



**LOCAL GOVERNMENT
ENERGY AUDIT PROGRAM:
ENERGY AUDIT REPORT**

PREPARED FOR:

**MORRIS MUSEUM
6 NORMANDY HEIGHTS ROAD
MORRISTOWN, NJ 07690
ATTN: CONNIE READ, CFO**

PREPARED BY:

CONCORD ENGINEERING GROUP



**520 S. BURNT MILL ROAD
VOORHEES, NJ 08043
TELEPHONE: (856) 427-0200
FACSIMILE: (856) 427-6529
WWW.CONCORD-ENGINEERING.COM**

CEG CONTACT:

**KEVIN BLANKENBUEHLER, MBA
DIRECTOR OF ENERGY SERVICES
EMAIL: KBLANK@CONCORD-ENGINEERING.COM**

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I. EXECUTIVE SUMMARY

This report presents the findings of the energy audit conducted for:

Morris Museum
6 Normandy Heights Road
Morristown, New Jersey 07960

Contact Persons: Linda Moore, Executive Director
Connie Read, Chief Financial Officer

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program for the Morris Museum. The purpose of this analysis is to provide the owner insight into the energy savings potential that exists within the facility. Energy Efficiency changes and upgrades requires support from the building occupants, operations personnel, and the administrators of the building in order to maximize the savings and overall benefit. The efficiency improvement of these buildings provides a benefit for the environment and the residents of New Jersey.

The Energy Conservation Measures (ECMs) identified within the report represent the potential annual savings at the facility. It is recommended to consider all ECMs as part of the Museum's initiative to save energy, reduce emissions, and lower operating costs. The owner should review and be familiar with all measures presented in the report prior to making a decision on which projects to move forward with. This will enable the owner to effectively align report recommendations with those outlined in their mid/long range facility and financial plans. The owner should also review all conventional and unconventional funding, along with all NJCEP funding opportunities for these projects and determine which options fit their budget most positively in the short and long term. The combination of this information will enable the owner to put together a strategy that maximizes the received benefits of the selected projects.

The annual energy costs at this facility are as follows:

Electricity	\$ 102,114
Natural Gas	\$ 1,606
Fuel Oil #2	\$ 49,214
Total	\$ 152,934

The potential annual energy cost savings for each Energy Conservation Measure (ECM) and Renewable Energy Measure (REM) are shown below in Table 1. Be aware that all ECM's and REM's are not additive because of the interrelation of some of the measures. This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is $\pm 20\%$. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

**Table 1
Financial Summary Table**

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST^A	ANNUAL SAVINGS^B	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
ECM #1	Lighting Upgrade - Interior	\$100,305	\$12,677	7.9	89.6%
ECM #2	Lighting Upgrade - Exterior	\$33,495	\$11,928	2.8	434.2%
ECM #3	Boiler Fuel Conversion (B-1)	\$30,000	\$9,296	3.2	364.8%
ECM #4	Boiler Replacement (B-2)	\$56,200	\$3,448	16.3	22.7%
ECM #5	Boiler Replacement (B-5)	\$122,000	\$22,253	5.5	264.8%
ECM #6	VFD Fans	\$41,500	\$6,258	6.6	126.2%
ECM #7	Premium Efficiency Motors	\$6,500	\$680	9.6	88.3%
ECM #8	Energy Star Refrigerator	\$988	\$78	12.7	18.4%
ECM #9	Water Conservation	\$600	\$554	1.1	1285.0%
ECM #10	Chiller Replacement	\$230,500	\$3,465	66.5	-69.9%
ECM #11	BMS Controls Upgrades	\$195,000	\$4,902	39.8	-49.7%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST	ANNUAL SAVINGS	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
REM #1	100 kW Solar Array	\$509,832	\$32,933	15.5	61.5%

Notes: A. Cost takes into consideration applicable NJ Smart Start™ incentives.

B. Savings takes into consideration applicable maintenance savings.

The estimated demand and energy savings for each ECM is shown below in Table 2. The descriptions in this table correspond to the ECM's listed in Table 1.

**Table 2
Energy Savings Summary Table**

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION			
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)	FUEL OIL (GALLONS)
ECM #1	Lighting Upgrade - Interior	44.0	100,607	0	0
ECM #2	Lighting Upgrade - Exterior	23.7	94,668	0	0
ECM #3	Boiler Fuel Conversion (B-1)	0.0	0	-4,268	3,071
ECM #4	Boiler Replacement (B-2)	0.0	0	-1,291	1,068
ECM #5	Boiler Replacement (B-5)	0.0	0	-7,014	6,632
ECM #6	VFD Fans	14.8	49,669	0	0
ECM #7	Premium Efficiency Motors	2.0	5,393	0	0
ECM #8	Energy Star Refrigerator	0.0	621	0	0
ECM #9	Water Conservation	0.0	0	201	0
ECM #10	Chiller Replacement	9.1	27,502	0	0
ECM #11	BMS Controls Upgrades	0.0	18,909	53	539
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION			
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)	FUEL OIL (GALLONS)
REM #1	100 kW Solar Array	84.2	118,677	-	-

**Table 3
Emissions Summary Table**

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	GREENHOUSE GAS EMISSIONS REDUCTION		
		CO₂ EMISSIONS (LBS)	NO_x EMISSIONS (LBS)	SO₂ EMISSIONS (LBS)
ECM #1	Lighting Upgrade - Interior	152,923	282	654
ECM #2	Lighting Upgrade - Exterior	143,895	265	615
ECM #3	Boiler Fuel Conversion (B-1)	18,855	(39)	0
ECM #4	Boiler Replacement (B-2)	8,819	(12)	0
ECM #5	Boiler Replacement (B-5)	66,493	(65)	0
ECM #6	VFD Fans	75,496	139	323
ECM #7	Premium Efficiency Motors	8,197	15	35
ECM #8	Energy Star Refrigerator	944	2	4
ECM #9	Water Conservation	2,352	2	0
ECM #10	Chiller Replacement	41,803	77	179
ECM #11	BMS Controls Upgrades	41,435	53	123

Notes: A. Emissions Reduction based on NJCEP published factors for electric & gas.

**Table 4
Combined Project Summary Table**

FACILITY PROJECT SUMMARY TABLE					
ENERGY CONSERVATION MEASURES	ANNUAL ENERGY SAVINGS (\$)	PROJECT COST (\$)	SMART START INCENTIVES	CUSTOMER COST	SIMPLE PAYBACK
Lighting Upgrade - Interior	\$12,677	\$103,230	\$2,925	\$100,305	7.9
Lighting Upgrade - Exterior	\$11,928	\$36,295	\$2,800	\$33,495	2.8
Boiler Fuel Conversion (B-1)	\$9,296	\$30,000	\$0	\$30,000	3.2
Boiler Replacement (B-2)	\$3,448	\$57,000	\$800	\$56,200	16.3
Boiler Replacement (B-5)	\$22,253	\$124,000	\$2,000	\$122,000	5.5
VFD Fans	\$6,258	\$44,000	\$2,500	\$41,500	6.6
Premium Efficiency Motors	\$680	\$6,500	\$0	\$6,500	9.6
Energy Star Refrigerator	\$78	\$988	\$0	\$988	12.7
Water Conservation	\$554	\$600	\$0	\$600	1.1
Chiller Replacement	\$3,465	\$233,000	\$2,500	\$230,500	66.5
BMS Controls Upgrades	\$4,902	\$195,000	\$0	\$195,000	39.8
Total Project	\$75,539	\$830,613	\$13,525	\$817,088	10.8

The facility peak electrical demand and total project savings meet the qualifications for the Pay for Performance Program. If the owner were to pursue this program option they would receive an estimated \$45,254 in incentive dollars, see the Installation Funding Options Section for more detail.

Overall Assessment:

Overall, the Morris Museum is operating less efficient compared to the National Peer Group Median Source Energy Intensity of 85.1 kBtu/square-foot/year of the closest comparable building type “Public Assembly”. The museum rating less efficient than the PEER Group in part is due to the indoor environment requirements for storing its collection pieces, and the resultant additional energy needed to maintain these requirements year round. The Museum is also paying an average in cost of energy at \$2.27 per square-foot above typical average costs of \$2.00 per square-foot.

On the whole, Concord Engineering recommends the Museum review and be familiar with all measures presented in each facility report prior to making a decision on which projects to move forward with. This will enable the Museum to effectively align report recommendations with those outlined in their mid/long range facility plans and financial plans. The Museum should also review all conventional and unconventional funding options, along with all NJCEP funding opportunities for these projects and determine which options fit their budget most positively in the short and long term. The combination of this information will enable the Museum to put together an effective Energy Savings Improvement Strategy that maximizes the received benefits of the selected projects. The Installation and Funding Options Section further outlines what programs are potentially available to the owner for funding the project.

Other Considerations:*Renewable Energy Conservation Measures:*

Renewable Energy Measures (REMs) were also reviewed for implementation at the Morris Museum. There is potential to install solar on the roof and in the parking lot at the facility. In total the two areas could accommodate 104 kWDC of solar arrays. The potential for wind generation was also reviewed for the Museum; however based on historical wind speed data, make it not a viable option.

Energy Procurement Recommendations:

It is recommended that the Museum continue its third party purchasing approach for electric and natural gas. Furthermore they should investigate cooperative purchasing groups in the event future cost savings could be realized. Further recommendations are outlined in the Energy Procurement Section of this report that could assist the owner in finding additional savings through their utility bills.

Maintenance and Operational Recommendations:

In addition to the ECMs and REMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with onsite staff or maintenance contractors and in turn have the potential to

provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building.

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on windows and doors.
3. Clean all light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better Indoor Air Quality (IAQ).
5. Confirm that outside air economizers on the packaged rooftop units are functioning properly to take advantage of free cooling and avoid excess outside air during occupied periods.
6. Perform annual steam trap surveys to minimize energy waste caused by failed traps, and to maintain an inventory of system equipment.
7. Verify all HVAC control systems are utilizing setback and scheduling capabilities.
8. Shutdown all non-essential equipment during unoccupied periods.

II. INTRODUCTION

This comprehensive energy audit covers the 65,000 square-foot Morris Museum, and 2,450 square-foot Annex Building in Morristown, New Jersey.

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program. The energy audit is conducted to promote the mission of the office of Clean Energy, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

Electrical and natural gas utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft²/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, doors, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

This audit is consistent with an ASHRAE Level 2 Energy Audit. The cost and savings for each measure is $\pm 20\%$. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs. It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved.

The project / entity summary tables are based on the implementation of multiple measures. The analysis is reviewed and determined if the nature of the ECMs will cause a major conflict of the overall savings. When additive measures do not cause a major effect on the overall savings the ECMs are included. Where a major conflict is identified, the combined savings is evaluated appropriately to ensure the overall estimates are $\pm 20\%$.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated based on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment costs to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

ECM Calculation Equations:

$$\text{Simple Payback} = \left(\frac{\text{Net Cost}}{\text{Yearly Savings}} \right)$$

$$\text{Simple Lifetime Savings} = (\text{Yearly Savings} \times \text{ECM Lifetime})$$

$$\text{Simple Lifetime Return on Investment (ROI)} = \frac{(\text{Simple Lifetime Savings} - \text{Net Cost})}{\text{Net Cost}}$$

$$\text{Lifetime Maintenance Savings} = (\text{Yearly Maintenance Savings} \times \text{ECM Lifetime})$$

$$\text{Net Present Value} = \sum_{n=0}^N \left(\frac{\text{Cash Flow of Period}_n}{(1 + \text{DR})^n} \right)$$

$$\text{Internal Rate of Return (IRR)} \rightarrow \text{Net Present Value} = 0 = \sum_{n=0}^N \left(\frac{\text{Cash Flow of Period}_n}{(1 + \text{IRR})^n} \right)$$

Net Present Value calculations are based on Discount Rate (DR) of 3%.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

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.

The facility receives electric delivery and supply from Jersey Central Power & Light (JCP&L) under their GS3 (General Service Secondary 3-Phase) rate structure. The Museum has contracted with a Third Party Supplier, NextEra Energy Services, to provide electric commodity supply (generation) service. 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. 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. The facility received Natural Gas through Public Service Electric & Gas (PSE&G) under the General Service Gas - Heat Rate Service. The Museum has not contracted with a Third Party Supplier, to provide natural gas commodity service.

The oil usage profile shows the actual oil consumption for the facility. Oil is provided by Petro to the facility. The oil provider measures consumption in gallons. One Gallon of #2 oil is equivalent to 140,000 BTUs of energy.

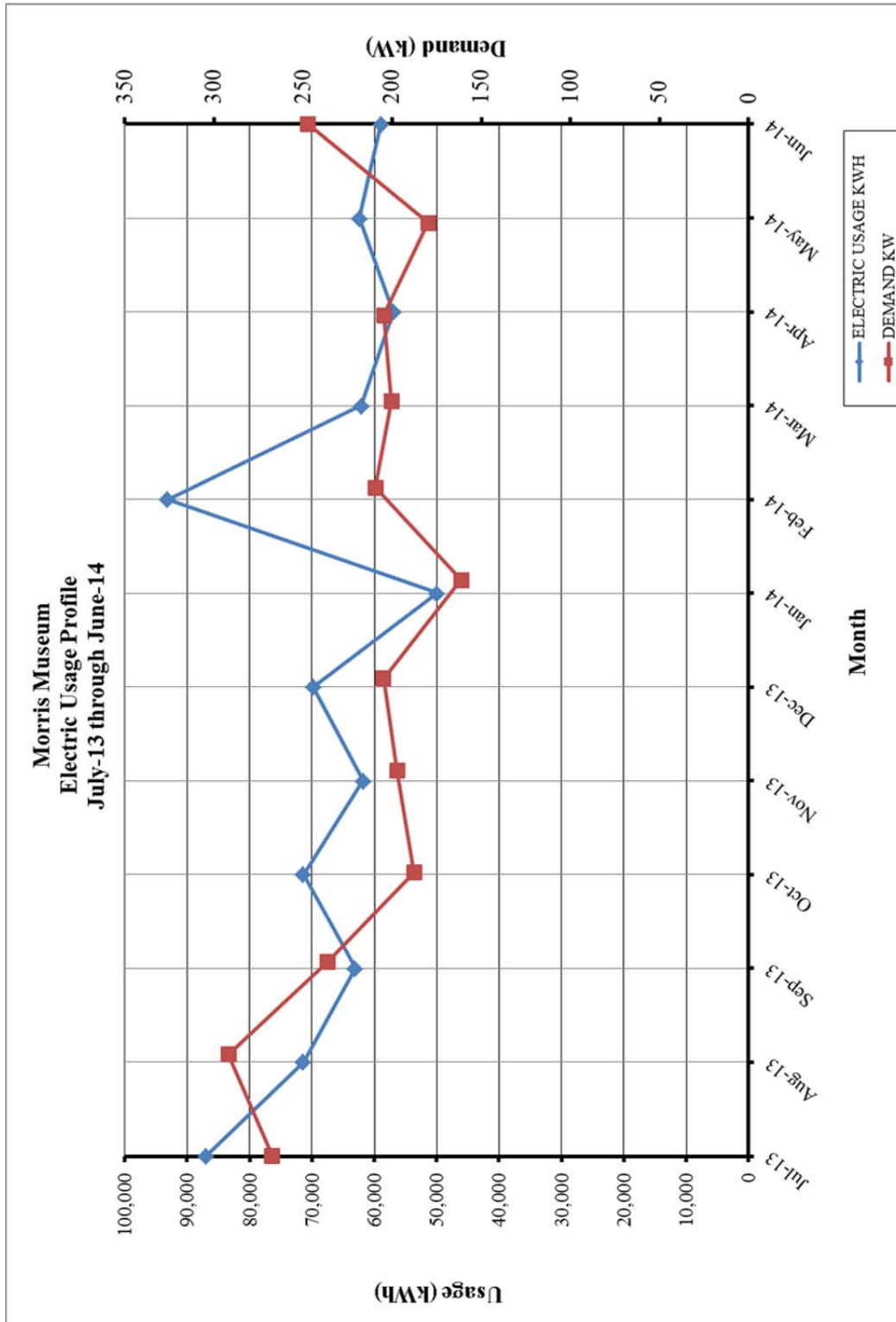
The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provided, the average cost for utilities at this facility is as follows:

<u>Description</u>	<u>Average</u>
Electricity	12.6¢ / kWh
Natural Gas	\$1.11 / therm
#2 Fuel Oil	\$4.57 / gallon

**Table 5
Electricity Billing Data**

ELECTRIC USAGE SUMMARY			
Utility Provider: Jersey Central Power & Light			
Rate: General Service Secondary(GS3)			
Meter No: G28742825			
Account No: 100 005 190 275			
Third Party Utility Provider: NextEra Energy Services			
TPS Meter / Acct No: -			
MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Jul-13	87,040	267.2	\$10,924
Aug-13	71,360	291.8	\$9,461
Sep-13	63,040	236.2	\$8,098
Oct-13	71,360	187.8	\$8,658
Nov-13	61,760	197.1	\$7,717
Dec-13	69,760	204.8	\$8,582
Jan-14	49,920	161.3	\$6,175
Feb-14	93,120	209.3	\$10,951
Mar-14	62,080	200.3	\$8,003
Apr-14	56,960	204.5	\$7,477
May-14	62,400	179.8	\$7,990
Jun-14	58,880	247.4	\$8,079
Totals	807,680	291.8 Max	\$102,114
AVERAGE DEMAND		215.6 KW average	
AVERAGE RATE		\$0.126 \$/kWh	

Figure 1
Electricity Usage Profile



**Table 6
Natural Gas Billing Data**

NATURAL GAS USAGE SUMMARY		
Utility Provider: PSE&G		
Rate: GSG (HTG)		
Meter No: 3341860		
Account No: 66 815 628 09		
Third Party Utility Provider: -		
TPS Meter No: -		
MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Jan-13	219.55	\$237.74
Feb-13	242.77	\$260.72
Mar-13	138.93	\$154.91
Apr-13	64.08	\$72.67
May-13	35.78	\$46.41
Jun-13	26.39	\$37.35
Jul-13	20.17	\$30.38
Aug-13	20.23	\$29.67
Sep-13	22.38	\$31.63
Oct-13	26.41	\$35.13
Nov-13	101.43	\$111.05
Dec-13	534.57	\$558.61
TOTALS	1,452.68	\$1,606.27
AVERAGE RATE:	\$1.11	\$/THERM

