

EAST ORANGE SCHOOL DISTRICT

CARVER ANNEX

**139 GLENWOOD AVENUE
EAST ORANGE, NEW JERSEY**

FACILITY ENERGY REPORT

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I. HISTORIC ENERGY CONSUMPTION/COST

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

Electric Utility Provider:	PSE&G
Electric Utility Rate Structure:	GLP
Third Party Supplier:	Direct Energy
Natural Gas Utility Provider:	PSE&G
Utility Rate Structure:	GSG
Third Party Supplier:	South Jersey Energy Co.

The electric usage profile represents the actual electrical usage for the facility. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile within each facility report shows the actual natural gas energy usage for the facility. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY			
Utility Provider: PSE&G Rate: GLP Meter No: 1454799 Account No: 69 590 494 07 Third Party Utility Provider: Direct Energy TPS Meter / Acct No: -			
MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Jun-14	4,134	21.4	\$849
Jul-14	2,706	21.4	\$565
Aug-14	2,616	14.9	\$546
Sep-14	2,886	29.8	\$603
Oct-14	2,814	13.3	\$437
Nov-14	3,097	14.4	\$481
Dec-14	2,903	14.4	\$451
Jan-15	2,640	11.2	\$404
Feb-15	3,030	11.6	\$458
Mar-15	3,078	12.1	\$467
Apr-15	3,060	13.5	\$470
May-15	2,922	13.4	\$465
Totals	35,886	29.8 Max	\$6,196
AVERAGE DEMAND 16.0 KW average AVERAGE RATE \$0.173 \$/kWh			

Figure 1
Electricity Usage Profile

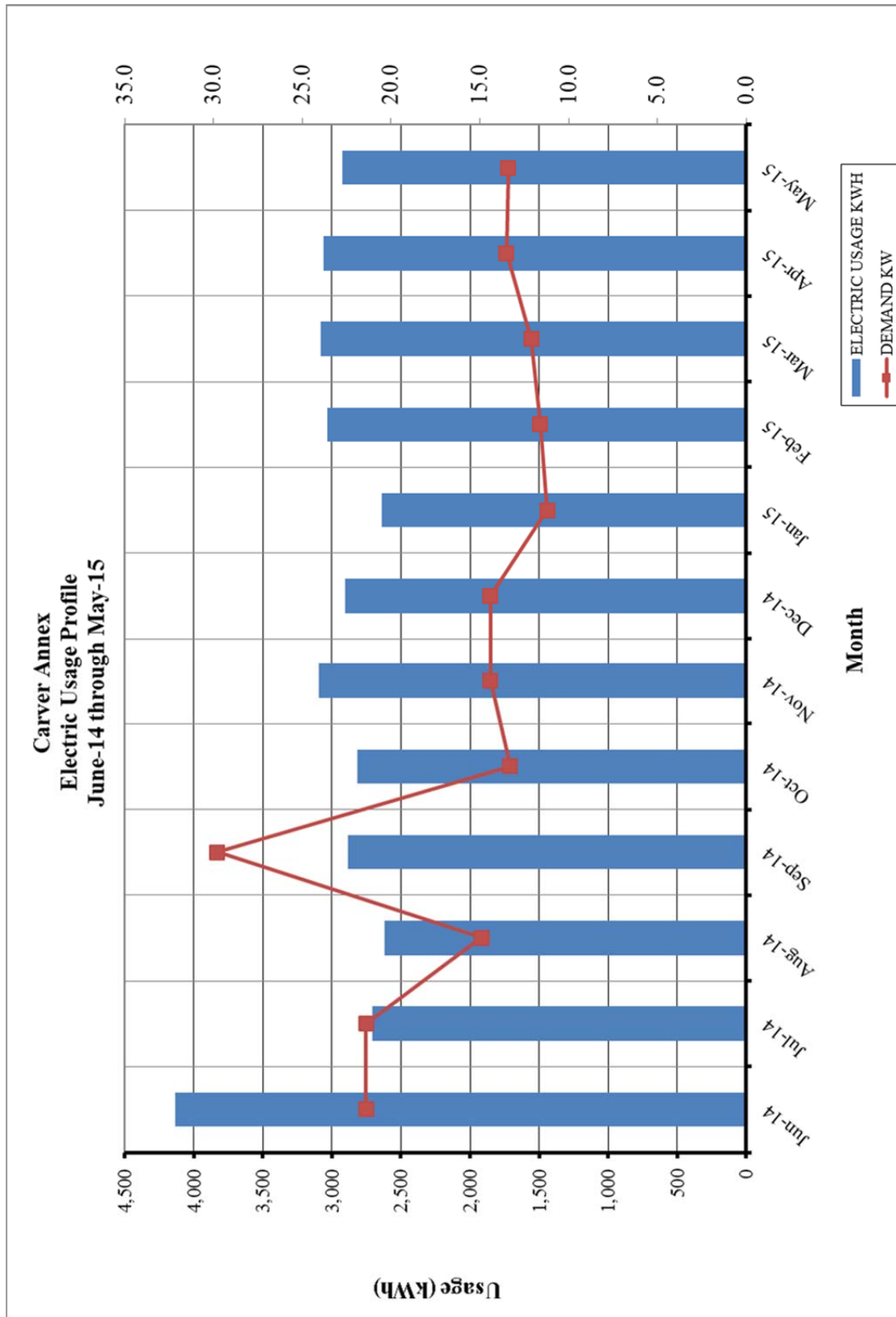
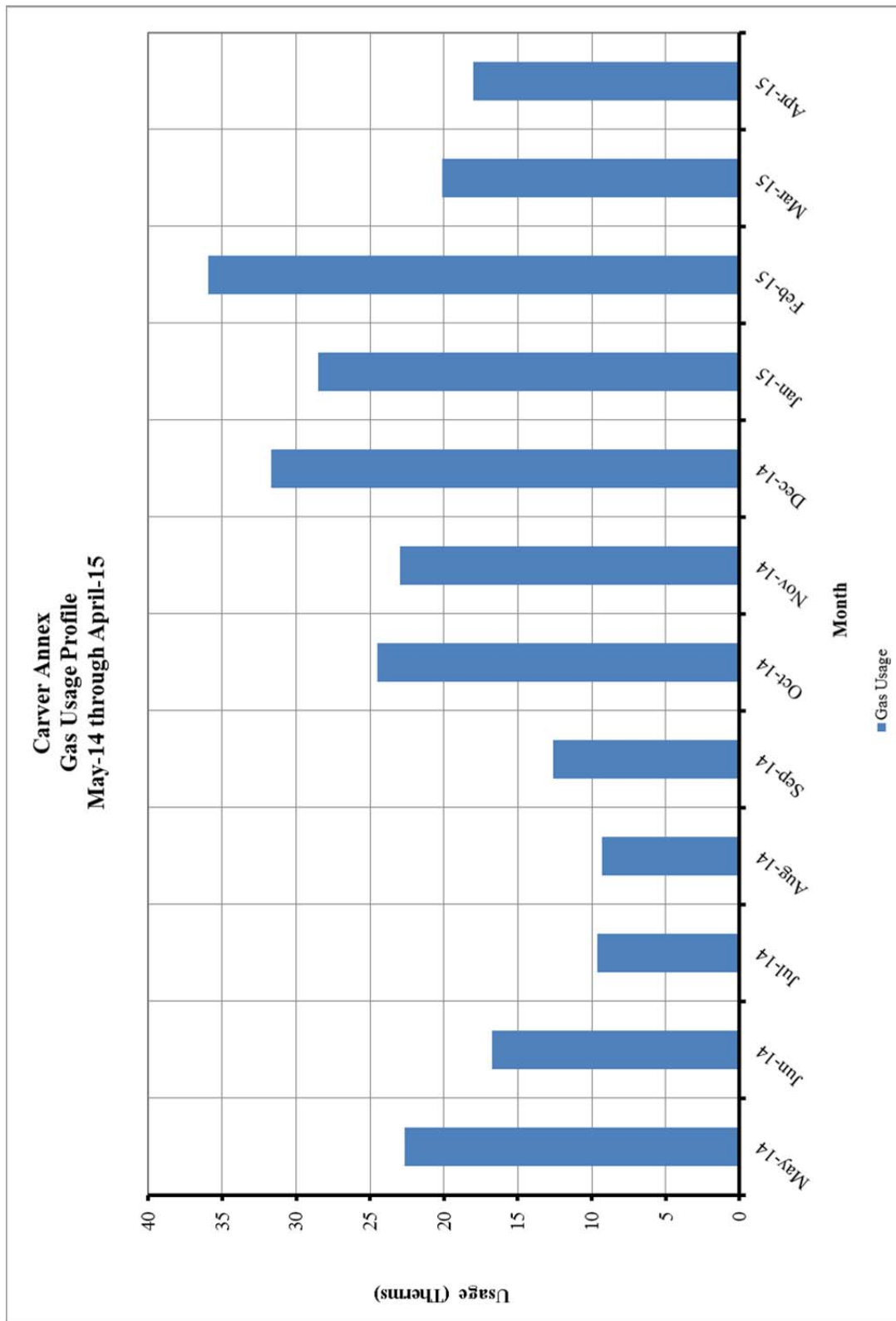


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: PSE&G Rate: GSG Meter No: 1717323 Account No: 69 590 494 07 Third Party Utility Provider: South Jersey Energy Co. TPS Meter No: -		
MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
May-14	22.65	\$18.56
Jun-14	16.78	\$25.00
Jul-14	9.59	\$24.90
Aug-14	9.28	\$24.09
Sep-14	12.64	\$21.12
Oct-14	24.48	\$32.00
Nov-14	22.95	\$30.00
Dec-14	31.67	\$42.53
Jan-15	28.53	\$36.83
Feb-15	35.96	\$42.51
Mar-15	20.11	\$17.29
Apr-15	18.00	\$16.66
TOTALS	252.62	\$331.49
AVERAGE RATE:	\$1.31	\$/THERM

Figure 2
Natural Gas Usage Profile



II. FACILITY ENERGY USE INDEX (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. Building Benchmarking data is collected and analyzed within the Commercial Building Energy Consumption Survey (CBECS), performed by the Energy and Information Administration (EIA). Building data is grouped by function types and tabulated, from which a median site and source energy intensity is determined. The national median or PEER Group Comparable in this instance is the middle value of the national population meaning half the buildings use more energy, and half use less. The PEER Group EUI allows us to compare the relative efficiency of the audited building to that of an average building with the same or similar primary function (i.e. group type).

