Energy Audit Report

REPORT DATE: Date

PROPERTY INFORMATION:
Client Project Name
Property Address
City, County County, State Zip

PROJECT INFORMATION:
AEI Project No. Sample Project
Site Assessment Date: Date

PREPARED FOR:
Client Name
Client Address
Client City, State Zip Code

PREPARED BY:
AEI Consultants - Corporate Headquarters
2500 Camino Diablo
Walnut Creek, California 94597

1.800.801.3224
www.aeiconsultants.com

Date

Client Contact Name
Client Name
Client Address
Client City, State Zip Code

Subject: **Energy Audit Report**
Client Project Name
Property Address
City, State Zip
AEI Project No. Sample Project

Dear Client Contact Name:

AEI Consultants is pleased to provide the *Energy Audit Report* of the above referenced property. This assessment was authorized and performed in accordance with the scope of services engaged.

We appreciate the opportunity to provide services to you. If you have any questions concerning this report, or if we can assist you in any other matter, please contact me at Phone Number or Email Address.

Sincerely,

Brian Morgan

AEI Contact
AEI Consultants

TABLE OF CONTENTS

TABLE OF APPENDICES

1.0 CERTIFICATION/DISCLAIMER

AEI has completed an Energy Audit for the Property located at Property Address, City, County County, State (the "Property"). AEI visited the site on Date.

The energy conservation opportunities contained in this report have been reviewed for technical accuracy. The reader is reminded that energy savings ultimately depend on variable factors including occupant behavior, weather, and quality of installation. Estimated installation costs are based on a variety of sources, including our own experience at similar facilities, our own pricing research using local contractors and vendors, and cost handbooks such as those produced by RS Means. The cost estimates represent the best judgment of the auditors for the proposed action. The Owner is encouraged to confirm these cost estimates independently since actual installed costs can vary widely for a particular installation. AEI does not guarantee installed cost estimates and shall in no event be liable should actual installed costs vary from the estimated costs herein.

AEI does not guarantee the costs savings estimated in this report. AEI shall in no event be liable should the actual energy savings vary from the savings estimated herein.

AEI certifies that it has no undisclosed interest in the Property and that AEI’s employment and compensation are not contingent upon the findings or estimated costs to remedy any deficiencies due to deferred maintenance and any noted component or system replacements.

2.0 EXECUTIVE SUMMARY

AEI Consultants (AEI) was retained by Client Name to conduct an ASHRAE Level II Energy Audit, in conformance with the scope and limitations of ASHRAE *Procedures for Commercial Building Energy Audits*, Second Edition (2011), and ANSI/ASHRAE/ACCA Standard 211-2018, *Standard for Commercial Building Energy Audits* for the Property located at Property Address, City, County County, State (the "Property"). The Energy Efficiency Measures (EEMs) from the audit will be used to prepare a Statement of Energy Design Intent showing the effect of energy use reduction on the energy performance score.

2.1 Energy Audit - Purpose and Scope

AEI has performed a comprehensive analysis of the Property to identify possible areas where Energy and Water may be conserved. The areas being considered include HVAC equipment, lighting, domestic water heating, appliances, fenestrations, insulation, roofing, bathroom fixtures, and miscellaneous equipment. AEI may also use infrared thermography to identify areas that may be losing energy.

Utility Analysis

AEI has performed a comprehensive utility analysis to determine the Energy and Water consumption of the buildings. The analysis utilizes at least 12 months of common area utility bills and as many tenant utility bills as possible. By observing peak loads during the year, a baseline for energy and water consumption can be determined.

Energy Audit Process

Where possible, in addition to the Site Survey, AEI has utilized construction drawings, interviews, repair records, etc. to determine the actual current efficiency of the Property's building envelopes and equipment.

Accuracy of Analysis

AEI used energy use simulation tools and spreadsheet calculations that base estimated savings on the as-built facility and energy consuming equipment's current operating condition. The simple payback calculations are based on the labor and material cost of the new equipment divided by the cost savings per year. AEI shall not be responsible for equipment that may not reach the end of its useful life or costs more to operate than noted in the EEMs.

Current Energy Code

The energy code adopted by State at the time of this report is 2021 International Energy Conservation Code (2021 IECC) or equivalent for Residential//Commercial construction. [https://www.energycodes.gov/status-state-energy-code-adoption]

2.2 Summary of Energy Efficiency Measures (EEMs)

The following table presents the ASHRAE Energy Efficiency Measure table from *Procedures for Commercial Building Energy Audits*. Note that the water savings do not register in the tables. We have included our Energy and Water Efficiency Measure tables later in this report.

EEM Summary

		ANNUAL ENERGY & COST SAVINGS			PAYBACK WITH INCENTIVE				
Measure Number	Measure Description	Electricity Savings (kWh)	Gas/Fuel Savings (Therms)	Total Cost Savings	Measure Cost	Potential Utility Incentive	Net Measure Cost	NPV*	Simple Payback (Year)
EEM-1	Program Supply Temperature Reset (approximately 2.5 F) from 48 F to 50.5 F for the LAB AHU's at Building 1	102,261	20,450	$26,770	$5,500		$5,500	$176,903	0.2
EEM-2	Program Supply Temperature Reset (approximately 3 F) from 55 F to 58 F for the three Packaged Rooftop Units at Building 1	108,137	11,772	$19,984	$7,500		$7,500	$128,666	0.4
EEM-3	Program Demand Control Ventilation for the three Packaged Rooftop Units at Building 1, and install CO2 sensors at the office spaces	29,350	-	$2,725	$7,500		$7,500	$11,065	2.8
EEM-4	Provide Daylight Controls Near Skylights and Exterior Glass	3,264	-	$303	$720		$720	$1,142	2.4
EEM-5	Install 35 kW DC Solar PV system on available roof area-Since roof area is limited, a ground mount or placement at parking garage roof is possible. (Approximately 100 modules.) Note that a 30% Federal Investment Tax Credit is available for commercial systems, or a production credit of $0.026/kWh of production credit for commercial systems, if the systems meet labor requirements issued by the Treasury Department, but neither are included in the pricing.	50,315	-	$4,671	$113,750	$34,125	$79,625	($39,859)	17.0
TOTALS (Recommended Measures)		293,327	32,222	$54,453	$134,970	$34,125	$100,845	$277,916	1.9

2.3 Energy and Water Efficiency Measures (EWEM) Table

The following EWEMs have been analyzed using calculations based on occupant usage, localized climate conditions, HVAC and ventilation operating hours, and lighting hours. The HVAC operating hours are approximations and may vary depending on the severity of the weather. Water consumption is based on the number of occupants and assumed running times for water consuming devices. The Property has been carefully evaluated for the EWEMs. The chart shows the initial investment, utility savings, utility cost savings, and paybacks for each EWEM. The utility cost increase over the life of the EWEMs implemented was not considered as a factor in the cost savings calculations.

EWEM Summary

EWEM Summary Description	Initial Cost	Electric Savings kWh	Gas Savings Therm	Water/ Sewer Savings kGal	Annual Utility $ Savings	Simple Pay Back (Years)	Owner % Energy Savings	Owner % Water Savings	Projected GHG Emissions Reduction MTCO2e
Program Supply Temperature Reset (approximately 2.5 F) from 48 F to 50.5 F for the LAB AHU's at Building 1801	$5,500	102,261	20,450	0	$26,770	0.2	4.42%	0.00%	140.16
Program Supply Temperature Reset (approximately 3 F) from 55 F to 58 F for the Packaged Rooftop Units at Building 1	$7,500	108,137	11,772	0	$19,927	0.4	2.85%	0.00%	96.30
Program Demand Control Ventilation for the three Packaged Rooftop Units at Building 1, and install CO2 sensors at the office spaces	$7,500	29,350	0	0	$2,725	2.8	0.18%	0.00%	9.30
Provide Daylight Controls Near Skylights and Exterior Glass	$720	3,264	0	0	$303	2.4	0.02%	0.00%	1.03
Install 35 kW DC Solar PV system on available roof area- Since roof area is limited, a ground mount or placement at parking garage roof is possible. (Approximately 100 modules.) Note that a 30% Federal Investment Tax Credit is available for commercial systems, or a production credit of $0.026/kWh of production credit for commercial systems, if the systems meet labor requirements issued by the Treasury Department, but neither are included in the pricing.	$113,750	50,315	0	0	$4,670	24.4	0.32%	0.00%	15.94
Totals	$134,970	293,327	32,222	0	$27,229	4.96	7.79%	0.00%	262.73

2.4 ENERGY BENCHMARKING

The owner obtained whole Property utility data from the utility company. The campus' energy use was input into Energy Star Portfolio Manager to produce a baseline year Statement of Energy Performance (SEP) score. However, for this property type, a SEP score cannot be produced. The site energy use intensity (EUI) is calculated to be 278 kBtu/ft^2 and the National Median site EUI is 175 kBtu/ft^2.