Figure 2
Natural Gas Usage Profile

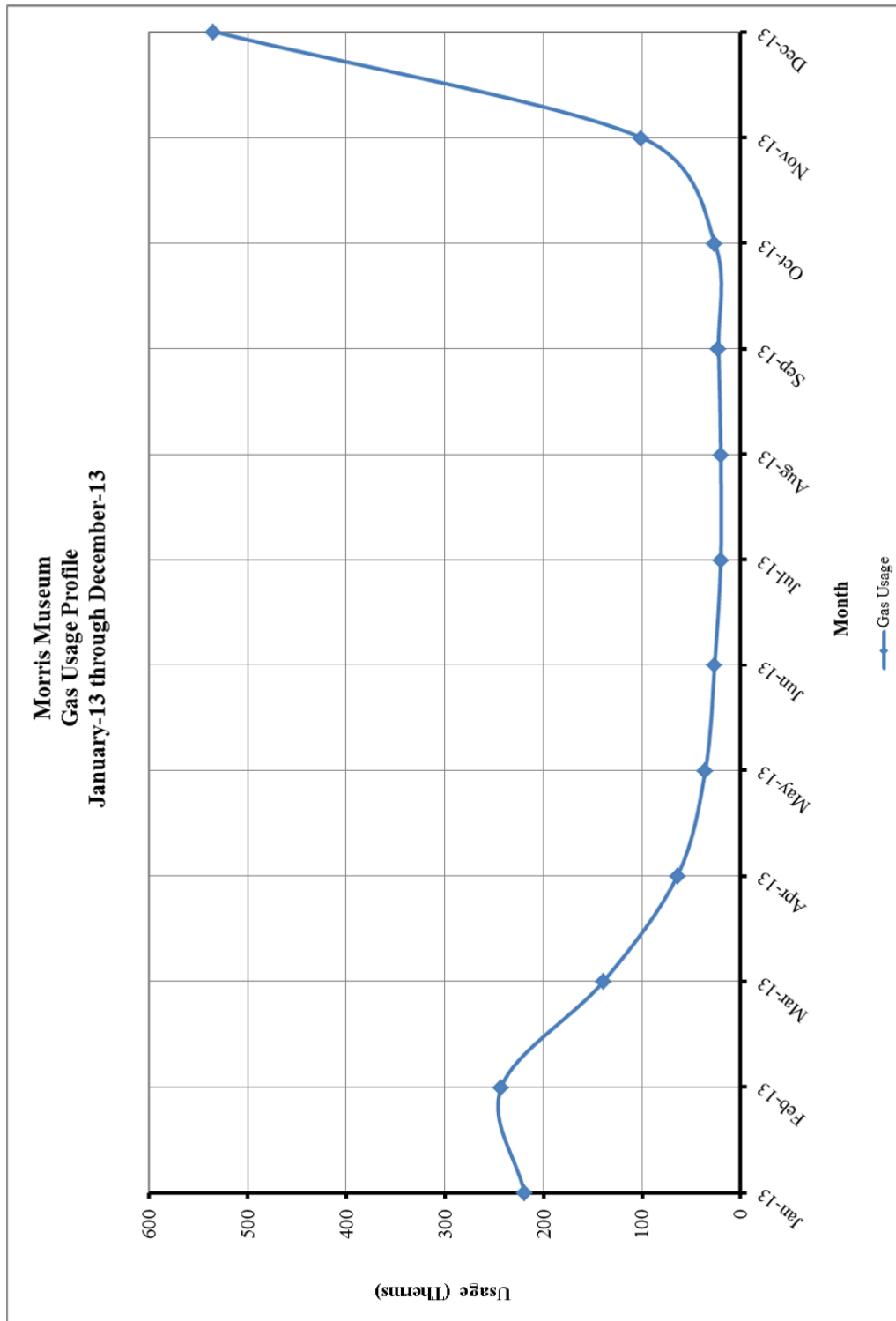
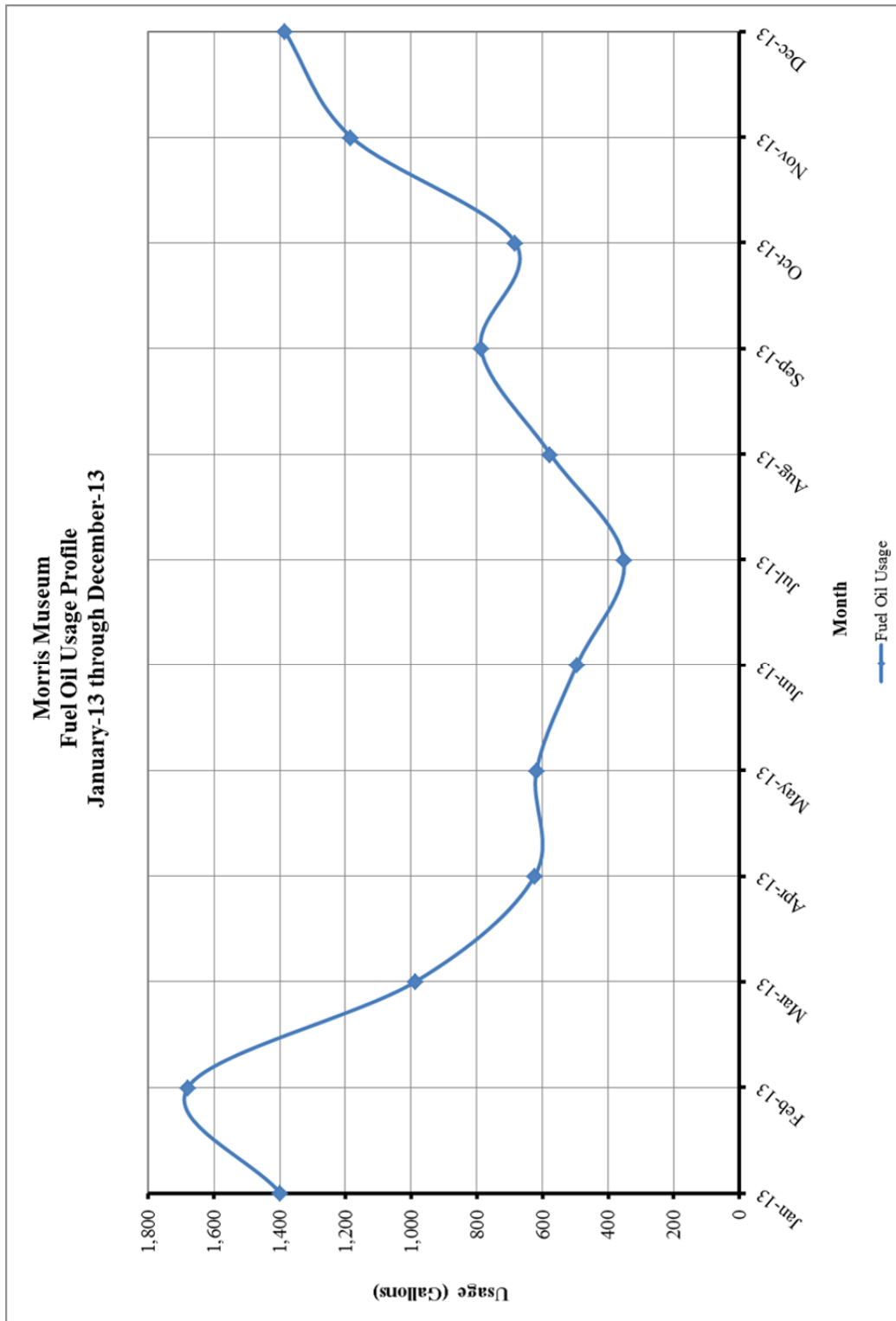


Table 7
#2 Fuel Oil Billing Data

FUEL OIL USAGE SUMMARY		
Utility Provider: Petro		
Account No: 10-902812, 10-902820, 10-902838		
Rate: Based on Time of Delivery Price		
MONTH OF USE	CONSUMPTION (GALLONS)	TOTAL BILL
Jan-13	1,398.40	\$6,625.46
Feb-13	1,679.40	\$8,174.57
Mar-13	986.30	\$4,516.26
Apr-13	623.90	\$2,780.48
May-13	618.40	\$2,691.79
Jun-13	495.50	\$2,217.13
Jul-13	352.70	\$1,107.30
Aug-13	576.90	\$2,488.06
Sep-13	787.70	\$3,367.59
Oct-13	683.00	\$3,029.14
Nov-13	1,183.10	\$5,368.40
Dec-13	1,385.60	\$6,848.30
TOTALS	10,770.90	\$49,214.48
AVERAGE RATE:	\$4.57	\$/Gallon

Figure 3
#2 Fuel Oil Usage Profile



B. 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. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

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 7
Facility Energy Use Index (EUI) Calculation**

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	807,680.0			2,757,420	3.140	8,658,297
NATURAL GAS		1,452.7		145,268	1.050	152,531
FUEL OIL			10,770.9	1,497,155	1.010	1,512,127
TOTAL				4,399,842		10,322,955
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	67,450		SQUARE FEET			
BUILDING SITE EUI	65.23		kBtu/SF/YR			
BUILDING SOURCE EUI	153.05		kBtu/SF/YR			

The chart above depicts the Site and Source Energy for the facility. The comparable building type in this instance is classified as “Public Assembly” with a median Site Energy of 36.7 kBtu/SF, and Source Energy of 85.1 kBtu/SF; from the U.S. National Peer Group Comparison Rating published by Department of Energy in July 2013. The Median Source Energy Use Intensity is the recommended benchmark metric for all buildings, and is the middle value of the national population meaning half the buildings use more energy, and half use less. The reference source for this data comes from the Department of Energy’s Commercial Building Energy Consumption Survey (CBECS).

C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov).

The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than \$10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions.

It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, Concord has created an ENERGY STAR account for the owner to access and monitor the facility's yearly energy usage as it compares to facilities of similar type. The login page for the account can be accessed at the following web address; the username and password are also listed below:

<https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login>

[REDACTED]

The above log in information allows the owner to continue to utilize Portfolio Manager to track and monitor their energy performance. For further direction on how to use the Portfolio Manager Tool such as adding properties, entering data, and viewing results, see training material and live training sessions provided by Energy Star that can be found on their website at www.energystar.gov/buildings/training

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 8
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Morris Museum	N/A	50

Refer to **Statement of Energy Performance Appendix** for the detailed energy summary for each facility.

V. FACILITY DESCRIPTION

The 65,000 square-foot Morris Museum at 6 Normandy Heights Road is a multi-story building in Morristown, New Jersey. The facility is comprised of multiple additions that stem from the original historic mansion built in 1913. The mansion is a three story converted home that now houses exhibit galleries, and office space. From the mansion sprawl three additions completed in 1970, 1990, and 2007. The additions included a main gallery, a theater, the Guinness Collection Gallery and theater lobby. The most recent additions were performed in such a way that the existing mansion was left intact and partially enclosed under the two-story gallery area. Separate from the museum on the grounds is a small 2,450 square-foot Annex Building utilized for theater prop/set fabrication and storage.

Occupancy Profile

The building is occupied Monday through Friday from approximately 7:30 AM until 7:00 PM, with the museum open to the public from 11:00 AM till 5:00 PM. On Saturdays and Sundays from 9:00 AM till 6:00 PM, with the museum open to the public from 11:00 AM; 12:00 PM till 5:00 PM. In addition to the standard hours of operation the Museum is open late on the second and third Thursday of each month until 8:00 PM. Events and performances also occur throughout the year, extending the occupied hours of the facility.

Building Envelope

The Mansion exterior walls are constructed of masonry brick, likely with limited insulation given the period of construction and plaster interior walls. The windows are single pane wood frame operable, and most windows are fitted with a storm window on the exterior side. The original roof is a wood frame A-Style roof with wood sheathing, and slate shingle roof.

The three additions exterior walls are constructed of masonry brick and concrete block construction with unknown insulation layer, and drywall interior or concrete block in some sections. The windows in these sections are double pane tinted glass with metal frames and are typically fixed. The roofs in these areas include A-Frame Style with sheathing and tar shingles; and secondly flat rubber built up roofing.

HVAC Systems

Mansion

The Mansion is conditioned by a combination of systems including steam heating, variable refrigerant flow heat pumps, and split systems. The main level of Mansion is mostly heated only with steam radiators along the perimeter, some of which no longer function. The first floor copy room has a wall mounted VRF heat pump. The second level of the Mansion which houses the administrative offices and a small model Train and American Indian Gallery is conditioned with VRF wall mounted fan coil units. These units provide cooling and heating, in addition to the steam radiation along the perimeter walls. The VRF units are manufactured by Daikin and range in capacity from 7,000 Btu/hr to 24,000 Btu/hr of cooling and heating. The units are connected to two (2) condensing unit located on the roof. The third floor has a single split system air

handler that is used to temper the space during peak cooling season, as it is utilized for storage purposes. The basement is conditioned via radiation heating only either from exposed steam pipe or radiators located in the room.

The Mansion has two boiler rooms located in the basement. The first has a single oil fired steam boiler manufactured by Burnham with an output capacity of 1,069 MBH and fuel input rating of 9.2 gallons per hour. This boiler is in good condition and is only halfway through its life expectancy. Condensate return is pumped back to the boiler via a single receiving station with two fractional horsepower motors. The second boiler room has two oil fired boilers, The Richardson boiler is no longer operational, and the remaining two provide heating and domestic hot water. The Weil McLain oil fired unit provides heating hot water with an output rating of 297.4 MBH and fuel input rating of 3.2 gallons per hour.

Gallery & Theater Additions

The remainder of the facility which includes the galleries and theater is conditioned by a variety of systems including direct expanding and chilled water cooling; and gas-fired and hot water heating.

The Theater basement, 2nd, and 3rd floor are conditioned by large split system air handlers with hot water heating coils. These units are manufactured by Lennox and are 1987 vintage. AH-8 is a 37 ton unit that feeds the Theater stage and seating area. AH-6 is an 18.5 ton unit that feeds the basement level offices and workshops, and the 2nd floor ticket booth, practice room, and stage lighting booth. Heating water for these two air handlers is provided by a single Peerless boiler located in the basement mechanical room. The oil fired boiler is rated for 2,252 MBH input and an output rating of 1,593 MBH. There are five hot water zone pumps with fractional horsepower motors with inline mounted pumps. *It was noted during the survey that some of the hot water supply lines were not insulated in the mechanical room.* The condensing units for AH-8 and 6 are located on grade next to the parking lot, two units service AH-8 and one serves AH-6.

The Guinness Collection Gallery Addition and Entrance Pavilion are served by three (3) McQuay rooftop units. The units have direct expansion cooling with capacity ratings of one at 35 tons, and two at 20 tons. The in unit heating is provided by natural gas fired furnaces with capacity ratings of one at 400 MBH, and two at 625 MBH. The rooftop units are connected to variable air volume terminal boxes with hot water reheat coils connected to the Peerless boiler.

The basement level that is utilized to store collection pieces, for offices, and has two classrooms which are conditioned by one large air handling unit (AH-7) manufactured by McQuay with a chilled water coil, and hot water reheat coils in the duct; and three smaller ceiling hung air handlers with chilled water and hot water coils. The large air handler feeds the offices and collection storage areas, while the small units feed the two classrooms, and the painting storage.

The Main Gallery is conditioned by a single McQuay air handler with chilled water and supply duct mounted humidification coil located in the basement mechanical room. The unit is rated for 70 tons of cooling and is fitted with a constant volume 20 horsepower fan.

The Hedley Gallery is conditioned by a single split system Liebert unit located in the room with a remote condensing unit on the roof.

The Mammals and Mineral Gallery is conditioned by a chilled water and hot water air handling unit located in the stairway ceiling. *It was noted during the survey that chilled water pipe insulation is torn causing condensation on the pipe and should be repaired. The hot water pipe is also uninsulated.*

Annex Building

The Annex Building is conditioned by a single oil fired furnace manufactured by Ultra and rated at 125 MBH. The unit rarely operates as the building is occupied a limited amount of time during the year.

Exhaust System

The air is exhausted from the toilet rooms via dedicated exhaust fans either located on the roof or inline fans above the ceiling.

HVAC System Controls

The McQuay Rooftop units (RTU-1, 2, 3), air handler (AH-7), and downstream terminal boxes for these systems are all controlled from a T.A.C. front end based platform. The system allows for local access only currently on a main frame computer located in the basement mechanical room. Equipment scheduling is currently being utilized and typical operating occupied is from 12:00 AM to 10:00 PM.

The remainder of the building is controlled through local building controls.

Domestic Hot Water

Mansion

The Mansion has two domestic hot water heaters located in the basement. The first unit is an A.O. Smith natural gas fired boiler with 38 gallons of storage and 40 MBH input capacity. The second unit is an American Standard gas fired boiler only with an input capacity of 90 MBH and no storage tank.

Gallery & Theater Additions

The lower level gallery addition has an electric hot water heater manufactured by RUUD rated at 18 kilowatts with 50 gallons of storage. This heater serves the restrooms and classroom sinks. Another electric hot water heater is located in the basement boiler room, and is an A.O. Smith 6 kilowatt electric unit with 50 gallons of storage. This unit is used to feed the workshop sinks and local restrooms.

The theater level lobby has an electric hot water heater located in the ceiling above the restrooms; details on this unit were not available.

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.

VI. 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.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade – Interior

Description:

The Museum interior has many different lighting systems throughout the building based on the exhibits being displayed. In addition to the general lighting in many areas that consists of fluorescent recessed and surface fixtures there is specialty track, recessed, and surface mounted lighting that consists of various lamp types. Lamp types include halogen, incandescent, compact fluorescent, and some LED.

This ECM includes replacing and retrofitting the interior lighting with new LED type lamps and fixtures. It is recommended the Museum staff review recommendations for conformance to exhibit requirements for light levels, color rendering index (CRI), and lamp color temperature.

