Assessment & Sustainable Replacement Options

155 George Street, Prince George, BC

Presented to: Regional District of Fraser-Fort George (RDFFG)
Prepared by: McCuaig & Associates Engineering Ltd.
Date: February 20, 2024

REGIONAL DISTRICT of Fraser-Fort George

AGENDA

- MAE Introduction
- Building Description
- Existing HVAC Assessment
- Energy & GHG Analysis
- Sustainable Replacement Options
- Recommendations
- Q&A

SERVING WESTERN CANADA

Company Introduction

McCuaig and Associates Engineering

- Founded: 1992 by Jak McCuaig
- Offices: Vancouver, Victoria, Calgary
- Staff: 40+ engineers, technologists, technicians, and administrative personnel
- Services:
  - Building asset management
  - Building science
  - Mechanical
  - Electrical
  - Energy Performance
  - Hazmat

Clients :

- Federal/Provincial/ Municipal governments
- School Boards
- Housing providers
- Large Portfolio Holders

McCUAIG & ASSOCIATES ENGINEERING

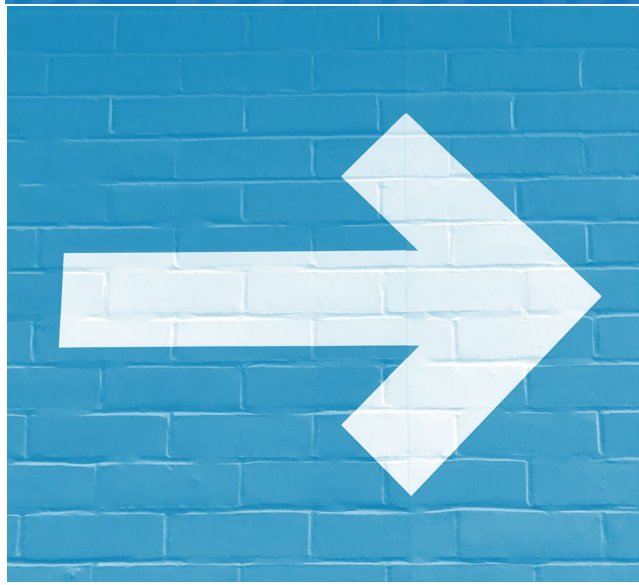
Today's Speaker

MAE
SERVING WESTERN CANADA

LEAD CONSULTANTS

Dmitrii Konkov, P. ENG.

Today's Discussion…



Building Description

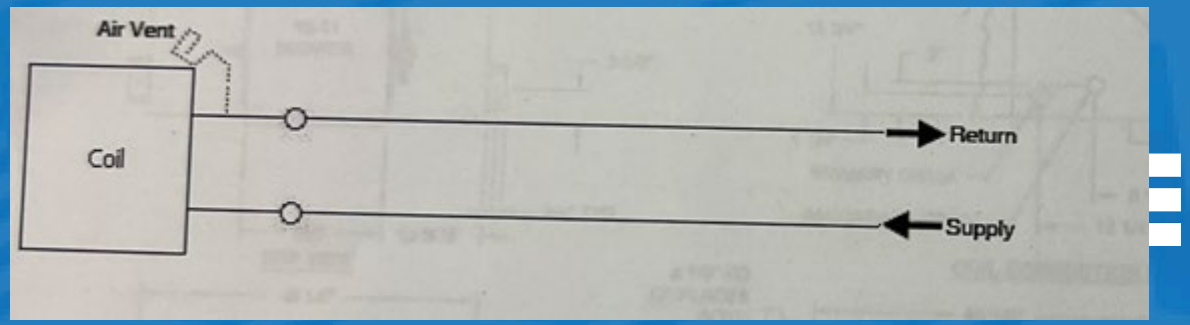
155 George Street, Prince George, BC

- Location: 155 George St, Prince George, BC. ASHRAE 4A Zone with 4720 HDD
- Year Built: 1999, 3 storeys, 27,934 sq. ft.
- Occupancy: RDFFG administrative offices
- Structure: Wood-framed, triple-glazed windows
- HVAC: Hydronic boilers, air-cooled chiller, 1 large AHU, fan coils

