

## Case study 10711 Cambie Rd.

**Existing Building  
Commissioning (EBCx)  
Case Study**

**Recommissioning of a B-class, low-rise  
office building (part of a suburban  
office park) in Richmond, BC**

### PROJECT SUMMARY

**Building Name/Type:** Airport Executive Park #14, 2 storeys, 98,700 SF, year built in 1981.

**Location:** Richmond, BC

**Project:** BOMA BC (Building Owners and Managers Association) Building Tune-Up Program: a recommissioning program primarily targeting the building automation systems (BAS) of B & C class properties.

**Commissioning Scope:** Revisions to the HVAC\* (see legend for list of acronyms) equipment sequencing through the building's DDC system, covering the whole building's central HVAC equipment (AHUs, rooftop units, boiler plant, chiller plant, and zone HVAC equipment (fan-coil units, VAV boxes, induction units)). Building assessment and sequencing recommendations were undertaken by BOMA's selected contractor and implementation was completed by the building's preferred contractor.

The project was initiated in August 2019; and the project was completed (with testing verifications) in November 2019.

**Size of Commissioned Area:** 9,170 sq. m. (representing 100% of the building's total floor area)

**Total Commissioning Investment:** \$13,189 (BOMA BC / NRCAN covered \$13,000 of the cost)

**Energy Cost Savings:** \$11,200 (and 7%) per year for electricity & gas combined (cost savings were based on the BC Hydro Large General Service Rate, and an assumed average natural gas cost of \$10/GJ).

**Simple Payback:** 0.2 years

**Energy Savings:** 266 MWh/yr

**GHG Emission Reductions:** 37 tonnes (and 19%) per year

**Quantified annual non-energy benefits:** N/A

### PROJECT OVERVIEW AND BACKGROUND

Airport Executive Park (AEP), Building 14 is a low-rise office building and one of 13 other buildings that comprise a suburban office park located in Richmond, BC.

The office park had recently been sold (early 2019) and a new property management firm took over management. The new ownership and property management firm chose one of the largest and oldest buildings within the office park for the retro-commissioning project to learn from the experience and identified opportunities. While the building has a controls contractor, the building operator had made modifications to scheduling along with further adjustments to accommodate maintenance of the mechanical systems. The system had not been optimized to account for those changes for many years.

The building management did not enter into the project with any specific objective other than their desire to share the learnings and opportunities from the project with their other buildings in the office park.



*10711 Cambie Rd. Richmond, BC*

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### PROJECT SCOPE OF WORK

ESC Automation Inc. was engaged by BOMA BC to provide recommissioning investigation and verification services for AEP 14 as part of the Building Tune Up program.

The project's investigation phase took approximately six weeks and involved a thorough review of the BAS settings, sequences and trend logs to identify and assess optimization opportunities (a list of the identified opportunities are detailed below under [Investigation and Opportunities Identified](#)). ESC then prepared a report for the building owner and manager outlining these recommendations.

The project's implementation phase saw the building manager asking their existing controls contractor (Controls Solutions) to put into place the recommended adjustments and re-sequencing. This took approximately 10 weeks (from August to October 2019).

Finally, ESC revisited the site to measure and verify the adjustments and re-sequencing, as well as train the building operator. The project's verification phase lasted two to three weeks and concluded with a final building verification report.

### PROJECT MANAGEMENT

As mentioned, AEP 14 took part in the Building Tune-Up Program shortly after it was purchased. The new owners recognized recommissioning the building's systems was long overdue. The building's mechanical and controls systems maintenance is contracted to third party firms. The operations staff was not trained to undertake systems repairs nor did they know the extent of the building's systems' inefficiencies.

ESC was granted full access to the building and its systems. They also developed the systems reprogramming report and Controls Solutions (the building's existing BAS service provider) undertook the reprogramming.

Budgeting was predetermined by BOMA BC for the assessment and verification phase of the project (at \$10,500) and implementation costs for the project were \$2,689.