Energy Savings Calculations:

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

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	SAVINGS
Electric Demand Savings (kW)	44.0
Electric Usage Savings (kWh)	100,607
Electric Cost Savings (\$)	\$12,677

No maintenance cost savings were estimated for this measure.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$103,230
NJ Smart Start Equipment Incentive (\$):	\$2,925
Net Installation Cost (\$):	\$100,305
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$12,677
Total Yearly Savings (\$/Yr):	\$12,677
Estimated ECM Lifetime (Yr):	15
Simple Payback	7.9
Simple Lifetime ROI	89.6%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$190,155
Internal Rate of Return (IRR)	9%
Net Present Value (NPV)	\$51,032.20

ECM #2: Lighting Upgrade – Exterior Lighting

Description:

The exterior lighting at the Museum is currently lit by metal halide and halogen fixtures. The exterior would be better served with more efficient LED lighting system. Concord Engineering recommends upgrading the lighting to an energy-efficient LED lighting system that includes LED lamps and fixtures for the existing exterior lighting.

This ECM would replace the existing exterior lamps and fixtures with equivalent LED lamps and fixtures. We recommend the owner consult with a professional engineer prior to installing recommendations to ensure required light levels are met.

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)	23.7
Electric Usage Savings (kWh)	94,668
Electric Cost Savings (\$)	\$11,928

No maintenance cost savings were estimated for this measure.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$36,295
NJ Smart Start Equipment Incentive (\$):	\$2,800
Net Installation Cost (\$):	\$33,495
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$11,928
Total Yearly Savings (\$/Yr):	\$11,928
Estimated ECM Lifetime (Yr):	15
Simple Payback	2.8
Simple Lifetime ROI	434.2%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$178,923
Internal Rate of Return (IRR)	35%
Net Present Value (NPV)	\$108,902.70

ECM #3: Boiler Fuel Conversion (B-1)

Description:

The Burnham boiler located in the Mansion Basement boiler room is fired utilizing #2 fuel oil. By converting this unit over to natural gas significant cost savings could be realized due to the difference in price per heating unit. The installation of a new gas fired burner unit with improved turn down control will also improve the boiler performance.

This ECM would install a new burner (recommend dual fuel) with improved turn down capability and be able to take natural gas as an input fuel. Natural gas is currently located in the boiler room for the water heater, and should be extended to the boiler.

Energy Savings Calculations:

Energy Savings were calculated utilizing the New Jersey Board of Public Utilities Protocols to Measure Resource Savings dated March, 2014. In order to calculate the consumption of each boiler the each boilers input capacity was taken as a percent of total input and then multiplied by winter fuel oil consumption to estimate each individual piece of equipment's usage. Boiler #5 is the only unit that operates year round, so summer fuel consumption was assigned to that unit.

FUEL OIL USAGE BREAKOUT	
Description	Gallons
B-1 Burnham	3,070.8
B-2 Weil McLain	1,068.1
B-5 Peerless (On Year round)	6,632.0

$$\text{Bldg Heat Required} = \text{Existing Fuel Use (Units)} \times \text{Heating Eff.(\%)} \times \text{Fuel Heat Value} \left(\frac{\text{BTU}}{\text{Units}} \right)$$

Bldg Heat Required (BTU)

$$\text{Proposed Heating Gas Usage} = \frac{\text{Bldg Heat Required (BTU)}}{\text{Heating Eff.(\%)} \times \text{Fuel Heat Value} \left(\frac{\text{BTU}}{\text{Therm}} \right)}$$

$$\text{Energy Cost} = \text{Heating Gas Usage(Therms)} \times \text{Ave Fuel Cost} \left(\frac{\$}{\text{Therm}} \right)$$

FUEL OIL TO NATURAL GAS CONVERSION CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	Oil Fired Steam	Gas Fired Steam	
Existing Fuel Oil Use (Gal)	3,071		
Boiler Efficiency (%)	80.0%	80.0%	0%
Nat Gas Heat Value (BTU/Therm)	139,000	100,000	
Equivalent Building Heat Usage (MMBTUs)	341	341	
Gas Cost (\$/Therm)	\$1.11	\$1.11	
Oil Cost (\$/Gallon)	\$4.57	\$4.57	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Natural Gas Usage (Therms)	0	4,268	-4,268
Fuel Oil Usage (Gallons)	3,071	0	3,071
Energy Cost (\$)	\$14,034	\$4,738	\$9,296
COMMENTS:	Boiler Efficiency Based on age of boiler and IBR Rating		

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$30,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$30,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$9,296
Total Yearly Savings (\$/Yr):	\$9,296
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.2
Simple Lifetime ROI	364.8%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$139,440
Internal Rate of Return (IRR)	30%
Net Present Value (NPV)	\$80,975.04

ECM #4: Boiler Replacement (B-2)

Description:

The Weil McLain boiler located in the Mansion Basement second boiler room is fired utilizing #2 fuel oil and produces heating hot water. By converting this unit over to natural gas significant cost savings could be realized due to the difference in price per heating unit. The installation of a high efficiency condensing boiler with improved turn down controls and hot water reset will also improve the system performance.

This ECM would install a Lochinvar natural gas fired Knight Boiler rated at 400 MBH or equal. The owner should consult a professional engineer prior to installation of this measure to verify load requirements and natural gas pipe sizing.

Energy Savings Calculations:

Energy Savings were calculated utilizing the New Jersey Board of Public Utilities Protocols to Measure Resource Savings dated March, 2014. In order to calculate the consumption of each boiler the each boilers input capacity was taken as a percent of total input and then multiplied by winter fuel oil consumption to estimate each individual piece of equipment’s usage. Boiler #5 is the only unit that operates year round, so summer fuel consumption was assigned to that unit.

FUEL OIL USAGE BREAKOUT	
Description	Gallons
B-1 Burnham	3,070.8
B-2 Weil McLain	1,068.1
B-5 Peerless (On Year round)	6,632.0

$$\text{Bldg Heat Required} = \text{Existing Fuel Use (Units)} \times \text{Heating Eff.(\%)} \times \text{Fuel Heat Value} \left(\frac{\text{BTU}}{\text{Units}} \right)$$

Bldg Heat Required (BTU)

$$\text{Proposed Heating Gas Usage} = \frac{\text{Bldg Heat Required (BTU)}}{\text{Heating Eff.(\%)} \times \text{Fuel Heat Value} \left(\frac{\text{BTU}}{\text{Therm}} \right)}$$

$$\text{Energy Cost} = \text{Heating Gas Usage(Therms)} \times \text{Ave Fuel Cost} \left(\frac{\$}{\text{Therm}} \right)$$

BOILER REPLACMEENT/CONVERSION CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	Oil Fired HW	Condensing NG	
Existing Fuel Oil Use (Gal)	1,068		
Boiler Efficiency (%)	80.0%	92.0%	12%
Nat Gas Heat Value (BTU/Therm)	139,000	100,000	
Equivalent Building Heat Usage (MMBTUs)	119	119	
Gas Cost (\$/Therm)	\$1.11	\$1.11	
Oil Cost (\$/Gallon)	\$4.57	\$4.57	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Natural Gas Usage (Therms)	0	1,291	-1,291
Fuel Oil Usage (Gallons)	1,068	0	1,068
Energy Cost (\$)	\$4,881	\$1,433	\$3,448
COMMENTS:	Boiler Efficiency Based on age of boiler and IBR Rating		

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$57,000
NJ Smart Start Equipment Incentive (\$):	\$800
Net Installation Cost (\$):	\$56,200
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$3,448
Total Yearly Savings (\$/Yr):	\$3,448
Estimated ECM Lifetime (Yr):	20
Simple Payback	16.3
Simple Lifetime ROI	22.7%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$68,960
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	(\$4,902.47)

ECM #5: Boiler Replacement (B-5)

Description:

The Peerless boiler located in the Theater Basement boiler room is fired utilizing #2 fuel oil and produces heating hot water year round for heating and reheat purposes. By converting this unit over to natural gas significant cost savings could be realized due to the difference in price per heating unit. The installation of a high efficiency condensing boiler with improved turn down controls and hot water reset will also improve the system performance.

This ECM would install a Lochinvar natural gas fired Crest Boiler rated at 2000 MBH or equal. The owner should consult a professional engineer prior to installation of this measure to verify load requirements and natural gas pipe sizing.

Energy Savings Calculations:

Energy Savings were calculated utilizing the New Jersey Board of Public Utilities Protocols to Measure Resource Savings dated March, 2014. In order to calculate the consumption of each boiler the each boilers input capacity was taken as a percent of total input and then multiplied by winter fuel oil consumption to estimate each individual piece of equipment's usage. Boiler #5 is the only unit that operates year round, so summer fuel consumption was assigned to that unit.

FUEL OIL USAGE BREAKOUT	
Description	Gallons
B-1 Burnham	3,070.8
B-2 Weil McLain	1,068.1
B-5 Peerless (On Year round)	6,632.0

$$\text{Bldg Heat Required} = \text{Existing Fuel Use (Units)} \times \text{Heating Eff.(\%)} \times \text{Fuel Heat Value} \left(\frac{\text{BTU}}{\text{Units}} \right)$$

Bldg Heat Required (BTU)

$$\text{Proposed Heating Gas Usage} = \frac{\text{Bldg Heat Required (BTU)}}{\text{Heating Eff.(\%)} \times \text{Fuel Heat Value} \left(\frac{\text{BTU}}{\text{Therm}} \right)}$$

$$\text{Energy Cost} = \text{Heating Gas Usage(Therms)} \times \text{Ave Fuel Cost} \left(\frac{\$}{\text{Therm}} \right)$$

BOILER REPLACMEENT/CONVERSION CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	Oil Fired HW	Condensing NG	
Existing Fuel Oil Use (Gal)	6,632		
Boiler Efficiency (%)	70.0%	92.0%	22%
Nat Gas Heat Value (BTU/Therm)	139,000	100,000	
Equivalent Building Heat Usage (MMBTUs)	645	645	
Gas Cost (\$/Therm)	\$1.11	\$1.11	
Oil Cost (\$/Gallon)	\$4.57	\$4.57	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Natural Gas Usage (Therms)	0	7,014	-7,014
Fuel Oil Usage (Gallons)	6,632	0	6,632
Energy Cost (\$)	\$30,308	\$7,786	\$22,523
COMMENTS:	Boiler Efficiency Based on age of boiler and IBR Rating		

Cost estimates are based on RS Means unit pricing and vendor quotes.

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$124,000
NJ Smart Start Equipment Incentive (\$):	\$2,000
Net Installation Cost (\$):	\$122,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$22,253
Total Yearly Savings (\$/Yr):	\$22,253
Estimated ECM Lifetime (Yr):	20
Simple Payback	5.5
Simple Lifetime ROI	264.8%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$445,060
Internal Rate of Return (IRR)	18%
Net Present Value (NPV)	\$209,068.45

ECM #6: Variable Frequency Drive Supply Fans

Description:

The air handlers' AH-1 and 7 are not fitted with variable speed drives and continually operate at a constant speed. These units would benefit from the installation of a VFD and static pressure sensors to more efficiently operate the system. By installing VFD's on these units the facility will be able to better balance the system air flows as well as operate at a reduced horsepower based on the modulation of existing volume control dampers.

This ECM would install a variable frequency drive controller, inverter duty rated motor, and duct mounted static pressure sensor. (Recommend functional testing on all dampers to ensure optimal system performance)

Energy Savings Calculations:

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

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

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

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

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

VARIABLE SPEED DRIVE SAVINGS CALCULATIONS										
EQMT ID	QTY	FUNCTION	MOTOR HP	HOURS OF OPERATION	EXISTING EFFICIENCY	PROPOSED EFFICIENCY	INSTALL VFD	DEMAND SAVINGS (KW)	ENERGY SAVINGS (KWH)	ENERGY COST SAVINGS
AH-1	1	Supply Fan	20	3,500	87.5%	93.0%	Yes	9.9	33,008	\$4,159
AH-7	1	Supply Fan	10	3,500	86.5%	91.7%	Yes	5.0	16,660	\$2,099
TOTAL	2							14.8	49,669	\$6,258

NJ Smart Start Incentives for Variable Frequency Drives are available based on motor horsepower.

$$\text{\$ Incentive} = \$155 \times \text{Horsepower (5 to < 10 HP)}$$

$$\text{\$ Incentive} = \$120 \times \text{Horsepower (10 to < 20 HP)}$$

$$\text{\$ Incentive} = \$65 \times \text{Horsepower (20 + HP)}$$

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$44,000
NJ Smart Start Equipment Incentive (\$):	\$2,500
Net Installation Cost (\$):	\$41,500
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$6,258
Total Yearly Savings (\$/Yr):	\$6,258
Estimated ECM Lifetime (Yr):	15
Simple Payback	6.6
Simple Lifetime ROI	126.2%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	\$93,874
Internal Rate of Return (IRR)	13%
Net Present Value (NPV)	\$33,210.59

ECM #7: 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 pumps and 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.

IMPLEMENTATION SUMMARY					
EQMT ID	FUNCTION	MOTOR HP	HOURS OF OPERATION	EXISTING EFFICIENCY	NEMA PREMIUM EFFICIENCY
AH-1	Supply Fan	20	3,391	87.5%	93.0%
AH-7	Supply Fan	10	3,391	86.5%	91.7%
CHWP-1	Chilled Water Pump	15	1,696	88.5%	93.0%
CHWP-2	Chilled Water Pump	15	1,696	88.5%	93.0%

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	QTY	MOTOR HP	LOAD FACTOR	EXISTING EFFICIENCY	PROPOSED EFFICIENCY	POWER SAVINGS kW	ENERGY SAVINGS kWh	COST SAVINGS
AH-1	1	20	75%	87.5%	93.0%	0.76	2,578	\$325
AH-7	1	10	75%	86.5%	91.7%	0.37	1,250	\$158
CHWP-1	1	15	75%	88.5%	93.0%	0.46	782	\$99
CHWP-2	1	15	75%	88.5%	93.0%	0.46	782	\$99
TOTAL						2.0	5,393	\$680

There are no longer incentives available through NJ Smart Start for premium efficiency motors. Cost Estimated are based on RS Means Unit Costs.

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$6,500
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$6,500
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$680
Total Yearly Savings (\$/Yr):	\$680
Estimated ECM Lifetime (Yr):	18
Simple Payback	9.6
Simple Lifetime ROI	88.3%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$12,240
Internal Rate of Return (IRR)	8%
Net Present Value (NPV)	\$2,852.39

ECM #8: Energy Star Refrigerator

Description:

The Museum has a few residential style refrigerators used by employees in the facility. Two of these units are over 10 years old and could be replaced by newer much more efficient units rated at today's Energy Star Standards.

The proposed replacement is a one-for-one unit of similar size and dimensions that has the most up-to-date Energy Star Rating. Frigidaire or equivalent should be considered as the replacement for this measure. (Note: There are currently no NJ OCE incentives for residential refrigerator replacement.)

Energy Savings Calculations:

ENERGY STAR REFRIGERATOR CALCULATION			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
Quantity	2	2	
Manufacturer	Whirlpool, GE	Frigidaire	
Type	Top Freezer, Compact	Top Freezer, Compact	
Model	-	-	
Size (Cu-Ft)	18, 4	18, 4	
Electric Rate (\$/kWh)	\$0.126	\$0.126	
ENERGY SAVINGS CALCULATIONS			
Electric Usage (kWh)	1,258	637	621
Energy Cost (\$)	\$159	\$80	\$78
COMMENTS:	Calculations based Energy Star Website http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator		

Cost estimates are based on vendor quotes.

Energy Savings Summary:

ECM #8 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$988
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$988
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$78
Total Yearly Savings (\$/Yr):	\$78
Estimated ECM Lifetime (Yr):	15
Simple Payback	12.7
Simple Lifetime ROI	18.4%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$1,170
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	(\$56.84)

ECM #9: Water Conservation

Description:

The Morris Museum utilizes standard plumbing fixtures. The typical water faucet consumption is rated at 1.5 gpm, 2 gpm, and 2.2 gpm. New fixtures are available that use less water than today's requirements and can add up to significant water reduction over a long period.

This ECM includes the retrofitting of the existing twenty (20) faucets within the facility with new low flow aerators. The estimated usage of the plumbing fixtures is based on the total population of the facility. The number of plumbing fixtures to be replaced is based on observations of the facility.

Energy Savings Calculations:

Faucets:

$$\text{Water Usage} = \text{Occupancy} \left(\frac{\text{Days}}{\text{yr}} \right) \times \frac{\text{Uses}}{\text{Day}} \times \text{Duration} \left(\frac{\text{min}}{\text{Use}} \right) \times \text{Fixture} \left(\frac{\text{Gal}}{\text{Min}} \right)$$

$$\text{Electric Cost (kWh)} = \text{Faucet Water Consumption (Gallons)} \times \frac{8.33 \text{ lbs}}{\text{Gal}} \times \Delta T(70F) \times \frac{\text{kWh}}{3,413 \text{ BTU}}$$

Electric Usage (kWh)

$$\begin{aligned} &= \text{Faucet Water Usage (Gal)} \times 8.33 \frac{\text{lbs}}{\text{Gal}} \times \text{Specific Heat (1)} \times \Delta T(70F) \\ &\times \frac{\text{kWh}}{3,413 \text{ Btu}} \times \frac{1}{\text{HWH Efficiency}} \end{aligned}$$

$$\text{Natural Gas Cost (Therms)} = \text{Faucet Water Consumption (Gallons)} \times \frac{8.33 \text{ lbs}}{\text{Gal}} \times \Delta T(70F) \times \frac{\text{Therm}}{100,000 \text{ BTU}}$$

Natural Gas Usage (Therms)

$$\begin{aligned} &= \text{Faucet Water Usage (Gal)} \times 8.33 \frac{\text{lbs}}{\text{Gal}} \times \text{Specific Heat (1)} \times \Delta T(70F) \\ &\times \frac{\text{Therms}}{100,000 \text{ Btu}} \times \frac{1}{\text{HWH Efficiency}} \end{aligned}$$

LOW FLOW WATER SAVING DEVICES			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
Quantity of Sinks	20	20	
Flow Rate (GPM)	1.9	0.5	1.4
Device Usage (min per day)	10	10	
Facility Operation (days / year)	200	200	
Heat Content of Water (Btu/gal/°F)	8.33	8.33	
Temperature Rise (°F)	70.0	70.0	
Efficiency of Heating System (%)	80%	80%	
Conversion Factor for Electric	3413	3413	
Conversion Factor for Gas	100000	100000	
Electric Rate (\$/kWh)	\$0.126	\$0.126	
Natural Gas Rate (\$/therm)	\$1.110	\$1.110	
Water Rate (\$/1000gal)	\$6.000	\$6.000	
ENERGY SAVINGS CALCULATIONS			
Electric Usage (kWh)	0	0	0
Natural Gas Usage (Therm)	274	73	201
Water Usage (gallons)	75,200	20,000	55,200
Energy Cost (\$)	\$755	\$201	\$554
COMMENTS:	Heating Savings based on 50% Hot Cold Mix. Weighted average flow rate based on surveyed sink ratings.		