Existing HVAC

Distribution

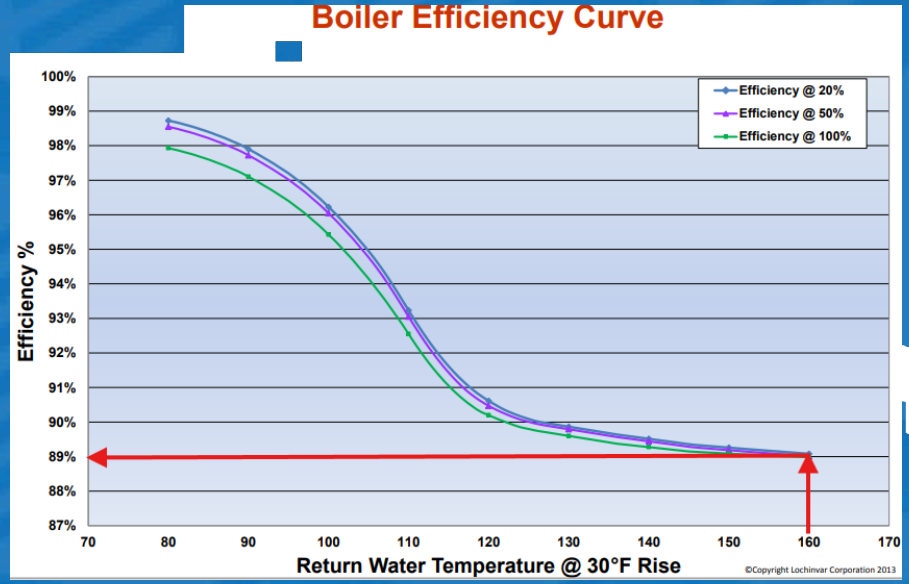
- 24 4- pipe fan coils
- All replaced in 2021 and in good condition
- Minor design issues when supply air goes to one room but returns from another
- All fan coils are “high temperature” fain coils



Existing HVAC

Heating

- 6 condensing boilers, ~270 MBH each
  - 2 IBC boilers installed in 2021. Good Condition
  - 1 Lochinvar installed in 2021. Good Condition
  - 3 HydroTherm boilers original to the building. Poor condition
- Issues:
  - Operating at non-condensing temps (~180°F).
  - Coupled DHW prevents lower return temps.
  - Three boilers used only for backup in extreme cold.



Existing HVAC

Cooling

- 50-ton Daikin chiller installed in 2016 – Good Condition
- Fluid cooler from 2007 (near end of life) – Acceptable Condition

- Issues:
  - Chiller pipe and HX insulation are damaged (likely birds)
  - Fluid cooler is not properly fastened

Existing HVAC

Ventilation

- Single Custom Maid McQuay AHU

- Issues:
  - Originally installed and reached its end of reliable service life

  - Significantly oversized. The unit is 10,000 cfm, while ASHRAE 62.1 (Ventilation in commercial buildings) only requires 3,000 cfm

  - The Oversizing is the reason of the poor performance of the generally well-maintained building

