
PARKING GARAGE

16,800 Square Feet

ECM EVALUATION

Temperature Setpoint
Heat Recovery Ventilator
Demand Controlled Ventilation

OpenStudio



WHOLE-BUILDING ENERGY MODELING

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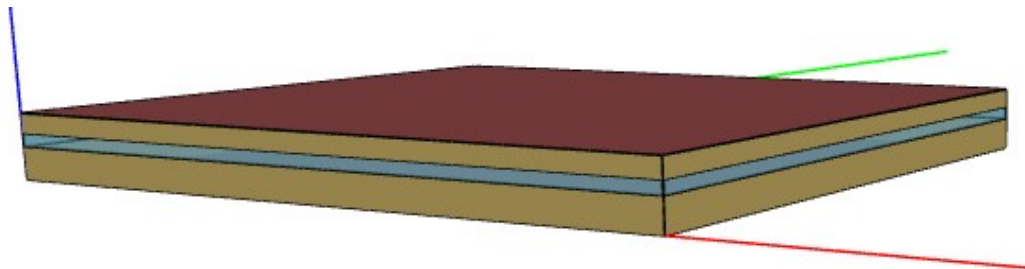
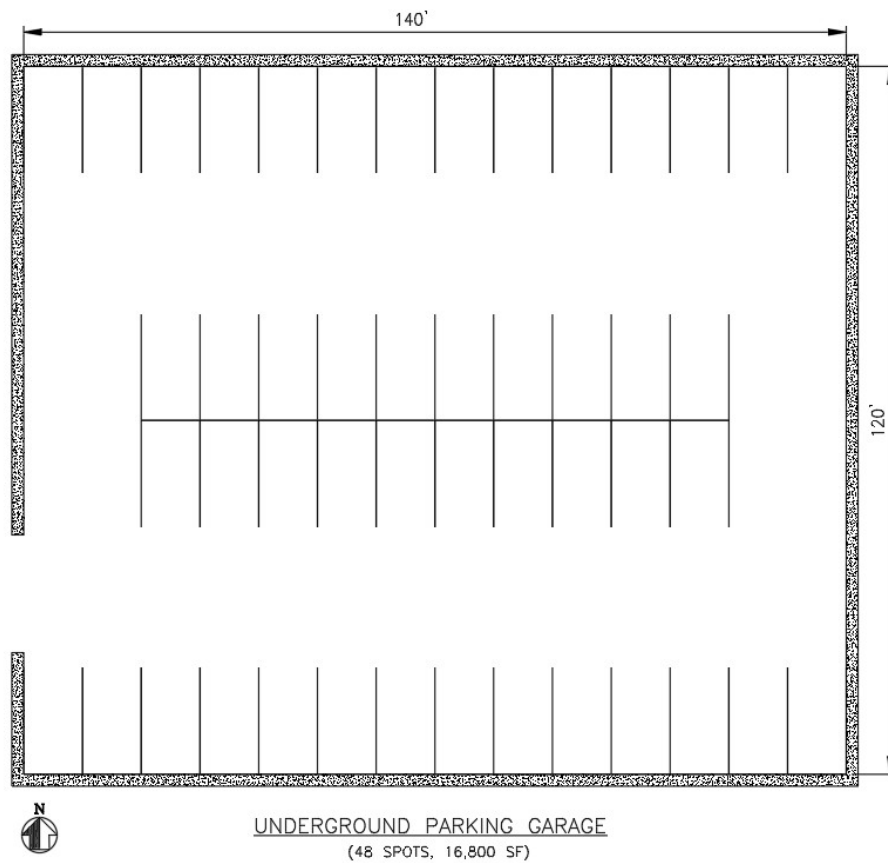
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3.2 GEOMETRY

The following spaces and geometry were modeled.

BUILDING GEOMETRY	
Building Footprint	140 ft x 120 ft
Ground Floor Area	16,800 SF
Floors	1
Gross Floor Area	16,800 SF
Floor Height	12 ft



3-D Building Simulation from OpenStudio

3.3 BUILDING ENVELOPE

The following building constructions inputs were used in the building energy models.