Building operator training is included in BOMA BC's Building Tune-Up program. It ensures the building staff is comfortable with the changes and inspires them to maintain the building in its newly optimized state.

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#### WHAT IS COMMISSIONING?

*Building commissioning is a systematic and documented process of ensuring that building systems perform according to the design intent and the owner's operational needs.*

#### *Existing Building Commissioning (EBCx):*

- Provides a better environment for occupants*
- Reduces indoor air quality problems*
- Reduces occupant complaints*
- Reduces contractor call-backs and warranty issues*
- Reduces energy consumption and operational costs*



## INVESTIGATION AND OPPORTUNITIES IDENTIFIED

The key opportunities identified during the assessment of AEP 14 were:

1. Reduce AHU3 operation during building unoccupied hours
2. Revise MUA unit schedules to align with occupancy
3. Reduce MUA unit SAT points
4. Reduce heat pump unoccupied run-times and short cycling
5. Reduce heat pump loop operations during unoccupied hours

<b>LEGEND</b>
<i>AHU – Air Handling Unit</i>
<i>DDC – Direct Digital Controls</i>
<i>HVAC – Heating, Ventilation, Air Conditioning</i>
<i>MUA – Make-Up Air (unit)</i>
<i>SAT – Supply Air Temperature</i>
<i>VFD – Variable Frequency Drive</i>
<i>VAV – Variable Air Volume</i>

## IMPLEMENTATION AND RESULTS

ESC visited AEP 14 one month after implementation of the recommendations to verify the work and energy savings results. The following chart details the recommended actions and the resulting savings:

<b>Facility Improvement Measure (FIM)</b>	<b>Energy Savings (MWh/yr)</b>	<b>CO2 Savings (tonnes)</b>	<b>Cost Savings (\$/yr)</b>	<b>FIM Cost (\$)</b>	<b>Simple Payback (years)</b>
Reduce AHU3 operation during building unoccupied hours	41	7.1	\$1,400	\$0	0.0
Revise MUA unit schedules to align with occupancy	35	5.8	\$1,290	\$0	0.0
Reduce MUA unit SAT points	104	22.2	\$2,710	\$0	0.0
Reduce heat pump unoccupied run-times and short cycling	37	1.0	\$2,490	\$2,420	0.97
Reduce heat pump loop operations during unoccupied hours	49	1.3	\$3,270	\$270	0.08
<b>TOTAL RECOMMENDED FIMs</b>	<b>224</b>	<b>30.3</b>	<b>\$12,590</b>	<b>\$2,690</b>	<b>0.2</b>