Existing HVAC

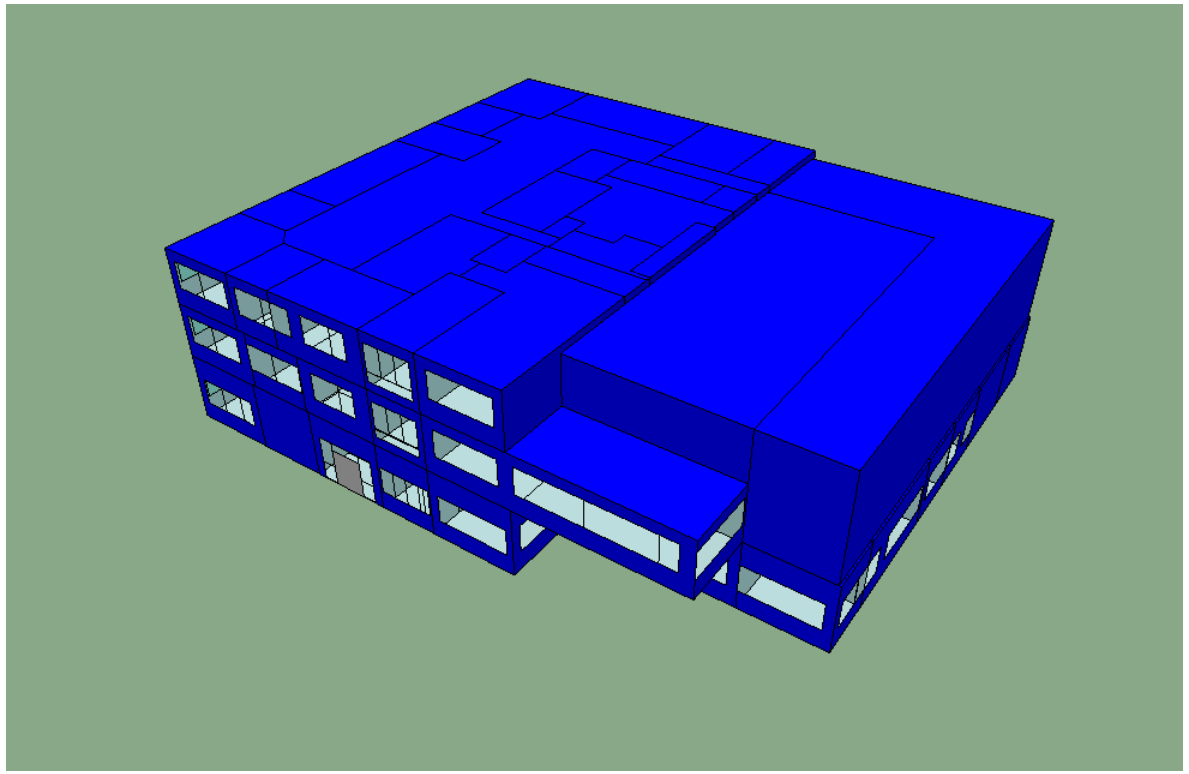
Domestic Hot Water

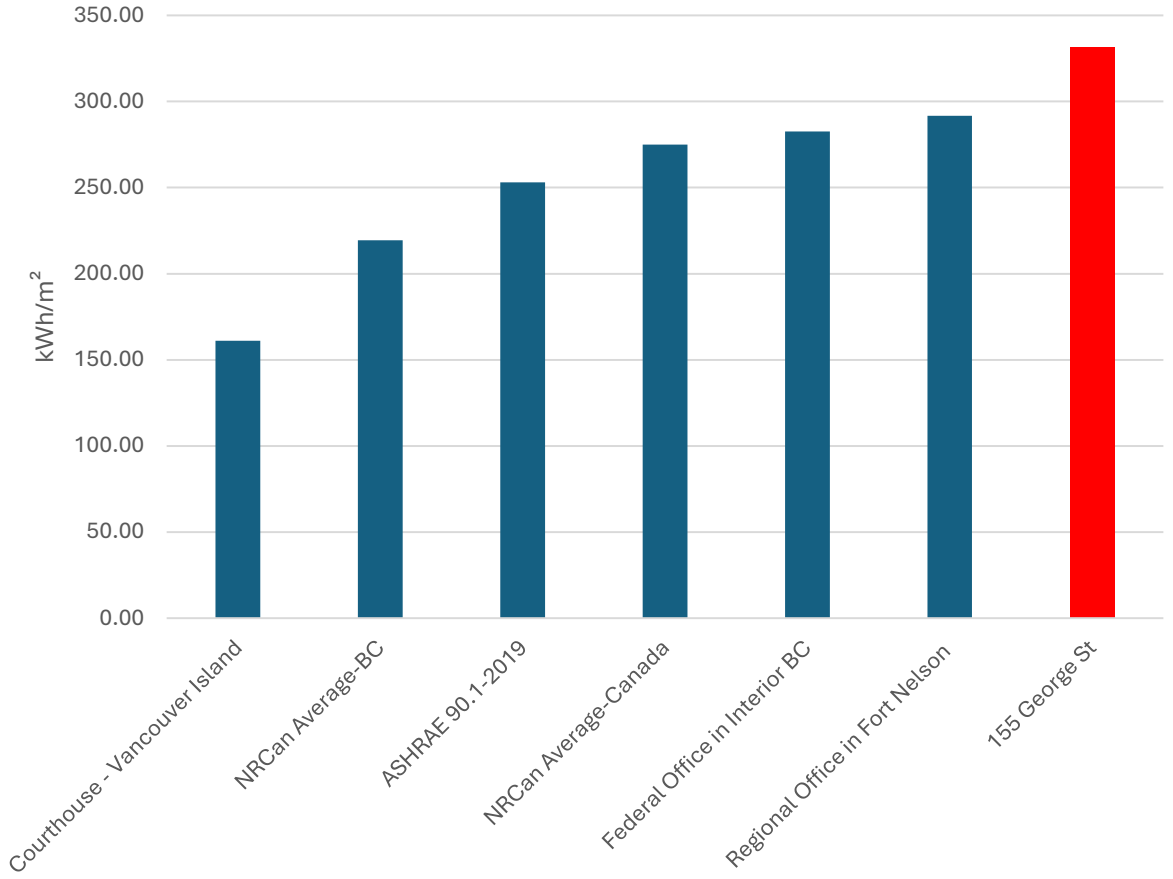
- One storage tank heater by the boiler plant
- One electric tank heater
- Issues:
  - Both reached the end of reliable service life
  - The storage tank is connected to the boiler plant, preventing it from working in a condensing range and decreasing overall efficiency

Electrical Capacity