BUILDING ENVELOPE	
Roof	R-10.46
Exterior Wall	R-9.15
Window: U-Factor	U-0.72
Window: Solar Heat Gain Coeff.	SHGC = 0.36
Window: Visible Transmittance	VT = 0.7
Window-Wall-Ratio	20%
Infiltration	0.2 ACH

3.4 INTERNAL LOADS & TEMPERATURE SETPOINTS

The following space loads and setpoints were used in the building energy models.

SPACE LOADS & SETPOINTS	
Space Type	Parking Garage
Lighting	1.0 W/SF
Equipment	0.25 W/SF
People	10 People
Ventilation	0.75 CFM per SF (12,600 CFM)
Cooling Temperature	None, Ventilated
Heating Temperature	65F, 24 hours, 7 days

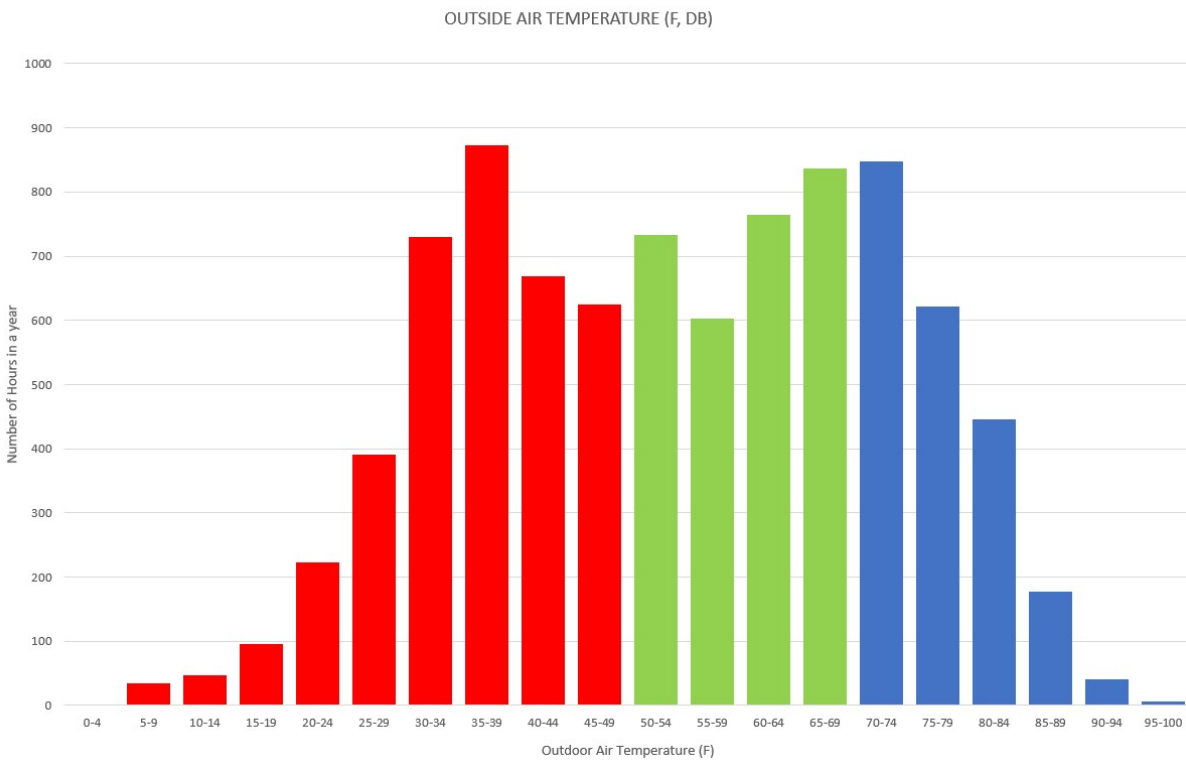
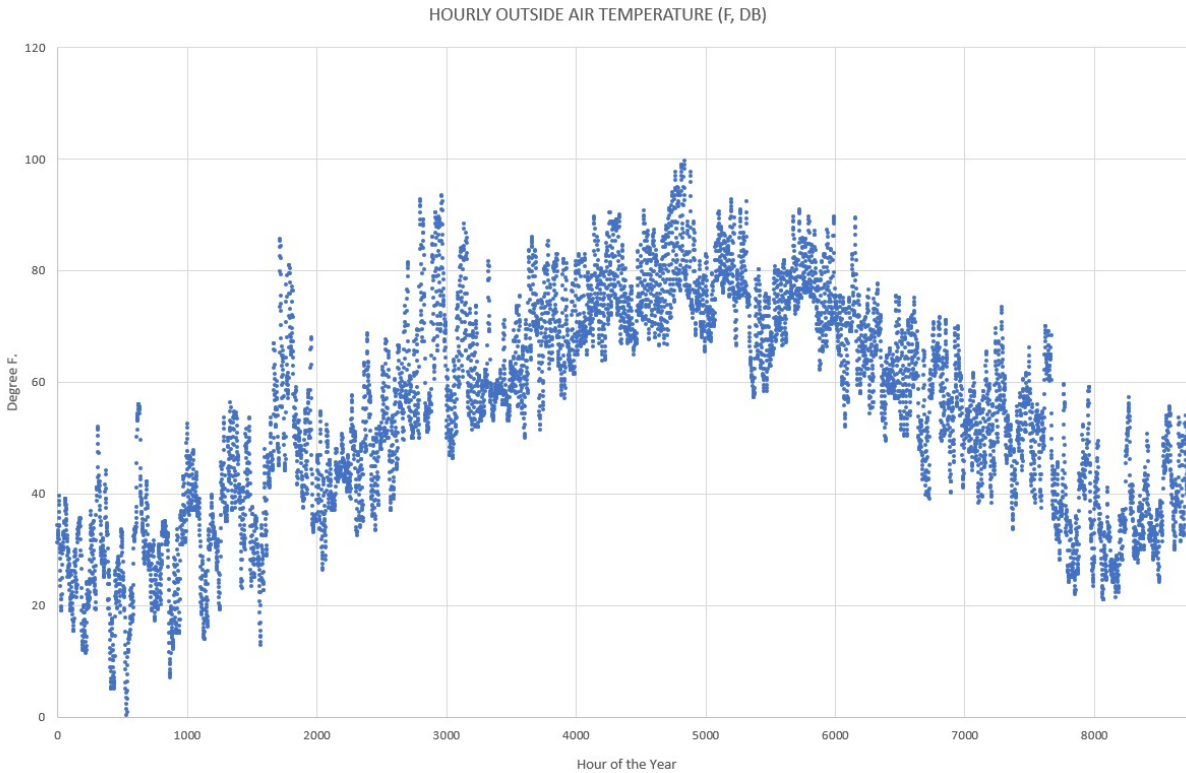
3.5 HVAC

