

Analysis Purpose & Goals

Goal of study: Evaluate & compare various HVAC systems qualitatively and quantitatively

- OPTION 1*: VAVs
- OPTION 2*: Active Chilled Beams (ACB)
- OPTION 3a: Air Source VRF
- OPTION 3b: Ground Source VRF
- OPTION 4*: Fan Coil Units (FCUs)

*Options were considered for Natural Gas (NG) & Propane (LPG)

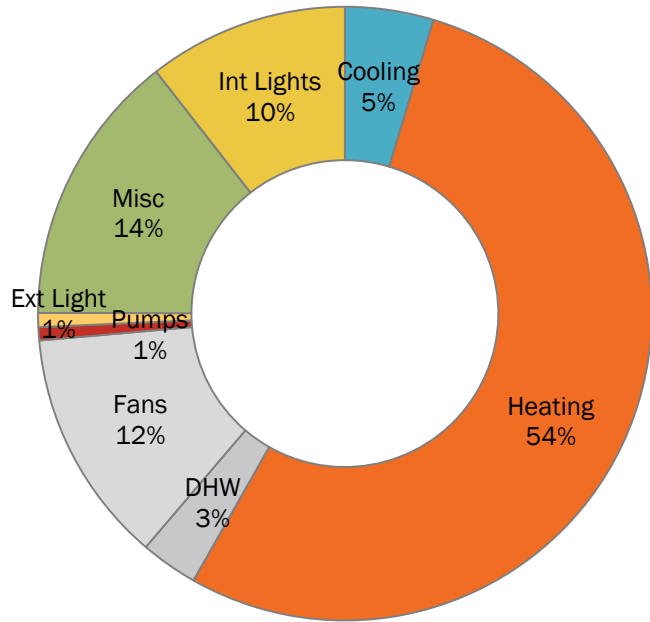
HVAC Matrix

	Heating	Cooling	Comfort	IAQ	Maintenance	Durability	Acoustics	GHG (On Site)	Capital Cost	Energy Use	Energy Cost	TOTAL
Option 1a VAV terminal units with reheat, ventilation through ERUs Single zone AHUs with DX cooling for gyms, café, and kitchen	NG	Air Cooled Chiller	3	3	3	2	4	5	2	5	5	32
Option 1b VAV terminal units with reheat, ventilation through ERUs Single zone AHUs with DX cooling for gyms, café, and kitchen	LPG	Air Cooled Chiller	3	3	3	2	4	5	2	5	8	35
Option 2a 4-pipe chilled beam system Single zone AHUs with DX cooling for gyms, café, and kitchen	NG	Air Cooled Chiller	1	1	1	1	1	2	3	3	1	14
Option 2b 4-pipe chilled beam system Single zone AHUs with DX cooling for gyms, café, and kitchen	LPG	Air Cooled Chiller	1	1	1	1	1	2	3	3	6	19
Option 3a Air Source VRF system with DOAS ventilation system Single zone AHUs with DX cooling for gyms, café, and kitchen	Electric	Electric	2	1	4	3	2	1	3	2	4	22
Option 3b Ground source VRF system with DOAS ventilation system Single zone AHUs with DX cooling for gyms, café, and kitchen	Electric	Electric	2	1	4	4	2	1	4	1	3	22
Option 4a Fan Coil Units with DOAS ventilation system Single zone AHUs with DX cooling for gyms, café, and kitchen	NG	Air Cooled Chiller	1	1	2	2	2	3	3	4	2	20
Option 4b Fan Coil Units with DOAS ventilation system Single zone AHUs with DX cooling for gyms, café, and kitchen	LPG	Air Cooled Chiller	1	1	2	2	2	3	3	4	7	25

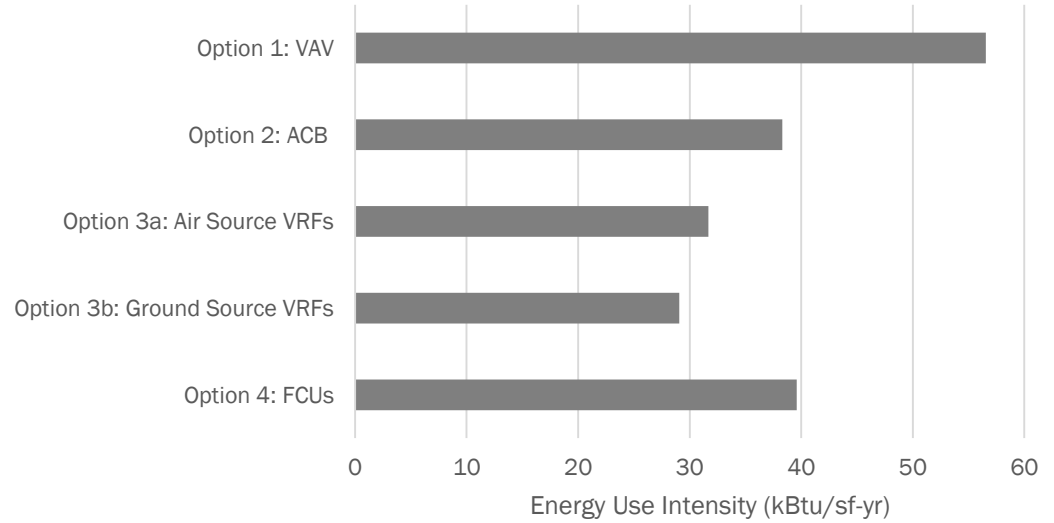
Lower total indicates a better system.