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that **source energy** is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows:

$$\text{Building Site EUI} = \frac{(\text{Electric Usage in kBtu} + \text{Fuel Usage in kBtu})}{\text{Building Square Footage}}$$

$$\text{Building Source EUI} = \frac{(\text{Electric Usage in kBtu} \times \text{SS Ratio} + \text{Fuel Usage in kBtu} \times \text{SS Ratio})}{\text{Building Square Footage}}$$

Table 3
Energy Use Index Summary

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	35,886.0			122,515	3.140	384,696
NATURAL GAS		252.6		25,262	1.050	26,525
TOTAL				147,776		411,221
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document.						
AUDITED BUILDING				PEER COMPARISON		
BUILDING TYPE		Office		Office		
BUILDING AREA		40,618	SQUARE FEET			
BUILDING SITE EUI		3.64	kBtu/SF/YR		67.3	kBtu/SF/YR
BUILDING SOURCE EUI		10.12	kBtu/SF/YR		148.1	kBtu/SF/YR
		93%		More Efficient than PEER Comparison		

III. FACILITY DESCRIPTION

The Carver Annex is located at 135 Glenwood Avenue in East Orange, NJ. This 40,618 square foot building was built in 1958. The building includes the School District's Childhood Study Team offices and the Department of Maintenance Services. The facility is comprised of offices, conference rooms, break room, restrooms, mechanical room and other various offices and utility/storage rooms.

Occupancy Profile

The typical hours of operation for the Carver Annex are Monday through Friday between 8:00 am and 5:30 pm, with custodial staff on site after hours till approximately 11 pm.

Building Envelope

The building is primarily concrete masonry block with brick veneer. The exterior windows and doors are single-pane with aluminum frames that are in very bad condition.

The roofing system is constructed of modified bitumen roofing and rigid insulation (R-11) over steel decking with a silver sealant over the top. Many areas of the roof show severe ponding where leaks are highly likely.

HVAC Systems

The heating system is comprised of a Davis Engineering Paracoil Model K2B-58D water-to-water exchanger that is fed from the boiler plant in the Carver Institute. The hot water is then pumped to adjacent hot water coils in two (2) air handling units via several Bell & Gossett pumps with motors from ½ to 1 HP and to various unit ventilators, fin-tube radiators, and cabinet heaters throughout the facility.

During the site inspection, Concord noticed numerous rusted valves, piping, piping connections, etc. In addition, with no chemical water treatment at the boiler plant, there is noticeable buildup of hardness, iron and other corrosion on the heat exchanger, air handlers and pumps.

There are numerous window air conditioning units in various offices that range in size from 10,000 to 18,000 BTUH and vary in efficiency from 9.4 to 9.8 EER.

Exhaust System

General and toilet exhaust air is removed through roof-mounted down blast mushroom style fans manufactured by Jenn-Air etc. Most of the nameplate information is unobtainable.

HVAC System Controls

The HVAC equipment in the facility was controlled through a pneumatic air system. However, the air compressor has failed and there is no control of actuators, thermostats, dampers, etc. The pneumatic valves and actuators are not closing/opening fully due to the age of the units. The

outside air dampers are not fully closing which could cause coil freezing during the coldest months of the winter and allow humidity into the space during the hot humid days of the summer. Also, the thermostats that used to control these units are out of calibration and are not reading the correct space temperature.

Concord Engineering strongly recommends that the School District replace the failed air compressor and controls so that the unit ventilators, cabinet heaters, fin-tube radiators, etc. can be controlled.

Domestic Hot Water

Domestic hot water is generated by the hot water boilers at the Carver Institute boiler room, pumped to a large holding tank and pumped to the Carver Annex via an in-line Bell & Gossett pump.

Plumbing System

The Carver Annex utilizes sinks rated at 2.2 gallons per minute. Additionally, water closets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Laundry Equipment

The laundry facility in the basement consists of two (2) G. E. Model DCVH640 washers and one G. E. Model WCVH640 dryer.

Lighting

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed list of the lighting throughout the facility and estimated operating hours per space.

IV. MAJOR EQUIPMENT LIST

The equipment list contains major energy consuming equipment that through implementation of energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

Refer to the **Major Equipment List Appendix** for this facility.

V. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 1
ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST ^A	ANNUAL SAVINGS ^B	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
ECM #1	Interior Lighting Upgrade	\$14,080	\$2,033	6.9	116.6%
ECM #2	Exterior Lighting Upgrade	\$1,793	\$227	7.9	89.6%
ECM #3	Lighting Controls	\$2,830	\$257	11.0	36.1%
ECM #4	Replace Window AC Units	\$8,750	\$591	14.8	1.3%
ECM #5	Premium Efficiency Motors for Airhandlers	\$1,920	\$106	18.1	-17.3%
ECM #6	VFD Installation for Air Handlers	\$15,665	\$953	16.4	-8.7%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

Table 2
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Interior Lighting Upgrade	6.4	11,819	0
ECM #2	Exterior Lighting Upgrade	0.4	1,317	0
ECM #3	Lighting Controls	0.0	1,493	0
ECM #4	Replace Window AC Units	2.3	3,414	0
ECM #5	Premium Efficiency Motors for Airhandlers	0.2	612	0
ECM #6	VFD Installation for Air Handlers	1.9	5,509	0

Table 3
ECM Emissions Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	GREENHOUSE GAS EMISSIONS REDUCTION		
		CO₂ EMISSIONS (LBS)	NO_x EMISSIONS (LBS)	SO₂ EMISSIONS (LBS)
ECM #1	Interior Lighting Upgrade	17,965	33	77
ECM #2	Exterior Lighting Upgrade	2,002	4	9
ECM #3	Lighting Controls	2,269	4	10
ECM #4	Replace Window AC Units	5,189	10	22
ECM #5	Premium Efficiency Motors for Airhandlers	931	2	4
ECM #6	VFD Installation for Air Handlers	8,374	15	36
Notes:	A. Emissions Reduction based on NJCEP published factors for electric & gas.			

Table 4
Facility Project Summary

FACILITY PROJECT SUMMARY TABLE					
ENERGY CONSERVATION MEASURES	ANNUAL ENERGY SAVINGS (\$)	PROJECT COST (\$)	SMART START INCENTIVES	CUSTOMER COST	SIMPLE PAYBACK
Interior Lighting Upgrade	\$2,033	\$16,025	\$1,945	\$14,080	6.9
Exterior Lighting Upgrade	\$227	\$2,003	\$210	\$1,793	7.9
Lighting Controls	\$257	\$3,000	\$170	\$2,830	11.0
Replace Window AC Units	\$591	\$8,750	\$0	\$8,750	14.8
Premium Efficiency Motors for Airhandlers	\$106	\$1,920	\$0	\$1,920	18.1
VFD Installation for Air Handlers	\$953	\$15,665	\$0	\$15,665	16.4
Total Project	\$4,166	\$47,363	\$2,325	\$45,038	10.8

Note the measure totals in this table do not take into account interactive effects of measures; see Method of Analysis Section III in Executive Report for further explanation.

This project does not qualify for additional incentives through the Pay for Performance Program; please see the Installation Funding Options section for additional program options.

ECM #1: Interior Lighting Upgrades

Description:

The majority of the interior lighting throughout the Carver Annex is provided by 1x4 and 2x4 fluorescent fixtures with newer generation 700 Series 32W T8 lamps in addition to various CFL and incandescent A-lamp bulbs. It is recommended that all fixtures within the building be replaced with LED equivalent tube lamps and screw-in bulbs due to their efficiency and low power usage.

This ECM includes replacing and retrofitting all of the interior lighting throughout the school with new LED type lamps and fixtures. It is recommended that the School District consult with a lighting engineer prior to retrofitting or replacing interior fixtures to ensure code required minimum light levels will be met.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed new fixtures/retrofits, costs, savings, and payback periods for each set of interior fixtures in the school.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	SAVINGS
Electric Demand Savings (kW)	6.4
Electric Usage Savings (kWh)	11,819
Electric Cost Savings (\$)	\$2,033

Maintenance Savings and Project Costs:

No maintenance cost savings were estimated for this measure.

Project Costs are based off RS Means Unit Cost Data and Vendor quotes.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$16,025
NJ Smart Start Equipment Incentive (\$):	\$1,945
Net Installation Cost (\$):	\$14,080
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$2,033
Total Yearly Savings (\$/Yr):	\$2,033
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.9
Simple Lifetime ROI	116.6%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$30,493
Internal Rate of Return (IRR)	12%
Net Present Value (NPV)	\$10,188.25

ECM #2: Exterior Lighting Upgrade

Description:

The exterior lighting at the school includes exterior building lighting only. The exterior of the building is currently lit by CFL A lamps and metal halide roof mounted floodlights.

Concord Engineering recommends upgrading all of the exterior lighting to an energy-efficient lighting system that includes LED floodlights and LED A-lamp bulb replacements for the CFL lamps.

This ECM would replace the existing exterior lamps and fixtures with equivalent LED lamps and fixtures.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in **Investment Grade Lighting Audit Appendix** that outlines the proposed retrofits, costs, savings, and payback periods.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	SAVINGS
Electric Demand Savings (kW)	0.4
Electric Usage Savings (kWh)	1,317
Electric Cost Savings (\$)	\$227

Maintenance Savings and Project Costs:

No maintenance cost savings were estimated for this measure.