3.0 BACKGROUND

3.1 PROPERTY DESCRIPTION

The Property is a parcel totaling approximately 20.38 acres and is located at Property Address in a commercial area of City, State. The Property is improved with One commercial building with lab in One two story building with other stories added recently in the major renovation. The older portion of the building was previously operated as department store in the early 1950's.
The net rentable area of all the combined units is 195,000 square feet and the gross building area of the Property is 195,000 square feet. The Property was originally developed in 1950 and underwent a substantial renovation in 2014.

The facility description is as follows: Property. follows the science, to find new ways to manage rare and often hard-to-treat diseases. By deciphering new pathways, and to discover first-of-their-kind treatments.

Since their start in 2002 with a small number of scientists, chemists and biologists in City, State, Client Name has grown into a global organization with a robust portfolio of treatments across Oncology and Inflammation & Autoimmunity. Today this passion for innovation is stronger than ever with a team of more than 2,000 employees.

The company takes a comprehensive approach to identifying new treatments for patients with cancer, enabling the company to explore both single agents and combinations of targeted and immuno-therapies from both within and beyond their portfolio. The company appears to collaborate with major universities and other companies to bring additional discovery platforms and therapeutics forward. Incyte's targeted therapy discovery efforts focus on identifying therapeutic intervention points within interdependent pathways that drive tumor growth, enabling them to leverage cross-program knowledge. Complementary to that is their immuno-therapy discovery strategy, which is built on a deep understanding of functional genomics, pharmacodynamics and state-of-the-art bioinformatics. Insights into the nuances of immune surveillance in health and disease are leading us to new opportunities to harness the immune system to fight cancer. The facility has world-class chemistry and biology groups to apply these learnings to develop small molecule, monoclonal antibody and bispecific antibody drug candidates for clinical testing.

As a result of the vast research several process systems (mainly industrial lab ventilation systems) are used for scientific and biologic research into various diseases including cancer. Several hundred lab fume hoods are used in conjunction with conducting research and clinical trials.

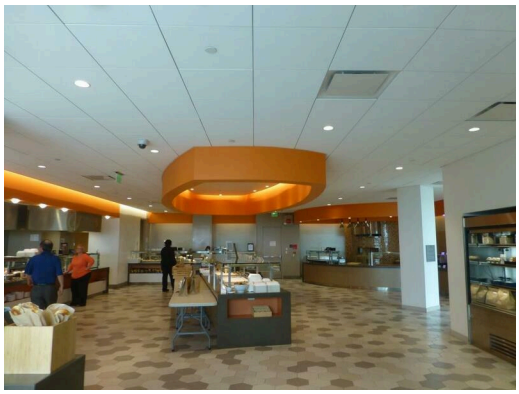
Amenities include a central cafeteria room with kitchen which is quite large in floor space. The Property does have an in-ground automatic sprinkler system.

The Project Team assessed a representative sample of the tenant spaces. The assessment also included the roof, parking areas and structures, building operational and structural components, and all exterior and common areas.

The site contact was Key Site Manager Name; phone: (215) 917-5226

Photographs

Side Elevation at the Building



LED Lights Lunch Area

Office LED Lighting-Typical

Rooftop at Bldg 1

Existing Energy and Water Efficiency Measures at the Property

The following existing energy and water efficiency improvements were observed at the subject property:

1. High efficiency LED lighting for most areas
2. Double glazed metal framed windows
3. High efficiency air handling units with integrated variable speed drives
4. Occupancy sensors for all major lighting zones in the corridor and private offices
5. Occupancy sensor camera devices as part of the phoenix control valves at all lab spaces
6. CHW and HHW pumps equipped programmed for variable flow and variable speed drives
7. Programmable thermostats and Central EMS system which controls all the Lab exhaust fans, air handling units, and the three large packaged rooftop units.

3.2 Occupancy and Use Schedules

The facility consists of several office spaces and lab spaces which emcompass a large percentage of building 1. The estimated occupancy schedule is shown below.

Occupancy Schedule

Space	# of Occupants	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Leasing Office	800	9 hours	9 hours	9 hours	9 hours	9 hours	0	0
Lab Spaces	1000	24/7	24/7	24/7	24/7	24/7	24/7	24/7
Facility office	15 (Estimated)	8 hours	8 hours	8 hours	8 hours	8 hours	4 hours-estimated	0
Cafeteria	200-depending on lunch and breakfast schedules	4 hours	4 hours	4 hours	4 hours	4 hours	0	0

3.3 Utility Analysis

The utility analysis covers the period of September 2022 to August 2023 and is based on bills obtained from the property owner. In the case of tenant bills a sample is normally used to establish an average energy consumption for the different size units. Both the electric and gas utilities are then converted to a common unit (kBtu's) so that the total energy can be examined and project an Energy Use and Cost Intensity for the property. The EUI can then be used to compare the property against similar properties to determine how efficiently the building is being operated.

EEM Summary Table		
Current Building Energy Usage	54,203,297	kBtu
Current Building Energy Cost	$904,650	$$$
Proposed Energy Savings	4,223,318	kBtu
Proposed Energy Cost Savings	$27,229	$$$
Energy Savings	7.8%	%
Energy Cost Savings	3.0%	%
Investment for ECM's	$134,970	$$$
Payback for Investments	4.96	Years
Site Energy Use		
Current Electric Site Energy	23,813,240	kBtu
Current Natural Gas Site Energy	30,390,056	kBtu
Total Building Area	185,000	SF
Proposed Electric Savings (kBtu)	1,001,125	kBtu
Proposed Gas Savings (kBtu)	3,222,193	kBtu
Site Energy Use Intensity		
Current Site Energy Use Intensity	277.97	kBtu/SF
Proposed Site Energy Use Intensity	256.31	kBtu/SF
Site Greenhouse Gas Emissions		
Current Site GHG Emissions	3812.69	MTCO2e/Yr
Proposed Site GHG Emissions	3549.96	MTCO2e/Yr
Source Energy Use Intensity		
Current Source Energy Use Intensity	505.57	kBtu/SF
Proposed Source Energy Use Intensity	473.85	kBtu/SF

3.3.1 Utility Providers

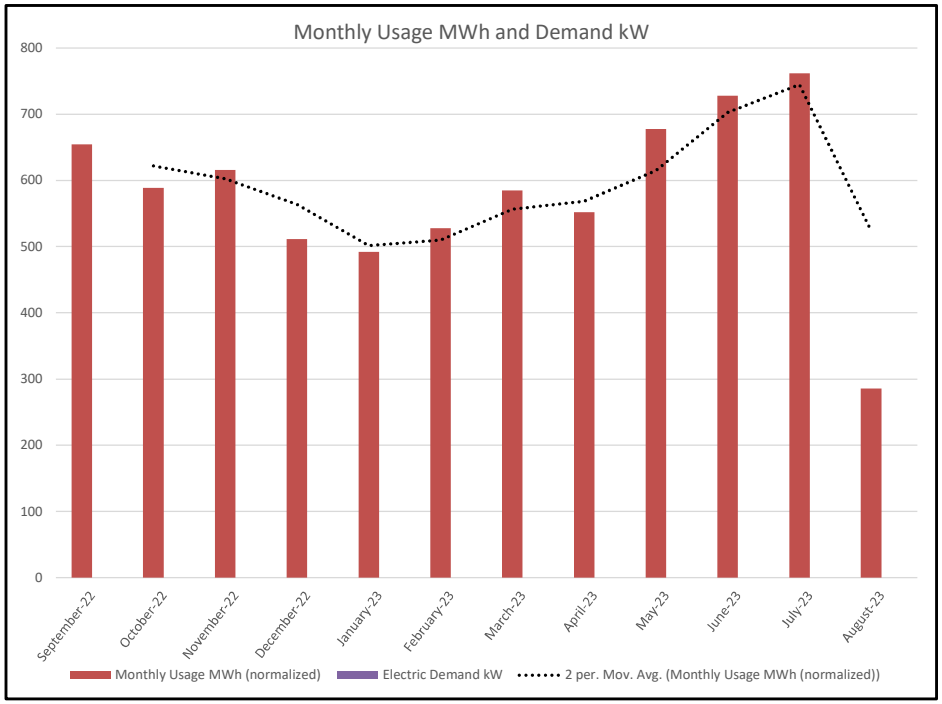
Utility Type	Utility Provider Name
Electricity	Utility Provider
Natural Gas	Utility Provider
Water	Utility Provider
Sewage Disposal/Treatment	Utility Provider