The following HVAC systems were modeled in the building energy models.

HVAC	
Type	HV-1 with 12,600 CFM of Outside Air, Gas Heat
Cooling System COP	N/A
Heating Efficiency	0.7
Fan TSP	2.5"
Heating Temperature Setpoints	65F at all time
Cooling Temperature Setpoints	None
Notes	No Heat Recovery, No Economizer, No DCV

3.6 WEATHER DATA

Site specific hourly weather data were used in the energy simulations. Below graphs are the hourly outdoor air temperature.



3.7 LOAD SCHEDULES

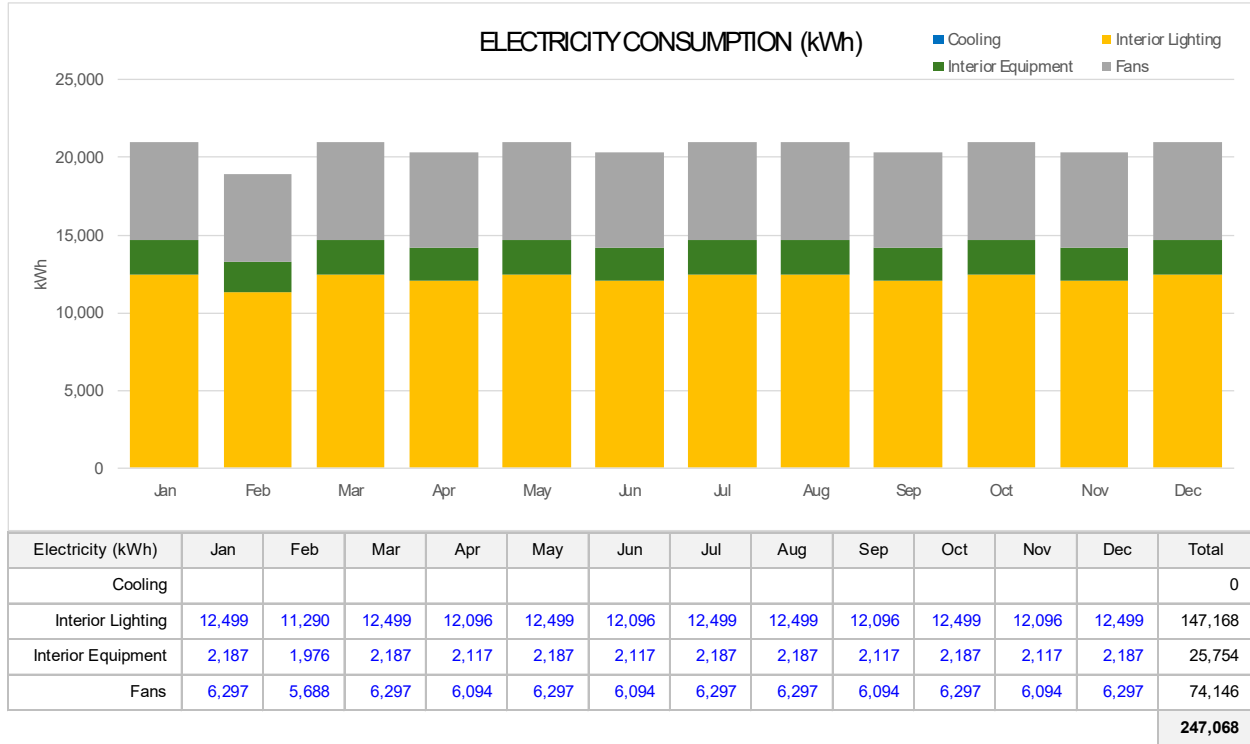
The following lighting, equipment, and people internal load schedules were used in the building energy simulation.



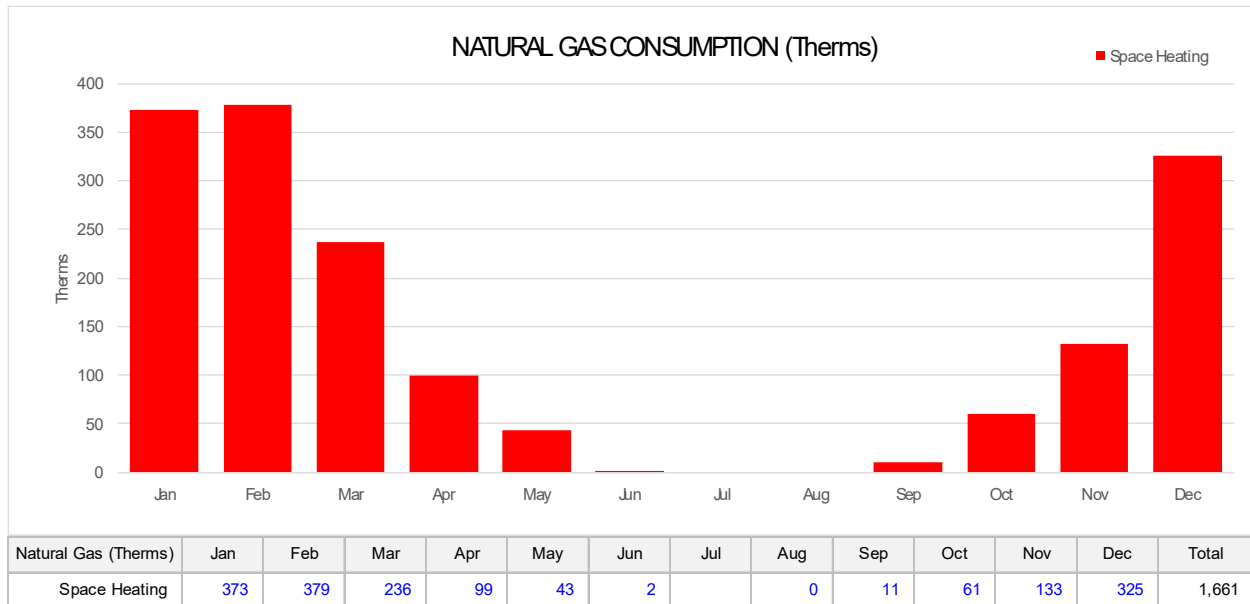
4 BUILDING ENERGY MODEL – RESULTS

4.1 ANNUAL ENERGY CONSUMPTION

The table below summarizes the monthly electricity consumption by end-use. Baseline and ECM.