Project Costs are based off RS Means Unit Cost Data and Vendor quotes.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$2,003
NJ Smart Start Equipment Incentive (\$):	\$210
Net Installation Cost (\$):	\$1,793
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$227
Total Yearly Savings (\$/Yr):	\$227
Estimated ECM Lifetime (Yr):	15
Simple Payback	7.9
Simple Lifetime ROI	90.0%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$3,405
Internal Rate of Return (IRR)	9%
Net Present Value (NPV)	\$917.41

ECM #3: Interior Lighting Controls Upgrade

Description:

Sometimes lights in a school are left on unnecessarily. In many cases the lights may be left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. In some instances lights might be left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are expected to be off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas. In addition, daylight control systems can be implemented using daylighting control systems that dim the electric lighting in response to interior daylight levels. The light output of the fluorescent lamps (T8) is varied by using electronic dimming ballasts. Photosensors, typically mounted in the ceiling, are used to measure the quantity of daylight in the space then determine the amount of dimming required to maintain adequate lighting levels in the total space.

The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the “Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways,” document posted for public use April 2005. The study has found that buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Occupancy Sensors for Lighting Control 20% - 28% energy savings.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors.

This ECM includes installation of ceiling or switch-mount sensors for the offices, conference rooms, and restrooms. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent.

The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls which can be implemented in this ECM and outlines the proposed lighting/daylighting controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls.

Energy Savings Calculations:

$$\text{Energy Savings} = (\% \text{ Savings} \times \text{Controlled Light Energy (kWh/Yr)})$$

$$\text{Savings} = \text{Energy Savings (kWh)} \times \text{Ave Elec Cost} \left(\frac{\$}{\text{kWh}} \right)$$

LIGHTING CONTROLS SAVINGS SUMMARY	
DESCRIPTION	SAVINGS
Electric Demand Savings (kW)	0.0
Electric Usage Savings (kWh)	1,493
Electric Cost Savings (\$)	\$257

Maintenance Savings and Project Costs:

No maintenance cost savings were estimated for this measure.

Project Costs are based off RS Means Unit Cost Data and Vendor quotes.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$3,000
NJ Smart Start Equipment Incentive (\$):	\$170
Net Installation Cost (\$):	\$2,830
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$257
Total Yearly Savings (\$/Yr):	\$257
Estimated ECM Lifetime (Yr):	15
Simple Payback	11.0
Simple Lifetime ROI	36.1%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$3,852
Internal Rate of Return (IRR)	4%
Net Present Value (NPV)	\$235.70

ECM #4: Window A/C Unit Replacement

Description:

The Carver Annex has many window air conditioning units located in offices. The units vary in size, manufacturer, and efficiency. Many of these units are old and less efficient than newer models.

This ECM includes replacement of select Window Air Conditioners that were designated for replacement based on the age and if the efficiency could be upgraded.

Existing Equipment Information					
Unit Tag	Unit Location	Unit Type	Number of Units	Cooling Capacity, Btu/hr	Manufacturer
Various Offices	Various Offices	Window AC	10	12,000	Various
Various Offices	Various Offices	Window AC	10	10,000	Various

This ECM includes replacement of twenty window air conditioning units of like size and type. The equipment list below is the basis of design and represents the efficiency and capacity minimum requirements for this ECM implementation:

Energy Savings Calculations:

Cooling Energy Savings:

Seasonal energy consumption of the air conditioners at the cooling mode is calculated with the equation below:

$$\text{Energy Savings, kWh} = \text{Cooling Capacity, } \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{\text{SEER}_{\text{Old}}} - \frac{1}{\text{SEER}_{\text{New}}} \right) \times \frac{\text{Operation Hours}}{1000 \frac{\text{W}}{\text{kWh}}}$$

$$\text{Demand Savings, kW} = \text{Cooling Capacity, } \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{\text{SEER}_{\text{Old}}} - \frac{1}{\text{SEER}_{\text{New}}} \right) \times \text{Coincidence Factor}$$

$$\text{Cooling Cost Savings} = \text{Energy Savings, kWh} \times \text{Cost of Electricity} \left(\frac{\$}{\text{kWh}} \right)$$

ENERGY SAVINGS CALCULATIONS - UNIT REPLACEMENT							
ECM INPUTS	COOLING CAPACITY, BTU/Hr	ANNUAL COOLING HOURS	EXISTING UNITS (S)EER	NEW UNITS (S)EER	# OF UNITS	ENERGY SAVINGS kWh	DEMAND SAVINGS kW
Various Offices	12,000	1,000	9.8 EER	11.3 EER	10	1,625	1.1
Various Offices	10,000	1,000	9.4 EER	11.3 EER	10	1,789	1.2
Total					20	3,414	2.3

Project Cost, Incentives and Maintenance Savings:

Project costs are based on vendor quote data for new units. Costs are based on the expectation the District will install the new window units and remove the existing ones.

There are not SmartStart incentives available for window air conditioning unit replacement.

There is no significant maintenance savings due to implementation of this ECM.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$8,750
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$8,750
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$591
Total Yearly Savings (\$/Yr):	\$591
Estimated ECM Lifetime (Yr):	15
Simple Payback	14.8
Simple Lifetime ROI	1.3%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$8,865
Internal Rate of Return (IRR)	0%
Net Present Value (NPV)	(\$1,694.68)

ECM #5: Install NEMA Premium® Efficiency Motors

Description:

The improved efficiency of the NEMA Premium® efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate continuously 24 hours a day, even small increases in efficiency can yield substantial energy and dollar savings.

The electric motors driving the supply fans in the air handlers are candidates for replacing with premium efficiency motors. These standard efficiency motors run considerable amount of time over a year.

This energy conservation measure replaces existing inefficient electric motors with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today.

IMPLEMENTATION SUMMARY					
EQMT ID	FUNCTION	MOTOR HP	HOURS OF OPERATION	EXISTING EFFICIENCY	NEMA PREMIUM EFFICIENCY
AC-1	Supply Fan	3	2,745	82.5%	89.5%
AC-2	Supply Fan	2	2,745	82.5%	86.5%

Energy Savings Calculations:

$$\text{Electric usage, kWh} = \frac{\text{HP} \times \text{LF} \times 0.746 \times \text{Hours of Operation}}{\text{Motor Efficiency}}$$

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor

Motor Efficiency = Motor Nameplate Efficiency

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric cost savings} = \text{Electric Usage Savings} \times \text{Electric Rate} \left(\frac{\$}{\text{kWh}} \right)$$

The calculations were carried out and the results are tabulated in the table below:

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	MOTOR HP	LOAD FACTOR	EXISTING EFFICIENCY	NEMA PREMIUM EFFICIENCY	POWER SAVINGS kW	ENERGY SAVINGS kWh	COST SAVINGS
AC-1	3	75%	82.5%	89.5%	0.16	439	\$76
AC-2	2	75%	82.5%	86.5%	0.06	173	\$30
TOTAL					0.2	612.2	105.9

Equipment Cost and Incentives

Cost estimate is based on RS Means Unit Cost Data.

There are no SmartStart Building® incentives for premium efficiency motors.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$1,920
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$1,920
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$106
Total Yearly Savings (\$/Yr):	\$106
Estimated ECM Lifetime (Yr):	15
Simple Payback	18.1
Simple Lifetime ROI	-17.3%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$1,589
Internal Rate of Return (IRR)	-2%
Net Present Value (NPV)	(\$655.53)

ECM #6: Variable Frequency Drive for Supply Fans

Description:

The heating and ventilating units in the Carver Annex are not fitted with variable speed drives and continually operate at a constant speed. These units could be retrofitted for variable air flow and would significantly benefit from the installation of a VFD and static pressure sensor. By installing VFD's on the units, the district will be able to better balance the system air flows as well as operate at a reduced horsepower based on the fan curve required power.

This ECM would install a variable frequency drive controller, inverter duty rated motor (assuming they get install through the premium efficiency motor ECM), and duct mounted static pressure sensor on the heating and ventilating units in the building. It is recommended if the district is planning on performing both the motor and this measure they look to replace these units in their entirety given they are past their useful life expectancy.

Energy Savings Calculations:

Energy Savings were calculated utilizing the New Jersey Board of Public Utilities Protocols to Measure Resource Savings dated July 2011.

$$\text{Energy Savings (kWh)} = 0.746 \times \text{HP} \times \text{HRS} \times (\text{ESF}/\eta_{\text{motor}})$$

$$\text{Demand Savings (kW)} = 0.746 \times \text{HP} \times (\text{DSF}/\eta_{\text{motor}})$$

$$\text{Energy Savings Factor (ESF)} = 0.475 \text{ (Airfoil/Backward Inclined Fans)}$$

$$\text{Demand Savings Factor (DSF)} = 0.448 \text{ (Airfoil/Backward Inclined Fans)}$$

VARIABLE SPEED DRIVE SAVINGS CALCULATIONS									
EQMT ID	QTY	FUNCTION	MOTOR HP	HOURS OF OPERATION	PROPOSED EFFICIENCY	INSTALL VFD	DEMAND SAVINGS (KW)	ENERGY SAVINGS (KWH)	ENERGY COST SAVINGS
AC-1	1	Supply Fan	3	2,745	89.5%	Yes	1.1	3,260	\$564
AC-2	1	Supply Fan	2	2,745	86.5%	Yes	0.8	2,249	\$389
TOTAL	2						1.9	5,509	\$953

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$15,665
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$15,665
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$953
Total Yearly Savings (\$/Yr):	\$953
Estimated ECM Lifetime (Yr):	15
Simple Payback	16.4
Simple Lifetime ROI	-8.7%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	\$14,295
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	(\$4,288.15)

REM #1: Solar System**Description:**

The Carver Annex's small roof area in combination with several large exhaust fans prevents any roof solar arrays from being installed. Additionally there is very little unshaded parking space suitable for the installation of parking lot solar array canopies.