- 600 V, 3-phase service
- 750 kVa Transformer and 800 A rated Distribution service
- Peak load is 88.9 kW within the last 3 years
- Building Capacity: 560 kW.
- Available Capacity: 471 kW

ENERGY MODEL

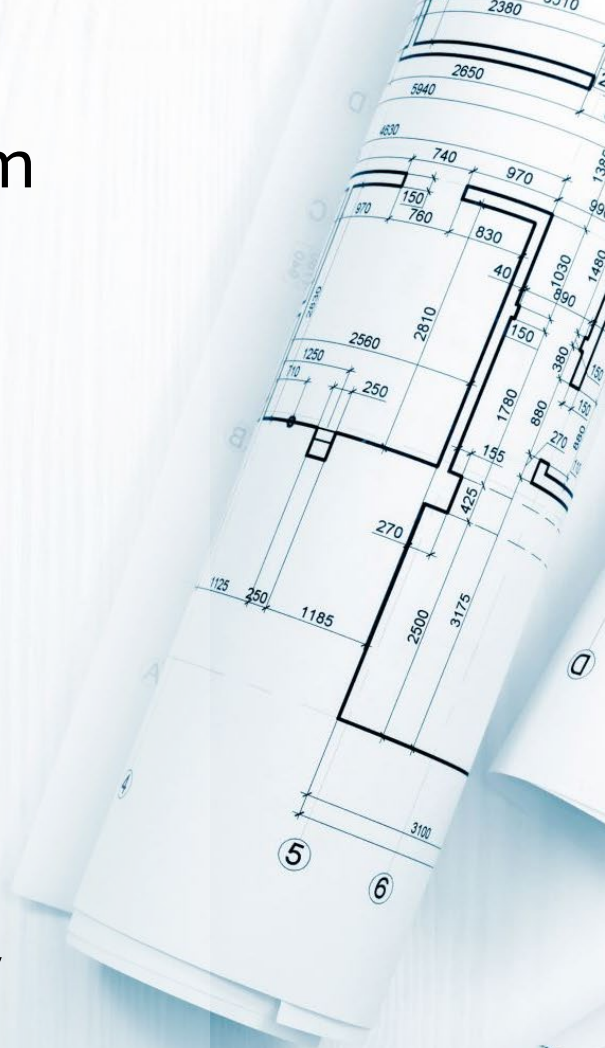




SCENARIO	BASELINE – UTILITY BILLS	BASELINE - SIMULATED	MAE	CVRMSE
Gas Consumption (kWh)	567,305.81	567,612.10	0.05%	14%
Electricity Consumption (kWh)	375,800.00	365,742.90	-2.7%	5%