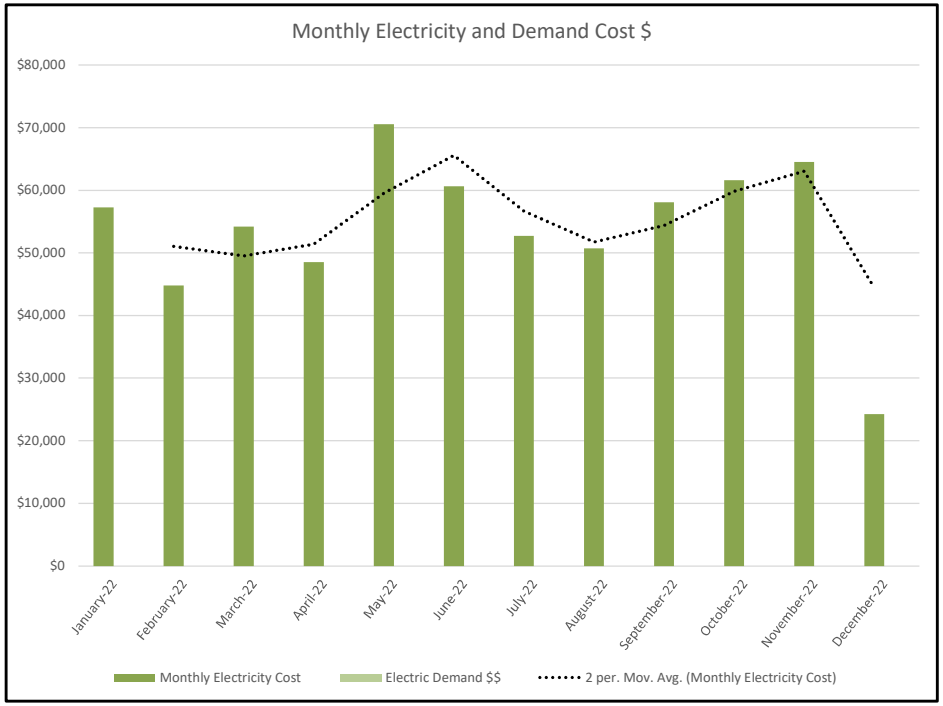
3.3.2 Electricity

The chart below shows the monthly consumption and cost of electric power for the Property. The cost per kWh is calculated in the fourth column. The bottom row shows the annual electrical power consumption and cost for the Property.

Electricity Chart

Billing Month & Year	Monthly Electricity Usage (kWh)	Monthly Electricity Cost	Cost per kWh	kBTU Usage (kWh x 3.41)
September-22	654,630	$57,271	$0.09	2,233,598
October-22	588,902	$44,821	$0.08	2,009,334
November-22	615,968	$54,232	$0.09	2,101,683
December-22	511,272	$48,552	$0.09	1,744,460
January-23	491,712	$70,517	$0.14	1,677,721
February-23	527,684	$60,612	$0.11	1,800,456
March-23	584,849	$52,721	$0.09	1,995,505
April-23	551,960	$50,730	$0.09	1,883,288
May-23	677,398	$58,043	$0.09	2,311,282
June-23	727,726	$61,600	$0.08	2,483,001
July-23	761,546	$64,518	$0.08	2,598,395
August-23	285,615	$24,286	$0.09	974,518
Annual Electricity Usage & Cost:	6,979,262	$647,902	$0.09	23,813,240

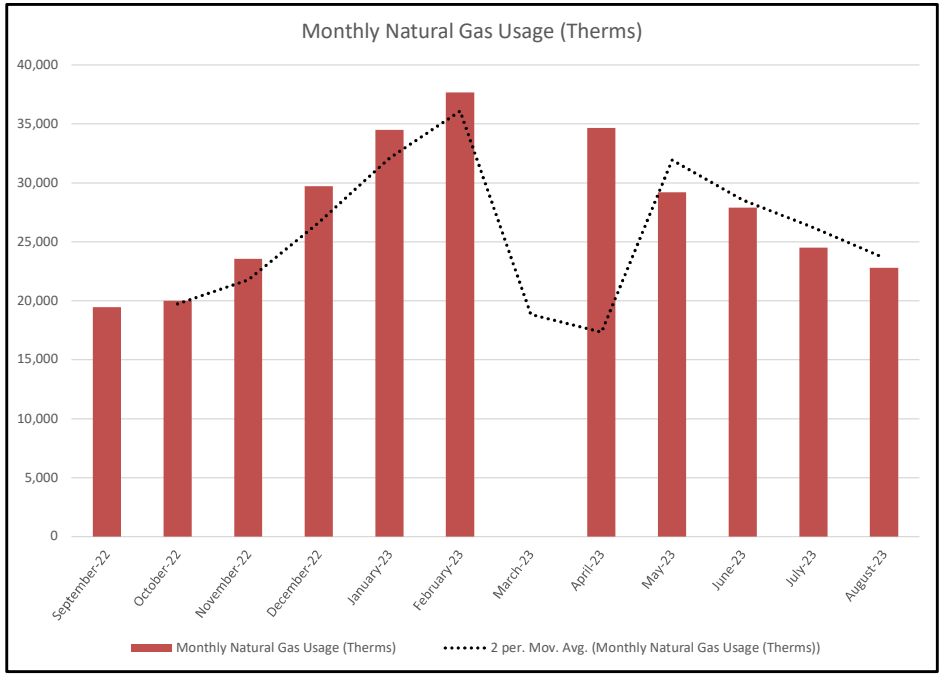

Monthly Usage MWh and Demand kW
800
700
600
500
400
300
200
100
0
September-22
October-22
November-22
December-22
January-23
February-23
March-23
April-23
May-23
June-23
July-23
August-23
Monthly Usage MWh (normalized)
Electric Demand kW
2 per. Mov. Avg. (Monthly Usage MWh (normalized))