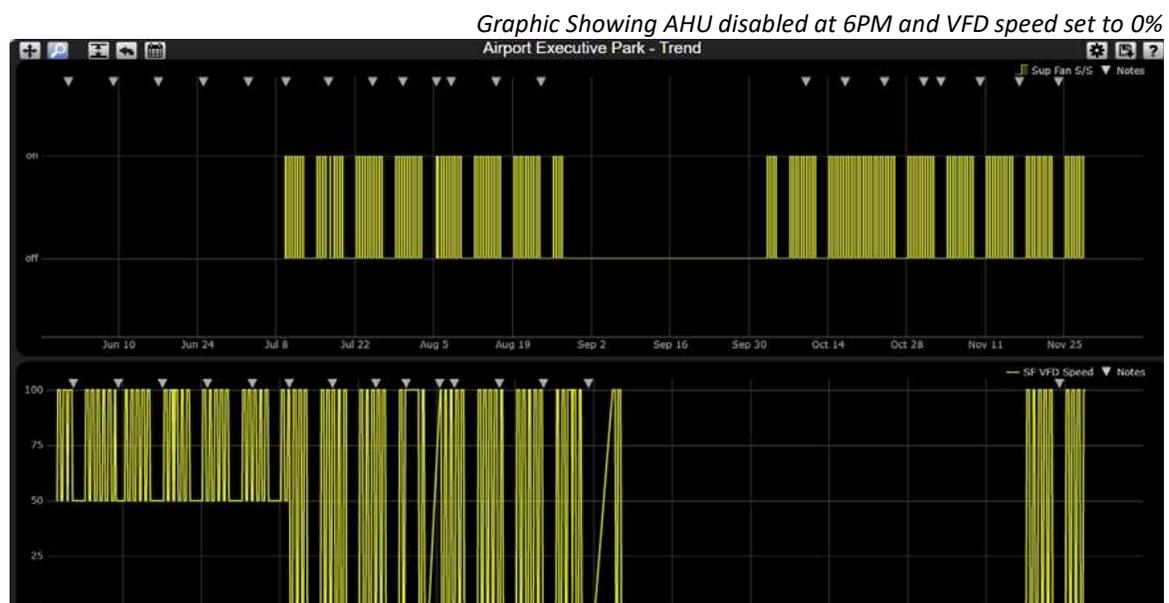
## PROJECT BENEFITS

ESC identified these benefits once the recommended changes were implemented:

- 1. Reduce AHU3 operation during building unoccupied hours, achieving an annual energy savings of \$1,400**

Prior to recommissioning AHU3 was sequenced to operate at a lower speed (50%) during unoccupied hours of operation (6 PM to 5:30 PM Monday to Friday, and 24/7 on weekends). Based on feedback from the operations team, constant ventilation was not required during unoccupied hours and the unit could be shut off. Accordingly, the sequencing was revised to allow AHU3 to stop running during unoccupied hours.

This measure principally reduced heating energy use as the unit was continuously maintaining an 18°C supply air temperature after hours, year- round.



### 2. Revise MUA unit schedules to align with occupancy, achieving an annual energy savings of \$1,290

As these units provide fresh air for occupancy, they are not required to operate until the building occupied period (6 AM to 6 PM Monday to Friday). Therefore, reducing the equipment run-times reduces unnecessary ventilation, decreasing fan electrical energy use and make-up air heating energy.

### 3. Reduce MUA unit SAT points for an annual energy savings of \$2,710.

Based on an analysis of trend data, the building was switching from being heating dominant to being cooling dominant at an outside air temperature of 13.5°C. In addition, many heat pumps were located at the building interior and

operating in cooling mode year-round.

Reducing the SAT setpoints of all MUAs to 10°C. reduces unnecessary heating of fresh air, which is then delivered to zones in cooling mode (a form of simultaneous heating and cooling). This measure reduces make-up air heating (offset somewhat by increased zone heating loads in perimeter areas) and reduces cooling loads and heat pump electrical use.

Reducing the MUA heating setpoint to 10°C also reduces the annual heating load at the MUAs by 73%, and shifts some of that load from the inefficient MUA furnaces (<80% efficient) to the condensing boiler (~95% efficient).

