



ASHRAE Level II Energy Audit

Arbutus Park Manor

207 Ottawa Street, Johnstown, PA 15904

Prepared by:



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Contents

Executive Summary	1
Background	1
Summary of Scope	1
EEM Summary Table	2
Summary of Benchmarking Results	2
Background Information	3
Contact Information.....	3
Site/Building Description.....	3
Building Space Function Summary.....	4
Historical Energy Consumption & Costs	5
Facility Energy Usage Tabulation by Fuel Type.....	5
Benchmarking Results.....	6
End-use Analysis	6
Existing Building Systems	8
Building Envelope.....	8
Lighting Systems	8
Mechanical Systems.....	8

Energy Efficiency Measures.....	10
No-Cost/Low-Cost Measures.....	10
EEM -1: Implement the ENERGY STAR® Guide for Restaurants Best Practices.....	10
EEM-2: Install Vacancy Sensors in Common Spaces.....	11
Capital Investment Measures	12
EEM-3: Corridor Lighting Controls	12
EEM-4: Install Building Automation System.....	12
EEM-5: Replace HVAC with Water-Source Heat Pump /DOAS System.....	13
Supporting Information	14
Analysis	14

Executive Summary

Background

The purpose of this report is to provide an ASHRAE Level II audit of the facility's energy use and recommend measures that may reduce energy consumption and costs.

The audit will follow the guidelines set forth in ASHRAE publication "Procedures for Commercial Building Energy Audits" – Second Edition

The report is not intended to serve as an evaluation of the existing building's systems, building construction, or compliance with current codes and standards.

Summary of Scope

Arbutus Park Retirement Community contracted the H.F. Lenz Company to develop an ASHRAE Level 2 Energy Audit on its facility located at 207 Ottawa St. Johnstown, Pennsylvania 15904. A Level 2 Energy Audit involves the following steps:

- Conduct a preliminary energy-use analysis (PEA)
- Conduct a walk-through survey
- Identify low cost/no-cost recommendations
- Identify capital improvements
- Review mechanical and electrical (M&E) design and condition and O&M practices
- Measure key parameters
- Analyze capital measures (savings and costs, including interactions).
- Meet with the owner/operators to review recommendations.

H.F. Lenz Company met with Mr. Kurt Roberts, Community Affairs Manager of Arbutus Park Retirement Community on Tuesday, January 8, 2019 to begin the walk-through survey of the facility. The initial survey included the following:

- Lobby
- HVAC Equipment located on the Roof
- Three (3) Boiler/Mechanical Rooms

- Kitchen/Dining spaces

H.F. Lenz Company conducted a follow-up visit on February 7, 2018 to survey the building envelope (walls and windows) and the equipment located in select rooms located in the Personal Care, Skilled Nursing and Dementia and Memory Care Units.

EEM Summary Table

The Energy Efficiency Measures (EEM) under consideration are summarized in Table 1 as follows:

Table 1 - EEM Summary Table

Measure Number	Measure Description	Annual Energy and Cost Savings				Payback with Incentive						
		Peak Demand Savings (kW)	Electricity Savings (kWh)	Gas/Fuel Savings (therms)	Total Cost Savings	Measure Cost	Potential Utility Incentive	Measure Life (years)	Net Measure Cost	IRR (over Life of Measure)	NPV*	Simple Payback (yr)
EEM-1	Implement Kitchen "Best Practices"											
EEM-2	Install Occupancy (Vacancy) Sensors in Common Areas		6,200		\$540	\$6,380		20	\$6,380	6%	\$959	11.8
EEM-3	Corridor Lighting Controls		41,400		\$3,185	\$30,000		20	\$30,000	9%	\$13,285	9.4
EEM-4	Install Building Automation System		71,000	1,500,000	\$8,903	\$85,000		25	\$85,000	8%	\$35,995	9.5
EEM-5	Replace HVAC with Heat Pump/DOAS System		-46,720	2,800,000	\$14,842	\$620,523		25	\$620,523	-4%	-\$418,815	41.8

* NPV assumes a discount rate of 4%

- (1) The net present value (NPV) is the value (the gain minus the cost) of an investment in today's dollars over some specified time period. If the investment has a positive NPV, it is generally considered to be beneficial.
- (2) The internal rate of return (IRR) is the annual yield from a project, usually expressed as a percentage of the total amount invested; the compound rate of interest which, when used to discount cash flows will result in zero net savings. If the IRR is greater than the investor's stated discount rate, the measure is considered beneficial.

Based on our analysis, we recommend that Energy Conservation Measures EEM-1, EEM-2, and EEM-3 implemented. EEM-4 has a large potential energy savings; however, since the equipment is recommended to be replaced and new controls are part of the equipment cost, it is the best interest of Arbutus Park Manor to not pursue this measure.

Summary of Benchmarking Results

Over the period from September 2017 through August 2018, Arbutus Park Manor consumed a total of 12,857,570 kBtu consisting of natural gas and electricity with a total energy cost of \$186,112.00. This equates to 117.1 kBtu/sf/year or \$1.70/sf in energy costs. We benchmarked the energy consumption using the ENERGY STAR Portfolio Manager to determine that the current ENERGY STAR Score is 34, which means that Arbutus Manor consumes more energy than 66% of all Senior Care Communities.

The median energy consumption for Senior Care Centers located in this climate is 104.5 kBtu/sf/year with a cost of \$1.52/sf in energy costs. An annual energy cost reduction of approximately \$20,000/year would be targeted to achieve the median performance with a score of 50.

A reduction of \$50,000/year would be necessary to achieve a score of 75, which would qualify Arbutus Park Manor for ENERGY STAR Certification. To achieve certification, the total energy consumption will need to be reduced by 26.4%.