The cost for installation and materials is based on 20 faucet aerators. There are no Smart Start rebates for installation of low flow plumbing fixtures.

Energy Savings Summary:

ECM #9 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$600
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$600
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$554
Total Yearly Savings (\$/Yr):	\$554
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.1
Simple Lifetime ROI	1285.0%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$8,310
Internal Rate of Return (IRR)	92%
Net Present Value (NPV)	\$6,013.62

ECM #11: Chiller Replacement

Description:

The Museum has an old 125 ton McQuay air-cooled chiller that is approaching the end of its useful life. By replacing this chiller with a new more efficient air-cooled machine, significant energy savings could be realized.

This ECM would install a new high efficiency air-cooled chiller manufactured by Trane model CGAM or equivalent with a full load efficiency rating of 10.3 EER and part load rating of 16.6 IPLV.

Energy Savings Calculations:

$$\text{Electric Usage} = \text{Capacity (tons)} \times \frac{12,000 \text{ Btu}}{1000 \text{ W}} \times \frac{1}{\text{EER}} \times \text{Operating Hours}$$

$$\text{Demand Savings} = \text{Capacity (tons)} \times \left(\frac{1}{\text{EER}_{\text{Old}}} - \frac{1}{\text{EER}_{\text{New}}} \right) \times 67\% \text{ Capacity Factor}$$

$$\text{Energy Cost} = \text{Electric Usage (kWh)} \times \text{Rate} \left(\frac{\$}{\text{kWh}} \right)$$

CHILLER CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	Existing Air Cooled Chiller	High Efficiency Chiller	
Operating Capacity (Tons)	125.0	125.0	
Chiller Efficiency (EER)	9.4	10.3	
Full Load Cooling Hrs (Est.)	800	800	
Cooling Energy (kWh)	127,380	116,505	
Chiller Operating Hours (Year Round)	2,000	2,000	
Chiller Part Load Hours Est.	1,200	1,200	
Chiller IPLV (EER)	12.0	16.6	
Chiller Part Load %	40.0%	40.0%	
Part Load Cooling Energy (kWh)	60,000	43,373	
Elec Cost (\$/kWh)	0.126	0.126	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Demand (KW)	106.7	97.6	9.1
Electric Energy (kWh)	187,380	159,878	27,502
Electric Energy Cost (\$)	\$23,610	\$20,145	\$3,465
COMMENTS:			

Energy Savings Summary:

ECM #10 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$233,000
NJ Smart Start Equipment Incentive (\$):	\$2,500
Net Installation Cost (\$):	\$230,500
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$3,465
Total Yearly Savings (\$/Yr):	\$3,465
Estimated ECM Lifetime (Yr):	20
Simple Payback	66.5
Simple Lifetime ROI	-69.9%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$69,300
Internal Rate of Return (IRR)	-9%
Net Present Value (NPV)	(\$178,949.55)

ECM #11: Digital Energy Management System (DDC EMS)

Description:

The Morris Museum has limited central control capability with only part of the systems in the recent addition being on a TAC front end building management system. The remaining systems are controlled through individual thermostats or control panels at the unit. The installation of a Central Management System that would integrate the TAC system, remaining air handlers, VRV Units, humidification coils, terminal boxes, boilers, pumps, and chillers could yield significant savings through setback and scheduling capability, and improved maintenance response time to outages and breakdowns.

This ECM includes installation of a Building Automation system to include control of the HVAC equipment in the facility. The system will include new interface controllers and control panels, a front end computer and main controller. With the communication between the control devices and the front end computer interface, the facility manager will be able to take advantage of scheduling for occupied and unoccupied periods based on the actual occupancy of each space in the facility. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours. Also additional system control will allow for greater space conditioning to accommodate museum collections with environmental constraints.

The Central DDC system installation has the potential to provide significant savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. 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 commercial 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 referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 5% of the electricity and 5% for the gas utility in this building.

The basis for the DDC system expansion is the Andover Energy Management System or similar.

Energy Savings Calculations:

Energy savings for each utility is calculated with the equation below.

Energy Savings (Utility) = Current Energy Consumption × Estimated Savings, %

Following table summarizes energy savings for this facility via implementation of an Energy Management System.

DDC ENERGY MANAGEMENT SYSTEM CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	Existing Controls w/ Local Thermostats	DDC Controls	
Existing Fuel Oil Usage (Gallons)	10,771	-	
Existing Nat Gas Usage (Therms)	1,056	-	
Existing Electricity Usage for HVAC (kWh)	378,178	-	
Energy Savings, Fuel Units	-	5%	
Energy Savings, Electricity	-	5%	
Oil Cost (\$/Gallon)	\$4.57	\$4.57	
Gas Cost (\$/Therm)	\$1.11	\$1.11	
Electricity Cost (\$/kWh)	\$0.126	\$0.126	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Fuel Oil Usage (Gallons)	10,771	10,232	539
Natural Gas Usage (Therms)	1,056	1,003	53
Electricity Usage (kWh)	378,178	359,269	18,909
Energy Cost (\$)	\$98,046	\$93,143	\$4,902
COMMENTS:			

Energy Savings Summary:

ECM #11 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$195,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$195,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$4,902
Total Yearly Savings (\$/Yr):	\$4,902
Estimated ECM Lifetime (Yr):	20
Simple Payback	39.8
Simple Lifetime ROI	-49.7%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$98,040
Internal Rate of Return (IRR)	-6%
Net Present Value (NPV)	(\$122,070.62)

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy.

Solar Generation

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which are mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). Parking lots can also be utilized for the installation of a solar array. A truss system can be installed that is high enough to park vehicles under the array and no parking lot area is lost.

The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit used in our financial calculations is \$152 per MWh. This equates to \$0.152 per kWh generated.

CEG has reviewed the existing roof, ground, and parking lot area potential of the facilities being audited for the purposes of determining a potential for a photovoltaic system. The facility was evaluated for the most economical and feasible areas for the installation of solar arrays. It should be noted a structural analysis was not performed on the areas where roof systems were recommended. A depiction of the areas utilized at each facility is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. The analysis shows available area for an approximately 104 kWDC solar array that will produce approximately 118,677 kWh annually, reducing the overall utility bill for the owner by approximately 14.7% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. This analysis illustrates the payback of the system over a 15 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

The proposed photovoltaic array layout is designed based on the specifications for the Sharp Model ND-240QCJ panel. This panel has a “DC” rated full load output of 240 watts, and has a total panel conversion efficiency of 14.4%. Although panels rated at higher wattages are available through Sharp and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity was sized based on available roof space, ground area, or parking canopy style system area available at each existing facility. Estimated solar array generation is calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

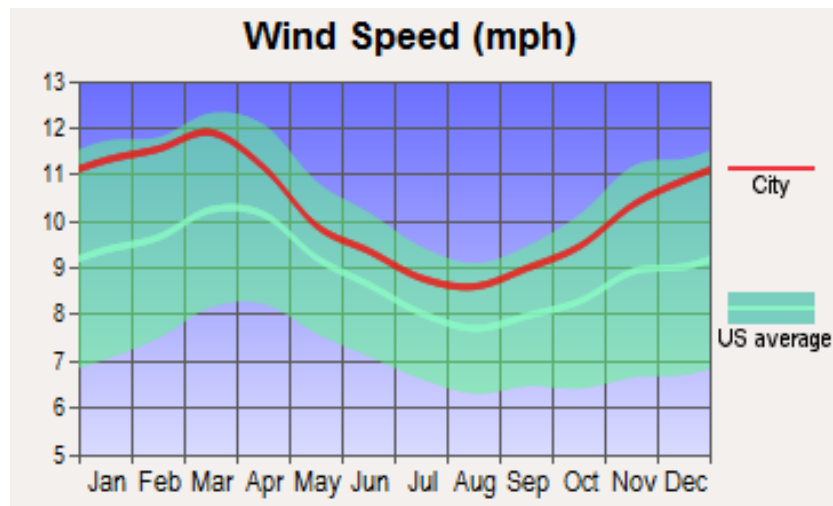
The proposed solar array for each facility is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today’s energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

Concord Engineering recommends the owner review all options available for installation of solar PV systems at their facility including a Power Purchase Agreement (PPA). This option utilizes providers who will own, operate, and maintain the system for a period of 15 years. During this time the PPA Provider would sell all of the electric generated by Solar Array to the owner at a reduced rate compared to their existing electric rate. It should be noted that current SREC pricing has significantly impacted the PPA market for public entities in addition to the end of the 30% grant in lieu of the investment tax credit. These recent market changes have made it more difficult for public entities to secure low cost power purchase price options.

Wind Generation

Concord conducted a review of the applicability of wind energy for the Museum. Wind energy production is another option available as a clean renewable energy generating source. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric generated. Concord investigated the potential for smaller building mountable wind turbines, and horizontal turbines to maximize the available free space. In order to be economically viable a site requires a minimum average wind speed of 6 meters per second (13.5 mph). Based on the obtained wind data shown in **Figure 4** for Morristown, NJ the annual average wind speed is 10.2 mph with a peak of 12 mph, making this area unattractive for wind development. Therefore, wind energy is not a viable option to implement.

**Figure 4: Monthly Wind Speed
(Morristown, New Jersey)**



IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facilities. Irregularities in the load profile will indicate potential problems within the facilities. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facilities energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to The Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The electricity usage profile demonstrates a summer cooling dominated load profile from winter to summer. The average summer (May-September) demand is 25% more than the average winter (October-April) demand, while the consumption profile is fairly flat year round. The following table outlines the seasonal average monthly consumption and demand for the facility.

ELECTRIC UTILITY SEASONAL LOAD PROFILE		
DESCRIPTION	SEASONAL AVERAGES	
	KWH PER MONTH	KW PER MONTH
Summer (May to September)	68,544	244.48
Winter (October to April)	66,423	195.01
Avg. Load Increase Winter to Summer	3.2%	25.4%

The historical usage profile is less than favorable as typically winter commodity rates are lower due to reduced demand on the grid, compared with summer. Third Party Supplier (TPS) electric commodity contracts that offer a firm, fixed price for 100% of the facilities electric requirements and are lower than the JCP&L's BGS-FP default rate are recommended.

Natural Gas:

The Natural Gas Usage Profile demonstrates a heating load dominated profile, with minimal consumption being contributed by domestic hot water and other gas consumers. The average summer (May – September) consumption is 86% less than the average winter (October- April) consumption. The follow table outlines the seasonal average monthly consumption for the facility.

NATURAL GAS UTILITY SEASONAL LOAD PROFILE		
DESCRIPTION	SEASONAL AVERAGES	
	THERM PER MONTH	
Summer (May to September)	25.0	
Winter (October to April)	189.7	
Avg. Load Increase Summer to Winter	659.0%	

This load profile will yield less than favorable natural gas prices due to the heating dominated profile. Higher winter month consumption will yield higher pricing which will not be offset by the summer month consumption. Nymex commodity pricing is generally higher in the winter months of November – March and lower in the summer months of April – October.

Fuel Oil:

The Fuel Oil Profile demonstrated a heating dominated load profile, with fuel use in the summer attributed to the single boiler which operates year round. The average summer (May – September) consumption is 50% less than the average winter (October- April) consumption. The follow table outlines the seasonal average monthly consumption for the facility.

FUEL OIL UTILITY SEASONAL LOAD PROFILE		
DESCRIPTION	SEASONAL AVERAGES	
	GAL PER MONTH	
Summer (May to September)	566.2	
Winter (October to April)	1,134.2	
Avg. Load Increase Summer to Winter	100.3%	

Typically fuel oil pricing is higher during the peak winter heating season, meaning this profile would be less than favorable prices.

Tariff Analysis:

Electricity:

The facility receives electrical service from Jersey Central Power & Light (JCP&L) under commercial rate classifications General Service Secondary (GS3). The facility has contracted a Third Party Supplier (TPS) to provide electric commodity service. NextEra Energy Services has been contracted however; the contract particulars such as product structure, price, term and conditions were not available for review or comments. For electric supply (generation) service, the client has a choice to either use JCP&L's default service rate BGS or contract with a Third Party Supplier (TPS) to supply electricity.

Each year since 2002, the four New Jersey Electric Distribution Companies (EDCs) - Public Service Gas & Electric Company (PSE&G), Atlantic City Electric Company (ACE), Jersey Central Power & Light Company (JCP&L), and Rockland Electric Company (RECO) - have procured several billion dollars of electric supply to serve their Basic Generation Service (BGS) customers through a statewide auction process held in February.

BGS refers to the service of customers who are not served by a third party supplier or competitive retailer. This service is sometimes known as Standard Offer Service, Default Service, or Provider of Last Resort Service.

The Auction Process has consisted of two auctions that are held concurrently, one for larger customers on an hourly price plan (BGS-CIEP) and one for smaller commercial and residential customers on a fixed-price plan (BGS-FP). This facility's rate structure is based on the fixed-price plan (BGS-FP).

The utility will continue to be responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. JCP&L's delivery service rate includes the following charges: Customer Service Charge, Distribution Charge (kWh and Demand), Societal Benefits Charge (SBC), and Securitization Transition Charge.

Natural Gas:

The facility currently receives natural gas distribution service from Public Service Electric and Gas under rate schedules General Service Gas Heating (GSG-HTG). The facility has not contracted with a Third Party Supplier (TPS). For natural gas supply service, the client has a choice to either use PSE&G's default service rate BGSS or contract with a Third Party Supplier (TPS) to supply natural gas commodity service.

PSE&G provides basic gas supply service (BGSS) to customers who choose not to shop from a Third Party Supplier (TPS) for natural gas commodity. The option is essential to protect the reliability of service to consumers as well as protecting consumers if a third party supplier defaults or fails to provide commodity service.

The utilities are responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. PSEG's delivery service rate includes the following charges: Customer Service Charge, Distribution Charge, & Societal Benefits Charge (SBC).

Fuel Oil:

Fuel Oil is typically purchased on a time of delivery price basis, meaning with every delivery the cost per gallon fluctuates. Some fuel oil provides due offer fixed price structures for yearlong contracts that vary dependent on the client's consumption rate. While these structures can be beneficial for the owner on a fixed budget, they do not typically offer savings back to the owner if oil prices drastically dip below the agreed on price.

Electric and Natural Gas Commodities Market Overview:

Winter 2014 proved to be one for the record books. Across the United States, temperatures plunged and states that rarely see snow have been paralyzed by icy conditions. The energy market was not spared. Market rates have been fluctuating wildly, reaching as much as \$1,765 per MWh (\$1.765/kWh) in PJM-West Hub when winter storms swept much of the northern half of the nation in January.

In our region, electricity is produced by natural gas, nuclear, coal and renewables. Much of the recent electricity increases are in relation to very high spot natural gas pricing on generation that produces electricity and the retirement of coal plants. Currently in PJM (PJM is the independent operating system that provides power to Pennsylvania, DC, New Jersey, Delaware and Maryland states) the severe cold in January 2014 led to the temporary lift of the \$1000/mWh cap on electric market based pricing. This cap is lifted thru March 31, 2014. Many natural gas generators were not hedged on natural gas and the natural gas spot market on January 24th reached over \$124.00/dth or \$12.40/therm. Unfortunately, these costs are now being passed on to clients who were not in a fixed price contract.

Commodity pricing in 2008 and winter of 2014 marked historical highs in both natural gas and electricity commodity. Commodity pricing commencing spring of 2014 although higher than previous years continues to be favorable for locking in long term (2-5 year) contracts with 3rd Party Supplier's for both natural gas and electricity supply requirements.

It is important to note that both natural gas and electric commodity market prices are moved by supply and demand, political conditions, market technicals and trader sentiment. The market is continuously changing Energy commodity pricing is also correlated to weather forecasts. Because weather forecasts are dependable only in the short-term, prolonged temperature extremes can really cause extreme price swings.

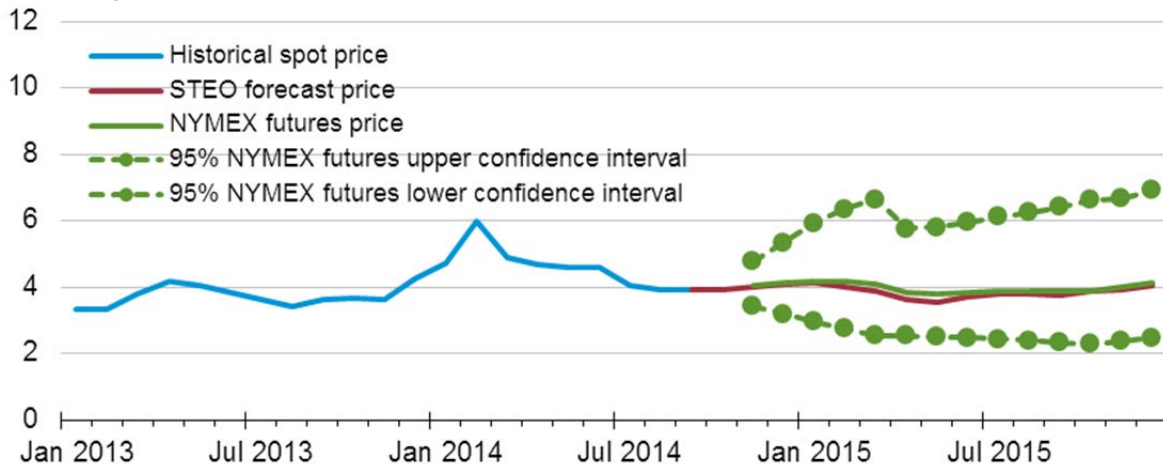
Short Term Energy Outlook - US Energy Information Administration (March/April 2014):

U.S. Natural Gas Prices. Natural gas spot prices averaged \$6.00/MMBtu at the Henry Hub in February, up \$1.29/MMBtu from January, the result of bitterly cold weather during the month. At the end of February, both spot and futures prices declined rapidly, falling below \$5/MMBtu. EIA projects that the March spot price will average \$4.48/MMBtu, and will continue to decline in the spring. Projected Henry Hub natural gas prices average \$4.44/MMBtu in 2014 and \$4.14/MMBtu in 2015.

