609 Granville Street - Chiller Upgrade Case Study

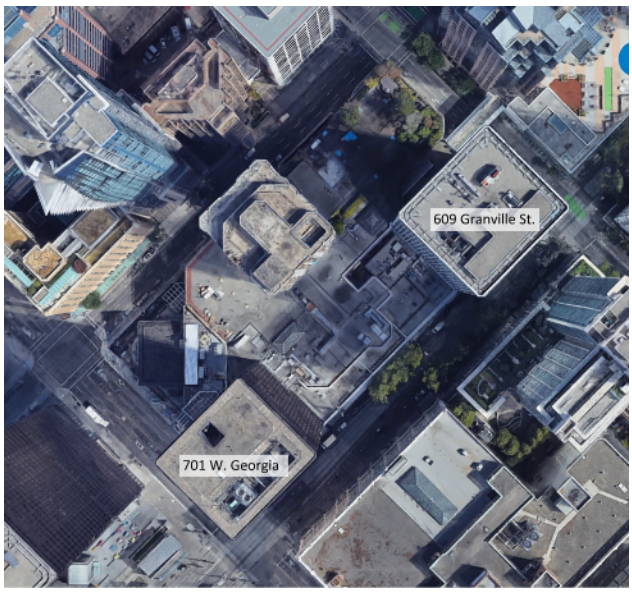
PREPARED BY: THE AME CONSULTING GROUP

Building Name/Address	609 Granville Street, Vancouver, BC
Building's Asset Class	Office
Building Size	~26,500 sq.m (~285,000 sq.ft.)
Year Built	1981
Building Owner & Manager	The Cadillac Fairview Corporation Limited
Prime/Mechanical Consultant	The AME Consulting Group
Structural Consultant	RJC Consulting
Electrical Consultant	AES Engineering

BOMA AMEGroup AES rjc Engineers

Project Overview & Background

609 Granville Street is a 25-storey office building, located in Downtown Vancouver, BC. The building was constructed in 1981, and consists of approximately 26,500 square meters (285,000 sq.ft.) of floor area. The tower spans a city block, identified as Block 42, which is situated over top of the Pacific Centre Mall. Block 42 is located between West Georgia Street and Dunsmuir Street, and Howe Street and Granville Street. 609 Granville is owned and operated by the Cadillac Fairview Corporation (CF).



Project Scope of Work

In 2019, AME was contracted by Cadillac Fairview to provide a feasibility study and conceptual-level design for 609 Granville's existing chillers that were approaching their end of service life. Included within the scope of work was to perform a comprehensive energy study, investigate and apply for funding through available CleanBC incentives and provide guidance and navigation for the team throughout the program and process.

After successful application and acceptance by BC Hydro, AME led the implementation phase of the chiller replacement through design and construction administration.

Investigation and Opportunities Identified

The existing building is heated through high pressure steam, delivered by Creative Energy. The steam is used to produce heating water loops at a supply temperature ranging between 60-75°C (140°F-267°F). The heating water temperature is typically reset based on outside air temperature (OAT).

The existing cooling system consisted of two (2) 358-ton centrifugal chillers and a 100-ton pony chiller, that provides chilled water to four (4) large air-handling units (AHUs). The chillers were only enabled when the AHUs were enabled, and outdoor air temperatures were too warm for free cooling using outdoor air.

During the investigation phase, AME reviewed existing records, drawings, balancing reports, system schematics, the sequence of operations and data collected from the building automation system (BAS), sub-metering records, and utility data.

The extensive review and analysis identified there was a significant amount of waste heat available from simultaneous cooling loads for the tower air handling units (AHUs) to potentially tap into. Three (3) options initially were investigated: a chiller heat recovery solution; connection to a data centre within 609 Granville; and a chilled water tie-in to the adjacent property, 701 West Georgia Street.

The piping tie-ins for connection to the 609 Granville Street data centre were not considered ideal due to the critical loads and the difficulty to execute without lengthy downtime. The chilled water tie-in to 701 West Georgia involved significant capital outlay that did not align with CF's budget at the time, and so it was proposed to be slated at a later date.

During the opportunities-investigation phase, simple payback and potential savings calculations were computed for each option, as detailed in the table below:

	Steam			Electrical			Average Energy Cost Savings	Payback (years)	Annual GHG Savings (tCO_2e)	Lifetime GHG Savings (tCO_2e)
	Current (GJ)	Future (GJ)	Savings ($)	Current (kWh)	New HRC Load (kWh)	Savings ($)				
Heat Recovery Chiller	8,262	3,634	$75,433	239,623	667,622	$33,546	$41,887	7.8	226	4,628
609 Data Centre Tie-in	0	1,095	(+$26,695)	0	114,461	(+$7,590)	$10,217	7.7	53	1,175
701 Chilled Water Tie-in	0	1,118	(+$18,219)	0	117,471	(+$5,096)	$13,123	7.9	55	1,200

As identified above, modelling for the heat recovery chiller project identified considerable GHG savings of approximately 226 tCO_2e/year and an annual steam use reduction of 4,628 GJ. These savings would have a substantial impact on Cadillac Fairview's GHG reductions goals, while also saving on operational costs annually.

Ultimately, due to simplicity and low-risk design, the heat recovery chiller was agreed upon as the best solution. As such, this also became the focus of the feasibility study and BC Hydro incentive program deliverable.

The above findings and calculations were shared with BC Hydro for determination of available incentives appropriate to pursuing the heat recovery project.

Implementation

Having completed and been involved in previous BC Hydro incentive programs, AME was able to navigate the process with ease. Ongoing and open communication between BC Hydro and AME resulted in only minor clarifications/comments to the energy study.

In consultation with the engineering project team, Cadillac Fairview opted to select Climacool UCH-70 (3 modules) for the heat recovery chillers along with Smardt WB095 (qty.2) replacement centrifugal cooling chillers. Upgrades to the existing refrigerant monitoring system and ventilation system would also become a necessary accompaniment to the new chiller upgrades in compliance with the latest codes and standards.

The existing chillers were located within a mechanical room, as such they needed to be disassembled to facilitate their removal through existing doorways and elevators. The new high-efficiency centrifugal cooling chillers and modular heat recovery chiller were specified such that they could be moved up to the mechanical room through the elevators and assembled within the mechanical room. This eliminated the need to remove sections of the curtainwall and associated crane costs to lift the chillers to the top of the building.

Construction of the project began in April 2020 and was completed by April 2021. Due to the existing chillers providing occupant cooling throughout the summer, decommissioning and demolition work needed to wait until the fall of 2020, after the cooling season had passed.

During the construction phase, the chillers were replaced in stages to ensure that partial cooling abilities were maintained. After completion, equipment start-up and commissioning of all new equipment and controls, a demonstration was provided to the Building Operations staff. This demonstration showcased the new operation of the chillers along with the operating parameters of the new heat recovery system. Additionally, the updated controls and controls graphics were demonstrated for the operations staff to ensure their familiarity with the upgrades.

During the 2021 “heat dome” event that was experienced in BC, this chilled water system struggled to meet and maintain the chilled water temperature; however, it appears this was largely resultant of the existing cooling tower capacity and not the HRC’s ability to reject the heat to the atmosphere. The replacement of these cooling towers are currently under development and will be replaced in the near future.