Background Information

Contact Information

The project team for this energy audit consisted of the following individuals:

Arbutus Park Retirement Community

Mr. Richard Wilson - *Administrator*

Mr. Kurt Roberts – *Community Affairs Manager*

Mr. Mike Yeager – *Director of Environmental Services*

H.F. Lenz Company

Mr. Paul Petrilli, P.E. – *Project Engineer*

Mr. Sean Butler, - *Engineering Technician*

Site/Building Description

The Arbutus Park Retirement Community has over 45 acres of ground with a central nursing facility and over 80 independent residences. The focus of this energy audit is the 109,800 s.f. Arbutus Park Manor which includes a Personal Care unit consisting of

35 rooms for residence to live independently while receiving assistance when needed; a Skilled Nursing Care unit with 141 beds; and a Dementia and Memory Care unit

Originally constructed in 1972, phase one of Arbutus Park Manor included the West Wing (Crossroads) and opened on June 10, 1973 as a continuing care retirement community. Construction of the East Wing followed in 1978. In the 1984, the Doerr Wing was constructed.

Building Space Function Summary

Tables 2 provides a summary of the characteristics of the building as observed during our walk-through survey.

Table 2 – Space Function Summary

#	Space Function Type	Gross Floor Area	Weekly Operating Hours	Weeks/Year	# Occupants	Principal Lighting Type	Principal HVAC Type	% of Spaces Heated	% of Spaces Cooled
1	Personal Care (Independent Living)	14,850 sf	168	52	35		Hot/Chilled water/2-pipe fancoil units	100	100
2	Skilled Nursing Care	43,960 sf	168	52	141		Hot/Chilled water/2-pipe fancoil units	100	100
3	Dementia and Memory Care	13,820 sf	168	52			Hot/Chilled water/2-pipe fancoil units	100	100
4	Kitchen/Dining	7,920 sf	84	52			Hot/Chilled water/2-pipe fancoil units	100	100
5	Common & Support Areas	29,250 sf					Hot/Chilled water/2-pipe fancoil units	100	100

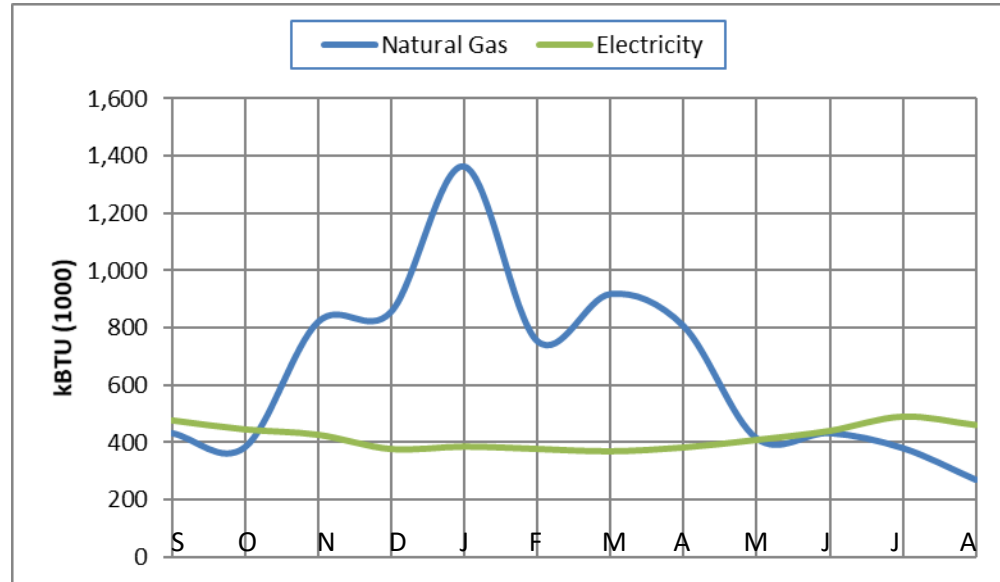
Historical Energy Consumption & Costs

Facility Energy Usage Tabulation by Fuel Type

Arbutus Park Retirement Community provide utility bills for the period of Sept. 2017 – August 2018. Table 3 shows a brief summary of the findings of the utility bills. Utility data for the audit is included in **Appendix A**

Table 3 – Fuel Consumption Summary for Sept. 2017 – Aug. 2018

Fuel Type	Total Consumption	Total Cost
Electricity	5,053,969 kBtu	\$132,806.92
Natural Gas	7,818,951 kBtu	\$53,306.69



Benchmarking Results

Table 4 shows how Arbutus Park Manor compares to both the median building type (Senior Care Community) and an ENERGY STAR certified Senior Care Community building in this climate. We entered Arbutus Park Manor's data into the ENERGY STAR Portfolio Manager site (<https://portfoliomanager.energystar.gov>) to determine the current ENERGY STAR score and comparable data for the median building and an ENERGY STAR certified building.

Table 4 – Energy Usage Summary

Comparable	Energy Utilization Index (EUI)	ENERGY STAR SCORE	Energy Cost/SF (\$/sf)	Annual Energy Cost
Arbutus Park Manor	117.1	34	1.70	\$186,112
Median Building	104.5	50	1.52	\$166,165
ENERGY STAR Building	86.2	75	1.26	\$136,982

With an ENERGY STAR score of 34, Arbutus Park Manor ranks in the bottom 34% of all comparable buildings and has an energy cost that is \$0.50/sf higher to operate than a certified building with a score of 75.