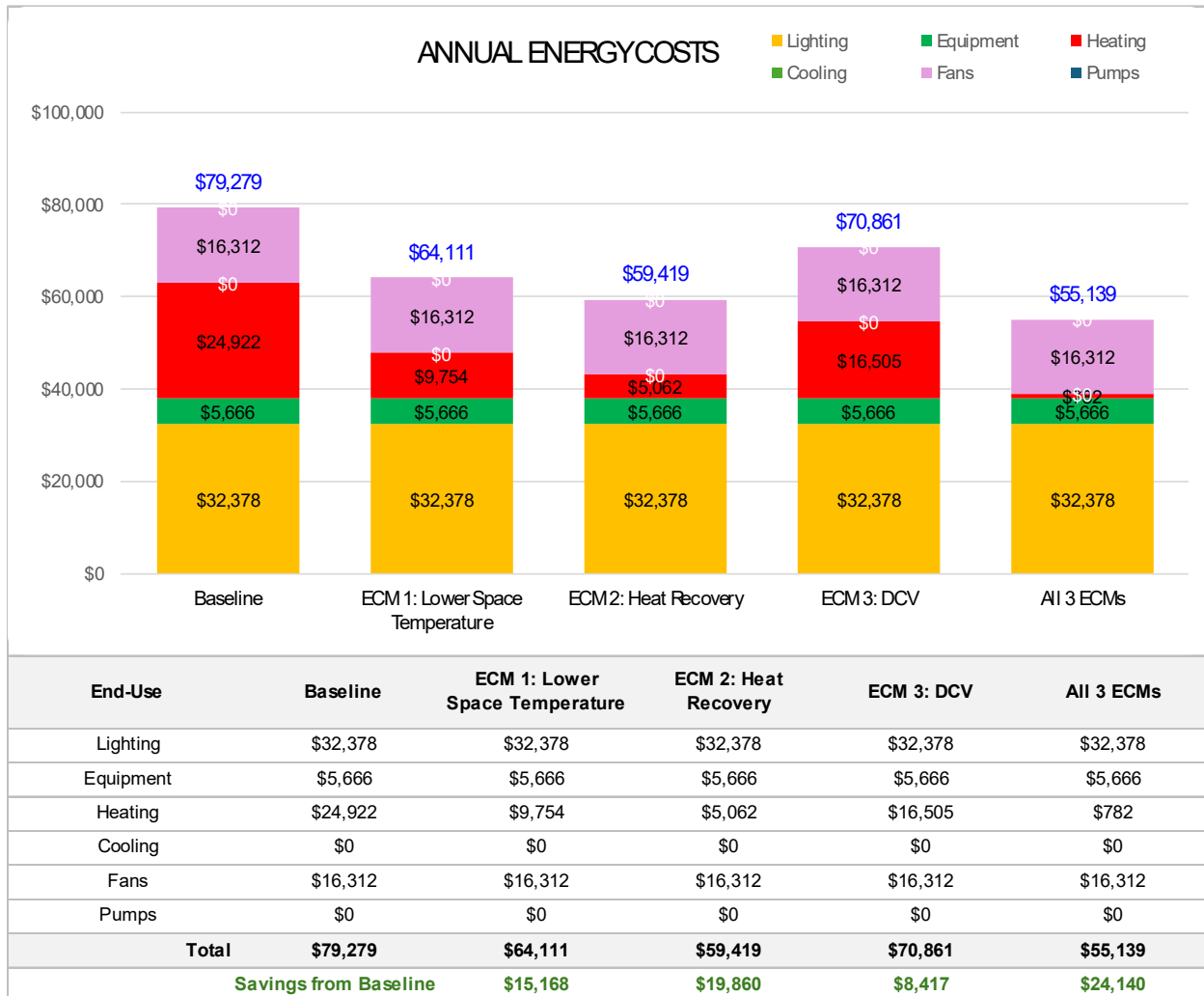


The table below summarizes the monthly natural gas consumption by end-use



