

Memorandum

To: Hazel National Landing Project Team
From: Abhishek Lal, James Ley
Date: February 12, 2021

SUBJECT: eQuest Energy Model for the Hazel National Landing Project

1. Introduction

This report presents energy analysis results for the Hazel National Landing project. The project is pursuing certification under the LEED for Homes Multifamily Midrise v4 Rating System. A conceptual proposed design eQUEST energy model of the building (Building 1) was created to evaluate a number of energy efficient design alternatives. Both buildings have similar envelope assemblies, HVAC systems and occupancies and so 1 building was modeled to inform design for the overall project.

The energy model is used to project the potential energy performance of the building. The model is not intended to fully predict actual operating performance of the building since building occupancy, operation and weather will vary compared to the model assumptions.

2. Background

The Hazel National Landing project will consist of 2 mixed use buildings. Phase 1 will be comprised of 297 units and Phase 2 will total 191 units. Phase 1 will be 14 stories above grade, with Phase 2 11-stories above grade. The project will have 2 levels of underground parking. Phase 1 and 2 will have ground floor retail ranging from 4,534 sf in Phase 1 to 4,818 sf in Phase 2. Each building will also have 2-level townhomes.

3. Energy Model Overview

A DOE 2.2 eQUEST 3.65 whole building hourly computer simulation was used to complete the performance analysis. Details of the design as well as performance alternatives evaluated are described in this report. Design case assumptions were taken from the Conceptual Design drawings dated December 14, 2017.

The project is in climate zone 4A. Typical annual weather data for the District of Columbia was used for the energy model. Weather data is sourced from the eQUEST database of weather files for the region.

3.1 Utility Data

The utility rates used are based on current EIA data for Arlington, Virginia. Utility rates are \$0.14/kWh for electricity and \$1.10/Therm for natural gas.

Table 1: Building Envelope Inputs for Current Design and Alternatives

Input Type	Conceptual Design	Energy Efficiency Alternatives
Steel Framed Wall Assembly	Steel studs with R-19 batt insulation between studs, R-7.5 continuous U-0.062 (ASHRAE 90.1 Appendix A, Table A3.3)	Same as Conceptual Design
Roof Assembly	R-30 insulation entirely above deck, U-0.032 (ASHRAE 90.1 Appendix A, Table A2.2)	Same as Conceptual Design
Floor Assembly (Exposed Floors)	R-21 continuous insulation, U-0.043 (ASHRAE 90.1 Appendix A, Table A5.2)	Same as Conceptual Design
Window Frames	Aluminum (Residential, Storefront)	Same as Conceptual Design
Glazing U-value (overall, including glass and frame)	U-0.45	U-0.40
Glazing SHGC	0.30 (Residential), 0.4 (Storefront)	Same as Conceptual Design
Window-to-Wall Ratio (WWR)	51% overall (50% East, 50% West, 51% North, 55% South)	Same as Conceptual Design

3.2 Interior Lighting

Table 2, below, describes the inputs for the internal lighting power density for each space type.

Table 2: Interior Lighting Power

Space Type	Conceptual Design LPD (W/sf)	Energy Efficiency LPD (W/sf)
Residential Units	0.9	0.50, 0.70
Office	1.11	1.11
Lobby	0.9	0.9
Mechanical & Electrical	0.95	0.95
Stairwell	0.69	0.69
Corridor	0.66	0.25
Garage	0.19	0.07
Club Room	0.73	0.73
Fitness Room	0.72	0.72
Retail	1.68	1.68

3.3 Mechanical Systems

HVAC system details for the conceptual design building are outlined in Table 3 below.

Table 3: HVAC System Types and Inputs

Input Type	Conceptual Design Case	Energy Efficiency Case
Residential Units		
System Type	Split System Heat Pump	Split System Heat Pump
Cooling	Direct Expansion	Direct Expansion
Cooling Efficiency	SEER 14	Same as Conceptual Design
Heating	Direct Expansion	Direct Expansion
Heating Efficiency	HSPF 8.2	Same as Conceptual Design
Supplemental Heating	Electric	Electric

Fan Control	Constant Volume	Constant Volume
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3.4 Domestic Hot Water

