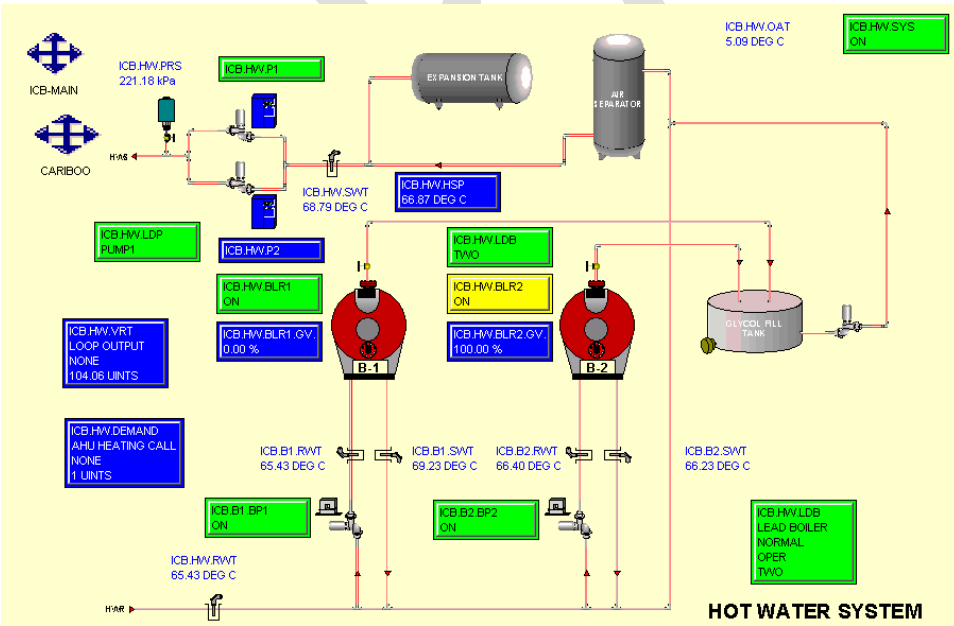

Figure 1: Boiler Plant DDC Graphic

Recommendations for Implementation

We recommend modifying the boiler firing sequence so the lag boiler is enabled when the output for the lead boiler reaches 80%. Once both boilers are enabled, the DDC will use the same output for both boilers. Lag boiler will be disabled once the boiler heating output is less than 50% of the rated capacity, as indicated by the temperature difference across the boiler.

The control loop dead band would be increased so the lead boiler does not cycle if the temperature difference between supply and return is less than 3° C.

Evidence of Proper Implementation

The recommended method for verifying that this measure is implemented properly is by trend logs for supply and return water temperature, boiler status and output.

2.4 Measure 4: Optimize AHU's Static Pressure Setpoint

Overview

Air handling units AHU-1 and AHU-2 are variable volume systems. The supply fans are equipped with a variable speed drive (VSD) for airflow modulation. The VSD speed is controlled by a control loop using a constant supply static pressure setpoint (SASPS) of 250 kPa.

According to the original sequence of operations, the fan VSD shall modulate to maintain a duct static pressure of 125 at the furthest VAV box (VAV-111 for AHU-1 and VAV-105 for AHU-2).

DDC observations during heating, cooling and shoulder seasons showed AHU-1 was always operating at 100% speed. Similarly, AHU-2 was always found either at or near 100% speed.

Figure 2 shows a screen from the DDC system. The AHU static pressure and its setpoint are circled in red. AHU-1 was never found operating above 130 kPa, which indicates that the setpoint is not appropriate.