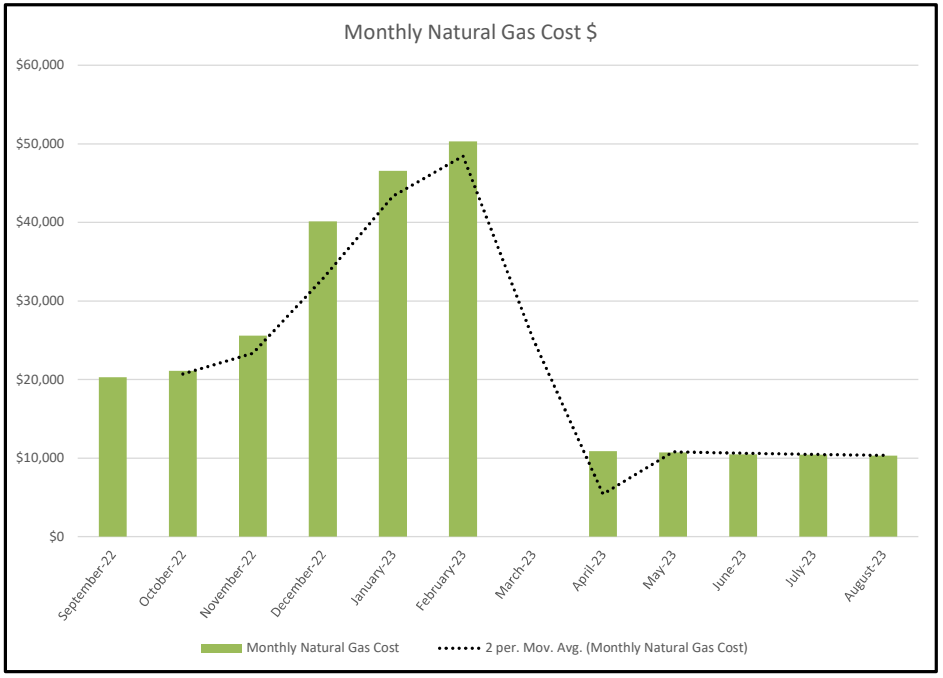

Monthly Electricity and Demand Cost $
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
January-22
February-22
March-22
April-22
May-22
June-22
July-22
August-22
September-22
October-22
November-22
December-22
Monthly Electricity Cost
Electric Demand $$
2 per. Mov. Avg. (Monthly Electricity Cost)

3.3.3 NATURAL GAS

The chart below shows the monthly consumption and cost of the natural gas for the Property. The cost per Therm is calculated in the fourth column. The bottom row shows the annual natural gas consumption and cost for the Property.

Billing Month & Year	Monthly Natural Gas Usage (Therms)	Monthly Natural Gas Cost	Cost per Therm	kBTU Usage (Therms x 100)
September-22	19,466	$20,296	$1.04	1,946,564
October-22	19,986	$21,104	$1.06	1,998,635
November-22	23,550	$25,577	$1.09	2,355,048
December-22	29,706	$40,115	$1.35	2,970,587
January-23	34,489	$46,565	$1.35	3,448,942
February-23	37,677	$50,295	$1.33	3,767,709
March-23	0	$0	$0.00	0
April-23	34,659	$10,859	$0.31	3,465,924
May-23	29,196	$10,723	$0.37	2,919,642
June-23	27,887	$10,500	$0.38	2,788,698
July-23	24,501	$10,426	$0.43	2,450,085
August-23	22,782	$10,287	$0.45	2,278,221
Annual Natural Gas Usage & Cost:	303,901	$256,748	$0.84	30,390,056


Monthly Natural Gas Usage (Therms)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
September-22
October-22
November-22
December-22
January-23
February-23
March-23
April-23
May-23
June-23
July-23
August-23
Monthly Natural Gas Usage (Therms)
2 per. Mov. Avg. (Monthly Natural Gas Usage (Therms))


Monthly Natural Gas Cost $
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
September-22
October-22
November-22
December-22
January-23
February-23
March-23
April-23
May-23
June-23
July-23
August-23
Monthly Natural Gas Cost
2 per. Mov. Avg. (Monthly Natural Gas Cost)

3.3.4 Water and Sewer

Water consumption and cost data were not provided.

3.4 End Use Analysis

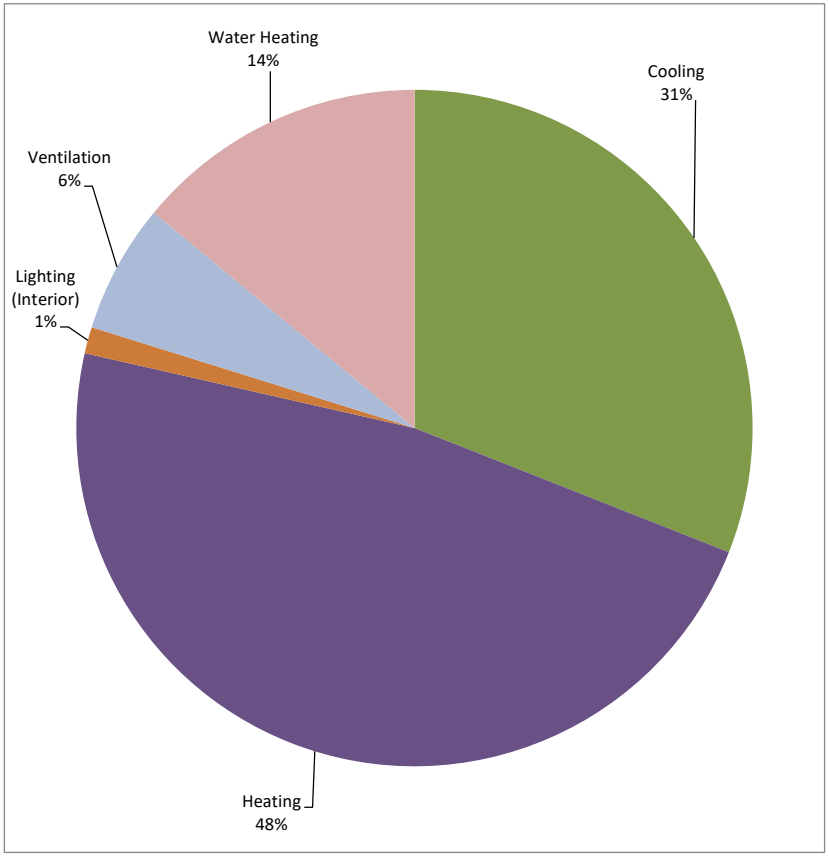
The following table presents the approximate end use analysis for all energy utilities on the Property:

Conversion Factor to kBtu

Input Unit 1	kWh	3.412142
Input Unit 2	therms	100
Input Unit 3	gallons (propane)	91.33
Combined Output Units	kBtu	1
Building Gross Floor Area	195,000	
Floor Area Units	ft^2	

	Input Energy Units			Combined Energy Use	
End Use	kWh	therms	gallons (propane)	kBtu	%
Air Compressors	-	-		-	0%
Cooking	-	-	-	-	0%
Cooling	4,922,667	-		16,796,838	31%
Heating	875,000	227,926		25,778,255	48%
Lighting (Exterior)	-	-		-	0%
Lighting (Interior)	200,665	-		684,697	1%
Miscellaneous	-	-	-	-	0%
Office Equipment	-	-		-	0%
Other Plug Loads	-	-		-	0%
Process	-	-		-	0%
Pumps	-	-		-	0%
Refrigeration	-	-		-	0%
Ventilation	980,930	-		3,347,072	6%
Water Heating	-	75,975		7,597,514	14%
Total Estimated	**6,979,262**	**303,901**	**-**	**54,204,377**	**100%**
Historical Billing	**6,979,262**	**303,901**	**-**	**54,204,288**	
Percent of Actual	**100.0%**	**100.0%**	**0.0%**	**100.0%**	
Total per ft^2	**35.8**	**1.6**	**-**	**278.0**	

Combined Fuel End-Use Breakdown



4.0 BUILDING SYSTEMS

4.1 OCCUPANCY

AEI visited approximately 80% of the building and 100% of all common areas which include all exterior common areas, observed the central BAS system, and conducted surveys on all of the mechanical equipment.

4.2 BUILDING ENVELOPE

4.2.1 FOUNDATION

The lab and corporate office buildings appear to be a steel braced frame structure and consists of a shallow foundation (thickened and reinforced concrete slab). The ground floor has standard concrete slab-on-grade construction that span to concrete beams, columns, and bearing walls. The foundations appeared to be in good condition.

4.2.2 FLOOR

4.2.3 STRUCTURE

The structures appears to be metal wood framed with wood truss joists and wood load bearing beams and columns.

4.2.4 EXTERIOR WALLS

The primary cladding on the exterior appears to be high end stucco with smooth brick and metal framing, with R-15 insulation (estimated). The exterior cladding appears to be in good condition.