Natural gas futures prices for June 2014 delivery (for the five-day period ending March 6, 2014) averaged \$4.55/MMBtu. Current options and futures prices imply that market participants place the lower and upper bounds for the 95% confidence interval for December 2014 contracts at around \$3.80/MMBtu and \$5.00/MMBtu, respectively.

Henry Hub Natural Gas Price

dollars per million Btu



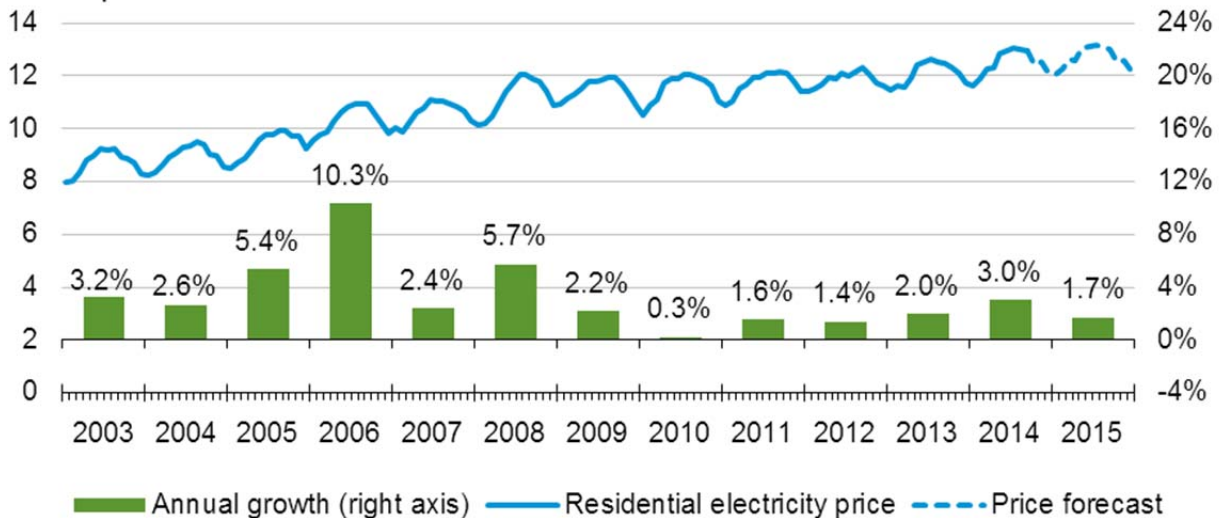
Note: Confidence interval derived from options market information for the 5 trading days ending Oct. 2, 2014. Intervals not calculated for months with sparse trading in near-the-money options contracts.

Source: Short-Term Energy Outlook, October 2014.

U.S. Electricity Retail Prices. EIA expects the U.S. residential price of electricity to average 13.0 cents per kilowatthour during 2014, an increase of 3.0% from 2013. Residential electricity prices increase 1.7% during 2015.

U.S. Residential Electricity Price

cents per kilowatthour



Source: Short-Term Energy Outlook, October 2014.

Contracting with Third Party Suppliers and BGS Bidding Options

Cooperative Purchasing:

Cooperative Purchasing agreements allow multiple parties to come together under the premise of using purchasing power in order to reduce the price for goods and services. In this instance the Cooperative is under the unified goal of reducing energy prices for its members. As such members of the cooperative pool their respective energy consumption together into a single bid to obtain low cost energy pricing.

Many Cooperatives have a formal bidding process and insure all suppliers provide the required documentation and paperwork necessary per New Jersey Administrative Code and Procurement Law. In addition, a Master Agreement is incorporated into the bid specifications with terms and conditions for the energy supply award protecting Local Government Entities. Concord does not recommend signing any Third Party Supplier contract or agreement unless it has been heavily vetted by an attorney that understands commodity law and regulation. Many government clients that have signed third party supplier contracts are now experiencing regulatory pass-thru charges due to vague or inadvertently agreed terms and conditions.

Important information can be found on DCA's website regarding Cooperative Purchasing. Please visit web link:

http://www.state.nj.us/dca/divisions/dlgs/programs/lpcl_docs/Procuring_Power_Supply_through_a_Cooperative_Purchasing_System.pdf

It is important with any commodity procurement undertaking that you incorporate a rational, defensible strategy for purchasing commodity in volatile markets based upon the following:

- Budgets that reflect sound market intelligence
- An understanding of historical prices and trends
- Awareness of seasonal opportunities (e.g. shoulder months)
- Negotiation of fair contractual terms
- An aggressive, market based price

Bidding Practices and Processes:

Different bid processes and methodologies can create different objectives, but transparency is always a primary goal. Closed bid competitive purchase RFBs, online bid receipt or online reverse auctions can be utilized. Firms which can provide online bidding and reverse auctions are approved by the New Jersey Division of Local Government Services pursuant to the Local Unit Electronic Technology Program, (P.L.2001, c. 30). Approved firms can be found on the website at: <http://www.state.nj.us/dca/divisions/dlgs/programs/lpcl.html>

Over the last decade, Concord has been involved with numerous approaches to bidding including the Traditional Sealed Bid format and Online Reverse Auction methods. In our experience, Online Reverse Auctions do not always produce optimum results for retail commodity purchases. The procurement consultant with the Client should determine a bidding practice that will yield optimum results and create a robust competitive environment. Many factors will come into consideration to determine whether the Online Bidding and/or Reverse Auction method is

appropriate. Factors such as annual consumption, number and complexity of accounts, potential supplier participation as well as rate tariffs must be taken into consideration.

LGE's Purchasing Options:

Per DCA's paper entitled "Taking Advantage of Lower Electric Rates for your Government Agency" they state, "First, it is important to emphasize that procurement of power supply *must* be consistent with the Local Public Contracts Law (LPCL) or for boards of education, the Public School Contracts Law (PSCL). Bottom line: When the estimated amount of spending for *power supply* is above the contracting unit's bid threshold, power supply must be publicly bid or purchased subject to an exception to the bid law. "Full text can be found via web link: http://www.state.nj.us/dca/divisions/dlgs/programs/lpcl_docs/Taking_Advantage_of_Lower_Electric_Rates_for_your_Government_Agency.pdf

1. Cooperative Purchasing

"When local governments put aside provincial interests in exchange for the broader benefits to be achieved through Cooperative Purchasing, they can secure the provision and performance of goods and services at a lower cost. Cooperative Purchasing has demonstrated a strong ability to serve as an effective tool to assist local officials save taxpayer dollars. Cooperative Purchasing represents viable alternatives to the conventional "go-it-alone" bidding process. " Many Cooperatives in the state utilize online bidding to secure attractive electricity and natural gas supply service. Utilizing a Cooperative is highly recommended.

Benefits can include:

- Increase staff effectiveness
- Reduce duplication of bidding and contract processing
- Reduce time, effort and costs associated with developing and managing the bid process
- Leverage established and large volume pricing of contracted products
- Great alternative contract option to save time, money and ensure quality products & services

2. Online Reverse Auctions and Online Sealed Bids

"For local government entities, the requirement to bid does not mean the solicitation of quotes; it means a formal process where there is a bid specification, notice to bidders, and a level playing field for all potential bidders. The Division's E-Procurement Pilot program (authorized under P.L. 2001, c. 30) allows local units to purchase commodities and services, including energy supply, through online bidding and reverse auctions programs approved by the Division. Any online organization participating in the online pilot program must be approved by the Division. Once the Division has approved an online service, any local unit can take advantage of the service. When conducted through an online service, however, the local unit is responsible to ensure that the online service is operating consistent with procurement laws for an individual procurement."

Both online reverse auctions and online sealed bids can produce significant cost savings results. The process is transparent and seamless. Many platforms are very flexible allowing for full customization to meet the Client's needs.

All providers of online reverse auction and online bidding charge a fee indirectly to LGE's. The fee is included in the bid pricing shown by suppliers as a \$/kWh or \$/therm charge and paid directly by the supplier to the vendor. Although LGE's do not have to formally bid for this type of service should they utilize a DCA pre-approved vendor, we would recommend that any and all fees paid by the supplier to the vendor be disclosed prior to any engagement of services.

An overview of both the Online Reverse Auction vs Sealed bid format was published in the NJBIZ Spring of 2007. To view this article, please go to web link:
<http://www.nbizmag.com/magarticles/sealedbidvsreverseauction.pdf>

Benefits can include:

- Provides full transparency during the procurement process with unbiased decision making
- Drives prices down through real-time competition
- Allows client to actively participate during the entire auction or online bidding process
- Execution of contracts are completed within hours of the auction's close
- Places the focus for suppliers solely on price, since all other factors and related contracting documentation is received and pre-qualified before the final auction bid due date
- Full audit and archival capabilities to substantiate award decisions
- Improves knowledge capture, transfer and re-use capabilities

3. Traditional Sealed Bid Format

This type of bid format is not endorsed by the Division of Local Government Services for the bidding of power supply. However, in a recent review of bidding methodologies and which methodology would likely to produce lower cost results, a NJ Government Agency allowed suppliers to choose the bidding format. The bidding options allowed were either via an Online Reverse Auction or via a Traditional Sealed Bid. The Agency understood that many suppliers will not participate in an online auction format or methodology and wanted to allow all NJBPU suppliers to participate. The Agency is the 2nd largest Cooperative in the state which includes participants from five Counties and over 200 municipalities. After the online reverse auction bid was closed and the traditional sealed bids opened and reviewed, the Agency awarded the electricity contract to a bidder that was the lowest price and submitted their bid via the Traditional Sealed Bid Format.

The below recommendations presented by Concord Engineering are based on current information provided by the owner for their facilities historical energy usage. Any savings presented with these recommendations are estimates only based on that information. It is recommended that further analysis and review of more recent utility data and actual TPS

electricity and natural gas supply contracts and historical billings be performed prior to performing any of the presented recommendations.

Recommendations:

1. Concord recommends the owner continue its aggregation approach for 3rd party commodity supply procurement strategies for the purchase of electricity and natural gas. Aggregating the usage of all facilities for both electricity and natural gas supply service, allows the owner to continue to achieve lower prices in commodity supply costs over the utility default service programs. Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive and contract terms longer than 12 months are desirable. Contracts due to expire in the near term would continue to yield very favorable pricing. It is important to aggregate usage where available and take advantage of these current market prices quickly, before energy increases.
2. After review of the utility consumption report and current commodity pricing outlook, Concord recommends that the owner utilize the advisement of a 3rd party unbiased Energy Consulting Firm licensed by the State of New Jersey Board of Public Utilities that is experienced in the procurement of commodities, New Jersey procurement laws, aggregation of facilities and energy supply risk and commodity management. This firm should be able to provide full service advisement over the term of the contract, provide market watch opportunities and identify any additional opportunities that may further reduce costs. Many of these opportunities may include: energy rates; utility bill auditing; energy data analytics; and efficiency improvements.

It is important that a rational, defensible strategy for purchasing commodity in volatile markets is incorporated. Examples include:

- Budgets that reflect sound market intelligence
 - An understanding of utility and market historical prices and trends
 - Awareness of seasonal opportunities (e.g. shoulder months)
 - Negotiation of fair contractual terms
 - An aggressive, market based price
3. Concord also recommends that the owner consider utilizing a third party utility billing-auditing service to further analyze historical utility invoices such as water, sewer, natural gas, electricity and fuel oil for incorrect billings and rate tariff optimization services. *This service can be based on a shared savings model with no direct cost. The service could provide refunds on potential incorrect billings that may have been passed through by the utilities and paid by the owner.*

X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the facility owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

A. Incentive Programs:

Pay For Performance

The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings that were audited as part of the NJ Clean Energy's Local Government Energy Audit Program. The facility's participation in the program is assisted by an approved program partner. An "Energy Reduction Plan" is created with the facility and approved partner to show at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant \$0.10 per square foot between \$5,000 and \$50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is capped at 50% of this value if the entity has completed a local government energy audit.)
2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example \$0.11 / kWh for 15% savings, \$0.12/ kWh for 17% savings, ... and \$1.10 / Therm for 15% savings, \$1.20 / Therm for 17% saving, ...) Increased incentives result from projected savings above 15%.
3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example \$0.07 / kWh for 15% savings, \$0.08/ kWh for 17% savings, ... and \$0.70 / Therm for 15% savings, \$0.80 / Therm for 17% saving, ...) Increased incentives result from verified savings above 15%.

Direct Install Program

The New Jersey Clean Energy's Direct Install Program is a state funded program that targets small commercial and industrial facilities with peak demand of less than 200 kW. This turnkey program is aimed at providing owners a seamless, comprehensive process for analysis, equipment replacement and financial incentives to reduce consumption, lower utility costs and improve profitability. The program covers up to 70% of the cost for eligible upgrades including lighting, lighting controls, refrigeration, HVAC, motors, variable speed drives, natural gas and food service. Participating contractors (refer to www.njcleanenergy.com) conduct energy assessments in addition to your standard local government energy audit and install the cost-effective measures.

Smart Start Program

Prescriptive Measures - The New Jersey Clean Energy's Smart Start prescriptive measures incentives include unit pricing incentives for installation of energy efficient equipment and controls. Proposed equipment and controls must meet the minimum efficiency requirements as well as other application requirements. The Smart Start prescriptive incentives applicable for new construction, renovations, remodeling and equipment replacements, for a wide range of equipment including:

- Electric Chillers
- Gas Cooling
- Electric Unitary HVAC
- Ground Source Heat Pumps
- Gas Heating
- Variable Frequency Drives
- Gas Water Heating
- Premium Motors
- Prescriptive Lighting
- Lighting Controls
- Technical Studies

Custom Measures - The New Jersey Clean Energy's Smart Start prescriptive measures incentives include all measures not identified in the prescriptive measures category or measures that must have savings verified through additional analysis such as energy model simulations. Custom measures are intended to include savings as a result of unique energy efficiency measures, which are typically facility specific such as waste heat recovery. Custom incentives are provided based on the amount of energy saved and minimum internal rate of return in order to be eligible.

CEG recommends that the owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

B. Financing Options:

On-Bill Financing

On-bill financing allows a loan for energy efficiency measures to be repaid over time via an additional line item on the recipient's utility bill, which decreases repayment risk for the lender. The lender in "classic" utility on-bill financing has traditionally been the utility itself. Hybrid models have also emerged in which public and private funds are pooled to offer low-interest loans, with repayment similarly attached to the utility bill. The utility then collects the payment and returns it to the lender, which lowers the lender's administrative costs. The utility customer benefits from lower energy costs after retrofits, and typically pays loans back over a period of about 2–5 years. This model has also recently become available with Third Party Commodity Suppliers allowing for energy efficiency project funding to be rolled into their bill for the customer. If the owner is interested in this funding mechanism they should contact their local utility or third party supplier if any such program is offered. Alternatively if the owner's current third party supply contract is expiring this could be included as an option when bidding for new suppliers.

Lease to Own (Leaseback)

A lease to own arrangement is where the seller of an asset (i.e. building, equipment, etc.) leases back the same asset from the purchaser. In a leaseback arrangement, the specifics of the arrangement are made immediately after the sale of the asset, with the amount of the payments and the time period specified. Essentially, the seller of the asset becomes the lessee and the purchaser becomes the lessor in this arrangement. A leaseback arrangement is useful when entities need to un-tie the cash invested in an asset for other investments, but the asset is still needed in order to operate. Leaseback deals can also provide the seller with additional tax deductions. The lessor benefits in that they will receive stable payments for a specified period of time.

Power Purchase Agreement

Public Law 2008, Chapter 3 authorizes contracts of up to fifteen (15) years for energy purchase contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party's work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

Conventional Financing

This optional involves taking a conventional approach to borrowing money from a lending institution for an agreed upon term at a negotiated or stipulated interest rate. The term of financing and rates can vary greatly base on institution and credit rating of the borrower.

XI. ADDITIONAL RECOMMENDATIONS

In addition to the ECMs and REMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit, many of which facility's staff are already performing. Maintenance items and small operational improvements are typically achievable with on-site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building

- 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. Confirm that outside air economizers on the air handling units are functioning properly to take advantage of free cooling and avoid excess outside air during occupied periods.
- F. Perform annual steam trap surveys to minimize energy waste caused by failed traps, and to maintain an inventory of system equipment.
- G. Verify all HVAC control systems are utilizing setback and scheduling capabilities.
- H. Shutdown all non-essential equipment during unoccupied periods.

