



Thompson Rivers University ASHRAE Level 1 Energy Study

Energy Study for:

House 8 – Radio Station

Attention:

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1. Background Description of Facility, Hardware and Systems

1.1 Overview and Facility Use

House 8, housing the Radio Station, was originally constructed in 1945. The gross conditioned square footage of the building is 131 m² (1,410 ft²). The first floor of the house contains a meeting area, and offices. The upper level has two sealed recording studios. The basement contains the music library and mechanical systems.

1.1.1 Physical condition and window type

The original building appears to be well maintained. The windows are double paned. The building insulation contains asbestos so there are no plans to upgrade the insulation in this building. The building will likely be torn down in the near future. Because of this, no insulation upgrades are considered for this facility.

1.2 Mechanical Systems

1.2.1 Ventilation

The building is ventilated by a gas fired furnace and natural ventilation through the attic. The upper level is sealed to provide sound insulation. The occupants have noted that the fan is on constantly to provide adequate ventilation to the sealed space.

1.2.2 Cooling

One direct expansion (DX) cooling unit located outside provides cooling to the building via the furnace.

1.2.3 Heating

A gas fired furnace provides heating to the house.

1.2.4 Domestic Hot Water

There is one electric domestic hot water tank in the basement. While this DHW tank is nearing the end of its recommended service life, we do not recommend replacing it at this time since the building is likely to be torn down in the near future. If the building plans change, this DHW could be replaced with a heat pump version.

1.3 Lighting System

Linear LEDs provide most of the lighting with CFLs making up the remaining portion. TRU is currently in the process of replacing all lighting on campus with LEDs.

1.4 Control Equipment

One programmable thermostat, located on the main level, controls the temperature for entire house. The thermostat is set at 22°C to maintain a reasonable temperature throughout the house. Since the upper levels are sealed, ventilation is constantly required.

1.5 Energy Analysis

1.5.1 Energy Use Profile

Energy metering is not available for this facility. Figure 1 presents the building's simulated electrical consumption based on equipment capacity and usage estimates. Electricity usage is assumed higher in the summer during cooling season.

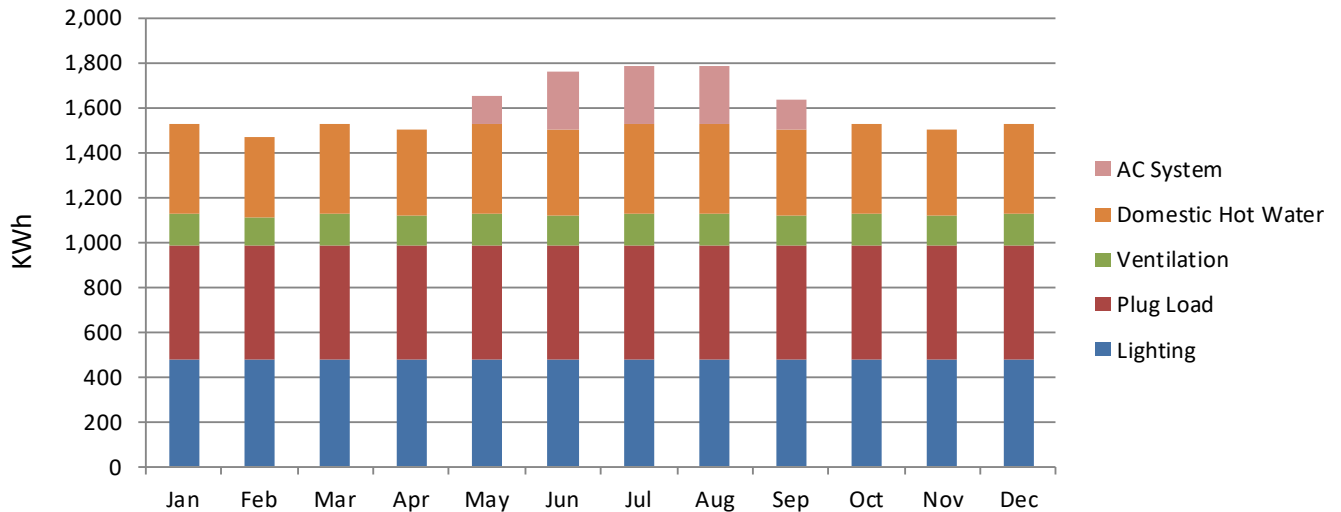


Figure 1: Simulated Monthly Electricity Consumption

Figure 2 presents the building's simulated gas consumption. Gas usage follows a typical heating profile. Summer usage is assumed due to heating and cooling conflicts between the upper and lower floors.