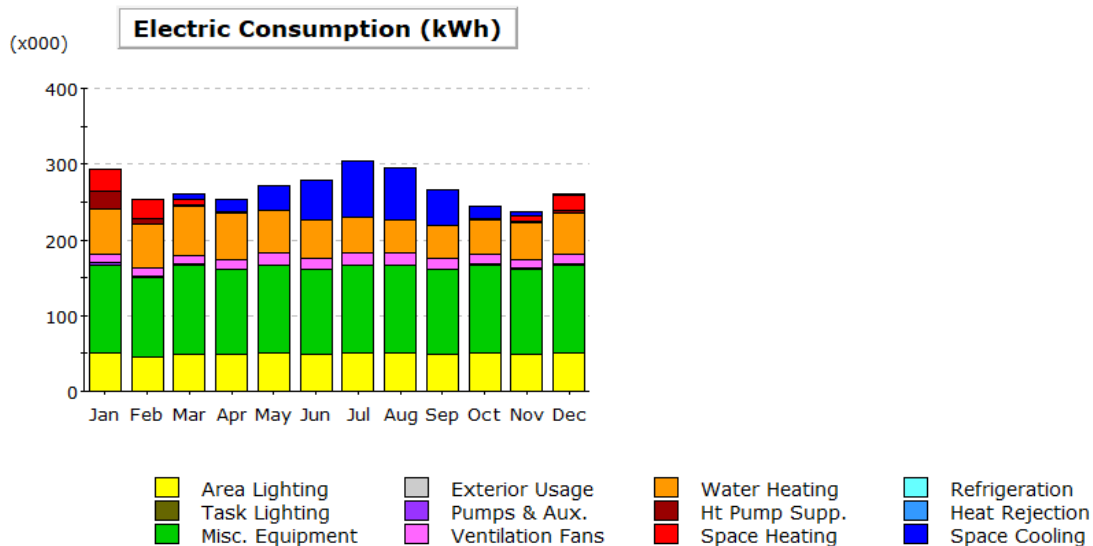
Domestic hot water is heated by in-unit electric storage water heaters. Hot water heaters are 0.93 EF rated. Hot water consumption of dwelling units are based on low-flow faucets, showerheads and ENERGY STAR clothes washers and dishwashers.

3.5 Equipment Power Density

Plug loads are based on ENERGY STAR for Multifamily High Rise (MFHR) building criteria for apartments, common areas and leasing offices. Dwelling unit equipment power is 1.2 W/sf. Leasing office equipment power is 1.5 W/sf. Corridor and stairwell equipment power is 0.2 W/sf. Other common areas are 0.5 W/sf. Equipment power operating schedules are also based on ENERGY STAR MFHR criteria.

4.0 Energy End Use Breakdown

The below figure shows the monthly energy use broken down by end-use for the design case model. The end-use break-down indicates that DHW heating, lighting and HVAC are the largest loads.



5.0 Energy Model Results

The below summarizes the annual energy consumption, energy savings anticipated for the building. The below provides savings for potential window and lighting efficiency measures.

Table 4: Energy Model Results Summary

Energy Model	Energy Savings (kWh)	Energy Use (\$)	Annual Energy Savings (\$)	Annual Percent Cost Savings
Conceptual Design Model	-	\$450,418	-	-
Design with 0.40 U-factor Glazing	9,828	\$449,042	\$1,376	0.3%
Design w/ 0.25 W/sf Corridor LPD	48,150	\$443,677	\$6,741	1.5%
Design with 0.7 W/sf Unit LPD	99,864	\$436,437	\$13,981	3.1%
Design with 0.5 W/sf Unit LPD	198,393	\$422,643	\$27,775	6.2%

The above table presents a number of potential energy efficiency measures. Reduced dwelling unit lighting power density (reduced from 0.9 W/sf to 0.7 W/sf and 0.5 W/sf) generates the most savings, ranging from 3.1% to 6.2% annually. Corridor lighting power reductions generate 1.5% in additional savings.

Energy model output reports for the current design are on the following pages.

REPORT- ES-D Energy Cost Summary

WEATHER FILE- WASHINGTON, DC

UTILITY-RATE	RESOURCE	METERS	METERED ENERGY UNITS/YR	TOTAL CHARGE (\$)	VIRTUAL RATE (\$/UNIT)	RATE USED ALL YEAR?
Custom Elec Rate	ELECTRICITY	EM1	3217270. KWH	450418.	0.1400	YES
Custom Gas Rate	NATURAL-GAS	FM1	0. THERM	0.	0.0000	YES

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450418.

ENERGY COST/GROSS BLDG AREA: 1.50
ENERGY COST/NET BLDG AREA: 1.50

REPORT- BEPS Building Energy Performance

WEATHER FILE- WASHINGTON, DC

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	2023.0	0.0	4671.0	317.8	1102.0	0.0	40.4	546.8	0.0	123.9	2157.0	0.0	10980.0
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MBTU	2023.0	0.0	4671.0	317.8	1102.0	0.0	40.4	546.8	0.0	123.9	2157.0	0.0	10980.0

TOTAL SITE ENERGY 10980.40 MBTU 36.6 KBTU/SQFT-YR GROSS-AREA 36.6 KBTU/SQFT-YR NET-AREA
 TOTAL SOURCE ENERGY 32941.40 MBTU 109.7 KBTU/SQFT-YR GROSS-AREA 109.7 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.00
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
 HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 0
 HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 0

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

REPORT- BEPU Building Utility Performance

WEATHER FILE- WASHINGTON, DC

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	592595.	0.	1368461.	93102.	322795.	0.	11844.	160219.	0.	36301.	631958.	0.	3217270.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL ELECTRICITY 3217270. KWH 10.714 KWH /SQFT-YR GROSS-AREA 10.714 KWH /SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.00
 PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
 HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 0
 HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 0

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.