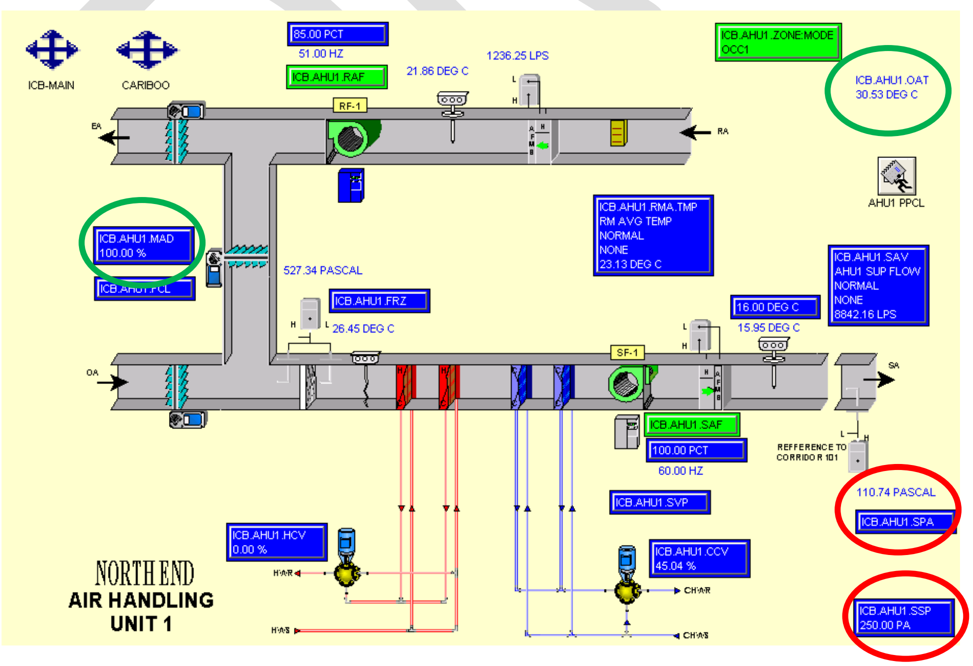

Figure 2: AHU-1 DDC Graphic Take on June 22nd 2012

Recommendations for Implementation

We recommend adding a SASPS reset to adjust the pressure setpoint in response to VAV box flow demand. Furthermore, a graphic screen would be added with all the VAV box performance data allowing for improved monitoring and diagnostics and for identification of critical zones.

Evidence of Proper Implementation

The recommended method for verifying that this measure is implemented properly is by reviewing trends of the fans speed.

2.5 Measure 5: Correct AHU1 and AHU2 Economizer Operation

Overview

Figure 2 shows AHU-1 operating with the outdoor damper at 100% but the outdoor temperature (circled in green) is above30°C.

The program code has a provision to disable the free cooling if the outdoor temperature is higher than the return. However, it seems that some changes made to disable a CO2 control (currently not in use), has left the economizer switch without effect, as can be seen in the program code for AHU2 shown below.

```
04140   C------MAD SYSEM TREE------¶
04150   $LOC1 = "%X%RAT" - 2¶
04160   DBSWIT(1,"%X%OAT",$LOC1,"%X%RAT",$FCL)¶
04170   IF("%X%VRT" .GT. 100 .AND. "%X%VRT" .LE. 300 .AND. $FCL .EQ. ON) THEN ON("%X%FCL")¶
04175   IF($FCL .EQ. OFF .OR. "%X%VRT" .LT. 100) THEN OFF("%X%FCL")¶
04180   MAX("%X%CO2.MAX","%X%FLR1.CO2","%X%FLR2.CO2","%X%FLR3.CO2")¶
04185   IF("ICB.OACO2" .GT. 800) THEN GOTO 4310¶
04186   IF("%X%FCL" .EQ. OFF) THEN GOTO 4310¶
04187   C FREE COOLING¶
04190   LOOP(0,"%X%MAT",$MAD1,"%X%MAS","%X%MPG","%X%MIG",0.0,1,50.0,0.0,100.0,0)¶
04195   TABLE(SECND1,$MAD2,0.0,0.0,300.0,100.0)¶
04200   MIN("%X%MAD",$MAD1,$MAD2)¶
04220   GOTO 8030¶
04300   C CO2 DAMPER¶
04310   LOOP(0,"%X%CO2.MAX",$CO21,"%X%CO2.SP","%X%CO2.PG","%X%CO2.IG",0.0,1,50.0,20.0,100.0,0)
04320   TABLE("%X%OAT",$CO22,-1.0,15.0,10.0,50.0,20.0,15.0)¶
04330   C       MIN("%X%MAD",$CO21,$CO22)¶
04340   GOTO 8030¶
```