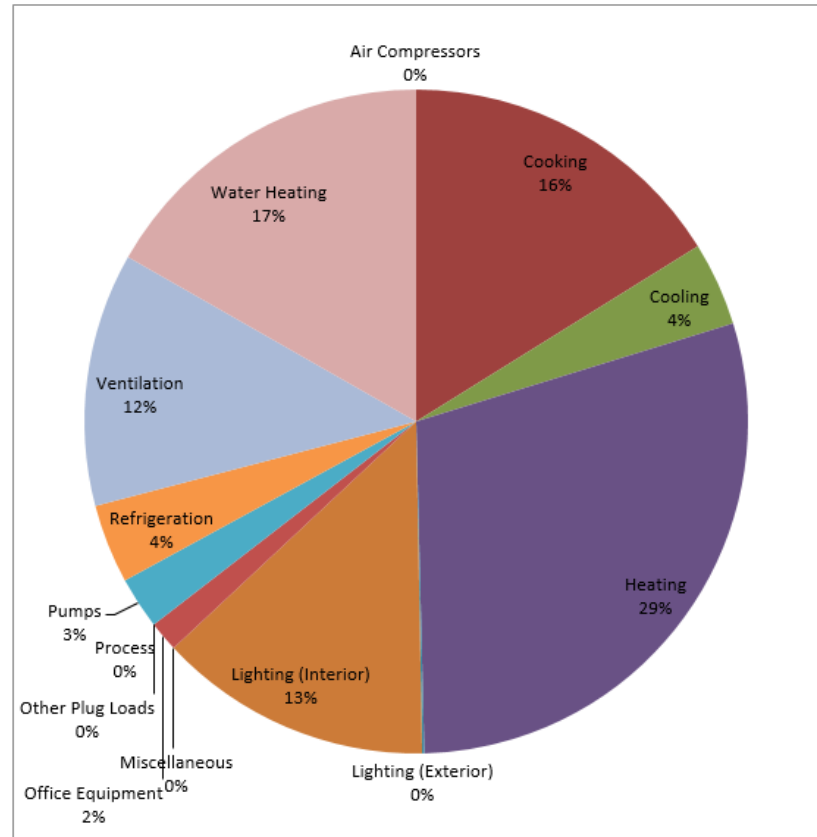
End-use Analysis

Using the information collected during our walk through survey we estimated the end-use energy breakdown for Arbutus Park Manor. Our breakdown is based on 2012 CBEC's data with modifications made from our observations and the actual utility information.

Conversion Factor to kBtu		
Input Unit 1	kWh	3.412142
Input Unit 2	MCF (NG)	1027
Input Unit 3		0
Combined Output Units	kBtu	1
Building Gross Floor Area	109,800	
Floor Area Units	ft^2	

End Use	Input Energy Units		Combined Energy Use	
	kWh	MCF (NG)	kBtu	%
Air Compressors	-	-	-	0%
Cooking	31,926	1,916	2,076,668	16%
Cooling	153,747	-	524,607	4%
Heating	27,025	3,592	3,781,197	29%
Lighting (Exterior)	4,074	-	13,901	0%
Lighting (Interior)	502,836	-	1,715,748	13%
Miscellaneous	-	-	-	0%
Office Equipment	55,471	-	189,275	1%
Other Plug Loads	-	-	-	0%
Process	-	-	-	0%
Pumps	95,512	-	325,901	3%
Refrigeration	145,044	-	494,911	4%
Ventilation	465,537	-	1,588,478	12%
Water Heating	-	2,098	2,154,646	17%
Total Estimated	1,481,172	7,606	12,865,331	100%
Historical Billing	1,481,172	7,606	12,865,331	
Percent of Actual	100.0%	100.0%	#DIV/0!	100.0%
Total per ft^2	13.5	0.1	-	117.2

Combined Fuel End-Use Breakdown



Existing Building Systems

Building Envelope

Based on the observations from our walk through assessment, and reviewing the construction drawings in H.F. Lenz Company's archives, it appears that the perimeter wall construction consists of facebrick; 1/2" airspace; 8" concrete block; 2" rigid insulation with 1/2" gypsum drywall. The perimeter windows are vinyl clad, double hung, wood windows with double pane insulating glass.

The roofing systems consist of metal decking with a minimum of 3.3" of mineral and composite urethane insulation board. A fully adhered, single-ply EPDM membrane roof exists everywhere except over the Doerr Wing. The door Wing roofing system is comprised of a ballasted, single-ply EPDM membrane.

Lighting Systems

The lighting fixtures are primarily fluorescent fixtures that have been upgraded to use T8 and compact fluorescent lamps. In the common areas such as dining rooms and corridors, incandescent globe type, wall sconces and downlights are used. In most cases, it appears that the incandescent lamps have been replaced with high efficiency, LED sources.

Arbutus Park Manor does not have any automatic lighting controls.

Mechanical Systems

The mechanical systems consist of air-cooled chillers and natural gas fired boilers serving three (3) separate 2-pipe, changeover hydronic heating and cooling distribution systems. The chilled water and hot water loops have their own set of dedicated circulation pumps to feed water throughout the building. The hydronic system features a three-way changeover valve for switching between chilled water and hot water. There is a Building Automation System (BAS) operator station for the mechanical equipment of the facility, however, the majority of the space temperature control is accomplished via local thermostat controllers in the space.