Photographs

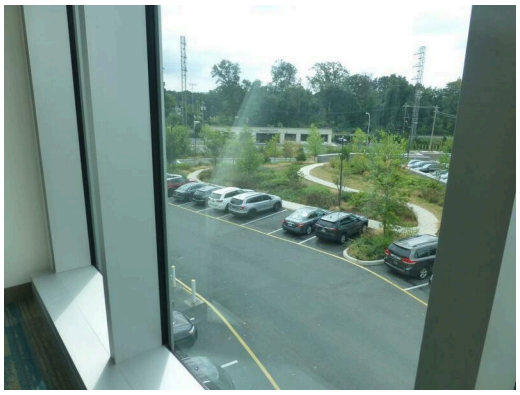
Side Elevation at the LAB Bldg 1801

4.2.5 DOORS AND WINDOWS

The entry doors into the buildings are metal framed. The weather stripping on each observed door appeared to be in good condition.

Glazing systems at the property consist of aluminum framed curtain wall ribbon window systems. The high curtain wall systems appear to be mostly doubel pane windows with metal frames, but the windows do not appear to be storm rated.
Flashing at the building appears to be in good condition.

Photographs



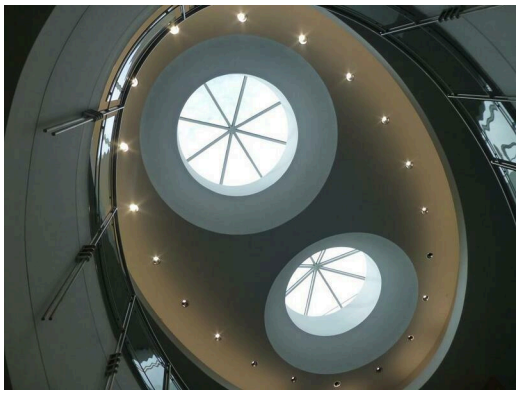
Dual Pane Metal Framed Window

4.2.6 Roof

The roof type is a standard TPO (Thermoplastic Polyolefin). No roof warranty was provided for our review. Roof accessories consist of mechanical equipment, plumbing vents, roof hatch, metal platform, limited telecommunication arrays and utility lines. No mechanical screen walls appear to be on the roof structure. The low-slope roof areas drain to internal roof drains oriented at structural low spots. Overflow drainage is provided by secondary drains adjacent to the primary drains. Internal roof drains appear to discharge to a subgrade drainage system. Skylight structures were observed on the roof which provide daylight to atrium areas on the lower floors.
Low roofs only have primary drains with no secondary drains. Consideration should be made to include secondary drains with next roof replacement. According to estimates, the insulation consists of R-15 rigid insulation.

Photographs

Rooftop at Bldg XXXX

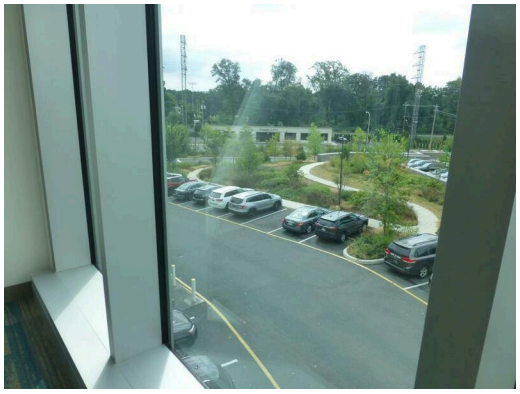


Skylights with LED Lights

4.2.7 Insulation Summary

Envelope Component	U-Factor	Insulation R-Value
Exterior Walls	0.065	R-15
Rigid Roof Insulation (Polyurethane-Estimated)	0.045	R-25
Windows	0.55	R-1.81
Doors	0.65	R-1.5
Ground Floor	0.35	R-2.85
Between Floors	0.07	R-14 (Estimated)

Photographs



Dual Pane Metal Framed Window

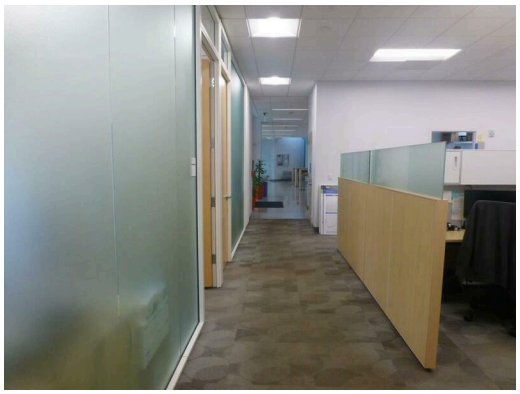
4.2.8 Lighting

The following tables provide an inventory of observed lighting fixtures, lamp type, and wattage.

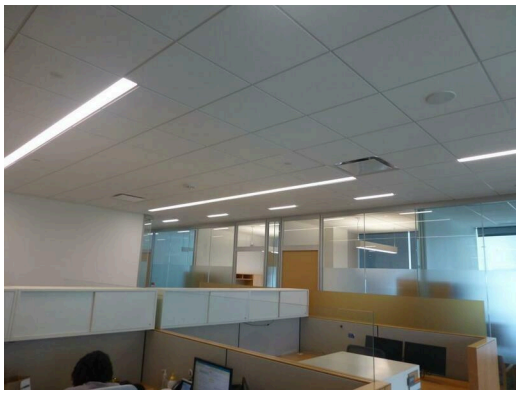
Lighting Audit (Common Area)

Area of Building	Existing Fixture	Total # Fixtures	Lamps Per Fixture	Total # of Lamps	LED Equivalent Wattage	Current kWh Usage	kWh Usage w/ LED	kWh Saved Per Year	Cost Per kWh	Current Annual Op Cost	Annual Cost Using LEDs	Savings	Cost to Install Lighting	Payback
Exterior Pole Lighting	1B 60W LED	50	1	50	0	13140	0	0	0.09	$1,220	$0	$0	$0	-
Wall Packs	1B 22W LED	80	1	80	0	7709	0	0	0.09	$716	$0	$0	$0	-
Parking Garage Lighting	1B 50W LED	20	1	20	0	8760	0	0	0.09	$813	$0	$0	$0	-
Office Recessed Can	1B 15W LED	120	1	120	0	5616	0	0	0.09	$521	$0	$0	$0	-
Common Corridor	1B 20W LED	150	1	150	0	9600	0	0	0.09	$891	$0	$0	$0	-
Office Linear Fixtures	2B 30W LED	550	2	1100	0	105600	0	0	0.09	$9,803	$0	$0	$0	-
Stairwells	2B 20W LED	350	2	700	0	44800	0	0	0.09	$4,159	$0	$0	$0	-
Common Corridor with Glass-Near Daylight	1B 20W LED	80	1	80	0	5,440	2,176	3,264	$0.09	$505	$202	$303	$720	2.4

Photographs



2nd View Office LED Lighting



Corporate Office LED Lighting

Corridor LED Lighting

LED Lighting At Restroom

4.2.9 Building Mechanical Systems

The heating and cooling systems consist of three large rooftop packaged AC units which serve the general occupied areas at various sections of the building. Additionally there are five large air handling units (AHU's) which primarily serve the lab spaces in the building on most floors of the building. There are three large exhaust lab hood fans which simultaneously exhaust air from the lab spaces and associated areas that need to be continuously exhausted from the areas that undergo biological and chemical processes in the building.

The ductwork from the lab units contains several zones which contain heating hot water reheat coils supplied by the central boilers for the heating source. The tonnages of the packaged rooftop units range from 60 to 80 tons. The supply fans on each of these large RTU's are equipped with VFD's. The rated efficiency of these units is approximately 9.5 to 10 EER.

The building is heavily centered on the function of laboratory fume hoods utilizing phoenix controls and occupancy camera sensors which can affect the sash opening levels. There are approximately 250 lab hoods in the building and are monitored by the building automation system. The AHU's serving the Lab areas have a supply temperature of 48°F to maintain

approximately 70ºF in all the lab zones. Two 500 ton variable speed water cooled chillers provide chilled water to the five air handling units and utilize a variable chilled water pumping system, in which the chilled water pumps are equipped with VFD's.

The heating and cooling systems throughout Building 1 are controlled by the central BMS system. The front end is located in the facility manager's office however it appears the facility manager indicated the system can be controlled remotely as the system is web based and can be accessed at any location.

Domestic hot water is produced by four large natural gas water heaters that provide comfort and process domestic hot water throughout the building.