THIS LINE DISABLES THE ECONOMIZER IF THE OAT IS HIGHER THAN THE RETURN TEMP-2

IF THE ECONOMIZER IS DISABLED, JUMPS TO LINE 4310

CO2 DAMPER CONTROL LOOP

THIS LINE CALCULATES THE MINIMUM POS BASED ON OAT

THIS LINE WAS USED TO SET THE DAMPER TO MINIMUM, SUBJECT TO CO2 OVERRIDE, BUT IT IS DISABLED

Figure 3: Program Code for AHU2

Recommendations for Implementation

Modify the existing program code to allow the outdoor damper to go to minimum position if the outdoor temperature is higher than the return air temperature.

Evidence of Proper Implementation

The recommended method for verifying that this measure is implemented is reviewing trends including outdoor and return air temperatures and the outdoor damper position.

2.6 Measure 6: Add DDC Control to the Foyer Lighting

Overview

Lighting in the foyer is primarily composed of metal halide flood lights (6 luminaires) and fluorescent wall sconces (6 luminaires) (Figure 5). In addition, there are some accent lights that may be on the same circuits. Accent lights will not be part of this measure.

All lights in the foyer are on at night (see Figure 4). The first floor lighting is already controlled by DDC. There is also a light sensor installed in the foyer to control the blinds operation.

Figure 4: Building Lighting at Night

Recommendations for Implementation

Add DDC control to the lighting in the foyer. The lights would be controlled by a weekly schedule.

Use the existing light sensor to turn off the fluorescent lights when the sun light level permits.

Evidence of Proper Implementation

The recommended method for verifying this measure is by reviewing trend logs including light status and light level.

2.7 Measure 7: Add Programmable Timers to TV Monitors

Overview

There are two TV monitors installed in the foyer that are continuously ON, as shown in Figure 5.

Figure 5: Building Foyer

Recommendations for Implementation

Install programmable timers to turn off the TV monitors when the building is unoccupied.

Evidence of Proper Implementation

The recommended method for verifying this measure is physically inspecting the installation of the timers.

3.0 Next Steps – Implementation and Hand-off Phases

3.1 Implementation Phase

To continue in the program, the owner is responsible for implementing the selected bundle of measures that pay back in two years or less. Using the *Retrocommissioning Investigation Report* for implementation allows flexibility in how the selected measures are implemented. Options include: utilize in-house building staff, hire the C.Op Provider to implement or provide technical assistance, contract with outside service contractors, or any combination of the above. The *Retrocommissioning Investigation Report* and *Investigation Summary Table* should provide sufficient detail to specify accurate implementation of the measures if handled by in-house staff, contractors or a combination of both.

According to the program agreement, the time period allowed for the Implementation Phase is the "rest of fiscal year + additional year" as measured from completion of the Investigation Phase (could range from 13 to 23 months), with the proviso that the Energy Management Information System (EMIS) must have sufficient time to collect the required baseline data. Therefore for this project, the Implementation phase must be completed by March 2014.

Once implementation is complete, the *Implementation Summary Table* will be submitted to the owner and the program (for approval) as part of the *Retrocommissioning Final Report*.