A summary of the mechanical equipment is as follows:

Table 5 - Existing HVAC Equipment

Equipment Type	Serves	Manufacturer	Model No.	Capacity
Air-Cooled Water Chiller	Doerr Wing	McQuay (Daikin)	AGZ110CHSNN-ER10	110 Tons
Air-Cooled Water Chiller	East Wing	McQuay (Daikin)	AGZ070CHHNN-ER10	70 Tons
Air-Cooled Water Chiller	West Wing	McQuay (Daikin)	AGZ060CHSNN-ER10	60 Tons
Natural Gas Fired Boilers	Doerr Wing	Bryan		
Natural Gas Fired Boilers	East Wing	Bryan		
Natural Gas Fired Boilers	West Wing			
Natural Gas Fire Boiler	East Wing – Summer	Buderus		
Rooftop AHU	2nd Floor Doerr Wing Corridors & Common Areas			
Rooftop AC DX AC Unit	2nd Floor East Wing Common Areas	Bryant		
Rooftop AC DX AC Unit	2nd Floor East Wing – Physical Therapy	Bryant		
Rooftop DX VAV Unit	East Wing – 2nd Floor Activities	York		
Kitchen Makeup Air Unit	Kitchen			
Indoor Air Handling Units (2)	1st Floor Doerr Wing Corridors & Common Areas			
Indoor Air Handling Unit	1st Floor West Wing			
Indoor Air Handling Unit	Chapel			
Indoor Air Handling Unit	East Wing Laundry			
Fan Coil Units	Resident Rooms (All Wings)			
Ductless Split System Units	East Wing – Medical Treatment and Nurses Station			
Ductless Split System Units	Doerr – Nurses Station			
Ductless Split System Units	Sun Porch & Gift Shops			
Ductless Split System Units	East Wing – 2nd Floor Dining			
Unit Ventilators (4)	East Wing - Community Room			
Power Roof Ventilators (22)				
Electric Wall Heaters	West Wing Resident Rooms			

H.F. Lenz Company's Building Assessment Report dated June 27, 2016 recommended replacing most of the HVAC equipment with the exception of the following; air cooled chillers; West Wing Boilers; East Wing Summer Boiler; hydronic pumps and piping, kitchen make up air unit; York VAV Roofop Unit; Split Systems serving the Sun Porch and Gift Shop; and package DX equipment less than 7 – 8 years old. The cost of the HVAC replacement was estimated at \$1.26 million in 2016. Assuming that this work were to occur in 2020, the cost would have escalated to \$1.54 million.

Energy Efficiency Measures

No-Cost/Low-Cost Measures

EEM -1: Implement the ENERGY STAR® Guide for Restaurants Best Practices

1. When kitchen equipment needs to be replaced, purchase ENERGY STAR qualified appliances and equipment.
2. Cut idle time – turn equipment off when it is not performing useful work. Implement a startup/shutdown plan to make sure that you are only using the equipment that you need, when you need it.
3. Examine your cooking methods and menu; use ovens in lieu of rotisseries; griddles instead of boilers.
4. Recalibrate kitchen equipment. Do regular thermostat checks on appliances, refrigeration, dish machines, and hot water supply heaters and recalibrate them to the correct operating temperature. Verify that equipment temperature controls are operating correctly.
5. Walk-In Refrigerators
 - a. Replace incandescent light bulbs for low-temperature ENERGY STAR qualified compact fluorescent lamps (CFL) with a "minimum start temperature" of 0°F.
 - b. Add strip curtains and automatic door closers to cut outside air infiltration.
 - c. Replace existing evaporator and condenser fan motors with ECM motors.
 - d. Check refrigerant charge
 - e. Repair and realign doors
 - f. Clean coils
6. Replace 3 gpm pre-rinse spray valves with low-flow (1.6 gpm) spray valves to save water, sewer and natural gas costs.
7. Dishwashers

- a. Run fully loaded dishracks to reduce wash cycles
- b. Turn off at night
- c. Replace torn wash curtains
- d. Replace worn spray heads

EEM-2: Install Vacancy Sensors in Common Spaces

Lighting in all spaces is currently controlled by local switches, which may result in lights being left on in unoccupied spaces. We recommend installing vacancy sensors in the spaces listed below to turn the lights off when the spaces when vacant. The vacancy sensors would include an adjustment to set the time period that would elapse before shutting the lights off. Users would turn the lights on when entering the space and can shut them off when leaving, or, in the event that they are left on, will automatically be shutoff (15-30 minutes after vacancy).

We recommend vacancy sensors be installed in the following spaces:

- Storage Rooms
- Mechanical & Electrical Rooms
- Offices
- Lounges
- Blue Room
- Dining Rooms
- Medical Records
- Community Room
- Arts & Crafts
- Laundry
- Physical Therapy
- Chapel

We estimate that installing the vacancy sensors will result in an annual energy savings of 6,200 kWh or \$540.00/yr.

Capital Investment Measures

EEM-3: Corridor Lighting Controls

Based on our discussions with the nursing staff, the lights in the corridors of both the Skilled Nursing Unit and the Dementia & Memory Care Units remain on 24 hours a day. We would also assume that the lighting in the Personal Care Units on the first floors remain on as well.

We recommend the installation of automatic lighting time of day/dimming controls to reduce the light levels at night when most occupants are asleep. Two methods of control are commonly used; shutting the lights completely off at night combined with occupancy sensors to turn sections on when occupied; or providing lower night time light levels by either shutting most of the lights off or dimming to provide a minimal light level to allow staff to complete their rounds at night.

We have estimated that corridor lighting controls would save approximately 37,640 kWh per year, while lighting controls combined with occupancy sensors will result in an annual energy savings of 41,400 kWh. The estimated annual energy savings is \$3,685.yr.

EEM-4: Install Building Automation System

An existing TAC/Schneider Electric building automation system exists; however, it appears to be limited to control of the VAV Rooftop unit and terminal boxes serving the second floor of the East Wing, and the three boiler plants. All of the remaining HVAC equipment have stand-alone thermostats to control space temperature. The fan-coil units have unit mounted thermostats which cycle the supply fan based on room temperature. Based on our sampling, it appears that many of the thermostat are either not operational or no longer in calibration.