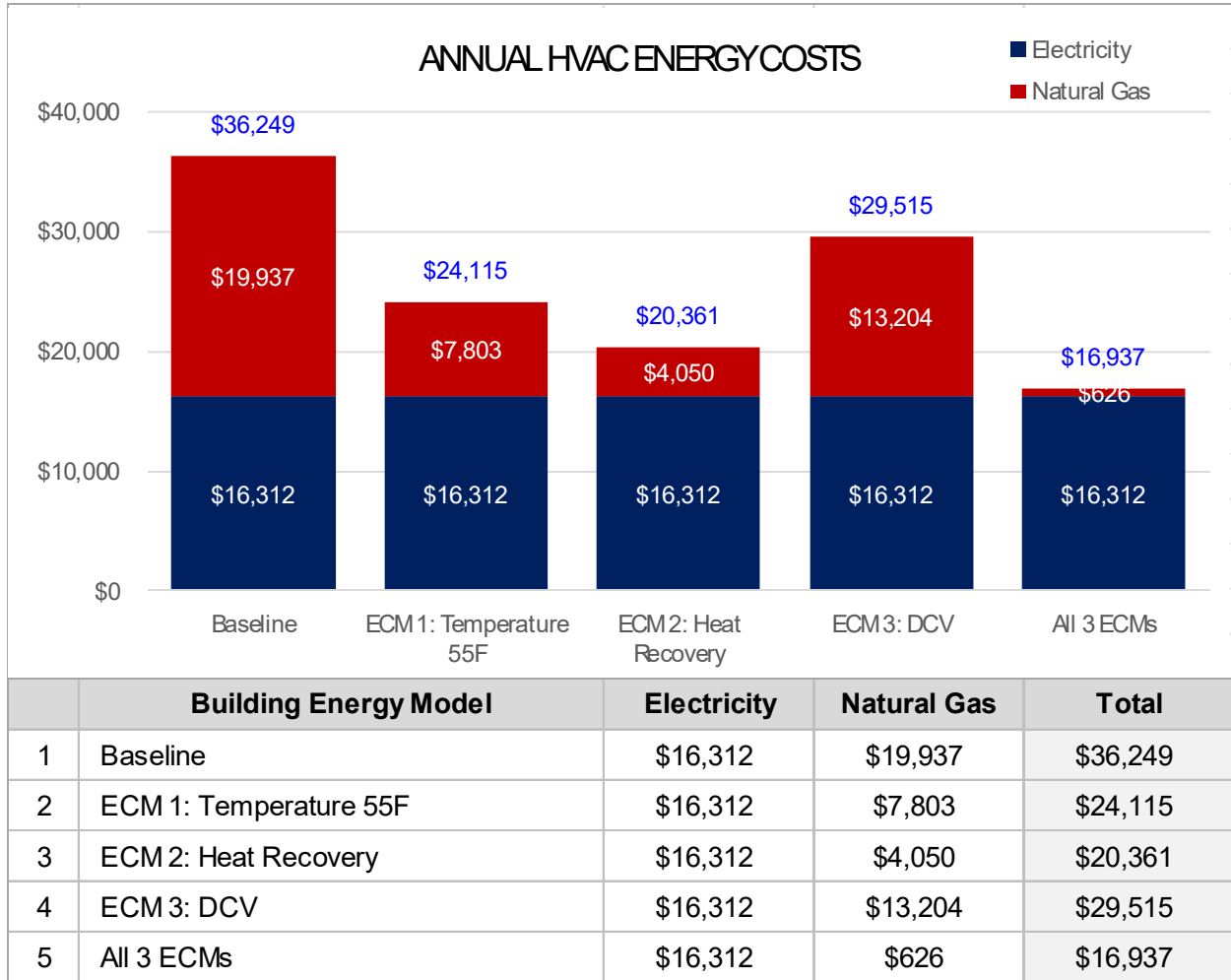
4.2 ECM SAVINGS

Below chart and table summarize the annual energy cost breakdown by end-use of the 5 energy models.