3.2 Hand-off Phase

The Program provides an incentive payment to Prism Engineering Ltd. to follow up after implementation of the selected measures to create the *Retrocommissioning Final Report (Final Report)*. The *Final Report* for the implemented measures includes, but is not limited to: a description of the new or improved sequences of operation, energy savings impact of the measures, requirements for ongoing maintenance and monitoring of the measures, the *Training Outline*, *Training Completion Form* and contact information for Prism Engineering Ltd., in-house staff and contractors responsible for implementation.

Appendix A: Investigation Summary Table

Investigation Summary Table

BC Hydro Continuous Optimization for Commercial Buildings Program
International Building

#	Measure	Estimated Annual Electric Usage Savings (kWh)	Estimated Annual Electric Usage Savings ($)	Estimated Annual Electric Demand Savings ($)	Estimated Annual Gas Savings (GJ)	Estimated Annual Gas Savings ($)	Estimated Annual Total Savings ($)	Estimated Implementation Cost ($)	Simple Payback (years)	Measure life (years)	NPV ($)	IRR (%)
1	Shutdown Heating Pumps at Night	1,190	$104	$0	0	$0	$104	$2,900	27.8	5.0	$ (2,422)	4%
2	Add Chiller Water Supply Water Temperature Setpoint and Pump Speed Reset	7,442	$653	$0	0	$0	$653	$3,200	4.9	5.0	$ (211)	20%
3	Optimize Boiler Firing Sequence	0	$0	$0	23	$193	$193	$2,900	15.0	5.0	$ (2,014)	7%
4	Optimize AHU's Static Pressure Setpoint	40,988	$3,595	$0	0	$0	$3,595	$3,800	1.1	5.0	$ 12,663	95%
5	Correct AHU1 and AHU2 Economizer Operation	18,366	$1,611	$0	0	$0	$1,611	$2,700	1.7	5.0	$ 4,677	60%
6	Add DDC Control to the Foyer Lighting	7,830	$687	$0	0	$0	$687	$3,500	5.1	5.0	$ (355)	20%
7	Add Programmable Timers to TV Monitors	1,182	$104	$0	0	$0	$104	$400	3.9	5.0	$ 75	26%
		76,997	**$ 6,753**	**$ -**	**23**	**$ 193**	**$ 6,946**	**$ 19,400**	**2.8**			

BC Hydro Continuous Optimization for Commercial Buildings Program
International Building