We recommend replacing all of the stand-alone thermostats with DDC thermostat which are interconnected to the BAS system. This measure should improve comfort in the spaces, and reduce use of the electric wall heaters in the Personal Care rooms. We are estimating a savings of approximately \$8,900 per year, resulting in a simple payback of just under 10 years. However, this measure should only be implemented if the fan coil units are going to remain in service instead of being replaced as recommended in the earlier report.

EEM-5: Replace HVAC with Water-Source Heat Pump /DOAS System.

An assessment of the roof condition and mechanical, electrical, and plumbing systems for Arbutus Park Manor in the spring of 2016. The assessment gave high priority to replacing the air-handling units that provided cooling and ventilation air to much of the common areas. The recommendations were to replace the equipment in kind.

At that time, the cost to replace the HVAC system was \$1.26 million dollars. Assuming that this work would occur in 2020, the current cost is \$1.54 million. This will be used as the base cost to compare the cost of the water source heat pump system.

Under this recommendation, all of the fan coil units, split system DX units, indoor air handling units and package rooftop units would either be replaced by watersource heat pump units configured to match the equipment being replaced. For example, the fan coil units installed in the rooms would be replaced by floor mounted console units. Concealed horizontal units will replace fan coil units and indoor air handling units.

A total of three (3) DOAS rooftop units would be installed to provide tempered ventilation air throughout the facility (with the exception of the kitchen makeup air unit). The existing 2-pipe distribution loop would be reused as the heat pump water loop and the Doerr Wing Boiler would remain in service to provide supplementary heat. A 200-ton closed loop fluid cooler would replace the existing chillers to provide heat rejection.

This measure results in an annual energy reduction of 2,264,300 kBtu/year which would reduce the total EUI by 2.4. While saving energy, it saves a total of \$14,800 per year. It slightly increase the annual electric usage while reducing natural gas use for heating. Because the measure has a simple payback of 41.8 years, and a net present value of -\$418,800, we do not recommend pursuit.

Supporting Information

Analysis

ENERGY PERFORMANCE SUMMARY
Commercial Building Energy Audit Sample Forms

Energy Type	Total Annual Use	Units	Conversion Multiplier	kBtu	Total Annual Cost (\$)
Electricity	1,481,172	kWh	3.412142	5,053,969	\$ 132,806.92
Natural Gas	7,606	MCF (NG)	1027	7,810,951	\$ 53,306.69
Purchased Steam			0	-	
Purchased Hot Water			0	-	
Purchased Chilled Water			0	-	
Oil #:			0	-	
Propane			0	-	
Coal			0	-	
Thermal—On-Site Generated			0	-	
Other			0	-	
Electricity—On-Site Generated			0	-	
Thermal or Electricity—Exported			0	-	
			0	-	
Total				12,864,920	\$ 186,113.61

Gross Conditioned Area	109800
	EUI (kBtu/ft ²)
	117.17
	<u>Target Finder Score*</u>
CBCECS EUI (for comparable , kBtu/ft ²)	86.1236318
	1.695023798
ECl (\$/ft ²)	

Notes:

* Additional data may be required for your building type.



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HISTORICAL UTILITY BILLS

Commercial Building Energy Audit Sample Forms

At least one year of data, or preferably two to three years of data, should be obtained for each meter or energy source in the building. Use multiple sheets as necessary.

ELECTRIC

Utility/Supplier Name	Penelec	
Account Number	1 000001511532	
Meter Number	L012876581	
Rate Schedule Name/Number		
Notes on Rate		

YEAR: Sept 2017 - Aug, 2018

Month	Bill Date	Days in Period	Ave. Temp. (F)	Actual Demand (kW)	Billed Demand (kW)	Electric Use (kWh)	Demand Cost (\$)	Electric Use (\$)	Other Fees (\$)	Total Bill (\$)
January	1/24/2018	29	20	246.4	246.4	113233	\$2,193	\$7,732	\$69	\$9,993
February	2/22/2018	29	34	249.3	249.3	110849	\$2,202	\$7,571	\$68	\$9,841
March	3/23/2018	29	32	235.2	235.2	108452	\$2,069	\$7,461	\$67	\$9,597
April	4/23/2018	31	41	316.2	316.2	112336	\$2,604	\$7,703	\$64	\$10,371
May	5/23/2018	30	60	282.4	282.4	120153	\$2,429	\$8,196	\$65	\$10,690
June	6/22/2018	30	67	308.7	308.7	129389	\$2,830	\$8,911	\$67	\$11,808
July	7/24/2018	32	70	297.5	297.5	144015	\$2,767	\$9,869	\$55	\$12,691
August	8/23/2018	30	69	303.3	303.3	135410	\$2,740	\$9,182	\$59	\$11,980
September	9/25/2017	32	63	325.2	325.2	140213	\$3,155	\$9,556	\$62	\$12,773
October	10/25/2017	30	60	302.1	302.1	130899	\$2,961	\$8,923	\$66	\$11,949
November	11/27/2017	33	40	266.1	266.1	125407	\$2,685	\$8,581	\$61	\$11,328
December	12/26/2017	29	32	234.9	234.9	110816	\$2,137	\$7,581	\$67	\$9,785
Annual Totals						1,481,172	\$30,773	\$101,265	\$769	\$132,807

Peak Demand (kW)	325.2
Total Annual Cost (\$)	\$132,807



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HISTORICAL UTILITY BILLS

Commercial Building Energy Audit Sample Forms

At least one year of data, or preferably two to three years of data, should be obtained for each meter or energy source in the building. Use multiple sheets as necessary.