SUSTAINABLE REPLACEMENT OPTIONS

- Option 1: Existing System Optimization
- Option 2: Geothermal System
- Option 3: Electrification
- Option 4: District Energy System
- Solar PV System



SUSTAINABLE REPLACEMENT OPTIONS

0. Baseline

Scope
Boiler Replacements EOL
AHU Replacement ASAP
Chiller replaced at EOL
Fan Coils replaced at EOL

Parameter	Impact
Energy Use	-0 GJ
Greenhouse Gas Emissions	- 0 Ton CO2e
Energy Costs	-$0
Capital Costs	$810,000.00
Financial Metrics (SPP/IRR/NPV)	N/A

SUSTAINABLE REPLACEMENT OPTIONS

1. Existing System Optimization

Scope
Boiler Plant Redesign
AHU Replacement and downsizing
Chiller replaced at EOL
Fan Coils

Parameter	Impact
Energy Use	-798 GJ
Greenhouse Gas Emissions	-41.5 Ton CO2e
Energy Costs	-$12,504.92
Capital Costs	$952,000.00
Financial Metrics (SPP/IRR/NPV)	11y/ 7% / $75,749.99

SUSTAINABLE REPLACEMENT OPTIONS

2 Geothermal

Scope
Water to Water Heat Pumps
Boreholes and resurfacing
AHU Replacement and downsizing
Fan Coils

Parameter	Impact
Energy Use	-1,143 GJ
Greenhouse Gas Emissions	-72.88 Ton CO2e
Energy Costs	-$7,750.70
Capital Costs	$1,117,000.00
Financial Metrics (SPP/IRR/NPV)	40y/ -3% / -$172,035.99

SUSTAINABLE REPLACEMENT OPTIONS

3 Electrification

Scope
Electric Boiler Plant
Chiller at EOL
AHU Replacement and downsizing
Fan Coils at EOL

Parameter	Impact
Energy Use	-976 GJ
Greenhouse Gas Emissions	-102.89 Ton CO2e
Energy Costs	$7,372.89
Capital Costs	$612,000.00
Financial Metrics (SPP/IRR/NPV)	N/A

SUSTAINABLE REPLACEMENT OPTIONS

4 District Energy System

Scope
Heat Exchangers and Connection to DES
Chiller at EOL
AHU Replacement and downsizing
Fan Coils at EOL

Parameter	Impact
Energy Use	-2,071 GJ
Greenhouse Gas Emissions	-92.11 Ton CO2e
Energy Costs	$2,337.54
Capital Costs	$765,000.00
Financial Metrics (SPP/IRR/NPV)	N/A/ N/A/ 82,221.35

SUSTAINABLE REPLACEMENT OPTIONS

5 Solar

Scope
No HVAC Scope
PV panels

Parameter	Impact
Energy Use	-144 GJ
Greenhouse Gas Emissions	-0.62 Ton CO2e
Energy Costs	-$3,685.82
Capital Costs	$135,000.00
Financial Metrics (SPP/IRR/NPV)	37y/ -3% / -$70,818.19

SUSTAINABLE REPLACEMENT OPTIONS

- Option 4: District Energy System

- Reuses recently replaced Fan coil Units
- Relies on high-temperature system
- Minimum changes to the existing Hydronics
- Significant GHG reduction due to Biomass DES
- HX service life is up to 50 years
- Low Capital and Maintenance Costs
- Aligns with the District Climate Action Plan
- Positive public outlook

Incentives and Rebates

Fortis BC	**$118,350**
Clean BC	**$184,220**
FCM	**$153,000**

THANK YOU

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