XII. ENERGY AUDIT ASSUMPTIONS

The assumptions utilized in this energy audit include but are not limited to following:

- A. Cost Estimates noted within this report are based on industry accepted costing data such as RS MeansTM Cost Data, contractor pricing and engineering estimates. All cost estimates for this level of auditing are +/- 20%. Prevailing wage rates for the specified region has been utilized to calculate installation costs. The cost estimates indicated within this audit should be utilized by the owner for prioritizing further project development post the energy audit. Project development would include investment grade auditing and detailed engineering.
- B. Energy savings noted within this audit are calculated utilizing industry standard procedures and accepted engineering assumptions. For this level of auditing, energy savings are not guaranteed.
- C. Information gathering for each facility is strongly based on interviews with operations personnel. Information dependent on verbal feedback is used for calculation assumptions including but not limited to the following:
 - a. operating hours
 - b. equipment type
 - c. control strategies
 - d. scheduling
- D. Information contained within the major equipment list is based on the existing owner documentation where available (drawings, O&M manuals, etc.). If existing owner documentation is not available, catalog information is utilized to populate the required information.
- E. Equipment incentives and energy credits are based on current pricing and status of rebate programs. Rebate availability is dependent on the individual program funding and applicability.
- F. Equipment (HVAC, Plumbing, Electrical, & Lighting) noted within an ECM recommendation is strictly noted as a **basis for calculation** of energy savings. The owner should use this equipment information as a benchmark when pursuing further investment grade project development and detailed engineering for specific energy conservation measures.
- G. Utility bill annual averages are utilized for calculation of all energy costs unless otherwise noted. Accuracy of the utility energy usage and costs are based on the information provided. Utility information including usage and costs is estimated where incomplete data is provided.
- H. Greenhouse Gas Emissions are calculated for each ECM, the basis for these emissions reductions are NJCEP published standard emissions factors, which are the following:
 - a. Electric Savings:
 1. CO₂: 1.52 lbs/kWh
 2. NO_x: 0.0028 lbs/kWh
 3. SO₂: 0.0065 lbs/kWh
 - b. Natural Gas Savings:
 1. CO₂: 11.7 lbs/therm
 2. NO_x: 0.0092 lbs/therm

APPENDIX A

ECM COST & SAVINGS BREAKDOWN
CONCORD ENGINEERING GROUP

Morris Museum

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME (Yr)	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	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	Lighting Upgrade - Interior	\$82,240	\$20,990	\$2,925	\$100,305	\$12,677	\$0	\$12,677	15	\$190,155	\$0	89.6%	7.9	9.32%	\$51,032.20
ECM #2	Lighting Upgrade - Exterior	\$29,920	\$6,375	\$2,800	\$33,495	\$11,928	\$0	\$11,928	15	\$178,923	\$0	434.2%	2.8	35.23%	\$108,902.70
ECM #3	Boiler Fuel Conversion (B-1)	\$15,000	\$15,000	\$0	\$30,000	\$9,296	\$0	\$9,296	15	\$139,440	\$0	364.8%	3.2	30.41%	\$80,975.04
ECM #4	Boiler Replacement (B-2)	\$30,000	\$27,000	\$800	\$56,200	\$3,448	\$0	\$3,448	20	\$68,960	\$0	22.7%	16.3	2.03%	(\$4,902.47)
ECM #5	Boiler Replacement (B-5)	\$68,000	\$56,000	\$2,000	\$122,000	\$22,253	\$0	\$22,253	20	\$445,060	\$0	264.8%	5.5	17.52%	\$209,068.45
ECM #6	VFD Fans	\$23,000	\$21,000	\$2,500	\$41,500	\$6,258	\$0	\$6,258	15	\$93,874	\$0	126.2%	6.6	12.50%	\$33,210.59
ECM #7	Premium Efficiency Motors	\$5,500	\$1,000	\$0	\$6,500	\$680	\$0	\$680	18	\$12,240	\$0	88.3%	9.6	7.72%	\$2,852.39
ECM #8	Energy Star Refrigerator	\$988	\$0	\$0	\$988	\$78	\$0	\$78	15	\$1,170	\$0	18.4%	12.7	2.19%	(\$56.84)
ECM #9	Water Conservation	\$400	\$200	\$0	\$600	\$554	\$0	\$554	15	\$8,310	\$0	1285.0%	1.1	92.33%	\$6,013.62
ECM #10	Chiller Replacement	\$141,000	\$92,000	\$2,500	\$230,500	\$3,465	\$0	\$3,465	20	\$69,300	\$0	-69.9%	66.5	-9.45%	(\$178,949.55)
ECM #11	BMS Controls Upgrades	\$130,000	\$65,000	\$0	\$195,000	\$4,902	\$0	\$4,902	20	\$98,040	\$0	-49.7%	39.8	-5.81%	(\$122,070.62)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	100 kW Solar Array	\$305,899	\$203,933	\$0	\$509,832	\$14,953	\$17,980	\$32,933	25	\$823,332	\$449,500	61.5%	15.5	4.09%	\$63,640.36

- 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, 2014 to June 30, 2015:

Electric Chillers

Water-Cooled Chillers	\$16 - \$170 per ton
Air-Cooled Chillers	\$8 - \$52 per ton

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Cooling

Gas Absorption Chillers	\$185 - \$450 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

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

Gas Fired Boilers < 300 MBH	\$2.00 per MBH, but not less than \$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	\$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	\$1.00 per MBH
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

Ground Source Heat Pumps

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

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	\$65 - \$155 per hp
Chilled-Water Pumps \geq 20 hp	\$60 per VFD rated hp
Rotary Screw Air Compressors \geq 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 \geq 10 hp	\$60 per VFD rated hp
Boiler Fans \geq 5 HP	\$65 to \$155 per hp
Boiler Feed Water Pumps \geq 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

Natural Gas Water Heating

Gas Water Heaters \leq 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

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)	\$15 per fixture
T-5 and T-8 High Bay Fixtures	\$16 - \$200 per fixture
HID \geq 100w Replace with new induction fixture. (must be 30% less watts/fixture than HID system)	\$70 per fixture
HID \geq 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	\$50 per fixture

Prescriptive Lighting - LED

LED Display Case Lighting	\$30 per display case
LED Shelf-Mtd. Display & Task Lights	\$15 per linear foot
LED Portable Desk Lamp	\$20 per fixture
LED Wall-wash Lights	\$30 per fixture
LED Recessed Down Lights	\$35 per fixture
LED Architectural Flood and Spot Luminaires	\$50 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	\$175 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	\$175 per fixture
LED Outdoor Wall-Mounted Area Luminaries	\$100 per fixture
LED Parking Garage Luminaries	\$100 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	\$30 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 Stairwell and Passageway Luminaires	\$40 per fixture
LED Bollard Fixtures	\$50 per fixture
Luminaires for Ambient Lighting of Interior Commercial Spaces (1x4, 2x2, 2x4)	\$50 per fixture
LED Fuel Pump Canopy	\$100 per fixture
LED Screw-based & Pin-based (PAR, MR, BR, R) Standards (A-Style) and Decorative Lamps	\$5 per lamp for R/PAR20,MR/PAR16,Globe,Candelabra or Misc \$10 per lamp for LED R/BR/PAR 30, R/BR/PAR 38-40, A-Lamp

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 Retrofit Kits	To be evaluated through the customer measure path

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	\$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

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)	\$250/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



LEARN MORE AT
energystar.gov

ENERGY STAR[®] Statement of Energy Performance

N/A

Morris Museum

Primary Property Function: Museum
Gross Floor Area (ft²): 65,000
Built: 1913

ENERGY STAR[®]
Score¹

For Year Ending: December 31, 2013
Date Generated: September 19, 2014

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

Morris Museum
6 Normandy Heights Road
Morristown, New Jersey 07960

Property Owner

Morris Museum
6 Normandy Heights Road
Morristown, NJ 07960
(____)____-____

Primary Contact

Connie Read
6 Normandy Heights Road
Morristown, NJ 07960
973-971-3702
cread@morrismuseum.org

Property ID: 4152386

Energy Consumption and Energy Use Intensity (EUI)

Site EUI	Annual Energy by Fuel	National Median Comparison	
65.4 kBtu/ft ²	Fuel Oil (No. 2) (kBtu)	1,498,252 (35%)	National Median Site EUI (kBtu/ft ²)
	Electric - Grid (kBtu)	2,604,871 (61%)	National Median Source EUI (kBtu/ft ²)
	Natural Gas (kBtu)	145,269 (3%)	% Diff from National Median Source EUI
Source EUI		Annual Emissions	
151.5 kBtu/ft ²		Greenhouse Gas Emissions (Metric Tons CO ₂ e/year)	468

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

Concord Engineering Group

Morris Museum

Split System Units

Tag	CU-1	CU-2	CU-3
Unit Type	Condensing Unit	Condensing Unit	Condensing Unit (VRV)
Qty	1	1	1
Location	Front On Grade	Promenade Roof	Hedley Gallery Roof
Area Served	-	3rd Floor Mansion	2nd Floor Mansion
Manufacturer	Concord	Goodman	Daikin
Model #	CCU10A42B-1A	GSC100903AD	RXYQ72MTJU
Serial #	8400C38117	1203102652	-
Cooling Type	DX (R-22)	DX (R-22)	DX (R410A)
Cooling Capacity (Tons)	3.5	7.5	6.0
Cooling Efficiency (SEER/EER)	9 EER	11 EER	12.6 EER
Heating Type	N/A	N/A	Heat Pump
Heating Input (MBH)	N/A	N/A	81
Efficiency	N/A	N/A	3.6 COP
Fuel	N/A	N/A	Electric
Approx Age	14	11	9
ASHRAE Service Life	15	15	15
Remaining Life	1	4	6
Comments	208/230V 3P	208/230V 3P	208/230V 3P

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

Split System Units

Tag	CU-4	CU-5	CU-6
Unit Type	Condensing Unit (VRV)	Condensing Unit	Condensing Unit
Qty	1	1	1
Location	Hedley Gallery Roof	Hedley Gallery Roof	On-Grade
Area Served	2nd Floor Mansion	Hedley Gallery	AH-6
Manufacturer	Daikin	Liebert	Lennox
Model #	RXYQ96MTJU	DCSF104-P	HS17-2753-3Y
Serial #	-	0436C72709	5189E23487
Cooling Type	DX (R410A)	DX (R22)	DX (R22)
Cooling Capacity (Tons)	8.0	5.0	18.5
Cooling Efficiency (SEER/EER)	11 EER	-	9.0 EER
Heating Type	Heat Pump	N/A	N/A
Heating Input (MBH)	108	N/A	N/A
Efficiency	3.4 COP	N/A	N/A
Fuel	Electric	N/A	N/A
Approx Age	9	10	25
ASHRAE Service Life	15	15	15
Remaining Life	6	5	(10)
Comments	208/230V 3P	208/230V 1P	

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

Split System Units

Tag	CU-8-1,2	
Unit Type	Condensing Unit	
Qty	1	
Location	On-Grade	
Area Served	AH-8	
Manufacturer	Lennox	
Model #	HS17-2753-3Y	
Serial #	5189E23553	
Cooling Type	DX (R22)	
Cooling Capacity (Tons)	18.5	
Cooling Efficiency (SEER/EER)	9.0 EER	
Heating Type	N/A	
Heating Input (MBH)	N/A	
Efficiency	N/A	
Fuel	N/A	
Approx Age	25	
ASHRAE Service Life	15	
Remaining Life	(10)	
Comments		

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Morris Museum

Rooftop Units

Tag	RTU #3	RTU #1	RTU #2
Unit Type	Packaged Rooftop	Packaged Rooftop	Packaged Rooftop
Qty	1	1	1
Location	Theater Lobby Roof	Orientation Theater Roof	Orientation Theater Roof
Area Served	Theater Lobby	Guinness Collection	2nd Floor Gallery
Manufacturer	McQuay	McQuay	McQuay
Model #	RPS020CSA	RPS036CLA	RPS020CSA
Serial #	FB0U061100976 00	FB0U061200250 00	FB0U061200266 00
Cooling Type	DX (R22)	DX (R22)	DX (R22)
Cooling Capacity (Tons)	20	35	20
Cooling Efficiency (SEER/EER)	-	-	-
Heating Type	Gas Furnace	Gas Furnace	Gas Furnace
Heating Input (MBH)	625	625	400
Efficiency	80%	80%	80%
Fuel	Natural Gas	Natural Gas	Natural Gas
Approx Age	8	8	8
ASHRAE Service Life	15	15	15
Remaining Life	7	7	7
Comments	208/60/3, 5 HP SF, 3 HP RF	208/60/3, 15 HP SF, 7.5 HP RF	208/60/3, 10 HP SF, 5 HP RF

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Morris Museum

AHUs

Tag	WFC-1	WFC-2	WFC-3
Unit Type	Wall Fan Coil	Wall Fan Coil	Wall Fan Coil
Qty	1	1	1
	Train Room	American Indian Gallery	2nd Floor Mansion
Area Served	Train Room	American Indian Gallery	Office #1
Manufacturer	Daikin	Daikin	Daikin
Model #	FXAQ24MVJU	FXAQ24MVJU	FXAQ07MVJU
Serial #	E001297	E000396	E000307
Cooling Type	DX (R410a)	DX (R410a)	DX (R410a)
Cooling Capacity (Tons)	2.0	2.0	7,000 Btu/h
Cooling Efficiency (EER)	-	-	-
Heating Type	Heat Pump	Heat Pump	Heat Pump
Heating Input (MBH)	27	27	8.50
Heating Efficiency (%)	N/A	N/A	N/A
Supply Fan (HP)	0.06	0.06	0.04
Approx Age	6	6	6
ASHRAE Service Life	15	15	15
Remaining Life	9	9	9
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

AHUs

Tag	WFC-4	WFC-5	WFC-6
Unit Type	Wall Fan Coil	Wall Fan Coil	Wall Fan Coil
Qty	1	1	1
	2nd Floor Mansion	2nd Floor Mansion	2nd Floor Mansion
Area Served	Office #2	Office #3	Conference Room
Manufacturer	Daikin	Daikin	Daikin
Model #	FXAQ07MVJU	FXAQ07MVJU	FXAQ24MVJU
Serial #	E000316	E000321	-
Cooling Type	DX (R410a)	DX (R410a)	DX (R410a)
Cooling Capacity (Tons)	7,000 Btu/h	7,000 Btu/h	2.0
Cooling Efficiency (EER)	-	-	-
Heating Type	Heat Pump	Heat Pump	Heat Pump
Heating Input (MBH)	8.50	8.50	27.00
Heating Efficiency (%)	N/A	N/A	N/A
Supply Fan (HP)	0.04	0.04	0.06
Approx Age	6	6	6
ASHRAE Service Life	15	15	15
Remaining Life	9	9	9
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

AHUs

Tag	WFC-7	WFC-8	WFC-9
Unit Type	Wall Fan Coil	Wall Fan Coil	Wall Fan Coil
Qty	1	1	1
	2nd Floor Mansion	2nd Floor Mansion	2nd Floor Mansion
Area Served	Director's Office	Office	Office
Manufacturer	Daikin	Daikin	Daikin
Model #	FXAQ24MVJU	FXAQ07MVJU	FXAQ07MVJU
Serial #	-	E000267	-
Cooling Type	DX (R410a)	DX (R410a)	DX (R410a)
Cooling Capacity (Tons)	2.0	7,000 Btu/h	7,000 Btu/h
Cooling Efficiency (EER)	-	-	-
Heating Type	Heat Pump	Heat Pump	Heat Pump
Heating Input (MBH)	27.00	8.50	8.50
Heating Efficiency (%)	N/A	N/A	N/A
Supply Fan (HP)	0.06	0.04	0.04
Approx Age	6	6	6
ASHRAE Service Life	15	15	15
Remaining Life	9	9	9
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

AHUs

Tag	WFC-10	WFC-11	WFC-12
Unit Type	Wall Fan Coil	Wall Fan Coil	Wall Fan Coil
Qty	1	1	1
	2nd Floor Mansion	2nd Floor Mansion	2nd Floor Mansion
Area Served	Office	Office	Office
Manufacturer	Daikin	Daikin	Daikin
Model #	FXAQ07MVJU	FXAQ07MVJU	FXAQ07MVJU
Serial #	E000317	E000299	E000320
Cooling Type	DX (R410a)	DX (R410a)	DX (R410a)
Cooling Capacity (Tons)	7,000 Btu/h	7,000 Btu/h	7,000 Btu/h
Cooling Efficiency (EER)	-	-	-
Heating Type	Heat Pump	Heat Pump	Heat Pump
Heating Input (MBH)	8.50	8.50	8.50
Heating Efficiency (%)	N/A	N/A	N/A
Supply Fan (HP)	0.04	0.04	0.04
Approx Age	6	6	6
ASHRAE Service Life	15	15	15
Remaining Life	9	9	9
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

AHUs

Tag	WFC-13	HAC-1	AH-1
Unit Type	Wall Fan Coil	Air Handler	Air Handler
Qty	1	1	1
	1st Floor Mansion	Stair A1 Ceiling	Basement Mech Room
Area Served	Copy Room	Mammals	Main Gallery
Manufacturer	Daikin	Witt	McQuay
Model #	FXAQ07MVJU	-	LSL141DH
Serial #	-	-	3UM00681-04
Cooling Type	DX (R410a)	Chilled Water	Chilled Water
Cooling Capacity (Tons)	7,000 Btu/h	-	70.0
Cooling Efficiency (EER)	-	N/A	N/A
Heating Type	Heat Pump	Hot Water	N/A
Heating Input (MBH)	8.50	-	N/A
Heating Efficiency (%)	N/A	N/A	N/A
Supply Fan (HP)	0.04	2.00	20.00
Approx Age	6	-	10
ASHRAE Service Life	15	20	20
Remaining Life	9	-	10
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

AHUs

Tag	AH-7	AH-8	AH-6
Unit Type	Air Handler	Air Handler	Air Handler
Qty	1	1	1
	Basement Mech Room	Theater Lower Level	Theater Lower Level
Area Served	-	Theater	
Manufacturer	McQuay	Lennox	Lennox
Model #	LSL122DH	B3-305-1FW	B3-205-1FW
Serial #	3UM00195-04	-	68-2
Cooling Type	Chilled Water	DX (R22)	DX (R22)
Cooling Capacity (Tons)	36.0	37.0	18.5
Cooling Efficiency (EER)	N/A	N/A	N/A
Heating Type	N/A	Hot Water	Hot Water
Heating Input (MBH)	N/A	N/A	N/A
Heating Efficiency (%)	N/A	N/A	N/A
Supply Fan (HP)	10.00	-	-
Approx Age	10	25	25
ASHRAE Service Life	20	20	20
Remaining Life	10	(5)	(5)
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

AHUs

Tag	F-1	HFC-1	AH	AH-3
Unit Type	Oil Furnace	Fan Coil	Split Air Handler	Air Handler
Qty	1	1	1	1
	Annex Building	Mansion 3rd Floor	Hedley Gallery Closet	Ceiling Classroom 1
Area Served	Annex Building	Mansion 3rd Floor	Hedley Gallery	Classroom 1
Manufacturer	Ultra	Unitary Products Group	Liebert	-
Model #	LUF80B112/125D/G	KDBC-S090AA	-	
Serial #	S8400F59561	NLFS008016	-	
Cooling Type	N/A	DX	DX (R22)	Chilled Water
Cooling Capacity (Tons)	N/A	7.5	5.0	2.0
Cooling Efficiency (EER)	N/A		-	N/A
Heating Type	Oil Furnace	N/A	-	Electric
Heating Input (MBH)	125	N/A	-	9 kW
Heating Efficiency (%)	80%	N/A	-	100%
Supply Fan (HP)	-	1.50	-	510 Watts
Approx Age	25	17	-	-
ASHRAE Service Life	20	20	20	20
Remaining Life	(5)	3	-	-
Comments				