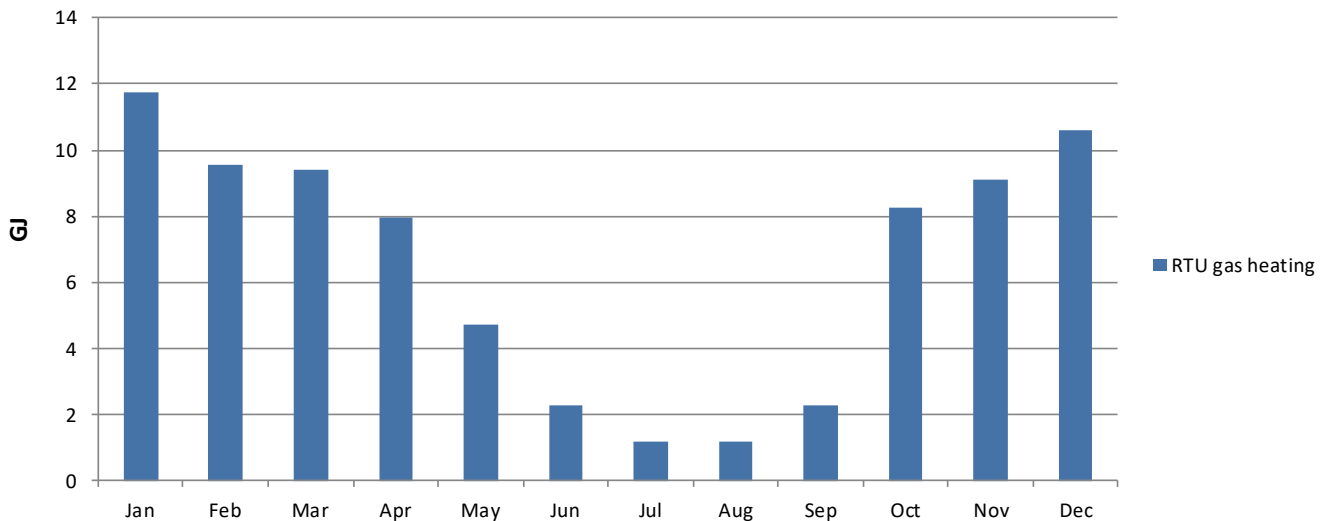


Figure 2: Simulated Monthly Gas Consumption

1.5.2 Energy Intensity Analysis

A summary of Baseline Energy consumption and the corresponding costs and energy intensity for the facility are presented in Table 1. House 8 has a Energy Use Intensity (EUI) of 1,000 MJ/m².

Table 1: Summary of Baseline Energy Data

Utility	Energy Use (GJ)	EUI (MJ/m2)	Cost (\$)	Cost (\$/ft2)
Gas	80	600	\$1,200	\$0.85
Electricity	50	400	\$900	\$0.62
Total	130	1,000	\$2,100	\$1.48

1.5.3 Energy End Use Breakdown

The energy use is based on estimated operation patterns. The estimated breakdown of electricity consumption by building system is presented in Figure 3. Gas is only used for space heating.

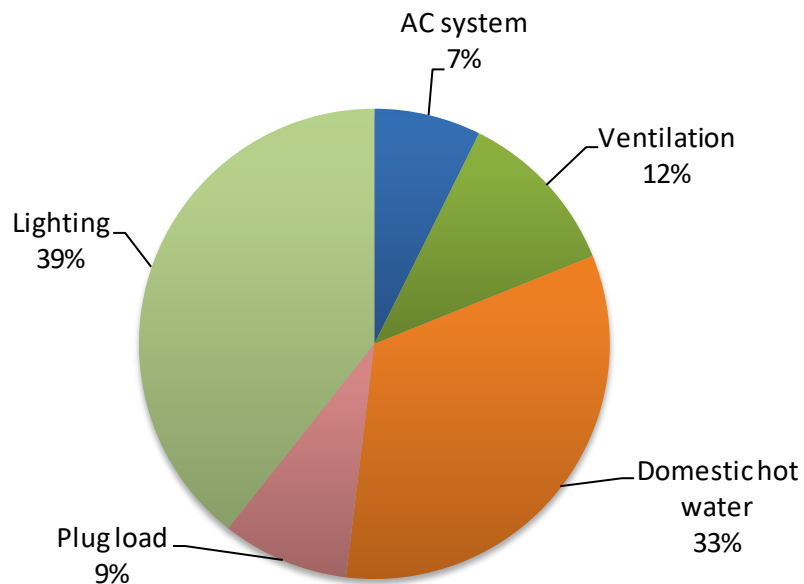


Figure 3: Electricity Consumption

The estimated percentage of total energy consumption by building system is presented in Figure 4.