NATURAL GAS

Utility/Supplier Name	Peoples
Account Number	4541930
Meter Number	12123099 & 9769054
Rate Schedule Name/Number	1.5908/MCF
Notes on Rate	GS-T Commerical (P)

YEAR: Sep. 2017 - August 2018

Month	Bill Date	Days in Period	Ave. Temp. (F)	Actual Demand in MCF (Peoples)	Billed Demand in MCF (Snyder)	MCF (NG)	Demand Cost (\$) (Snyder)	Gas Use (\$) (Peoples)	Other Fees (\$)	Total Bill (\$)
January	1/25/2018	33	17	1325.8	1325.8	1325.8	\$4,187	\$4,416	\$0	\$8,603
February	2/22/2018	29	31	732.5	732.5	732.5	\$2,811	\$1,942	\$0	\$4,752
March	3/22/2018	29	32	892.3	892.3	892.3	\$3,424	\$2,994	\$0	\$6,417
April	4/23/2018	32	39	783.9	783.9	783.9	\$3,008	\$2,658	\$0	\$5,666
May	5/23/2018	29	54	401.9	401.9	401.9	\$1,542	\$1,378	\$0	\$2,920
June	6/22/2018	30	63	419.6	419.6	419.6	\$1,610	\$1,437	\$0	\$3,047
July	7/22/2018	32	71	368.8	368.8	368.8	\$1,415	\$1,228	\$0	\$2,643
August	8/22/2018	29	70	260.9	260.9	260.9	\$1,001	\$904	\$0	\$1,905
September	9/22/2017	30	61	419.7	419.7	419.7	\$1,589	\$1,361	\$0	\$2,950
October	10/23/2017	30	63	371.3	371.3	371.3	\$1,406	\$1,252	\$0	\$2,658
November	11/22/2017	32	43	797.1	797.1	797.1	\$3,058	\$2,672	\$0	\$5,731
December	12/22/2017	30	33	831.8	831.8	831.8	\$3,192	\$2,822	\$0	\$6,014
Annual Totals						7,606	\$28,243	\$25,064	\$0	\$53,307

* Choose appropriate units for gas (typically MMBtu, therms, or MCF).

Peak Demand (_____)	1325.8
Total Annual Cost (\$)	\$53,307



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Arbutus Manor Energy Audit

Location	Johnstown
Building owner	Arbutus Park Retirement Community
Program user	P E Petrilli
Company	H F Lenz
Comments	

By	H.F. Lenz Company
Dataset name	C:\Trane Trace Projects\APRC\Arbutus Park Manor.trc

Calculation time	04:02 PM on 03/05/2019
TRACE® 700 version	6.3.3

Location	Johnstown	
Latitude	40.3	deg
Longitude	78.8	deg
Time Zone	5	
Elevation	1,802	ft
Barometric pressure	28.0	in. Hg
Air density	0.0000	lb/cu ft
Air specific heat	0.0000	Btu/lb·°F
Density-specific heat product	0.0000	Btu/h·cfm·°F
Latent heat factor	0.0	Btu·min/h·cu ft
Enthalpy factor	0.0000	lb·min/hr·cu ft
Summer design dry bulb	84.0	°F
Summer design wet bulb	74.0	°F
Winter design dry bulb	0.0	°F
Summer clearness number	1.00	
Winter clearness number	1.00	
Summer ground reflectance	0.20	
Winter ground reflectance	0.20	
Carbon Dioxide Level	400	ppm
Design simulation period	January - December	
Cooling load methodology	TETD-TA1	
Heating load methodology	UATD	



Energy Cost Budget / PRM Summary

By H.F. Lenz Company

Project Name: Arbutus Manor Energy Audit	Date: March 07, 2019
City: Johnstown	Weather Data: Johnstown

Note: The percentage displayed for the "Proposed/ Base %" column of the base case is actually the percentage of the total energy consumption.

* Denotes the base alternative for the ECB study.

		* Alt-1 Existing Systems			Alt-2 Corridor Lighting Controls			Alt-3 DOAS Ventilation		
		Energy 10 ⁶ Btu/yr	Proposed / Base %	Peak kBtuh	Energy 10 ⁶ Btu/yr	Proposed / Base %	Peak kBtuh	Energy 10 ⁶ Btu/yr	Proposed / Base %	Peak kBtuh
Lighting - Conditioned	Electricity	1,716.2	20	280	1,577.1	92	278	1,716.2	100	280
Space Heating	Electricity	85.3	1	17	89.2	105	17	513.0	602	307
	Gas	3,524.9	42	2,704	3,626.7	103	2,711	722.3	20	1,007
Space Cooling	Electricity	506.6	6	803	494.5	98	803	718.1	142	462
Pumps	Electricity	410.7	5	61	415.9	101	61	13.2	3	6
Heat Rejection	Electricity	65.2	1	94	63.6	98	94	116.7	179	35
Fans - Conditioned	Electricity	1,896.1	23	267	1,891.9	100	267	1,762.4	93	329
Receptacles - Conditioned	Electricity	189.3	2	28	189.3	100	28	189.3	100	28
Total Building Consumption		8,394.3			8,348.4			5,751.1		

		* Alt-1 Existing Systems		Alt-2 Corridor Lighting Controls		Alt-3 DOAS Ventilation	
Total	Number of hours heating load not met	90		90		609	
	Number of hours cooling load not met	16		16		0	

		* Alt-1 Existing Systems		Alt-2 Corridor Lighting Controls		Alt-3 DOAS Ventilation	
		Energy 10 ⁶ Btu/yr	Cost/yr \$/yr	Energy 10 ⁶ Btu/yr	Cost/yr \$/yr	Energy 10 ⁶ Btu/yr	Cost/yr \$/yr
Electricity		4,869.4	0	4,721.6	0	5,028.8	0
Gas		3,524.9	0	3,626.7	0	722.3	0
Total		8,394	0	8,348	0	5,751	0