VI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

- A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
- B. Maintain all weather stripping on windows and doors.
- C. Clean all light fixtures to maximize light output.
- D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
- E. Turn off computers when not in use. Ensure computers are not running in screen saver mode.
- F. Replace any old CRT Monitors with LED/LCD Type Monitors, which can draw as much as a quarter the power of an equivalent CRT monitor.
- G. Ensure outside air dampers are functioning properly and only open during occupied mode.
- H. Replace the failed air compressor and controls so that the unit ventilators, cabinet heaters, fin-tube radiators, etc. can be controlled.
- I. Fix areas of the roof that show severe ponding.
- J. Replace exterior windows and doors that are in very bad condition.
- K. Replace any rusted valves, piping, piping connections, etc.
- L. Chemically treat boiler water to prevent hardness, iron, and other corrosion on the heat exchanger, air handlers, and pumps.

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING

East Orange School District - Carver Annex

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Saving * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^N \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^N \frac{C_n}{(1+DR)^n}$
		(\$)	(\$)	(\$)	(\$)	(\$/Yr)	(\$/Yr)	(\$/Yr)		(\$)	(\$)	(%)	(Yr)	(\$)	(\$)
ECM #1	Interior Lighting Upgrade	\$9,360	\$6,665	\$1,945	\$14,080	\$2,033	\$0	\$2,033	15	\$30,493	\$0	116.6%	6.9	11.69%	\$10,188.25
ECM #2	Exterior Lighting Upgrade	\$1,175	\$828	\$210	\$1,793	\$227	\$0	\$227	15	\$3,398	\$0	89.6%	7.9	9.31%	\$911.73
ECM #3	Lighting Controls	\$1,950	\$1,050	\$170	\$2,830	\$257	\$0	\$257	15	\$3,852	\$0	36.1%	11.0	4.13%	\$235.70
ECM #4	Replace Window AC Units	\$7,000	\$1,750	\$0	\$8,750	\$591	\$0	\$591	15	\$8,865	\$0	1.3%	14.8	0.16%	(\$1,694.68)
ECM #5	Premium Efficiency Motors for Airhandlers	\$1,350	\$570	\$0	\$1,920	\$106	\$0	\$106	15	\$1,589	\$0	-17.3%	18.1	-2.28%	(\$655.53)
ECM #6	VFD Installation for Air Handlers	\$6,450	\$9,215	\$0	\$15,665	\$953	\$0	\$953	15	\$14,295	\$0	-8.7%	16.4	-1.12%	(\$4,288.15)

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period*.

APPENDIX B

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508



SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives from July 1, 2015 to June 30, 2016, further details including how to apply, forms, and calculated incentive values can be found the Clean Energy Website. (www.njcleanenergy.com)

Electric Chillers

Water-Cooled Chillers	Constant Speed: Base: \$8 - \$30 per ton Performance Add: \$2 - \$2.25 per ton Variable Speed: Base: \$12 - \$44 per ton Performance Add: \$2 - \$4.00 per ton
Air-Cooled Chillers	Constant Speed: Base: \$20 per ton Performance Add: \$3.50 per ton Variable Speed: Base: \$90 - \$92 per ton Performance Add: \$4.00 per ton

Energy Efficiency must comply with ASHRAE 90.1-2013

Gas Cooling

Gas Absorption Chillers (Indirect & Direct-Fired)	\$185 - \$450 per ton
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Desiccant Systems

\$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	\$73 - \$92 per ton
Air-to-Air Heat Pumps	\$73 - \$92 per ton
Water-Source Heat Pumps	\$81 per ton
Packaged Terminal AC & HP	\$65 per ton
Central DX AC Systems	\$40- \$72 per ton
Dual Enthalpy Economizer Controls	\$250
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	\$75 per thermostat
A/C Economizing Controls	≤ 5 tons \$85/unit; >5 tons \$170/unit

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Heating

Hot Water Gas Fired Boilers < 300 MBH	Non-Condensing: \$0.95 per MBH, Minimum \$400 per unit Condensing: \$2.00 per MBH, Minimum \$1000 per unit
Hot Water Gas Fired Boilers ≥ 300 - 1500 MBH	Non-Condensing: \$1.75 per MBH Condensing: \$2.20 per MBH Minimum \$1000 per unit
Hot Water Gas Fired Boilers >1500 - ≤ 2500 MBH	Non-Condensing: \$1.50 per MBH Condensing: \$2.20 per MBH
Hot Water Gas Fired Boilers >2500 - ≤ 4000 MBH	Non-Condensing: \$1.30 per MBH Condensing: \$2.00 per MBH
Steam, Except Natural Draft, Gas fired Boilers < 300 MBH	\$1.40 per MBH, Minimum \$400 per unit
Steam, Except Natural Draft, Gas fired Boilers ≥ 300 – 1500 MBH	\$1.20 per MBH
Steam, Except Natural Draft, Gas fired Boilers > 1500 – 2500 MBH	\$1.20 per MBH
Steam, Except Natural Draft, Gas fired Boilers > 2500 – 4000 MBH	\$1.00 per MBH
Steam, Natural Draft < 300 MBH	\$1.40 per MBH, Minimum \$300 per unit
Steam, Natural Draft ≥ 300 - 1500 MBH	\$1.00 per MBH
Steam, Natural Draft >1500 - ≤ 2500 MBH	\$0.90 per MBH
Steam, Natural Draft >2500 - ≤ 4000 MBH	\$0.70 per MBH
All Types Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	\$400 per unit, AFUE ≥ 95%
Boiler Economizing Controls	\$1,200 - \$2,700
Low Intensity Infrared Heating	\$300 - \$500 per unit

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons, 0.67 energy factor or better	\$50 per unit
Gas-Fired Water Heaters > 50 gallons	\$1.00 - \$2.00 per MBH
Gas-Fired Booster Water Heaters	\$17 - \$35 per MBH
Gas Fired Tankless Water Heaters	\$300 per unit

Ground Source Heat Pumps

Closed Loop	\$450 per ton, EER ≥ 16
	\$600 per ton, EER ≥ 18
	\$750 per ton, EER ≥ 20

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	\$65 - \$155 per hp
Chilled-Water Pumps ≥ 20 hp	\$60 per VFD rated hp
Rotary Screw Air Compressors ≥ 25 hp	\$5,250 to \$12,500 per drive
Centrifugal Fan Applications on Constant Volume HVAC Systems	\$80 per VFD rated hp, maximum \$6,000 per drive
Cooling Towers ≥ 10 hp	\$60 per VFD rated hp
Boiler Fans ≥ 5 HP	\$65 to \$155 per hp
Boiler Feed Water Pumps ≥ 5 HP	\$60 to \$155 per hp
Commercial Kitchen Hood up to 50 HP	Retrofit \$55 – \$300 per hp
	New Hood \$55 - \$250 per hp

Prescriptive Lighting

T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	\$10 per fixture
For retrofit of T-8 fixtures by permanent de-lamping & new reflectors (Electronic ballast replacement required)	\$5 per fixture
T-5 and T-8 High Bay Fixtures	\$25 - \$150 per fixture
HID ≥ 100 w Replace with new induction fixture. (must be 30% less watts/fixture than HID system)	\$70 per fixture
HID ≥ 100 w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	\$50 per fixture

Prescriptive Lighting - LED

LED Architectural Floor and Spot Luminaires	\$50 per fixture
LED Bollard Fixtures	\$50 per fixture
LED Display Case Lighting	\$30 per display case
LED Fuel Pump Canopy	\$100 per fixture
LED High-Bay and Low-Bay Fixtures for Commercial & Industrial Bldgs.	\$150 per fixture
LED High-Bay-Aisle Lighting	\$150 per fixture
LED Linear Ambient Luminaires (Indirect, Indirect/Direct, Direct/Indirect, Direct)	2' Fixtures - \$20/fixture 3' Fixtures - \$30/fixture 4' Fixtures - \$45/fixture 6' Fixtures - \$60/fixture 8' Fixtures - \$75/fixture
LED Linear Replacement Lamps (2' & 4' only)	\$5 per lamp
Luminaires for Ambient Lighting of Interior Commercial Spaces (1x4, 2x2, 2x4 New Fixtures and Retrofit Kits)	1x4 LED - \$15 per fixture 2x2 LED - \$15 per fixture 2x4 LED - \$25 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	\$100 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	\$50 per fixture
LED Outdoor Wall-Mounted Area Luminaries	\$100 per fixture
LED Parking Garage Luminaries	\$100 per fixture
LED Retrofit Kits for Large Outdoor Pole / Arm-Mounted Area and Roadway Luminaires	\$150 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	\$30 per 4 foot \$42 per 5 foot \$65 per 6 foot
LED Shelf-Mtd. Display & Task Lights	\$15 per linear foot

LED Stairwell and Passageway Luminaires	\$40 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	\$30 per fixture
LED Wall-Wash Lights	\$30 per fixture
EnergyStar Commercial Lighting Fixtures	\$5 to \$10 per fixture
EnergyStar Screw and Pine-Based Bulbs	\$5 to \$10 per lamp

Lighting Controls – Occupancy Sensors

Wall Mounted (Existing Facilities Only)	\$20 per control
Remote Mounted (Existing Facilities Only)	\$35 per control
Daylight Dimming Controls	\$45 per fixture controlled
Occupancy Based hi-low Dimming Control	\$35 per fixture controlled
Occupancy Sensor Remote Mounted High-Bay (Existing Facilities Only)	\$35 per control

Refrigeration Doors/Covers

Energy-Efficient Doors/Covers for Installation on Open Refrigerated Cases	\$100 per door
Aluminum Night Curtains for Installation on Open Refrigerated Cases	\$3.50 per linear foot

Refrigeration Controls

Door Heater Controls	\$50 per control
Electric Defrost Controls	\$50 per control
Evaporator Fan Controls	\$75 per control
Novelty Cooler Shutoff	\$50 per control

Refrigerator / Freezer Case Premium Efficiency Motors

Fraction ECM Motor < 1 HP	\$40 per ECM for replacement of existing shaded-pole motor
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Food Service Equipment