HVAC Equipment

Location or Unit Address	Description	Manufacturer	Model No.	Year of Manufacture	RUL	Quantity	Heating Fuel	Heating Capacity	Heating Efficiency (AFUE, TE, COP, HSPF)	Cooling Capacity (Tons)	Efficiency
Rooftop	Lab Exhaust Fans with VFD's	Strobic	TS4L750 Series	2014	12	3	N/A	N/A	0.9	1.1	11 EER (Est)
Rooftop-RTU's	Gas fired RTU	Daikin	MPS075E	2014	12	3	Gas	800 MBH	0.8	72	9.2 EER
Rooftop-LABs	AHU's	Aerofin	W12OAW	2014	12	5	HHW	11.2 MBH	N/A	120	N/A
Mechanical Room	Water Cooled Chiller	York	YKH3F3P8	2014	16	2	N/A	N/A	N/A	500	11 EER
Zone Level	VAVs with hydronic reheat	Envirotech	SDR	2014	16	35	HHW	6 to 25 MBH	0.8	N/A	N/A
Mechanical Room	Steam Boiler	Triad High Press	Ser. 2000	2014	20	3	Gas	1513 lbs	0.7	N/A	N/A

Domestic Water Heating

Location of Unit Address	Manufacturer	Model No.	Year of Manufacture	Storage Capacity (Gal)	Input Capacity	Input Units of Measure (kW, BTUH, MBH)	Fuel (e.g., electric, natural gas)	Quantity	RUL	Efficiency (TE, AFUE, Energy Factor, etc.)
Mechanical Room	PVI	Unknown	2016	100	150	MBH	natural gas	4	12	96% TE

Photographs

Domestic Water Heater for LAB Areas

Strobic Fans and Rooftop

2nd set of Strobic Fans

Typical LAB Hood with Sash Control

4.2.10 Appliances

There are no major appliances at the property.

4.2.11 Laundry Equipment

There are no central laundry systems on the Property.

5.0 RECOMMENDED EEMS

The EEMs in the chart at the beginning of the report have been analyzed using calculations based on occupant usage, localized climate conditions, HVAC and ventilation operating hours, and lighting hours. The HVAC operating hours are approximations and may vary depending on the severity of the weather. Water consumption is based on the number of occupants and assumed running times for water consuming devices. The Property has been carefully evaluated for the EEMs. The chart shows the initial investment, utility savings, utility cost savings, and paybacks for each EEM. The utility cost increase over the life of the EEM implemented was not considered as a factor in the cost savings calculations.

5.1 NO-COST/LOW-COST MEASURES

There were no low cost measures identified for this site. Capital measures have been identified in the Capital Projects section.

5.2 CAPITAL COST MEASURES

EEM #1- Program Supply Temperature Reset (approximately 2.5°F) from 48°F to 50.5°F for the LAB AHU's at Building 1

The existing EMS control system operating the five Lab air handling units appear to be currently at constant temperature setpoint of 48°F providing conditioned air to all the Lab spaces. It is proposed to provide a supply temperature discharge air temperature reset strategy which is selectable by the operator with an option for a fixed supply air temperature setpoint as well. All reset strategies shall be stepwise and reset every five (5) minutes (adj.). All reset values shall be adjustable and available to the operator.

The measure will include installation and is estimated at approximately $5,500.

Increasing the setpoint will reduce energy consumption on the LAB air handling units and Strobic exhaust fans as well as decrease the cooling load on the existing VFD chillers. One concern is that the process equipment could increase in heat load however a mild reset (at approximately 2°F) is still recommended which may not cause a heavy impact to the work spaces. The discharge air temperature setpoint is selected by the operator and set to a fixed value.

Some control adjustments from the facility manager and or contracted controls contractor may be required

Potential O&M savings: the long term O&M savings will result from operating fans at lower RPM and power, generating less wear on fan belts, housing, and motors. Installation and commissioning of this control measure can be installed with little impact on occupants and personnel.

There may be custom rebates available thru Delmarva Power, however an inquiry needs to be made as to the dollar amount per kWh saved for which the measure will qualify. The following is the weblink for applying for custom rebates thru Delmarva Power, which is the link for custom incentives:

website.com

EEM #2- Program Supply Temperature Reset (approximately 3°F) from 55°F to 58°F for the three Packaged Rooftop Units at Building 1

The existing EMS control system operating the three main packaged units appear to be currently at constant temperature setpoint of 48°F providing conditioned air to all the Lab spaces

The measure will include installation and is estimated at approximately $7,500 based on an average cost of $2,500 per control point that would need to be adjusted.

Increasing the setpoint will reduce energy consumption on the supply fans as well as decrease the cooling load on the existing Packaged RTU compressors This will also interactively reduce the heating required by the gas furnaces at the units and will save natural gas energy.

There should be no concerns on this measure as this resets the supply temperature by approximately 3°F during lower load conditions and appears to serve non-lab or non-critical areas of the building.

Some control adjustments from the facility manager and or contracted controls contractor may be required

Potential O&M savings: the long term O&M savings will result from operating fans at lower RPM and power, generating less wear on fan belts, housing, and motors. Installation and commissioning of this control measure can be installed with little impact on occupants and personnel.

There may be custom rebates available thru Delmarva Power, however an inquiry needs to be made as to the dollar amount per hp for which the measure will qualify.

The following is the weblink for applying for custom rebates through utility company, which is the link for custom incentives : website.com

EEM #3-Provide Demand Control Ventilation to three Packaged Rooftop Units with CO_2 sensor controls

The three existing Packaged Rooftop Units do not appear to be equipped with demand control ventilation

Measure will be installed at the unit with demand controls and CO2 sensors to detect occupancy in some limited office spaces inside the building at office and limited corridor spaces.

Demand-controlled ventilation (DCV) is an energy-saving control strategy that reduces the rate at which outdoor air is delivered to a zone during periods of partial occupancy, which does appear to occur in the office portions of the building

The measure will include installation and is estimated at approximately $7,500 based on an average cost of $2,500 per control point that would need to be adjusted to re-program supply temperature setpoints. Assumes a constant supply temperature of approximately 55 F and some modulation of the outside air dampers but does not appear to be occupancy based, but rather temperature based.

Provide Demand Control Ventilation internal controls to three Packaged Rooftop Units with CO2 sensor controls. A sample case study is shown in the appendices.

Some control adjustments from the facility manager and or contracted controls contractor may be required

Potential O&M savings: the long term O&M savings will result from operating fans at lower RPM and power, generating less wear on fan belts, housing, and motors. Installation and commissioning of this control measure can be installed with little impact on occupants and personnel.

There may be custom rebates available thru Delmarva Power, however an inquiry needs to be made as to the dollar amount per hp for which the measure will qualify.

The following is the weblink for applying for custom rebates through Utility company which is the link for custom incentives : Delmarva Power | Delmarva Power - An Exelon Company (programprocessing.com)

EEM #4- Provide Daylight Controls Near Skylights and Exterior Glass at Building 1

Existing LED interior lighting have areas at the building that could be controlled by day light controls.

AEI recommends: Installing daylight controls in some glass areas and skylit areas of the building to provide day light harvesting and reduce lighting power when sufficient daylight is available.

Basis for how the measure will save energy: Installing high-efficiency day light sensor controls will significantly reduce the property's electrical consumption while maintaining equivalent or better light levels. In addition, many of the recommended bulbs and fixtures have longer lifespans, which will reduce the number of bulbs replaced at the property.

The measure is expected to cost approximately $720.

Key analytical assumptions: Lighting without day light controls uses more energy as verified by nameplate and heat output

The selected LED lamps should have a color temperature around 2,700K to 3,000K to provide the same "feel" as incandescent lighting.

Energy usage will decrease and lamp replacement frequencies will be less frequent.

Rebates/Incentives available from utility company or municipality: Possible incentives are available through Utility Company Generally an account executive is assigned to the property and a custom rebate may be available. No prescriptive rebates were found for this measure.