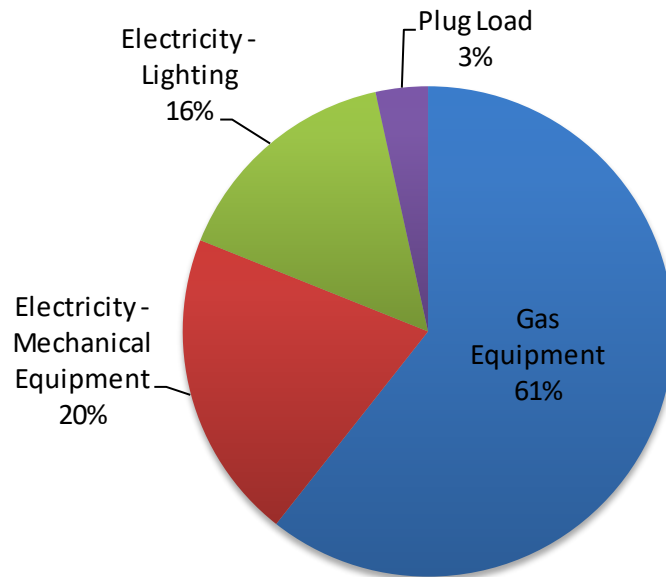


Figure 4: Total Energy Breakdown

2. Conservation Opportunities

The primary objective of this study was to identify and analyse energy conservation opportunities at House 8. The rate schedules used in this analysis for financial savings estimates are presented in Table 2. The financial savings estimates include goods and services tax (GST) and provincial sales tax (PST). For Greenhouse Gas estimates, we have used emissions factors of 0.010 kg CO_{2e} / kWh of electricity in BC, and 49.87 kg CO_{2e} / GJ for gas.

It should be noted that the paybacks for the measures consider the carbon tax escalation provided by the federal government.

Table 2: Rate Schedules

Utility	Rate
Electricity	
Marginal Demand Charge	\$12.26 / kW (inc taxes)
Marginal Consumption	\$0.063 / kWh (inc taxes)
Gas	
Recent Gas Consumption	\$15.00 / GJ (inc taxes)

A number of potential conservation opportunities have been analyzed. A detailed explanation as well as an estimated cost and energy saving potential are summarized for these projects.

If all of the recommended measures are implemented, we estimate the following savings outcomes:

Table 3: Estimated Savings

Energy footprint	Electricity	Natural Gas	Greenhouse gases	Cost per ft ²
38%	-42%	89%	85%	\$ 0.72

2.1 Energy Conservation Measures

A summary of the analysis for the recommended measures is presented in Table 4. The analysis of the measures does not include incentives from BC Hydro or Fortis BC. Detailed descriptions for each project are presented below. Based on conversations with operators, the houses are likely to be torn down in the near future. As such, it may not make sense to implement any conservation measures at this time.

Table 4: Measure Summary

Item	Description	Base Case Cost	Incremental Cost	Total Cost	Effective Payback	NPV	Annual Savings			
							\$	GJ	kWh	GHG
1.1	Furnace Heat Pump	\$5,000	\$6,500	\$11,500	6.0	2,900	\$1,100	70	(5,900)	3.4
1.2	Renewable Natural Gas				≥ 40		(\$90)			0.4

2.1.1 Furnace Heat Pump

Heating and cooling for the building is provided by a single gas furnace that has a direct expansion (DX) cooling coil and external condensing unit. Given the minimal gas usage in the building, it is unlikely it will be connected to the central plant. As such, we recommend replacing the existing condensing unit with a heat pump. This will allow for efficient heating and cooling of the building. The gas heating can still be used as a backup in the colder winter months. Please note the analysis of this measure using incremental costing as it assumes the heat pump is not installed until the condensing unit is due to be replaced. It does not include the incentives available for heat pumps which will further reduce the payback. It should be noted that the gas furnace itself has also reached the end of its recommended service life, however, given the plans for the building and the minimal gas savings achieved from upgrading the furnace itself, we do not recommend upgrading the furnace unless necessary. If it is upgraded, we recommend installing a high efficiency condensing unit.

A single programmable thermostat controls the supply air temperature for the furnace, while the building is divided into at least 3 distinct zones. Often there is a temperature differential between the first and second floor. Installing additional thermostats would allow the supply air temperature to be set based on average temperature conditions. This would more appropriately maintain comfortable space temperatures and avoid heating/cooling conflicts. While this is not an energy savings measure, it will result in improved occupant comfort.

2.1.1 Renewable Natural Gas

FortisBC offers Renewable Natural Gas (RNG), or biomethane, as an alternative to non-renewable natural gas. This presents an easy path to reducing GHG emissions. The cost of RNG is approximately 1.5 times the cost of non-renewable natural gas, however, there is no additional cost for implementing this measure, given that RNG is delivered using existing FortisBC infrastructure. The analysis of this measure assumes the remaining natural gas in the building is converted to RNG however, there are options for converting any portion (5%, 10%, 25%, 50%, 100%) of the total gas consumption to RNG. The cost per tonne would be the same regardless of the portion converted. Given the plans for this building, renewable natural gas may be the best option to offset emissions in this facility in the short term.

3. Disclaimer

This document was prepared by SES Consulting Inc. for Thompson Rivers University. The scope was to perform a Level 1 Energy Study at this site. An initial investigation has been performed to estimate the probable costs and savings associated with each project. Further detailed design work will be required for project implementation. Any estimates of probable cost are made on the basis of SES's judgment and experience. SES makes no warranty, express or implied, that cost of the work will not vary from the SES's estimate of probable cost. SES accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.