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Domestic Water Heaters

Tag	HWH-1	HWH-2	HWH-3
Unit Type	Heater w/ Storage	Heater w/ Storage	Heater w/ Storage
Qty	1	1	1
Location	Basement Mansion	Theater Lower Level	Fire Pump Room
Area Served	Mansion	Lower Level Theater	Gallery Lower Level
Manufacturer	A.O. Smith	A.O. Smith	RUUDGLAS
Model #	GCV 40 100	DEN 52 110	EGLS50-18-G
Serial #	H06A127276	E06M010458	1292E00083
Size (Gallons)	38	50	50
Input Capacity (MBH/KW)	40 MBH	6 kW	18 kW
Recovery (Gal/Hr)	39.32	-	-
Efficiency %	80%	98%	98%
Fuel	Natural Gas	Electric	Electric
Approx Age	8	8	8
ASHRAE Service Life	15	15	15
Remaining Life	7	7	7
Comments		480V 1/3P	208V 3P

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Morris Museum

Boilers

Tag	B-1	B-2	B-3
Unit Type	Oil Fired Cast Iron Steam	Oil Fired Cast Iron	Oil Fired Cast Iron
Qty	1	1	1
Location	Mansion Basement	Mansion Basement	Mansion Basement
Area Served	Mansion	Mansion	Mansion
Manufacturer	Burnham	Weil McLain	Richardson
Model #	V1106	A-B-672	21B-A
Serial #	26002786	-	-
Input Capacity (Btu/Hr)	9.2 GPH	3.2 GPH	-
Rated Output Capacity (Btu/Hr)	1,069,000	297,400	-
Approx. Efficiency %	83%	66.4%	-
Fuel	Fuel Oil #2	Fuel Oil #2	Fuel Oil #2
Approx Age	16	35	35
ASHRAE Service Life	35	35	35
Remaining Life	19	0	0
Comments		Hot Water	No Longer in Use

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

Boilers

Tag	B-4	B-5
Unit Type	Cast Iron	Oil fired Cast Iron
Qty	1	1
Location	Mansion Basement	Theater Lower Level
Area Served	Mansion	Theater Addition
Manufacturer	American Standard	Peerless
Model #	G-24 DG	LC-12
Serial #	6BSEN-J5	LC-108
Input Capacity (Btu/Hr)	90,000	2,252,000
Rated Output Capacity (Btu/Hr)	72,000	1,593,000
Approx. Efficiency %	80.0%	70.7%
Fuel	Natural Gas	Fuel Oil #2
Approx Age	35	30
ASHRAE Service Life	35	35
Remaining Life	0	5
Comments	Domestic Boiler	15.6 GPH Oil

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Morris Museum

Exhaust Fans

Tag	EF-1	EF-2	
Unit Type	Downblast	Upblast	
Qty	1	1	
Location	Theater Lobby Roof	Mammals Roof	
Area Served	-	-	
Manufacturer	Greenheck	Dayton	
Model #	GB-141-5-X	4C400 C	
Serial #	10646987 0610	-	
Motor (HP)	-	1/2	
Electrical (V/H/P)	-	115/1/60	
Approx Age	-	15	
ASHRAE Service Life	20	20	
Remaining Life	-	5	
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Chiller

Tag	CH-1		
Unit Type	Air-Cooled		
Qty	1		
Location	On-Grade		
Area Served	Main Gallery, Guinness Collection		
Manufacturer	McQuay		
Model #	ALR125C		
Serial #	5U0183000		
Refrigerant	R-22		
Cooling Capacity (Tons)	125		
Cooling Efficiency (KW/Ton)	1.158		
Volts / Phase / Hz	208/3/60		
Fuel	Electric		
Chilled Water GPM / ΔT	412 GPM, 10F dT		
Condenser Water GPM / ΔT	-		
Approx Age	13		
ASHRAE Service Life	20		
Remaining Life	7		
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Pumps

Tag	CHWP-1, 2		
Unit Type	End Suction		
Qty	2		
Location	Basement Mech Room		
Area Served	Chilled Water		
Manufacturer	Bell & Gossett		
Model #	4BC 8-1/4 BF		
Serial #	1577866		
Horse Power	15.0		
Flow	412 GPM, 60' HD		
Motor Info	Marathon Fr 254T		
Electrical Power	208/230V 3P		
RPM	1745		
Motor Efficiency %	88.5%		
Approx Age	18		
ASHRAE Service Life	18		
Remaining Life	0		
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Morris Museum

Other Equipment

Tag	Washer #1	Washer #2	Dryer #1
Unit Type	Tub Washer	Tub Washer	Electric Dryer
Qty	1	1	1
Location	Mansion Basement	Mansion Basement	Mansion Basement
Manufacturer	Maytag	Maytag	Kenmore
Model #	A712	LAT9416AAE	110.69422801
Serial #	007270 VP	25165973WY	M04482330
Approx Age			
ASHRAE Service Life	-	-	-
Remaining Life	-	-	-
Comments	Series 04		Type: D433-LEL2406026-FM54

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

Other Equipmen

Tag	Refrigerator #1	Refrigerator #2	Refrigerator #3
Unit Type	Bottom Freezer	Top Freezer	Compact
Qty	1	1	1
Location	Mansion Break Room	Mansion Basement Shop	Theater Basement
Manufacturer	Whirlpool	Whirlpool	GE
Model #	MBL2256KES6	ET18SCRFW0 1	TAX4SNSB
Serial #	K01894862	EG3128340	VH081788
Approx Age	13	17	21
ASHRAE Service Life	-	-	-
Remaining Life	-	-	-
Comments		18 CUFT	4 CUFT

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

APPENDIX E

CEG Project #: IC14166
 Facility Name: Morris Museum
 Address: 4 Normandy Heights Road
 City, State, Zip: Morrisons, NJ 07960

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, 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	119 - Gallery, 1st Fl.	2600	2x4, 3-Lamp, T8, 32w, Recessed Mount, Prismatic Lens	3	82	8	0.66	1,706	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	3	54	8	0.43	1,123	0.22	582	\$73	0	No New Controls	0	0.0%	0	\$0	\$960.00	\$280.00	\$1,240.00	\$0.00	16.90	\$0.00	\$0.00	\$0.00	FALSE	-
2	119 - Gallery Track, 1st Fl.	2600	1 Track Lamp, GE 25 deg Halogen, 70w, Surface Mount	1	70	13	0.91	2,366	Re-lamp	Install Sylvania Lamp LED 17 PAR30 DMM P 930 NFL 30	1	17	13	0.22	575	0.69	1,791	\$226	0	No New Controls	0	0.0%	0	\$0	\$715.00	\$130.00	\$845.00	\$130.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-
3	119 - Egress, 1st Fl.	2600	LED Lamps, 2w, Surface Mount, Exit Signs	1	2	3	0.01	16	Existing to Remain	Existing to Remain	1	2	0	0.01	16	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	\$20.00	-
4	3 - Stair, 1st Fl.	3000	1x4, 1-Lamp, T12, 34w, Magnetic Ballast, Surface Mount, Slip / Lens	1	50	2	0.10	300	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	1	18	2	0.04	108	0.06	192	\$24	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$60.00	\$140.00	\$0.00	5.79	\$0.00	\$0.00	\$0.00	FALSE	-
5	120 - Gallery Display, 1st Fl.	2600	1x4, 2-Lamp, T12, 34w, Magnetic Ballast, Surface Mount, Slip / Lens	2	80	14	1.12	2,912	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	14	0.50	1,310	0.62	1,602	\$202	0	No New Controls	0	0.0%	0	\$0	\$1,120.00	\$490.00	\$1,610.00	\$0.00	7.98	\$0.00	\$0.00	\$0.00	FALSE	-
2	120 - Gallery, 1st Fl.	2600	1 Track Lamp, GE 25 deg Halogen, 70w, Surface Mount	1	70	4	0.28	728	Re-lamp	Install Sylvania Lamp LED 17 PAR30 DMM P 930 NFL 30	1	17	4	0.07	177	0.21	551	\$69	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$40.00	\$260.00	\$40.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-
5	120 - Gallery Display, 1st Fl.	2600	1x4, 2-Lamp, T12, 34w, Magnetic Ballast, Surface Mount	2	80	1	0.08	208	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	94	0.04	114	\$14	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$35.00	\$115.00	\$0.00	7.98	\$0.00	\$0.00	\$0.00	FALSE	-
6	120 - Gallery Display, 1st Fl.	2600	1-Lamp, Incandescent, 25w, Surface Mount	1	25	2	0.05	130	Re-lamp	Install Sylvania Lamp LED A19 F8Z7G2	1	6	2	0.01	31	0.04	99	\$12	0	No New Controls	0	0.0%	0	\$0	\$18.00	\$20.00	\$38.00	\$20.00	1.45	\$0.00	\$0.00	\$0.00	FALSE	-
7	120 - Gallery Display, 1st Fl.	2600	1-Lamp, Halogen, 35w, Surface Mount	1	35	2	0.07	182	Re-lamp	Oscon Sylvania Lamp LED 7 MR16-DM8-830 NFL 25	1	7	2	0.01	36	0.06	146	\$18	0	No New Controls	0	0.0%	0	\$0	\$34.00	\$20.00	\$54.00	\$20.00	1.85	\$0.00	\$0.00	\$0.00	FALSE	-
3	120 - Gallery Display, 1st Fl.	2600	LED Lamps, 2w, Surface Mount, Exit Signs	1	2	1	0.00	5	Existing to Remain	Existing to Remain	1	2	0	0.00	5	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
8	Corridor, 1st Fl.	3000	1-Lamp, LED, 24w, Track Lighting	1	24	13	0.31	936	Existing to Remain	Existing to Remain	1	24	0	0.31	936	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
2	4 - Gallery A Display, 1st Fl.	2600	1 Track Lamp, GE 25 deg Halogen, 70w, Surface Mount	1	70	8	0.56	1,456	Re-lamp	Install Sylvania Lamp LED 17 PAR30 DMM P 930 NFL 30	1	17	8	0.14	354	0.42	1,102	\$139	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$80.00	\$520.00	\$80.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-
9	4 - Gallery A Display, 1st Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	3	0.15	390	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	3	0.06	144	0.09	246	\$31	0	No New Controls	0	0.0%	0	\$0	\$210.00	\$30.00	\$240.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-
2	4 - Gallery B Display, 1st Fl.	2600	1 Track Lamp, GE 25 deg Halogen, 70w, Surface Mount	1	70	7	0.49	1,274	Re-lamp	Install Sylvania Lamp LED 17 PAR30 DMM P 930 NFL 30	1	17	7	0.12	309	0.37	965	\$122	0	No New Controls	0	0.0%	0	\$0	\$385.00	\$70.00	\$455.00	\$70.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-
9	4 - Gallery C Display, 1st Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	1	0.05	130	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	1	0.02	48	0.03	82	\$10	0	No New Controls	0	0.0%	0	\$0	\$70.00	\$10.00	\$80.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-
9	4 - Gallery B Display, 1st Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	1	0.05	130	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	1	0.02	48	0.03	82	\$10	0	No New Controls	0	0.0%	0	\$0	\$70.00	\$10.00	\$80.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-
9	4 - Gallery C Display, 1st Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	1	0.05	130	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	1	0.02	48	0.03	82	\$10	0	No New Controls	0	0.0%	0	\$0	\$70.00	\$10.00	\$80.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-
2	4 - Gallery D Display, 1st Fl.	2600	1 Track Lamp, GE 25 deg Halogen, 70w, Surface Mount	1	70	4	0.28	728	Re-lamp	Install Sylvania Lamp LED 17 PAR30 DMM P 930 NFL 30	1	17	4	0.07	177	0.21	551	\$69	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$40.00	\$260.00	\$40.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-
2	4 - Gallery C Display, 1st Fl.	2600	1 Track Lamp, GE 25 deg Halogen, 70w, Surface Mount	1	70	17	1.19	3,094	Re-lamp	Install Sylvania Lamp LED 17 PAR30 DMM P 930 NFL 30	1	17	17	0.29	751	0.90	2,343	\$295	0	No New Controls	0	0.0%	0	\$0	\$935.00	\$170.00	\$1,105.00	\$170.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-
9	4 - Gallery C Display, 1st Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	4	0.20	520	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	4	0.07	192	0.13	328	\$41	0	No New Controls	0	0.0%	0	\$0	\$280.00	\$40.00	\$320.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-
2	6 - Gallery, 1st Fl.	2600	1 Track Lamp, GE 25 deg Halogen, 70w, Surface Mount	1	70	21	1.47	3,822	Re-lamp	Install Sylvania Lamp LED 17 PAR30 DMM P 930 NFL 30	1	17	21	0.36	928	1.11	2,894	\$365	0	No New Controls	0	0.0%	0	\$0	\$1,155.00	\$210.00	\$1,365.00	\$210.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-
9	6 - Gallery, 1st Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	4	0.20	520	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	4	0.07	192	0.13	328	\$41	0	No New Controls	0	0.0%	0	\$0	\$280.00	\$40.00	\$320.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-
3	5 - Gallery Exit, 1st Fl.	2600	LED Lamps, 2w, Surface Mount, Exit Signs	1	2	1	0.00	5	Existing to Remain	Existing to Remain	1	2	0	0.00	5	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
3	6 - Gallery Exit, 1st Fl.	2600	LED Lamps, 2w, Surface Mount, Exit Signs	1	2	1	0.00	5	Existing to Remain	Existing to Remain	1	2	0	0.00	5	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
7	Mansion Entry, 1st Fl.	2600	1-Lamp, LED, 24w, Track Lighting	1	24	8	0.19	499	Existing to Remain	Existing to Remain	1	24	0	0.19	499	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
10	8 - Mansion Entry, 1st Fl.	2600	12" Ø, 2-Lamp, Incandescent, 60w, Surface Mount	2	120	1	0.12	312	Re-Lamp	Install 11w LED A-Lamp	2	22	1	0.02	57	0.10	255	\$32	0	No New Controls	0	0.0%	0	\$0	\$19.00	\$10.00	\$29.00	\$20.00	0.28	\$0.00	\$0.00	\$0.00	FALSE	-
3	7 - Mansion Exit, 1st Fl.	2600	LED Lamps, 2w, Surface Mount, Exit Signs	1	2	1	0.00	5	Existing to Remain	Existing to Remain	1	2	0	0.00	5	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
11	7 - Mansion Chandelier, 1st Fl.	2600	1-Lamp, Incandescent, 25w, Pendant Mount, Chandelier	1	25	12	0.30	780	Re-Lamp	Install Phillips Lamp A58A11/B5C250 112 DIM 83	1	3.5	12	0.04	109	0.26	671	\$85	0	No New Controls	0	0.0%	0	\$0	\$180.00	\$60.00	\$240.00	\$40.00	2.13	\$0.00	\$0.00	\$0.00	FALSE	-
12	9 - Gallery, 1st Fl.	2600	1-Lamp, Incandescent, 25w, Surface Mount, Pendant, Wall Sconce, Chandelier	1	25	17	0.43	1,105	Re-lamp	Install Sylvania Lamp LED 6 A19 F8Z7G2	1	6	17	0.10	265	0.32	840	\$106	0	No New Controls	0	0.0%	0	\$0	\$155.00	\$170.00	\$325.00	\$85.00	2.25	\$0.00	\$0.00	\$0.00	FALSE	-