#	Measure	Description of Finding	Implementer	Recommendations for Implementation	Recommended Evidence of Implementation Method	Implement without incentives as part of <2 year simple payback bundle? (Y or N)
1	Shutdown Heating Pumps at Night	Hot water circulation is achieved by two 7 ½ hp Bell & Gosset pumps(P-1 & P-2) piped in parallel. The pumps run in a duty/standby fashion and are equipped with VFDs. The heating plant is enabled as the outdoor temperature falls below 15 °C and disabled when it rises above 17 °C. The pumps speed is modulated to maintain a differential pressure setpoint of 220 Pa. Based on the existing outdoor temperature control, the heating pumps are continuously enabled from November to March, according to Kamloops hourly weather data, regardless of occupancy.	DDC contractor	Shut down the heating pumps at the end of the building's occupancy. The heating pumps would be enabled if at least three temperature sensors read below 15°C and disabled when all temperature sensors are above 17 °C. Pumps will run continuously if the outdoor temperature is 3°C or lower.	Set trends showing the heating pump status and the building's minimum room temperature.	Y
2	Add Chiller Water Supply Water Temperature Setpoint and Pump Speed Reset	Chilled water circulation is achieved by two pumps (P-3 & P4) arranged in parallel. The pumps operate in duty/standby fashion and are equipped with a VSD although all the air handling cooling valves are 3-way. The pump speed is modulated by the DDC system through a control loop to keep a differential pressure setpoint of 225 kPa but, according to the shop drawings, the pumps were selected for 180 kPa,. Observations of the DDC system showed that the pump speed was constant at 100%. Chilled water supply temperature is currently set at the chiller controller. No reset is provided by the DDC system.	DDC contractor	Reset the pump speed and the chilled water supply temperature in sequence to maintain at least one cooling valve 90% open. The pump speed would ramp down from 100% to a speed that would assure minimum flow through the chiller. Once the pump is at the minimum allowable speed, the chiller setpoint would be raised from 6°C to 11°C.	Set trends for the chilled water pump speed and supply chilled water temperature and setpoint.	Y
3	Optimize Boiler Firing Sequence	Heating boilers are sequenced in lead/lag fashion with a control loop using split range control. The supply water temperature (SWT) setpoint is reset with an outdoor temperature schedule and the control loop uses the SWT temperature as input to maintain the setpoint. The DDC sends a reset to the boilers (0-100%) in sequence calculated from the loop output. This control strategy is effective but it has the problem that when the loop is in the range just above the first boiler capacity, i.e. the lead boiler at 100% and the lag boiler less than 20% output, the lag boiler will cycle at low fire.	DDC contractor	Modify the boiler firing sequence so the lag boiler is enabled when the output for the lead boiler reaches 80%. Once both boilers are enabled, the DDC will use the same output for both boilers. Lag boiler will be disabled once the boiler heating output is less than 50% of the rated capacity, as indicated by the temperature difference across the boiler. The control loop dead band would be increased so the lead boiler does not cycle if the temperature difference between supply and return is less than 3° C.	Trend logs for supply and return water temperature, boiler status and output.	Y
4	Optimize AHU's Static Pressure Setpoint	Air handling units AHU-1 and AHU-2 are variable volume systems. The supply fans are equipped with a variable speed drive (VSD) for airflow modulation. The VSD speed is controlled by a control loop using a constant supply static pressure setpoint (SASPS) of 250 kPa. According to the original sequence of operations, the fan VSD shall modulate to maintain a duct static pressure of 125 at the furthest VAV box (VAV-111 for AHU-1 and VAV-105 for AHU-2). DDC observations during heating, cooling and shoulder seasons showed AHU-1 was always operating at 100% speed. Similarly, AHU-2 was always found either at or near 100% speed. AHU-1 was never found operating above 130 kPa, which indicates that the setpoint is not appropriate.	DDC contractor	Add a SASPS reset to adjust the pressure setpoint in response to VAV box flow demand. Furthermore, a graphic screen would be added with all the VAV box performance data allowing for improved monitoring and diagnostics and for identification of critical zones.	Review trends of the fans speed.	Y
5	Correct AHU1 and AHU2 Economizer Operation	AHU-1 was found operating when the outdoor damper at 100% and the outdoor temperature was above30°C. The program code has a provision to disable the free cooling if the outdoor temperature is higher than the return. However, it seems that some changes made to disable a CO2 control (currently not in use), has left the economizer switch without effect	DDC contractor	Modify the existing program code to allow the outdoor damper to go to minimum position if the outdoor temperature is higher than the return air temperature.	Review trends including outdoor and return air temperatures and the outdoor damper position.	Y
6	Add DDC Control to the Foyer Lighting	Lighting in the foyer is primarily composed of metal halide flood lights (6 luminaires) and fluorescent wall sconces (6 luminaires). In addition, there are some accent lights that may be on the same circuits. Accent lights will not be part of this measure. All lights in the foyer are on at night. The first floor lighting is already controlled by DDC. There is also a light sensor installed in the foyer to control the blinds operation.	DDC contractor	Add DDC control to the lighting in the foyer. The lights would be controlled by a weekly schedule. Use the existing light sensor to turn off the fluorescent lights when the sun light level permits.	Review trend logs including light status and light level.	Y
7	Add Programmable Timers to TV Monitors	There are two TV monitors installed in the foyer that are continuously ON	DDC contractor	Install programmable timers to turn off the TV monitors when the building is unoccupied.	Physical inspection the installation of the timers.	Y