MONTHLY ENERGY CONSUMPTION

By H.F. Lenz Company

----- Monthly Energy Consumption -----

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Alternative: 1 Existing Systems													
Electric													
On-Pk Cons. (kWh)	108,802	98,901	114,833	111,361	113,531	123,622	161,559	150,989	114,416	115,252	109,334	104,112	1,426,713
On-Pk Demand (kW)	196	204	218	222	248	322	420	391	301	220	201	173	420
Gas													
On-Pk Cons. (therms)	9,145	6,881	3,422	821	47	0	0	0	3	928	3,499	10,504	35,249
On-Pk Demand (therms/hr)	25	23	18	10	6	0	0	0	0	9	16	27	27

Energy Consumption	
Building	79,429 Btu/(ft2-year)
Source	173,349 Btu/(ft2-year)
Floor Area	105,683 ft2

Environmental Impact Analysis	
CO2	No Data Available
SO2	No Data Available
NOX	No Data Available

MONTHLY ENERGY CONSUMPTION

By H.F. Lenz Company

----- Monthly Energy Consumption -----

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Alternative: 2 Corridor Lighting Controls													
Electric													
On-Pk Cons. (kWh)	105,333	95,763	111,039	107,983	111,535	119,478	156,832	145,753	111,422	111,554	105,943	100,791	1,383,426
On-Pk Demand (kW)	195	203	217	221	248	321	420	391	300	220	200	172	420
Gas													
On-Pk Cons. (therms)	9,284	7,007	3,566	928	133	8	0	0	23	1,048	3,632	10,637	36,267
On-Pk Demand (therms/hr)	25	23	18	10	6	0	0	0	0	9	16	27	27

Energy Consumption	
Building	78,994 Btu/(ft2-year)
Source	170,168 Btu/(ft2-year)
Floor Area	105,683 ft2

Environmental Impact Analysis	
CO2	No Data Available
SO2	No Data Available
NOX	No Data Available

MONTHLY ENERGY CONSUMPTION

By H.F. Lenz Company

----- Monthly Energy Consumption -----

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Alternative: 3 DOAS Ventilation													
Electric													
On-Pk Cons. (kWh)	132,573	116,230	122,358	117,234	120,537	106,801	140,957	133,487	107,765	121,732	117,677	136,082	1,473,433
On-Pk Demand (kW)	242	239	241	243	251	294	324	319	271	235	229	247	324
Gas													
On-Pk Cons. (therms)	2,575	1,451	18	0	0	0	0	0	0	0	13	3,165	7,223
On-Pk Demand (therms/hr)	9	8	5	0	0	0	0	0	0	0	2	10	10
Water													
Cons. (1000gal)	0	0	14	47	73	114	238	206	63	49	6	0	810

Energy Consumption

Building 54,418 Btu/(ft2-year)
 Source 149,960 Btu/(ft2-year)

Floor Area 105,683 ft2

Environmental Impact Analysis

CO2 No Data Available
 SO2 No Data Available
 NOX No Data Available

ENERGY CONSUMPTION SUMMARY

By H.F. Lenz Company

	Elect Cons. (kWh)	Gas Cons. (kBtu)	% of Total Building Energy	Total Building Energy (kBtu/yr)	Total Source Energy* (kBtu/yr)
Alternative 1					
Primary heating					
Primary heating		3,524,936	42.0 %	3,524,936	3,710,459
Other Htg Accessories	24,982		1.0 %	85,265	255,821
Heating Subtotal	24,982	3,524,936	43.0 %	3,610,201	3,966,280
Primary cooling					
Cooling Compressor	145,547		5.9 %	496,750	1,490,400
Tower/Cond Fans	19,105		0.8 %	65,205	195,633
Condenser Pump			0.0 %	0	0
Other Clg Accessories	2,882		0.1 %	9,835	29,507
Cooling Subtotal....	167,533		6.8 %	571,790	1,715,540
Auxiliary					
Supply Fans	555,557		22.6 %	1,896,116	5,688,916
Pumps	120,333		4.9 %	410,695	1,232,210
Stand-alone Base Utilities			0.0 %	0	0
Aux Subtotal....	675,890		27.5 %	2,306,811	6,921,126
Lighting					
Lighting	502,837		20.4 %	1,716,181	5,149,058
Receptacle					
Receptacles	55,471		2.3 %	189,324	568,028
Cogeneration					
Cogeneration			0.0 %	0	0
Totals					
Totals**	1,426,713	3,524,936	100.0 %	8,394,307	18,320,032

* Note: Resource Utilization factors are included in the Total Source Energy value .

** Note: This report can display a maximum of 7 utilities. If additional utilities are used, they will be included in the total.