Combination Oven/Steamer (Electric)	\$1,000/oven
Combination Oven/Steamer (Natural Gas)	\$750/oven
Convection Oven (Electric)	\$350/oven
Convection Oven (Natural Gas)	\$500/oven
Rack Oven (Natural Gas)	\$1,000/single oven, \$2,000/double oven
Conveyor Oven (Natural Gas)	\$500/small deck \$750/large deck
Fryer (Electric)	\$200/vat
Fryer (Natural Gas)	\$749/vat
Large Vat Fryer (Electric)	\$200/vat
Large Vat Fryer (Natural Gas)	\$500/vat
Griddle (Electric)	\$300/griddle
Griddle (Natural Gas)	\$125/griddle
Steam Cooker (Electric)	\$1,250/steamer
Steam Cooker (Natural Gas)	\$2,000/steamer
Insulated Holding Cabinets	\$200 to \$300/unit
Glass Door Refrigerators	\$75 to \$150/unit
Solid Door Refrigerators	\$50 to \$200/unit
Glass Door Freezers	\$200 to \$1,000/unit
Solid Door Freezers	\$100 to \$600/unit
Ice Machines	\$50 to \$500/unit
Dishwashers	\$400 to \$1,500/unit

Other Equipment Incentives

Performance Lighting	\$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2007 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive
Custom Measures	\$0.16 KWh and \$1.60/Therm of 1st year savings, or a buy down to a 1 year payback on estimated savings. Minimum required savings of 75,000 KWh or 1,500 Therms and an IRR of at least 10%.

APPENDIX C



ENERGY STAR® Data Verification Checklist

48
ENERGY STAR®
Score¹

Carver Institute / Carver Annex

Registry Name: Carver Institute / Carver Annex
Primary Function: K-12 School
Gross Floor Area (ft²): 143,418
Built: 1935
For Year Ending: 04/30/2015
Date Generated: 08/13/2015

1. The ENERGY STAR score is a 1-to-100 assessment of a building's energy efficiency as compared with similar building nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address

Carver Institute / Carver Annex
135 Glenwood Avenue
East Orange, New Jersey 07017

Property ID: 4449879

Property Owner

East Orange School District
199 4th Avenue, 5th Floor
East Orange, NJ 07017
() -

Primary Contact

Racquel Ferguson
199 4th Avenue, 5th Floor
East Orange, NJ 07017
(973) 266-5742
racquel.ferguson@eastorange.k12.nj.us

1. Review of Whole Property Characteristics

Basic Property Information

1) Property Name: Carver Institute / Carver Annex

Is this the official name of the property?

☐ Yes ☐ No

If "No", please specify: _____

2) Primary Function: K-12 School

Is this an accurate description of the primary use of this property?

☐ Yes ☐ No

3) Location:

135 Glenwood Avenue
East Orange, New Jersey 07017

Is this correct and complete?

☐ Yes ☐ No

4) Gross Floor Area: 143,418 ft²

☐ Yes ☐ No

Does this represent the entire property? (i.e., no part of the building/property was excluded/subtracted from the total) If "no" please specify what space has been excluded.

5) Average Occupancy: 90

Is this occupancy accurate for the entire 12 month period being assessed?

☐ Yes ☐ No

6) Number of Buildings: 2

Does this number accurately represent all structures?

☐ Yes ☐ No

Notes:

Indoor Environmental Standards

1) Ventilation for Acceptable Indoor Air Quality

Does this property meet the ASHRAE Standard 62 for ventilation for acceptable indoor air quality?

☐ Yes ☐ No

2) Acceptable Thermal Environmental Conditions

Does this property meet the ASHRAE Standard 55 for thermal comfort?

☐ Yes ☐ No

3) Adequate Illumination

Does this property adhere to the IESNA Lighting Handbook for lighting quality?

☐ Yes ☐ No

Notes:

2. Review of Property Use Details

K-12 School: Building Use

1) Gross Floor Area: 143,418 ft²

Is this the total size, as measured between the principal exterior surfaces of the enclosing fixed walls of the building(s)? This includes all areas inside the building(s) such as: occupied tenant areas, common areas, meeting areas, break rooms, restrooms, elevator shafts, mechanical equipment areas, and storage rooms. Gross

☐ Yes ☐ No

Floor Area should not include interstitial plenum space between floors, which may house pipes and ventilation. Gross Floor Area is not the same as rentable, but rather includes all area inside the building(s). Leasable space would be a sub-set of Gross Floor Area. In the case where there is an atrium, you should count the Gross Floor Area at the base level only. Do not increase the size to accommodate open atrium space at higher levels. The Gross Floor Area should not include any exterior spaces such as balconies or exterior loading docks and driveways.

2) Gymnasium Floor Area: 0 ft²

Does the gymnasium floor area include all areas devoted to a gymnasium, including gymnasium/athletic areas, spectator areas, locker rooms, and other associated spaces?

☐ Yes ☐ No

3) High School: No

Is the property a high school (teaching grades 10, 11, and/or 12)? If the property teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.

☐ Yes ☐ No

4) Number of Workers on Main Shift: 107

Is this the number of workers present during the main shift? Note that this is not a total count of workers, but rather a count of workers who are present at the same time. For example, if there are two daily eight hour shifts of 100 workers each, the Number of Workers on Main Shift value is 100. Number of Workers on Main Shift may include employees of the property, sub-contractors who are onsite regularly, and volunteers who perform regular onsite tasks. Number of Workers should not include visitors to the buildings such as clients, customers, or patients.

☐ Yes ☐ No

5) Student Seating Capacity: 378

Is this the maximum number of students for which the school was designed? This should include the seating capacity of the entire school. If portable classrooms have been added to the school, include the capacity of these classrooms, as they expand the overall capacity of the school.

☐ Yes ☐ No

6) Months in Use: 10

Is this the total number of months that the property is open for standard activities?

☐ Yes ☐ No

7) Weekend Operation: No

Does the property include regular activities on the weekend beyond the scope of maintenance, cleaning, and security personnel? Weekend activity could include any time when the property is used for classes, performances, or other school or community activities. The Yes selection is appropriate for any property that is open on one or both days of the weekend during one or more seasons of the year.

☐ Yes ☐ No

8) Number of Computers: 384

Is this the total number of desktop computers, laptops, and data servers at the property? This number should not include tablet computers, such as iPads, or any other types of office equipment. The count should only reflect computers that are owned by the school. It should not include any computers that are brought onsite by students or staff.

☐ Yes ☐ No

9) Cooking Facilities: 100% Yes

Does the property have a commercial cooking area designed to provide and serve food to occupants and/or visitors? This may include restaurants and cafeterias. If the property contains only employee break room kitchens, this field should be marked No.

☐ Yes ☐ No

10) Number of Walk-in Refrigeration/Freezer Units: 0

Is this the total count of walk-in units at the property? Walk-in Refrigeration/Freezers are typically very large units located in storage areas or commercial kitchens that would not be accessible to all building occupants. This count should only include large storage units that a person actually walks into in order to store or retrieve perishable goods.

☐ Yes ☐ No

11) Percent That Can Be Heated: 100

Is this the total percentage of the property that can be heated by mechanical equipment?

☐ Yes ☐ No

12) Percent That Can Be Cooled: 10

Is this the total percentage of the property that can be cooled by mechanical equipment? This includes all types of cooling from central air to individual window units.

☐ Yes ☐ No

13) School District: East Orange

Is this the administrative school district in which the property is located?

☐ Yes ☐ No

Notes:

3. Review of Energy Consumption

Data Overview

Site Energy Use Summary

Fuel Oil (No. 2) (kBtu)	6,073,379.9 (65%)
Natural Gas (kBtu)	1,105,636.3 (12%)
Electric - Grid (kBtu)	2,191,388.3 (23%)
Total Energy (kBtu)	9,370,404.5

Energy Intensity

Site (kBtu/ft ²)	65.3
Source (kBtu/ft ²)	98.8

National Median Comparison

National Median Site EUI (kBtu/ft ²)	64.4
National Median Source EUI (kBtu/ft ²)	97.4
% Diff from National Median Source EUI	1.5%

Emissions (based on site energy use)

Greenhouse Gas Emissions (Metric Tons CO ₂ e)	802.8
--	-------

Power Generation Plant or Distribution Utility:

Public Service Electric & Gas Co

Note: All values are annualized to a 12-month period. Source Energy includes energy used in generation and transmission to enable an equitable assessment.

Summary of All Associated Meters

The following meters are associated with the property, meaning that they are added together to get the total energy use for the property. Please see additional tables in this checklist for the exact meter consumption values.

Meter Name	Fuel Type	Start Date	End Date	Associated With
Electric Grid Meter #3	Electric	11/07/2013	In Use	Carver Institute / Carver Annex

Meter Name	Fuel Type	Start Date	End Date	Associated With
Natural Gas #3	Natural Gas	11/07/2013	In Use	Carver Institute / Carver Annex
Natural Gas #2	Natural Gas	12/09/2013	In Use	Carver Institute / Carver Annex
Electric Grid Meter #2	Electric	12/09/2013	In Use	Carver Institute / Carver Annex
Electric Grid Meter #1	Electric	12/09/2013	In Use	Carver Institute / Carver Annex
Natural Gas #1	Natural Gas	12/09/2013	In Use	Carver Institute / Carver Annex
Fuel Oil (No. 2)	Fuel Oil No 2	02/19/2014	In Use	Carver Institute / Carver Annex

Total Energy Use ☐ Yes ☐ No

Do the meters shown above account for the total energy use of this property during the reporting period of this application?

Additional Fuels ☐ Yes ☐ No

Do the meters above include all fuel *types* at the property? That is, no additional fuels such as district steam, generator fuel oil have been excluded.

On-Site Solar and Wind Energy ☐ Yes ☐ No

Are all on-site solar and wind installations reported in this list (if present)? All on-site systems must be reported.