Energy Usage Comparison

ENERGY USE BREAKDOWN: BASELINE VAV

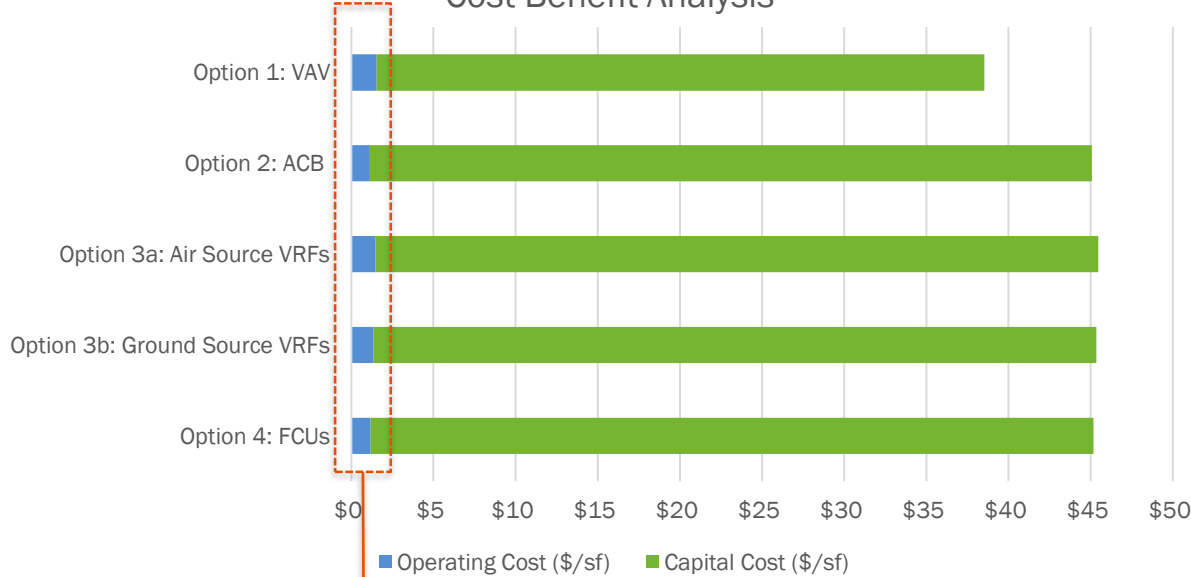


ENERGY USE INTENSITY



Cost Analysis

Cost-Benefit Analysis



Utility Rates source:
Energy Information Agency

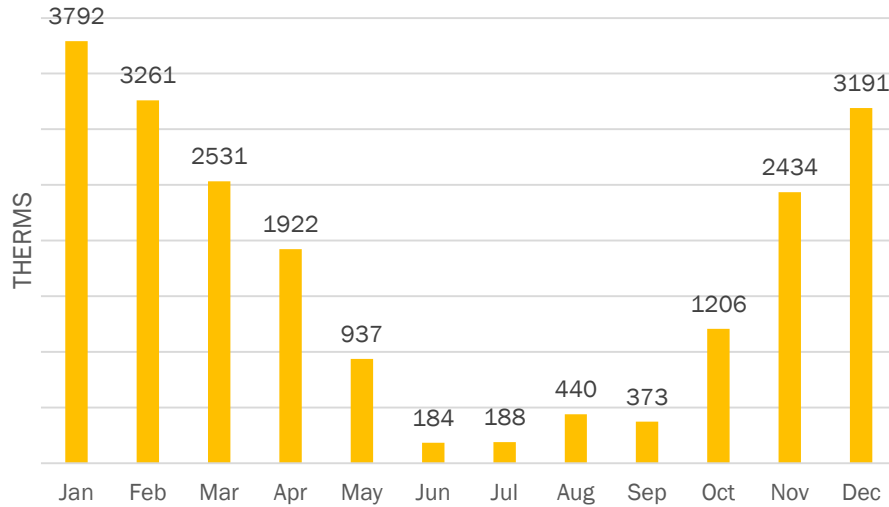
Electricity: 16 cents/KWH
NG: 1.05 \$/Therm
LPG: 3 \$/Therm

Operating Cost



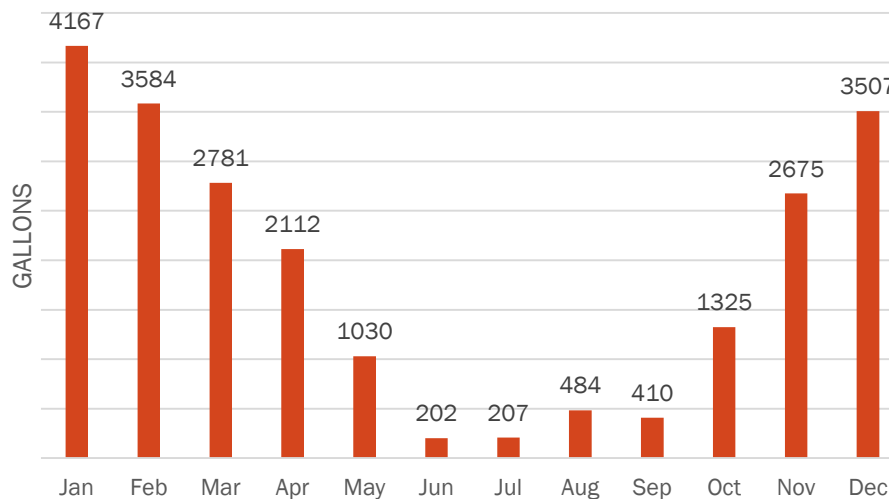
Gas Use Profiles

Natural Gas (NG)



The gas use profiles shown in these charts are for Options 2a (NG) and 2b (LPG).

Propane (LPG)



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