ENERGY CONSUMPTION SUMMARY

By H.F. Lenz Company

	Elect Cons. (kWh)	Gas Cons. (kBtu)	% of Total Building Energy	Total Building Energy (kBtu/yr)	Total Source Energy* (kBtu/yr)
Alternative 2					
Primary heating					
Primary heating		3,626,720	43.4 %	3,626,720	3,817,600
Other Htg Accessories	26,140		1.1 %	89,217	267,677
Heating Subtotal	26,140	3,626,720	44.5 %	3,715,937	4,085,277
Primary cooling					
Cooling Compressor	142,021		5.8 %	484,717	1,454,298
Tower/Cond Fans	18,643		0.8 %	63,628	190,902
Condenser Pump			0.0 %	0	0
Other Clg Accessories	2,878		0.1 %	9,821	29,467
Cooling Subtotal....	163,541		6.7 %	558,166	1,674,666
Auxiliary					
Supply Fans	554,322		22.7 %	1,891,899	5,676,266
Pumps	121,863		5.0 %	415,918	1,247,879
Stand-alone Base Utilities			0.0 %	0	0
Aux Subtotal....	676,184		27.6 %	2,307,817	6,924,145
Lighting					
Lighting	462,088		18.9 %	1,577,108	4,731,796
Receptacle					
Receptacles	55,471		2.3 %	189,324	568,028
Cogeneration					
Cogeneration			0.0 %	0	0
Totals					
Totals**	1,383,426	3,626,720	100.0 %	8,348,352	17,983,912

* Note: Resource Utilization factors are included in the Total Source Energy value .

** Note: This report can display a maximum of 7 utilities. If additional utilities are used, they will be included in the total.

ENERGY CONSUMPTION SUMMARY

By H.F. Lenz Company

	Elect Cons. (kWh)	Gas Cons. (kBtu)	Water Cons. (1000 gals)	% of Total Building Energy	Total Building Energy (kBtu/yr)	Total Source Energy* (kBtu/yr)
Alternative 3						
Primary heating						
Primary heating	144,218	722,253		21.1 %	1,214,469	2,237,064
Other Htg Accessories	6,084			0.4 %	20,765	62,302
Heating Subtotal	150,302	722,253		21.5 %	1,235,235	2,299,366
Primary cooling						
Cooling Compressor	210,180			12.5 %	717,343	2,152,244
Tower/Cond Fans	34,203		810	2.0 %	116,733	350,235
Condenser Pump				0.0 %	0	0
Other Clg Accessories	219			0.0 %	747	2,243
Cooling Subtotal....	244,601		810	14.5 %	834,824	2,504,722
Auxiliary						
Supply Fans	516,366			30.6 %	1,762,357	5,287,599
Pumps	3,855			0.2 %	13,159	39,480
Stand-alone Base Utilities				0.0 %	0	0
Aux Subtotal....	520,221			30.9 %	1,775,515	5,327,079
Lighting						
Lighting	502,837			29.8 %	1,716,181	5,149,058
Receptacle						
Receptacles	55,471			3.3 %	189,324	568,028
Cogeneration						
Cogeneration				0.0 %	0	0
Totals						
Totals**	1,473,433	722,253	810	100.0 %	5,751,078	15,848,251

* Note: Resource Utilization factors are included in the Total Source Energy value .

** Note: This report can display a maximum of 7 utilities. If additional utilities are used, they will be included in the total.

ELECTRICAL PEAK CHECKSUMS

By H.F. Lenz Company

Alternative 1

Existing Systems

Yearly Time of Peak: 15(Hr) 7(Month)

Equipment Description	Electrical Demand (kw)	Percent of Total (%)
Cooling Equipment		
Air-cooled chiller - 001	72.79	17.32
DX Rooftop Units	80.92	19.25
Air-cooled chiller - 003	48.52	11.54
Air-cooled chiller - 002	67.91	16.16
Sub total	270.14	64.27
Fan Equipment		
Sys 4: Doerr Air Handling Units	17.45	4.15
Sys 7: DX Rooftop Air Handling Units	25.44	6.05
Sys 5: Main_West Wing Air Handling Unit	4.93	1.17
Sys 3: Crosswinds FCU	3.34	0.79
Sys 2: Main_West Wing FCU	4.78	1.14
Sys 1: Doerr Wing FCUs	5.30	1.26
Sys 6: Crossover Wing Air Handling Unit	10.80	2.57
Sub total	72.04	17.13
Miscellaneous		
Misc Equipment	7.91	1.88
Base Utilities	0.00	0.00
Lights	70.28	16.72
Sub total	78.19	18.60
Total	420.37	100

Alternative 2

Corridor Lighting Controls

Yearly Time of Peak: 15(Hr) 7(Month)

Equipment Description	Electrical Demand (kw)	Percent of Total (%)
Cooling Equipment		
Air-cooled chiller - 001	72.86	17.36
DX Rooftop Units	80.70	19.23
Air-cooled chiller - 002	67.93	16.19
Air-cooled chiller - 003	48.56	11.57
Sub total	270.05	64.35
Fan Equipment		
Sys 6: Crossover Wing Air Handling Unit	10.80	2.57
Sys 7: DX Rooftop Air Handling Units	25.33	6.04
Sys 5: Main_West Wing Air Handling Unit	4.93	1.18
Sys 4: Doerr Air Handling Units	17.45	4.16
Sys 3: Crosswinds FCU	3.34	0.80
Sys 2: Main_West Wing FCU	4.78	1.14
Sys 1: Doerr Wing FCUs	5.30	1.26

ELECTRICAL PEAK CHECKSUMS

By H.F. Lenz Company

	Sub total	71.93	17.15
Miscellaneous			
Misc Equipment	7.91	1.89	
Base Utilities	0.00	0.00	
Lights	69.75	16.62	
	Sub total	77.66	18.51
	Total	419.64	100

Alternative 3
Yearly Time of Peak: 17(Hr) 7(Month)

DOAS Ventilation

Equipment Description	Electrical Demand (kw)	Percent of Total (%)
Cooling Equipment		
Water source heat pump - 001	146.92	45.31
	Sub total	146.92
Fan Equipment		
Sys 1 : Watersource Heat Pump	87.40	26.95
	Sub total	87.40
Miscellaneous		
Base Utilities	0.00	0.00
Lights	81.93	25.27
Misc Equipment	8.01	2.47
	Sub total	89.94
	Total	324.26
		100