Notes:

Electric Meter: Electric Grid Meter #3 (kWh (thousand Watt-hours))

Associated With: Carver Institute / Carver Annex

Start Date	End Date	Usage	Green Power?
04/08/2014	06/10/2014	5,670	No
06/10/2014	09/09/2014	8,208	No
09/09/2014	10/08/2014	2,814	No

Start Date	End Date	Usage	Green Power?
10/08/2014	12/09/2014	6,000	No
12/09/2014	01/09/2015	2,640	No
01/09/2015	02/09/2015	3,030	No
02/09/2015	03/11/2015	3,078	No
03/11/2015	04/10/2015	3,060	No
04/10/2015	05/11/2015	2,922	No
		Total Consumption (kWh (thousand Watt-hours)):	37,422
		Total Consumption (kBtu (thousand Btu)):	127,683.9

Total Energy Consumption for this Meter

☐ Yes ☐ No

Do the fuel consumption totals shown above include consumption of all energy tracked through this meter that affect energy calculations for the reporting period of this application (i.e., do the entries match the utility bills received by the property)?

Notes:

Natural Gas Meter: Natural Gas #3 (therms)

Associated With: Carver Institute / Carver Annex

Start Date	End Date	Usage
04/08/2014	06/10/2014	43.24 ⚡ estimate
06/10/2014	07/10/2014	16.78 ⚡ estimate
07/10/2014	09/09/2014	18.88 ⚡ estimate
09/09/2014	10/08/2014	12.64
10/08/2014	12/09/2014	47.42
12/09/2014	01/09/2015	31.67
01/09/2015	02/09/2015	28.53
02/09/2015	03/11/2015	35.96
03/11/2015	04/10/2015	20.11
04/10/2015	05/11/2015	18
Total Consumption (therms):		273.23
Total Consumption (kBtu (thousand Btu)):		27,323

Total Energy Consumption for this Meter☐ Yes ☐ No

Do the fuel consumption totals shown above include consumption of all energy tracked through this meter that affect energy calculations for the reporting period of this application (i.e., do the entries match the utility bills received by the property)?

Notes:

Natural Gas Meter: Natural Gas #2 (therms)

Associated With: Carver Institute / Carver Annex

Start Date	End Date	Usage
04/08/2014	05/12/2014	277.6 ⚡ estimate
05/12/2014	06/10/2014	5.63 ⚡ estimate
06/10/2014	07/10/2014	0 ⚡ estimate
07/10/2014	08/08/2014	161.3 ⚡ estimate
08/08/2014	09/09/2014	16.81
09/09/2014	10/08/2014	269.69
10/08/2014	11/06/2014	287.88
11/06/2014	12/09/2014	983.96
12/09/2014	01/09/2015	1,162.12
01/09/2015	02/09/2015	1,499.21
02/09/2015	03/11/2015	1,417.1
03/11/2015	04/10/2015	948.46
04/10/2015	05/11/2015	279.46
Total Consumption (therms):		7,309.22
Total Consumption (kBtu (thousand Btu)):		730,922

Total Energy Consumption for this Meter☐ Yes ☐ No

Do the fuel consumption totals shown above include consumption of all energy tracked through this meter that affect energy calculations for the reporting period of this application (i.e., do the entries match the utility bills received by the property)?

Notes:

Electric Meter: Electric Grid Meter #2 (kWh (thousand Watt-hours))

Associated With: Carver Institute / Carver Annex

Start Date	End Date	Usage	Green Power?
04/09/2014	05/09/2014	49,440	No
05/09/2014	06/10/2014	37,200	No
06/10/2014	07/10/2014	33,120	No
07/10/2014	08/08/2014	23,760	No
08/08/2014	09/09/2014	28,560	No
09/09/2014	10/08/2014	37,200	No
10/08/2014	11/06/2014	41,760	No
11/06/2014	12/09/2014	78,960	No
12/10/2014	01/09/2015	42,017	No
01/10/2015	02/09/2015	45,546	No
02/10/2015	03/11/2015	46,250	No
03/11/2015	04/10/2015	41,345	No
04/10/2015	05/11/2015	45,535	No
		Total Consumption (kWh (thousand Watt-hours)):	550,693
		Total Consumption (kBtu (thousand Btu)):	1,878,964.5

Total Energy Consumption for this Meter

☐ Yes ☐ No

Do the fuel consumption totals shown above include consumption of all energy tracked through this meter that affect energy calculations for the reporting period of this application (i.e., do the entries match the utility bills received by the property)?

Notes:

Electric Meter: Electric Grid Meter #1 (kWh (thousand Watt-hours))

Associated With: Carver Institute / Carver Annex

Start Date	End Date	Usage	Green Power?
04/08/2014	05/12/2014	9,040	No
05/12/2014	06/10/2014	10,880	No
06/10/2014	07/10/2014	11,280	No
07/10/2014	08/08/2014	8,960	No
08/08/2014	09/09/2014	12,000	No
09/09/2014	10/08/2014	8,480	No
10/08/2014	11/06/2014	7,760	No
11/06/2014	12/09/2014	8,880	No
12/09/2014	01/09/2015	8,160	No
01/09/2015	02/09/2015	8,000	No
02/09/2015	03/11/2015	8,080	No
03/11/2015	04/10/2015	7,440	No
04/10/2015	05/11/2015	7,760	No
		Total Consumption (kWh (thousand Watt-hours)):	116,720
		Total Consumption (kBtu (thousand Btu)):	398,248.6

Total Energy Consumption for this Meter

☐ Yes ☐ No

Do the fuel consumption totals shown above include consumption of all energy tracked through this meter that affect energy calculations for the reporting period of this application (i.e., do the entries match the utility bills received by the property)?

Notes:

Natural Gas Meter: Natural Gas #1 (therms)

Associated With: Carver Institute / Carver Annex

Start Date	End Date	Usage
04/08/2014	05/12/2014	369.43 ⚡ estimate
05/12/2014	06/10/2014	223.34 ⚡ estimate
06/10/2014	07/10/2014	228.56 ⚡ estimate
07/10/2014	08/08/2014	430.49 ⚡ estimate

Start Date	End Date	Usage
08/08/2014	09/09/2014	251.06
09/09/2014	10/08/2014	269.69
10/08/2014	11/06/2014	286.83
11/06/2014	12/09/2014	331.85
12/09/2014	01/09/2015	313.49
01/09/2015	02/09/2015	342.32
02/09/2015	03/11/2015	355.33
03/11/2015	04/10/2015	357.79
04/10/2015	05/11/2015	388.49
Total Consumption (therms):		4,148.67
Total Consumption (kBtu (thousand Btu)):		414,867

Total Energy Consumption for this Meter

☐ Yes ☐ No

Do the fuel consumption totals shown above include consumption of all energy tracked through this meter that affect energy calculations for the reporting period of this application (i.e., do the entries match the utility bills received by the property)?

Notes:

Fuel Oil No 2 Meter: Fuel Oil (No. 2) (Gallons (US))

Associated With: Carver Institute / Carver Annex

Delivery Date	Quantity
10/22/2014	950
10/28/2014	583
10/28/2014	415
10/28/2014	887
11/05/2014	779
11/12/2014	1,038
11/17/2014	1,003
11/25/2014	1,279
12/02/2014	1,033
12/08/2014	1,290
12/10/2014	1,135
12/11/2014	452

Delivery Date	Quantity
12/16/2014	1,196
12/19/2014	645
12/23/2014	798
12/29/2014	786
01/03/2015	661
01/06/2015	691
01/12/2015	1,627
01/15/2015	1,451
01/15/2015	1,400
01/16/2015	1,418
01/21/2015	1,380
01/26/2015	1,381
01/30/2015	1,200
02/03/2015	1,164
02/03/2015	856
02/03/2015	1,395
02/07/2015	1,276
02/12/2015	1,506
02/17/2015	1,577
02/20/2015	1,199
02/20/2015	999
02/20/2015	856
02/24/2015	1,250
02/28/2015	1,007
03/03/2015	1,000
03/06/2015	1,001
03/11/2015	1,108
03/13/2015	1,027
03/17/2015	1,311
Total Consumption (Gallons (US)):	44,010
Total Consumption (kBtu (thousand Btu)):	6,073,380

Total Energy Consumption for this Meter ☐ Yes ☐ No

Do the fuel consumption totals shown above include consumption of all energy tracked through this meter that affect energy calculations for the reporting period of this application (i.e., do the entries match the utility bills received by the property)?

Notes:

4. Signature & Stamp of Verifying Licensed Professional

_____ (Name) visited this site on _____ (Date). Based on the conditions observed at the time of the visit to this property, I verify that the information contained within this application is accurate and in accordance with the Licensed Professional Guide.

Signature: _____ Date: _____

Licensed Professional

,
() - _____

NOTE: When applying for the ENERGY STAR, the signature of the Verifying Professional must match the stamp.