#### **4. Reduce heat pump unoccupied run-times and short cycling for an annual energy savings of \$2,490.**

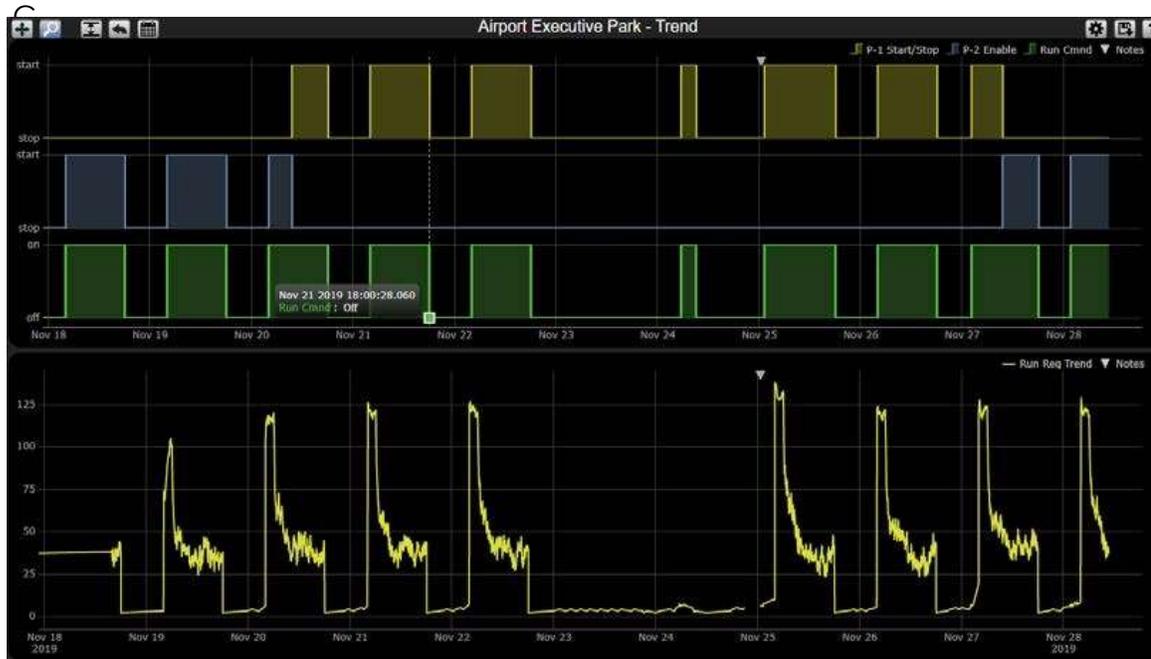
The supply fans were running outside of scheduled hours and short cycling. The reversing valve and compressor were also short cycling. As a result, the heat pump cooling was ineffective.

Addressing these issues resulted in a reduction of unoccupied heat pump operation (reducing fan and compressor energy), a reduction of short cycling (which wears equipment prematurely), and an increase of occupant comfort by resolving deficient units, and simultaneous heating and cooling.

#### **5. Reduce heat pump loop operations during unoccupied hours for an annual energy savings of \$3,270.**

The heat pump loops were operating for prolonged amounts of time. To correct this issue, the 'Point Transfer from Reliable' parameters were set to 0. This drastically reduced the number of heat pump requests for the central loop and resulted in significantly reduced energy use by the loop pump, which was consuming almost 250,000 kWh annually. A 20% run-time reduction was conservatively estimated.

*Graphic: Heat pump loop pump disabled during unoccupied hours, less than 8 heat pumps requesting to run*



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## FUTURE OPPORTUNITIES

As a complement to their recommissioning efforts, building management chose to invest in the Kaizen energy software program for AEP 14. This software functions by connecting the building's automation system to Kaizen's cloud based software. Kaizen then continuously monitors and analyzes the building's systems' data to identify energy anomalies and resulting savings opportunities. The program also creates on-demand reports for the building operation team to review and share with ownership and management.

In the coming months and years, AEP 14 will essentially have a 'built-in recommissioning program' attached to their DDC system.

## LESSONS LEARNED

1. During the building's verification phase some of the recommended measures experienced minor 'slippages' out of their reprogrammed modulations (for instance temperature adjustments by a degree or two). While minor, these measures showcase how quickly a sophisticated BAS system could become



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compromised; minor slippages can add up and potentially result in an inefficient or challenged system.

Fortunately, the Kaizen system quickly identified these 'slippages'. However in a building without the Kaizen system, the building operations team must be knowledgeable about the intent and value behind the ideal modulations. The team must also check the BAS daily to identify slippages. If one system slips, it can throw off associated systems, in a domino-like effect. Hence, if not checked and attended to daily, it becomes increasingly more challenging to identify the prime mover in this domino effect.

### **PROJECT PARTNERS/TEAM:**

<b>Building Manager:</b>	Colliers International
<b>Commissioning Provider:</b>	ESC Automation
<b>Project Sponsor:</b>	BOMA BC
<b>Controls contractor:</b>	Controls Solutions