EEM #5

Install 35 kW Solar PV system on available roof area. (Approximately 100 modules.). Note that a 30% Federal Investment Tax Credit is available for commercial systems, or a production credit of $0.026/kWh of production credit for commercial systems, if the systems meet labor requirements issued by the Treasury Department, but neither are included in the pricing.

The building has a high electricity baseload, installation of a solar PV array would offset a percentage of the load.

There is ample space on the south flat roof sections to install a solar PV system. The property is located in a region with a significant solar days.

The estimated cost of this measure is $113,750. A 30% Federal tax rebate is available, but is not accounted for the in the proposed cost.

Solar modules not only generate electricity but also provide shading to the roof membrane and partly protect it from weather.

The installation of the system will not affect any facility operation.

EEM Simulation Results

Input parameters in each modeled building were changed to reflect the proposed changes in conditions then a simulation was run to predict the results. The simulation tool considers the interactive effects on all systems such as increased heating requirements from retrofitting high wattage lighting with lower wattage LED lighting. The following tables provide a summary of the EWEMs evaluated and the simulation results showing projected use per building type, subtotal for all buildings by type, total for all buildings, and the projected reduction in consumption.

Note that EEM #1 thru 3 was not modeled, but rather was the result of lighting calculations based on an inventory of common area and site lighting. Modeling was not necessary as consumption for lighting is included in the owner-paid utilities.

Energy Model Assumptions

The following assumptions were made in building the building energy model:

An approximation was made on the following based on observations during the site visit and plan drawings

- Local Vegetation/shading
- Interior conditions and HVAC set points
- Air infiltration goals
- Building orientation (should rotate the model to 4 compass points and average the modeled usage).
- Lighting loads W/SF
- Plug loads W/SF
- Schedules (lighting, plug loads)
- HVAC equipment types and efficiencies
- Economizers and heat recovery
- Water heating systems
- Specialty Systems
- Renewable energy systems

6.0 SIGNATURES OF PARTICIPATING PROFESSIONALS

AEI Consultants performed this ASHRAE Level II Energy Audit for the Property located at Property Address, City, County County, State, in conformance with the scope and limitations of ASHRAE *Procedures for Commercial Building Energy Audits, Second Edition*, ANSI/ASHRAE/ ACCA Standard 211-2018, *Standard for Commercial Building Energy Audits*.

Prepared By: Project Manager	Reviewed By: Vice President

APPENDIX B

SUPPORTING DOCUMENTATION

ASHRAE Equipment Life Expectancy chart

ASHRAE is the industry organization that sets the standards and guidelines for most all HVAC-R equipment. For additional info about ASHRAE the website is www.ashrae.org .

Equipment Item	Median Years
Air conditioners	
Window unit	10
Residential single or Split	
Package	15
Commercial through-the wall	15
Water-cooled package	15
Heat Pumps	
Residential air-to-air	15
Commercial air-to-air	15
Commercial water-to-air	19
Roof-top air conditioners	
Single-zone	15
Multi-zone	15
Boilers, hot water (steam)	
Steel water-tube	24 (30)
Steel fire-tube	25 (25)
Cast iron	35 (30)
Electric	15
Burners	21
Furnaces	
Gas- or oil-fired	18
Unit heaters	
Gas or electric	13
Hot water or steam	20
Radiant Heaters	
Electric	10
Hot water or steam	25

Equipment Item	Median Years
Air terminals	
Diffusers, grilles, and registers	27
Induction and fan coil units	20
VAV and double-duct boxes	20
Air washers	17
Ductwork	30
Dampers	20
Fans	
Centrifugal	25
Axial	20
Propeller	15
Ventilating roof-mounted	20
Coils	
DX, water, or steam	20
Electric	15
Heat Exchangers	
Shell-and-tube	24
Reciprocating compressors	20
Packaged chillers	
Reciprocating	20
Centrifugal	23
Absorption	23
Cooling towers	
Galvanized metal	20
Wood	20
Ceramic	34

Equipment Item	Median Years
Air-cooled condensers	20
Evaporative condensers	20
Insulation	
Molded	20
Blanket	24
Pumps	
Base-mounted	20
Pipe-mounted	10
Sump and well	10
Condensate 15	
Reciprocating engines	20
Steam turbines	30
Electric motors	18
Motor starters	17
Electric transformers	30
Controls	
Pneumatic	20
Electric	16
Electronic	15
Valve actuators	
Hydraulic	15
Pneumatic	20
Self-contained	10

Caution: Photovoltaic system performance predictions calculated by PVWatts® include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts® inputs. For example, PV modules with better performance are not differentiated within PVWatts® from lesser performing modules. Both NREL and private companies provide more sophisticated PV modeling tools (such as the System Advisor Model at //sam.nrel.gov) that allow for more precise and complex modeling of PV systems.

The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

The energy output range is based on analysis of 30 years of historical weather data, and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

RESULTS

50,315 kWh/Year*

System output may range from 47,830 to 52,147 kWh per year near this location.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)
January	3.12	3,092
February	3.92	3,432
March	4.99	4,707
April	5.75	5,060
May	5.72	5,033
June	6.14	5,188
July	6.13	5,248
August	5.71	4,941
September	4.99	4,222
October	4.20	3,882
November	3.38	3,144
December	2.41	2,365
Annual	**4.71**	**50,314**