Professional Engineer Stamp
(if applicable)



ENERGY STAR[®] Statement of Energy Performance

48

ENERGY STAR[®]
Score¹

Carver Institute / Carver Annex

Primary Property Function: K-12 School
Gross Floor Area (ft²): 143,418
Built: 1935

For Year Ending: April 30, 2015
Date Generated: August 13, 2015

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address

Carver Institute / Carver Annex
135 Glenwood Avenue
East Orange, New Jersey 07017

Property Owner

East Orange School District
199 4th Avenue, 5th Floor
East Orange, NJ 07017
() -

Primary Contact

Racquel Ferguson
199 4th Avenue, 5th Floor
East Orange, NJ 07017
(973) 266-5742
racquel.ferguson@eastorange.k12.nj.us

Property ID: 4449879

Energy Consumption and Energy Use Intensity (EUI)

Site EUI

65.3 kBtu/ft²

Annual Energy by Fuel

Fuel Oil (No. 2) (kBtu)	6,073,380 (65%)
Natural Gas (kBtu)	1,105,636 (12%)
Electric - Grid (kBtu)	2,191,388 (23%)

National Median Comparison

National Median Site EUI (kBtu/ft ²)	64.4
National Median Source EUI (kBtu/ft ²)	97.4
% Diff from National Median Source EUI	2%

Source EUI

98.8 kBtu/ft²

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO ₂ e/year)	803
---	-----

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____ Date: _____

Licensed Professional

,
() -



Professional Engineer Stamp
(if applicable)

APPENDIX D

MAJOR EQUIPMENT LIST

Air Handlers

Concord Engineering

Air Handler Units

Tag	AC-1	AC-2
Unit Type	Central Air Handling Unit	Central Air Handling Unit
Qty	1	1
Location	Mechanical Room	Mechanical Room
Area Served	Various	Various
Manufacturer	Nesbitt	Nesbitt
Model No.	-	-
Serial No.	-	-
Cooling Type	Chilled Water	Chilled Water
Cooling Capacity (Tons)	-	-
Heating Type	Hot Water	Hot Water
Heating Input (MBH)	-	-
Supply Fan (HP)	3	2
Supply Fan VFD	☐ Yes ☒ No ☐ N/A	☐ Yes ☒ No ☐ N/A
Return Fan (HP)	N/A	N/A
Return Fan VFD	☐ Yes ☐ No ☒ N/A	☐ Yes ☐ No ☒ N/A
Approx Age	50	50
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments	No chilled water since chiller has failed.	No chilled water since chiller has failed.

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Terminal Units

Terminal Units

Tag	WAC
Unit Type	Window Unit
Qty	20
Location	Various Offices
Area Served	Various Offices
Manufacturer	Various
Model No.	"_"
Serial No.	"_"
Cooling Type	Packaged DX
Cooling Capacity (Tons)	10,000 to 12,000 BTUH
Cooling Efficiency	EER=9.4 to 9.8
Heating Type	N/A
Heating Input (MBH)	N/A
Heating Efficiency	N/A
Approx Age	15
ASHRAE Service Life	12
Remaining Life	0
Comments	

Note:

"N/A" = Not Applicable.

"_" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Boilers

Boilers

Tag	HX-1
Unit Type	Water-to-Water Heat Exchanger
Qty	1
Location	Basement Mech Room
Manufacturer	Davis Engineering Paracoil
Model No.	K2B-58D
Serial No.	"_"
Input Capacity (Btu/h)	"_"
Output Capacity (Btu/h)	"_"
Approx. Efficiency %	65% (Boilers)
Fuel Type	N/A
Approx Age	56
ASHRAE Service Life	25
Remaining Life	0
Comments	Steam From Carver Institute Boilers

Note:

"N/A" = Not Applicable.

"_" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Chiller

Chiller

Tag	AC-1
Unit Type	Water-Cooled
Qty	1
Location	Mechanical Room
Area Served	Entire Annex
Manufacturer	ACME (Carlyle Compressor Co.)
Model No.	06DM 8186 AC1200A
Serial No.	0387PD6765
Refrigerant	R-11
Cooling Capacity (Tons)	"-"
Cooling Efficiency (KW/Ton)	"-"
Volts / Phase / Hz	208/230 Volt 3-phase 60 Hz
Chilled Water GPM / ΔT	"-"
Condenser Water GPM / ΔT	"-"
Approx Age	56
ASHRAE Service Life	25
Remaining Life	0
Comments	Chiller Has Failed

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Pumps

Pumps

Tag	HWP-1	HWP-2
Unit Type	Pipe-mounted	Base-mounted
Qty	1	1
Location	Mechanical Room	Mechanical Room
System Served	Heating Hot Water	Heating Hot Water
Manufacturer	Bell & Gossett	Bell & Gossett
Model #	-	"_"
Serial #	-	"_"
Horse Power	$\frac{3}{4}$	$\frac{1}{2}$
Flow Rate (GPM)	-	-
Head Pressure (FTHD)	-	-
Motor Manufacturer	FHP Performa+	Bell & Gossett
Motor Frame	S56J	-
Electrical Power (V/P/HZ)	208-230 Volts	
Motor RPM	3450	-
Motor Efficiency %	75.5%	-
Pump VFD	☐ Yes ☒ No ☐ N/A	☐ Yes ☒ No ☐ N/A
Approx Age	4	5
ASHRAE Service Life	18	18
Remaining Life	14	13
Comments	Hot Water Circulator Pump to AHUs	Secondary HW Pump to Fin-Tube Radiators and Unit Heaters

Note:

"N/A" = Not Applicable.

"_" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Laundry Rm

Laundry Room

Tag		
Unit Type	Washer	Dryer
Qty	2	1
Location	Basement	Basement
Manufacturer	GE	GE
Model No.	DCVH640EJ0WW	WCVH6400J0WW
Serial No.	RR724867A & 24864A	LR200052T
Fuel	Electric	Electric
Volts/Phase/HZ	120/240 V 60 Hz	120/240 V 60 Hz
Comments		

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

APPENDIX E

CEG Project #:	1C15143
Facility Name:	Carver Annex
Address:	139 Glenwood Ave.
City, State, Zip	East Orange, NJ 07017

EXISTING FIXTURES									PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, \$	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, \$	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
1	café	2600	2-Lamp T8 1x4 Surface Mount Wrap Prismatic Lens	2	62	6	0.37	967	Re-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	2	30	6	0.18	468	0.19	499	\$86	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	94	\$16	\$360.00	\$270.00	\$630.00	\$60.00	6.64	\$200.00	\$50.00	\$250.00	YES	-
5	room2	2000	4-Lamp T8 2x4 Surface Mount Prismatic Lens	4	114	6	0.68	1,368	Re-Lamp / De-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	3	45	6	0.27	540	0.41	828	\$142	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	108	\$19	\$540.00	\$270.00	\$810.00	\$90.00	5.06	\$50.00	\$50.00	\$100.00	FALSE	5.38
1	room3	2000	2-Lamp T8 1x4 Surface Mount Wrap Prismatic Lens	2	62	4	0.25	496	Re-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	2	30	4	0.12	240	0.13	256	\$44	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	48	\$8	\$240.00	\$180.00	\$420.00	\$40.00	8.63	\$50.00	\$50.00	\$100.00	FALSE	12.11
1	room 4	2000	2-Lamp T8 1x4 Surface Mount Wrap Prismatic Lens	2	62	2	0.12	248	Re-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	2	30	2	0.06	120	0.06	128	\$22	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	24	\$4	\$120.00	\$90.00	\$210.00	\$20.00	8.63	\$50.00	\$50.00	\$100.00	FALSE	24.22
1	room 5	2000	2-Lamp T8 1x4 Surface Mount Wrap Prismatic Lens	2	62	10	0.62	1,240	Re-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	2	30	10	0.30	600	0.32	640	\$110	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	120	\$21	\$600.00	\$450.00	\$1,050.00	\$100.00	8.63	\$200.00	\$50.00	\$250.00	\$35.00	10.42
5	room 6	2000	4-Lamp T8 2x4 Surface Mount Prismatic Lens	4	114	2	0.23	456	Re-Lamp / De-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	3	45	2	0.09	180	0.14	276	\$47	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	36	\$6	\$180.00	\$90.00	\$270.00	\$30.00	5.06	\$50.00	\$50.00	\$100.00	FALSE	16.15
1	entrance	2200	2-Lamp T8 1x4 Surface Mount Wrap Prismatic Lens	2	62	2	0.12	273	Re-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	2	30	2	0.06	132	0.06	141	\$24	0	No New Controls	0	0.0%	0	\$0	\$120.00	\$90.00	\$210.00	\$20.00	7.85	\$0.00	\$0.00	\$0.00	FALSE	-
5	conference	2000	4-Lamp T8 2x4 Surface Mount Prismatic Lens	4	114	2	0.23	456	Re-Lamp / De-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	3	45	2	0.09	180	0.14	276	\$47	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	36	\$6	\$180.00	\$90.00	\$270.00	\$30.00	5.06	\$50.00	\$50.00	\$100.00	\$20.00	12.92
1	hall lower	2200	2-Lamp T8 1x4 Surface Mount Wrap Prismatic Lens	2	62	6	0.37	818	Re-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	2	30	6	0.18	396	0.19	422	\$73	0	No New Controls	0	0.0%	0	\$0	\$360.00	\$270.00	\$630.00	\$60.00	7.85	\$0.00	\$0.00	\$0.00	FALSE	-
5	room 7	2000	4-Lamp T8 2x4 Surface Mount Prismatic Lens	4	114	3	0.34	684	Re-Lamp / De-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	3	45	3	0.14	270	0.21	414	\$71	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	54	\$9	\$270.00	\$135.00	\$405.00	\$45.00	5.06	\$50.00	\$50.00	\$100.00	\$20.00	8.61
1	room 8	2000	2-Lamp T8 1x4 Surface Mount Wrap Prismatic Lens	2	62	2	0.12	248	Re-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	2	30	2	0.06	120	0.06	128	\$22	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	24	\$4	\$120.00	\$90.00	\$210.00	\$20.00	8.63	\$50.00	\$50.00	\$100.00	FALSE	24.22
3	Restroom	2200	1-Lamp CFL Surface Mount	1	23	2	0.05	101	Replace	Philips 18W LED A-Lamp	1	18	2	0.04	79	0.01	22	\$4	0	No New Controls	0	0.0%	0	\$0	\$30.00	\$55.00	\$85.00	\$20.00	17.18	\$0.00	\$0.00	\$0.00	FALSE	-
5	room 9	2000	4-Lamp T8 2x4 Surface Mount Prismatic Lens	4	114	3	0.34	684	Re-Lamp / De-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	3	45	3	0.14	270	0.21	414	\$71	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	54	\$9	\$270.00	\$135.00	\$405.00	\$45.00	5.06	\$50.00	\$50.00	\$100.00	FALSE	10.77
3	Restroom	2200	1-Lamp CFL Surface Mount	1	23	2	0.05	101	Replace	Philips 18W LED A-Lamp	1	18	2	0.04	79	0.01	22	\$4	0	No New Controls	0	0.0%	0	\$0	\$30.00	\$55.00	\$85.00	\$20.00	17.18	\$0.00	\$0.00	\$0.00	FALSE	-
5	multiple office	2000	4-Lamp T8 2x4 Surface Mount Prismatic Lens	4	114	18	2.05	4,104	Re-Lamp / De-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	3	45	18	0.81	1,620	1.24	2,484	\$427	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	324	\$56	\$1,620.00	\$810.00	\$2,430.00	\$270.00	5.06	\$200.00	\$50.00	\$250.00	FALSE	4.49
4	Restroom	2200	1-Lamp Incandescent	1	100	2	0.20	440	Replace	Philips 18W LED A-Lamp	1	18	2	0.04	79	0.16	361	\$62	0	No New Controls	0	0.0%	0	\$0	\$30.00	\$55.00	\$85.00	\$20.00	1.05	\$0.00	\$0.00	\$0.00	FALSE	-
5	Restroom	2200	4-Lamp T8 2x4 Surface Mount Prismatic Lens	4	114	1	0.11	251	Re-Lamp / De-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	3	45	1	0.05	99	0.07	152	\$26	0	No New Controls	0	0.0%	0	\$0	\$90.00	\$45.00	\$135.00	\$15.00	4.60	\$0.00	\$0.00	\$0.00	FALSE	-
5	basement	400	4-Lamp T8 2x4 Surface Mount Prismatic Lens	4	114	5	0.57	228	Re-Lamp / De-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	3	45	5	0.23	90	0.35	138	\$24	0	No New Controls	0	0.0%	0	\$0	\$450.00	\$225.00	\$675.00	\$75.00	25.28	\$0.00	\$0.00	\$0.00	FALSE	-
3	basement	400	1-Lamp CFL Surface Mount	1	23	10	0.23	92	Replace	Philips 18W LED A-Lamp	1	18	10	0.18	72	0.05	20	\$3	0	No New Controls	0	0.0%	0	\$0	\$150.00	\$275.00	\$425.00	\$100.00	94.48	\$0.00	\$0.00	\$0.00	FALSE	-
1	basement	400	2-Lamp T8 1x4 Surface Mount Wrap Prismatic Lens	2	62	16	0.99	397	Re-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	2	30	16	0.48	192	0.51	205	\$35	0	No New Controls	0	0.0%	0	\$0	\$960.00	\$720.00	\$1,680.00	\$160.00	43.15	\$0.00	\$0.00	\$0.00	FALSE	-
2	hall upper	2200	3-Lamp CFL Surface Mount Globe	3	99	7	0.69	1,525	Replace	Philips 18W LED A-Lamp	3	48	7	0.34	739	0.36	785	\$135	0	No New Controls	0	0.0%	0	\$0	\$315.00	\$192.50	\$507.50	\$70.00	3.24	\$0.00	\$0.00	\$0.00	FALSE	-
2	break room	2600	3-Lamp CFL Surface Mount Globe	3	99	3	0.30	772	Replace	Philips 18W LED A-Lamp	3	48	3	0.14	374	0.15	398	\$68	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	75	\$13	\$135.00	\$82.50	\$217.50	\$30.00	2.74	\$50.00	\$50.00	\$100.00	FALSE	7.76
2	stair 1	2400	3-Lamp CFL Surface Mount Globe	3	26	4	0.10	250	Replace	Philips 18W LED A-Lamp	3	48	4	0.19	461	(0.09)	(211)	(\$36)	0	No New Controls	0	0.0%	0	\$0	\$180.00	\$110.00	\$290.00	\$40.00	(6.88)	\$0.00	\$0.00	\$0.00	FALSE	-
1	room 1-11	2000	2-Lamp T8 1x4 Surface Mount Wrap Prismatic Lens	2	62	12	0.74	1,488	Re-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	2	30	12	0.36	720	0.38	768	\$132	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	144	\$25	\$720.00	\$540.00	\$1,260.00	\$120.00	8.63	\$200.00	\$50.00	\$250.00	\$35.00	8.68