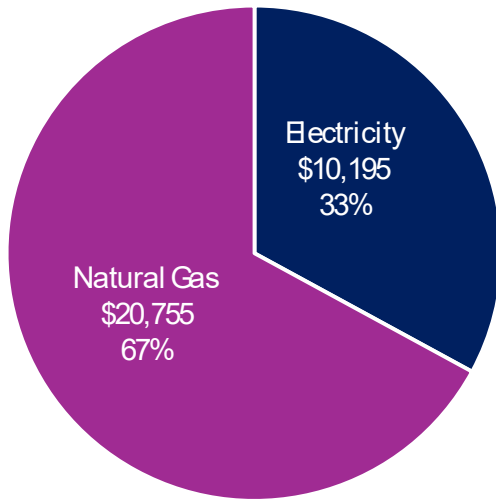


4.3 ANNUAL ENERGY COSTS & SAVNGS

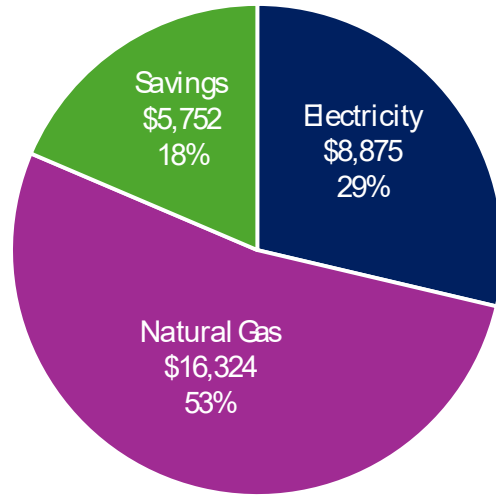
Below chart and table summarize the annual electricity and natural gas costs of the 5 energy models.



BASELINE MODEL



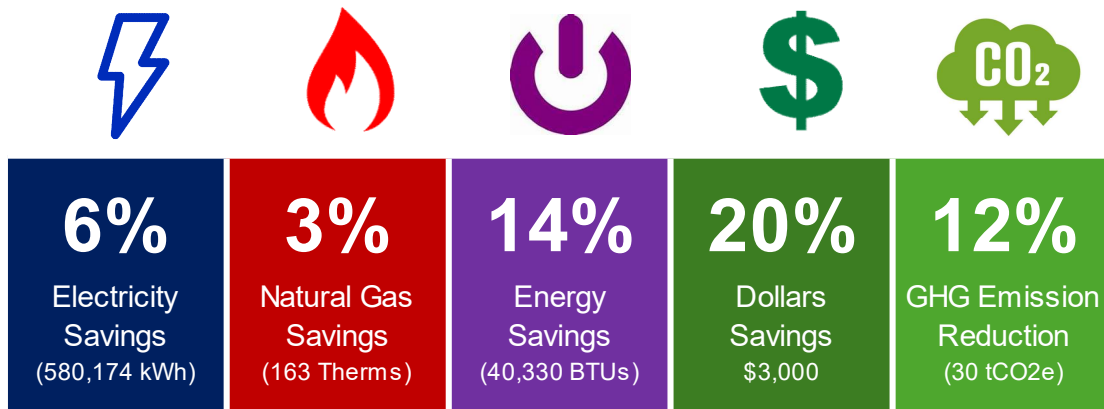
PROPOSED MODEL



ANNUAL	ELECTRICITY	NATURAL GAS	TOTAL COST
BASELINE	\$10,195	\$20,755	\$30,950
PROPOSED	\$8,875	\$16,324	\$25,199
\$ SAVINGS	\$1,320	\$4,432	\$5,752
% SAVINGS	13%	21%	19%

4.4 ANNUAL SAVINGS OVERVIEW

Below is a summary of the annual savings of the proposed BEM from the baseline model.



APPENDIX A: ABBREVIATIONS

Below are the common abbreviations and their meaning.

ABBREVIATION	
ABBREVIATION	MEANING
ACH	Air Change Per Hour
BEM	Building Energy Modeling
BTU	British Thermal Unit (Unit of Heat)
DB	Dry Bulb (Temperature)
DCV	Demand Controlled Ventilation
DOE	U.S. Department of Energy
ECM	Energy Conservation Measure
F	Fahrenheit (Temperature)
ft	Feet
GFA	Gross Floor Area
kWh	kilowatt-Hour (Unit of Electricity)
MER	Mechanical Equipment Room
SF	Square Feet
SHGC	Solar Heat Gain Coefficient
Therm	Unit of Natural Gas