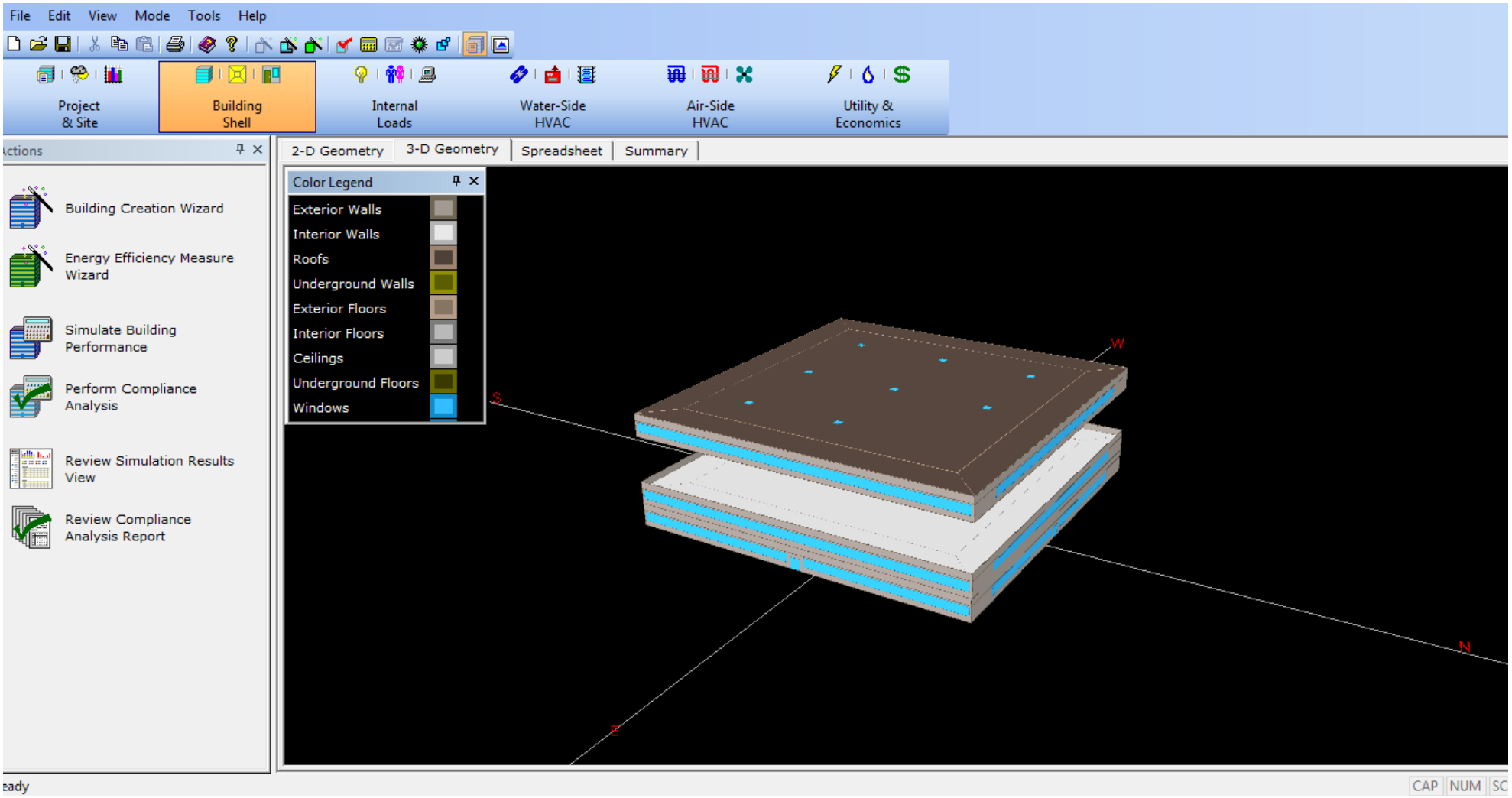
Location and Station Identification

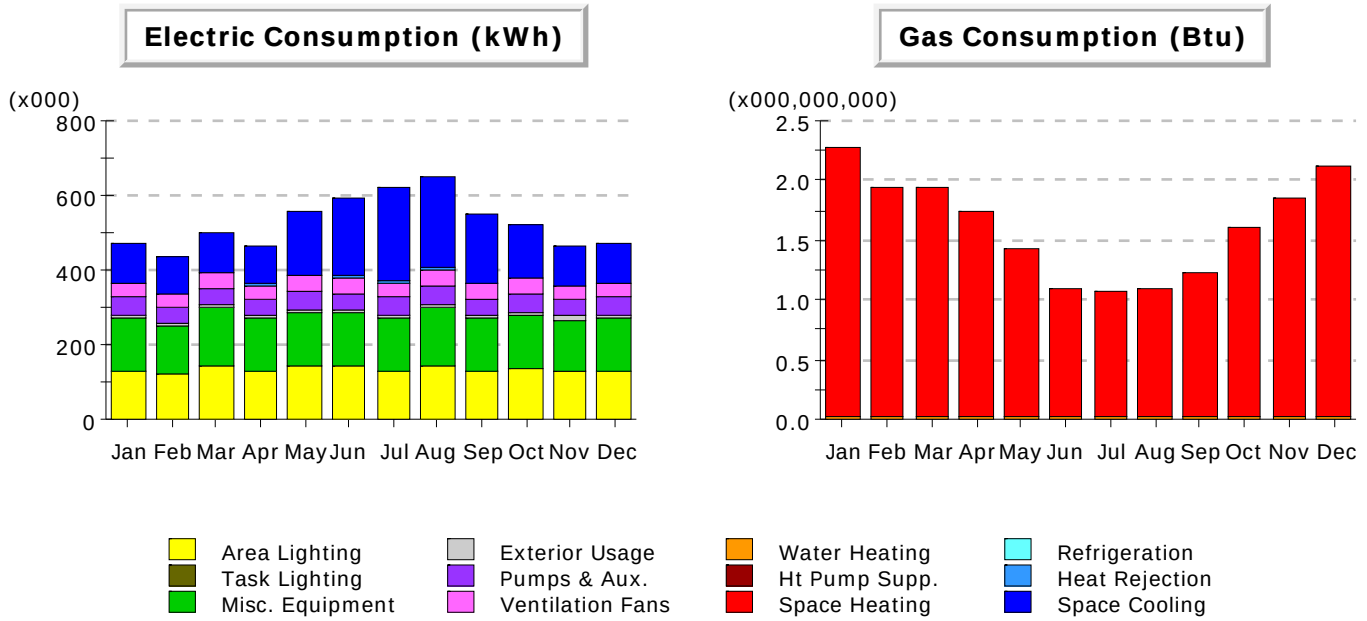
Requested Location	wilmington, de
Weather Data Source	Lat, Lng: 39.93, -75.06 29 mi
Latitude	39.93° N
Longitude	75.06° W

PV System Specifications

DC System Size	35 kW
Module Type	Standard
Array Type	Fixed (open rack)
System Losses	8%
Array Tilt	20°
Array Azimuth	180°
DC to AC Size Ratio	1.2
Inverter Efficiency	96%
Ground Coverage Ratio	0.4
Albedo	*From weather file*
Bifacial	No (0)
Monthly Irradiance Loss	Jan 0% Feb 0% Mar 0% Apr 0% May 0% June 0% July 0% Aug 0% Sept 0% Oct 0% Nov 0% Dec 0%

Performance Metrics	
DC Capacity Factor	16.4%


File
Edit
View
Mode
Tools
Help
Project & Site
Building Shell
Internal Loads
Water-Side HVAC
Air-Side HVAC
Utility & Economics
Actions
Building Creation Wizard
Energy Efficiency Measure Wizard
Simulate Building Performance
Perform Compliance Analysis
Review Simulation Results View
Review Compliance Analysis Report
2-D Geometry
3-D Geometry
Spreadsheet
Summary
Color Legend
Exterior Walls
Interior Walls
Roofs
Underground Walls
Exterior Floors
Interior Floors
Ceilings
Underground Floors
Windows
W
S
N
E
Ready
CAP
NUM
SC



Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	103.1	95.2	106.3	103.7	170.3	209.7	248.9	243.1	180.0	142.6	107.2	104.1	1,814.5
Heat Reject.	0.4	0.4	0.8	1.0	3.6	5.3	6.8	6.3	4.2	2.5	1.1	0.6	33.1
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	38.9	35.6	40.4	38.2	40.7	40.2	40.4	42.0	39.0	39.8	37.8	38.7	471.8
Pumps & Aux.	47.5	42.7	47.0	45.2	47.6	46.8	48.3	48.6	46.2	47.1	45.1	46.7	558.8
Ext. Usage	9.3	7.2	7.9	7.7	5.5	5.3	5.5	8.9	8.6	8.9	9.0	9.3	93.3
Misc. Equip.	140.9	131.2	152.6	139.7	148.7	146.8	141.7	152.6	139.7	144.8	138.9	141.6	1,719.4
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	129.1	122.1	145.4	129.7	139.9	139.3	130.2	145.4	129.5	134.6	128.5	130.2	1,603.9
Total	469.3	434.4	500.4	465.3	556.4	593.5	621.9	646.9	547.2	520.4	467.7	471.2	6,294.7

Gas Consumption (Btu x000,000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	2.24	1.92	1.92	1.71	1.41	1.08	1.05	1.07	1.22	1.59	1.84	2.09	19.13
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.28
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	2.27	1.95	1.95	1.73	1.43	1.10	1.07	1.09	1.24	1.61	1.86	2.11	19.41

ABBREVIATIONS AND ACRONYMS

AC	Air Conditioning	**kBTU**	Kilo-British Thermal Unit
AEI	AEI Consultants	**kGal**	Kilogallons
ALTA	American Land Title Association	**kW**	Kilowatt
APN	Assessor's Parcel Number	**kWh**	Kilowatt hour
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	**LED**	Light Emitting Diode
BTU	British Thermal Unit	**M**	Model
CH	Clubhouse	**MBH**	1,000 BTUs/hour
DHW	Domestic Hot Water	**O**	Occupied
ECM	Energy Conservation Measure	**OFC**	Office
EEM	Energy Efficiency Measures	**OSHA**	Occupational Safety and Health Administration
EUI	Energy Use Intensity	**PCA**	Property Condition Assessment
EUL	Estimated Useful Life	**PCR**	Property Condition Report
EWEM	Energy and Water Efficiency Measures	**ROI**	Return On Investment
F	Fahrenheit	**RP**	Responsible Party
FCU	Fan Coil Unit	**SEDI**	Statement of Energy Design Intent
Gal	Gallon	**SF**	Square Footage/Square Feet
GFA	Gross Floor Area	**SIR**	Savings to Investment Ratio
GPF	Gallons Per Flush	**SP**	Subject Property
GPM	Gallons Per Minute	**SEP**	Statement of Energy Performance
HUD	Department of Housing and Urban Development	**V**	Vacant
HVAC	Heating, Ventilation and Air Conditioning	**ZAR**	Zoning Analysis Report