Fixture Reference #	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST					
			Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, \$	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, \$	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
3	closet	400	1-Lamp CFL Surface Mount	1	23	1	0.02	9	Replace	Philips 18W LED A-Lamp	1	18	1	0.02	7	0.01	2	\$0	0	No New Controls	0	0.0%	0	\$0	\$15.00	\$27.50	\$42.50	\$10.00	94.48	\$0.00	\$0.00	\$0.00	FALSE	-
3	room 5,6	2000	1-Lamp CFL Surface Mount	1	23	1	0.02	46	Replace	Philips 18W LED A-Lamp	1	18	1	0.02	36	0.01	10	\$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	7	\$1	\$15.00	\$27.50	\$42.50	\$10.00	18.90	\$50.00	\$50.00	\$100.00	FALSE	80.75
3	ladies + mens bathroom	2200	1-Lamp CFL Surface Mount	1	23	9	0.21	455	Replace	Philips 18W LED A-Lamp	1	18	9	0.16	356	0.05	99	\$17	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	71	\$12	\$135.00	\$247.50	\$382.50	\$90.00	17.18	\$200.00	\$50.00	\$250.00	FALSE	20.39
3	supervisor	2000	1-Lamp CFL Surface Mount	1	23	2	0.05	92	Replace	Philips 18W LED A-Lamp	1	18	2	0.04	72	0.01	20	\$3	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	14	\$2	\$30.00	\$55.00	\$85.00	\$20.00	18.90	\$50.00	\$50.00	\$100.00	FALSE	40.37
4	room 12	2000	1-Lamp Incandescent	1	100	4	0.40	800	Replace	Philips 18W LED A-Lamp	1	18	4	0.07	144	0.33	656	\$113	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	29	\$5	\$60.00	\$110.00	\$170.00	\$40.00	1.15	\$50.00	\$50.00	\$100.00	\$20.00	16.15
1	Restroom	2200	2-Lamp T8 1x4 Surface Mount Wrap Prismatic Lens	2	62	2	0.12	273	Re-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	2	30	2	0.06	132	0.06	141	\$24	0	No New Controls	0	0.0%	0	\$0	\$120.00	\$90.00	\$210.00	\$20.00	7.85	\$0.00	\$0.00	\$0.00	FALSE	-
1	room 13-16	2000	2-Lamp T8 1x4 Surface Mount Wrap Prismatic Lens	2	62	4	0.25	496	Re-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	2	30	4	0.12	240	0.13	256	\$44	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	48	\$8	\$240.00	\$180.00	\$420.00	\$40.00	8.63	\$50.00	\$50.00	\$100.00	\$20.00	9.69
3	janitor	400	1-Lamp CFL Surface Mount	1	23	1	0.02	9	Replace	Philips 18W LED A-Lamp	1	18	1	0.02	7	0.01	2	\$0	0	No New Controls	0	0.0%	0	\$0	\$15.00	\$27.50	\$42.50	\$10.00	94.48	\$0.00	\$0.00	\$0.00	FALSE	-
3	mens room	2200	1-Lamp CFL Surface Mount	1	23	9	0.21	455	Replace	Philips 18W LED A-Lamp	1	18	9	0.16	356	0.05	99	\$17	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	71	\$12	\$135.00	\$247.50	\$382.50	\$90.00	17.18	\$200.00	\$50.00	\$250.00	FALSE	20.39
2	room17-19	2000	3-Lamp CFL Surface Mount Globe	3	99	3	0.30	594	Replace	Philips 18W LED A-Lamp	3	48	3	0.14	288	0.15	306	\$53	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	58	\$10	\$135.00	\$82.50	\$217.50	\$30.00	3.56	\$50.00	\$50.00	\$100.00	FALSE	10.09
5	conference	2000	4-Lamp T8 2x4 Surface Mount Prismatic Lens	4	114	3	0.34	684	Re-Lamp / De-Lamp	Seesmart LED Tube 15W 4K bypass ballast and provide new tombstones	3	45	3	0.14	270	0.21	414	\$71	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	54	\$9	\$270.00	\$135.00	\$405.00	\$45.00	5.06	\$50.00	\$50.00	\$100.00	\$20.00	8.61
2	hall 2	2200	3-Lamp CFL Surface Mount Globe	3	99	2	0.20	436	Replace	Philips 18W LED A-Lamp	3	48	2	0.10	211	0.10	224	\$39	0	No New Controls	0	0.0%	0	\$0	\$90.00	\$55.00	\$145.00	\$20.00	3.24	\$0.00	\$0.00	\$0.00	FALSE	-
3	stair 2	2400	1-Lamp CFL Surface Mount	1	23	2	0.05	110	Replace	Philips 18W LED A-Lamp	1	18	2	0.04	86	0.01	24	\$4	0	No New Controls	0	0.0%	0	\$0	\$30.00	\$55.00	\$85.00	\$20.00	15.75	\$0.00	\$0.00	\$0.00	FALSE	-
7	Exterior	3000	1-Lamp Metal Halide Roof Mount	1	295	2	0.59	1,770	Replace	RAB LED Floodlight 78W	1	78	2	0.16	468	0.43	1,302	\$224	0	No New Controls	0	0.0%	0	\$0	\$1,160.00	\$800.00	\$1,960.00	\$200.00	7.86	\$0.00	\$0.00	\$0.00	FALSE	-
8	Exterior	3000	1x1 CFL Canopy	1	23	1	0.02	69	Replace	Philips 18W LED A-Lamp	1	18	1	0.02	54	0.01	15	\$3	0	No New Controls	0	0.0%	0	\$0	\$15.00	\$27.50	\$42.50	\$10.00	12.60	\$0.00	\$0.00	\$0.00	FALSE	-
TOTAL						176	13	23,986					176	6	10,850	7	13,136	2,259			21	4	1,493	257	10,535	7,493	18,028	2,155	625	1,950	1,050	3,000	\$170.00	11.02