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	Base 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
13	9 - Gallery, 1st Fl.	2600	1-Lamp, Incandescent, 40w, Surface Mount, Type T Lamp	1	40	4	0.16	416	Existing to Remain	Existing to Remain	1	40	0	0.16	416	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
14	10 - Corridor, 1st Fl.	3000	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Recessed Mount, Prismatic Lens	2	73	1	0.07	219	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	93	0.04	126	\$16	0	No New Controls	0	0.0%	0	\$0	\$10.00	\$35.00	\$145.00	\$0.00	9.13	\$0.00	\$0.00	\$0.00	FALSE	-
3	10 - Corridor Exit, 1st Fl.	3000	LED Lamp, 2w, Surface Mount, Exit Signs	1	2	1	0.00	6	Existing to Remain	Existing to Remain	1	2	0	0.00	6	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
13	7 - Mansion Entry, 1st Fl.	2600	1-Lamp, Incandescent, 40w, Surface Mount, Type T Lamp	1	40	1	0.04	104	Existing to Remain	Existing to Remain	1	40	0	0.04	104	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
15	12 - Cour Room, 1st Fl.	750	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	1	0.07	55	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	23	0.04	32	\$4	0	No New Controls	0	0.0%	0	\$0	\$10.00	\$35.00	\$145.00	\$0.00	36.53	\$0.00	\$0.00	\$0.00	FALSE	-
16	11 - Storage Room, 1st Fl.	750	1x4, 2-Lamp, T8, 32w, Electronic Ballast, Surface Mount, Prismatic Lens	2	58	2	0.12	87	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	2	0.07	54	0.04	33	\$4	0	No New Controls	0	0.0%	0	\$0	\$160.00	\$70.00	\$230.00	\$0.00	55.32	\$0.00	\$0.00	\$0.00	FALSE	-
15	13 - Office, 1st Fl.	2600	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-
17	11 - Office Lavatory, 1st Fl.	1200	1-Lamp, Incandescent, 25w, Pendant Mount	3	75	1	0.08	90	Re-lamp	Install Sylvania Lamp LED 6.9W 9827Q2	3	18	1	0.02	22	0.06	68	\$9	0	No New Controls	0	0.0%	0	\$0	\$27.00	\$15.00	\$42.00	\$10.00	3.71	\$0.00	\$0.00	\$0.00	FALSE	-
18	14 - Corridor, 1st Fl.	3000	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Recessed Mount	2	73	4	0.29	876	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	4	0.12	372	0.17	504	\$64	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$140.00	\$580.00	\$0.00	9.13	\$0.00	\$0.00	\$0.00	FALSE	-
19	15 - Kitchen, 1st Fl.	2600	2x2, 3-Lamp, T8, 17w, Electronic Ballast, Recessed Mount	3	47	4	0.19	489	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	4	0.12	322	0.06	166	\$21	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$140.00	\$580.00	\$0.00	27.66	\$0.00	\$0.00	\$0.00	FALSE	-
18	16 - Office, 1st Fl.	2600	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Recessed Mount	2	73	4	0.29	759	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	4	0.12	322	0.17	437	\$55	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$140.00	\$580.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-
20	14 - Corridor, 1st Fl.	3000	6", 1-Lamp, CFL, 13w	1	13	1	0.01	39	Existing to Remain	Existing to Remain	1	13	0	0.01	39	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
14	17 - Office, 1st Fl.	2600	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Recessed Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-
21	18 - Canopy, 1st Fl.	3000	12" 0.5, 2-Lamp, CFL, 11w, Electronic Ballast, Recessed Mount	1	26	1	0.03	78	Existing to Remain	Existing to Remain	1	26	0	0.03	78	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
22	19 - Corridor, 1st Fl.	3000	6" 0.5, 2-lamp, DTT CFL, 13w, Electronic Ballast, Recessed Mount	2	26	2	0.05	156	Existing to Remain	Existing to Remain	2	26	0	0.05	156	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
22	20 - Corridor, 1st Fl.	3000	6" 0.5, 2-lamp, DTT CFL, 13w, Electronic Ballast, Recessed Mount	27	26	27	0.70	2,106	Existing to Remain	Existing to Remain	27	26	0	0.70	2,106	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
9	20 - Corridor, 1st Fl.	3000	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	8	50	8	0.40	1,200	Re-Lamp	Install Sylvania Premium Lamp SR111-18-30D-830-03	1	18.5	8	0.15	444	0.25	756	\$95	0	No New Controls	0	0.0%	0	\$0	\$560.00	\$80.00	\$640.00	\$0.00	6.72	\$0.00	\$0.00	\$0.00	FALSE	-
9	20 - Corridor, 1st Fl.	3000	1 Track Lamp, Halogen ARI11, 50w, Surface Mount, Exit Signs	9	50	9	0.45	1,350	Re-Lamp	Install Sylvania Premium Lamp SR111-18-30D-830-03	1	18.5	9	0.17	500	0.28	851	\$107	0	No New Controls	0	0.0%	0	\$0	\$630.00	\$90.00	\$720.00	\$0.00	6.72	\$0.00	\$0.00	\$0.00	FALSE	-
3	20 - Corridor Exit, 1st Fl.	3000	LED Lamp, 2w, Surface Mount, Exit Signs	2	2	2	0.00	12	Existing to Remain	Existing to Remain	2	2	0	0.00	12	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
23	21 - Closet, 1st Fl.	750	1x4, 2-Lamp, T8, 32w, Electronic Ballast, Pendant Mount	1	58	1	0.06	44	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	27	0.02	17	\$2	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$35.00	\$115.00	\$0.00	55.32	\$0.00	\$0.00	\$0.00	FALSE	-
23	22 - Closet, 1st Fl.	750	1x4, 2-Lamp, T8, 32w, Electronic Ballast, Pendant Mount	1	58	1	0.06	44	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	27	0.02	17	\$2	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$35.00	\$115.00	\$0.00	55.32	\$0.00	\$0.00	\$0.00	FALSE	-
24	23 - Corridor, 1st Fl.	3000	6" 0.5, 1-Lamp, Triple Tube CFL, 32w, Electronic Ballast, Recessed Mount	14	32	14	0.45	1,344	Existing to Remain	Existing to Remain	14	32	0	0.45	1,344	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
22	24 - Corridor, 1st Fl.	3000	6" 0.5, 2-lamp, DTT CFL, 13w, Electronic Ballast, Recessed Mount	21	26	21	0.55	1,638	Existing to Remain	Existing to Remain	21	26	0	0.55	1,638	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
2	24 - Corridor, 1st Fl.	3000	1 Track Lamp, GE 25 deg Halogen, 70w, Surface Mount	4	70	4	0.28	840	Re-Lamp	Install Sylvania Premium Lamp LED 17 PAR30 DIM P300 NFL 30	1	17	4	0.07	204	0.21	636	\$80	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$40.00	\$260.00	\$40.00	2.75	\$0.00	\$0.00	\$0.00	FALSE	-
9	24 - Corridor, 1st Fl.	3000	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	5	50	5	0.25	750	Re-Lamp	Install Sylvania Premium Lamp SR111-18-30D-830-03	1	18.5	5	0.09	278	0.16	473	\$60	0	No New Controls	0	0.0%	0	\$0	\$350.00	\$50.00	\$400.00	\$0.00	6.72	\$0.00	\$0.00	\$0.00	FALSE	-
3	24 - Corridor Exit, 1st Fl.	3000	LED Lamp, 2w, Surface Mount, Exit Signs	2	2	2	0.00	12	Existing to Remain	Existing to Remain	2	2	0	0.00	12	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
23	25 - Stair B1, 1st Fl.	3000	1x4, 2-Lamp, T8, 32w, Electronic Ballast, Pendant Mount	2	58	2	0.12	348	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	2	0.07	216	0.04	132	\$17	0	No New Controls	0	0.0%	0	\$0	\$160.00	\$70.00	\$230.00	\$0.00	13.83	\$0.00	\$0.00	\$0.00	FALSE	-
22	25 - Stair B1, 1st Fl.	3000	6" 0.5, 2-lamp, DTT CFL, 13w, Electronic Ballast, Recessed Mount	1	26	1	0.03	78	Existing to Remain	Existing to Remain	1	26	0	0.03	78	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
3	25 - Stair Exit, 1st Fl.	3000	LED Lamp, 2w, Surface Mount, Exit Signs	1	2	1	0.00	6	Existing to Remain	Existing to Remain	1	2	0	0.00	6	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
8	26 - Gallery, 1st Fl.	2600	1-Lamp, LED, 24w, Track Lighting	15	24	15	0.36	936	Existing to Remain	Existing to Remain	15	24	0	0.36	936	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
25	26 - Gallery, 1st Fl.	2600	1-Lamp, Halogen, 25w, Surface Mount, Prismatic Lens	10	35	10	0.35	910	Re-lamp	Install Sylvania Lamp LED 7 MR16 DIM 830 NPL 25	1	7	10	0.07	182	0.28	728	\$92	0	No New Controls	0	0.0%	0	\$0	\$170.00	\$100.00	\$270.00	\$100.00	1.85	\$0.00	\$0.00	\$0.00	FALSE	-

Fixture Reference	Location	Average Burn Hours	EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT						RETROFIT ENERGY SAVINGS					PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
			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	Base 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	
26	26 - Gallery Exit, 1st FL	2600	2	2	2	0.00	10	Existing to Remain	Existing to Remain	2	2	0	0.00	10	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
26	27 - Gallery Exits, 1st FL	2600	5	2	5	0.01	26	Existing to Remain	Existing to Remain	5	2	0	0.01	26	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
9	27 - Gallery Exits, 1st FL	2600	1	50	27	1.35	3,510	Re-Lamp	Install Soria Premium Lamp SR111-18-36D-R30-03	1	18.5	27	0.50	1,299	0.85	2,211	\$279	0	No New Controls	0	0.0%	0	\$0	\$1,890.00	\$270.00	\$2,160.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-	
9	27 - Gallery Exits, 1st FL	2600	1	50	33	1.65	4,290	Re-Lamp	Install Soria Premium Lamp SR111-18-36D-R30-03	1	18.5	33	0.61	1,587	1.04	2,703	\$341	0	No New Controls	0	0.0%	0	\$0	\$2,310.00	\$330.00	\$2,640.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-	
2	27 - Gallery Exit, 1st FL	2600	1	70	45	3.15	8,190	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DIM P 930 NFL 30	1	17	45	0.77	1,989	2.39	6,201	\$781	0	No New Controls	0	0.0%	0	\$0	\$2,475.00	\$450.00	\$2,925.00	\$450.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-	
27	28 - Pavilion, 1st FL	3000	6	75	39	2.93	8,775	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DIM P 930 NFL 30	1	17	39	0.66	1,989	2.26	6,786	\$855	0	No New Controls	0	0.0%	0	\$0	\$2,145.00	\$390.00	\$2,535.00	\$390.00	2.51	\$0.00	\$0.00	\$0.00	FALSE	-	
27	28 - Pavilion Lobby, 1st FL	3000	4	75	4	0.30	900	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DIM P 930 NFL 30	1	17	4	0.07	204	0.23	696	\$88	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$40.00	\$260.00	\$40.00	2.51	\$0.00	\$0.00	\$0.00	FALSE	-	
3	28 - Pavilion Exit, 1st FL	3000	2	2	2	0.00	12	Existing to Remain	Existing to Remain	2	2	0	0.00	12	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
28	29 - Women's Rest Room, 1st FL	2600	2	47	6	0.28	733	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	6	0.19	484	0.10	250	\$31	0	No New Controls	0	0.0%	0	\$0	\$600.00	\$210.00	\$870.00	\$0.00	27.66	\$0.00	\$0.00	\$0.00	FALSE	-	
24	29 - Women's Rest Room, 1st FL	2600	4	32	4	0.13	333	Existing to Remain	Existing to Remain	4	32	0	0.13	333	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
28	30 - Men's Rest Room, 1st FL	2600	2	47	4	0.19	489	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	4	0.12	322	0.06	166	\$21	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$140.00	\$580.00	\$0.00	27.66	\$0.00	\$0.00	\$0.00	FALSE	-	
24	30 - Men's Rest Room, 1st FL	2600	2	32	2	0.06	166	Existing to Remain	Existing to Remain	2	32	0	0.06	166	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
24	31 - Corridor, 1st FL	3000	5	32	5	0.16	480	Existing to Remain	Existing to Remain	5	32	0	0.16	480	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
24	32 - Men's Janitor's Closet, 1st FL	750	1	32	1	0.03	24	Existing to Remain	Existing to Remain	1	32	0	0.03	24	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
29	33 - Museum Shop, 1st FL	2600	1	32	2	0.06	166	Existing to Remain	Existing to Remain	2	32	0	0.06	166	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
33	33 - Museum Shop, 1st FL	2600	1	70	4	0.28	728	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DIM P 930 NFL 30	1	17	4	0.07	177	0.21	551	\$69	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$40.00	\$260.00	\$40.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-	
9	33 - Museum Shop, 1st FL	2600	1	50	15	0.75	1,950	Re-Lamp	Install Soria Premium Lamp SR111-18-36D-R30-03	1	18.5	15	0.28	722	0.47	1,229	\$155	0	No New Controls	0	0.0%	0	\$0	\$1,050.00	\$150.00	\$1,200.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-	
9	33 - Museum Shop, 1st FL	2600	1	50	10	0.50	1,300	Re-Lamp	Install Soria Premium Lamp SR111-18-36D-R30-03	1	18.5	10	0.19	481	0.32	819	\$103	0	No New Controls	0	0.0%	0	\$0	\$700.00	\$100.00	\$800.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-	
34	34 - Theatre Lobby, 1st FL	2600	2	32	2	0.06	166	Existing to Remain	Existing to Remain	2	32	0	0.06	166	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
30	34 - Theatre Lobby, 1st FL	2600	4	70	14	0.98	2,548	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DIM P 930 NFL 30	1	17	14	0.24	619	0.74	1,929	\$243	0	No New Controls	0	0.0%	0	\$0	\$770.00	\$140.00	\$910.00	\$140.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-	
2	34 - Theatre Lobby, 1st FL	2600	1	70	6	0.42	1,092	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DIM P 930 NFL 30	1	17	6	0.10	265	0.32	827	\$104	0	No New Controls	0	0.0%	0	\$0	\$330.00	\$60.00	\$390.00	\$60.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-	
3	34 - Theatre Lobby Exits, 1st FL	2600	3	2	3	0.01	16	Existing to Remain	Existing to Remain	3	2	0	0.01	16	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
9	35 - Exhibit Lobby, 1st FL	2600	1	50	14	0.70	1,820	Re-Lamp	Install Soria Premium Lamp SR111-18-36D-R30-03	1	18.5	14	0.26	673	0.44	1,147	\$144	0	No New Controls	0	0.0%	0	\$0	\$980.00	\$140.00	\$1,120.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-	
29	35 - Exhibit Lobby, 1st FL	2600	4	32	4	0.13	333	Existing to Remain	Existing to Remain	4	32	0	0.13	333	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
3	35 - Exhibit Lobby Exit, 1st FL	2600	1	2	1	0.00	5	Existing to Remain	Existing to Remain	1	2	0	0.00	5	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
3	36A - Exhibit Lobby Exit, 1st FL	2600	2	2	2	0.00	10	Existing to Remain	Existing to Remain	2	2	0	0.00	10	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
30	36A - Exhibit Lobby, 1st FL	2600	6	70	6	0.42	1,092	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DIM P 930 NFL 30	1	17	6	0.10	265	0.32	827	\$104	0	No New Controls	0	0.0%	0	\$0	\$330.00	\$60.00	\$390.00	\$60.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-	
9	36A - Exhibit Lobby, 1st FL	2600	1	50	51	2.55	6,630	Re-Lamp	Install Soria Premium Lamp SR111-18-36D-R30-03	1	18.5	51	0.94	2,453	1.61	4,177	\$526	0	No New Controls	0	0.0%	0	\$0	\$1,570.00	\$510.00	\$4,080.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-	
3	36B - Exhibit Lobby Exit, 1st FL	2600	1	2	1	0.00	5	Existing to Remain	Existing to Remain	1	2	0	0.00	5	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
30	36B - Exhibit Lobby, 1st FL	2600	3	70	3	0.21	546	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DIM P 930 NFL 30	1	17	3	0.05	133	0.16	413	\$52	0	No New Controls	0	0.0%	0	\$0	\$165.00	\$30.00	\$195.00	\$30.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-	
9	36B - Exhibit Lobby, 1st FL	2600	1	50	26	1.30	3,380	Re-Lamp	Install Soria Premium Lamp SR111-18-36D-R30-03	1	18.5	26	0.48	1,251	0.82	2,129	\$268	0	No New Controls	0	0.0%	0	\$0	\$1,820.00	\$260.00	\$2,080.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-	

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	Base 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	30C - Exhibit Lobby Exit, 1st Fl.	2600	LED Lamp, 2w, Surface Mount, Exit Signs	4	2	4	0.01	21	Existing to Remain	Existing to Remain	4	2	0	0.01	21	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
9	36C - Exhibit Lobby, 1st Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	70	50	70	1.50	9,100	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	70	1.30	3,367	2.21	5,733	\$722	0	No New Controls	0	0.0%	0	\$0	\$4,900.00	\$700.00	\$5,600.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-				
30	36C - Exhibit Lobby, 1st Fl.	2600	6" Ø, 1-Lamp, Halogen, 70w, Recessed Mount	8	70	8	0.56	1,456	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DDM P 930 NFL 30	1	17	8	0.14	354	0.42	1,102	\$139	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$80.00	\$520.00	\$80.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-				
9	36D - Exhibit Lobby, 1st Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	24	50	24	1.20	3,120	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	24	0.44	1,154	0.76	1,966	\$248	0	No New Controls	0	0.0%	0	\$0	\$1,680.00	\$240.00	\$1,920.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-				
30	36D - Exhibit Lobby, 1st Fl.	2600	6" Ø, 1-Lamp, Halogen, 70w, Recessed Mount	1	70	1	0.07	182	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DDM P 930 NFL 30	1	17	1	0.02	44	0.05	138	\$17	0	No New Controls	0	0.0%	0	\$0	\$55.00	\$10.00	\$65.00	\$10.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-				
3	30D - Exhibit Lobby Exit, 1st Fl.	2600	LED Lamp, 2w, Surface Mount, Exit Signs	2	2	2	0.00	10	Existing to Remain	Existing to Remain	2	2	0	0.00	10	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
31	14A - Office, 1st Fl.	2600	6" Ø, 1-Lamp, Triple Tube CFL, 2w, Electronic Ballast, Pendant Mount	2	32	2	0.06	166	Existing to Remain	Existing to Remain	2	32	0	0.06	166	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
32	14A - Office, 1st Fl.	2600	6" Ø, 1-Lamp, CFL, 32w, Electronic Ballast, Surface Mount	1	32	1	0.03	83	Existing to Remain	Existing to Remain	1	32	0	0.03	83	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
22	17 - Corridor, 2nd Fl.	3000	6" Ø, 2-Lamp, DTT CFL, 13w, Electronic Ballast, Recessed Mount	2	26	4	0.10	312	Existing to Remain	Existing to Remain	2	26	0	0.10	312	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
3	17 - Corridor Exit, 2nd Fl.	3000	LED Lamp, 2w, Surface Mount, Exit Signs	1	2	1	0.00	6	Existing to Remain	Existing to Remain	1	2	0	0.00	6	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
22	38 - Corridor, 2nd Fl.	3000	6" Ø, 2-Lamp, DTT CFL, 13w, Electronic Ballast, Recessed Mount	2	26	24	0.62	1,872	Existing to Remain	Existing to Remain	2	26	0	0.62	1,872	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
9	38 - Corridor, 2nd Fl.	3000	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	14	0.70	2,100	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	14	0.26	777	0.44	1,223	\$167	0	No New Controls	0	0.0%	0	\$0	\$980.00	\$140.00	\$1,120.00	\$0.00	6.72	\$0.00	\$0.00	\$0.00	FALSE	-				
2	38 - Corridor, 2nd Fl.	3000	1 Track Lamp, GE 25 deg Halogen, 70w, Surface Mount	1	70	3	0.21	630	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DDM P 930 NFL 30	1	17	3	0.05	153	0.16	477	\$60	0	No New Controls	0	0.0%	0	\$0	\$165.00	\$30.00	\$195.00	\$30.00	2.75	\$0.00	\$0.00	\$0.00	FALSE	-				
3	38 - Corridor Exit, 2nd Fl.	3000	LED Lamp, 2w, Surface Mount, Exit Signs	1	2	2	0.00	12	Existing to Remain	Existing to Remain	1	2	0	0.00	12	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
9	39 - Gallery, 2nd Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	45	2.25	5,850	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	45	0.83	2,165	1.42	3,686	\$464	0	No New Controls	0	0.0%	0	\$0	\$3,150.00	\$450.00	\$3,600.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-				
22	39 - Gallery, 2nd Fl.	2600	6" Ø, 2-Lamp, DTT CFL, 13w, Electronic Ballast, Recessed Mount	2	26	8	0.21	541	Existing to Remain	Existing to Remain	2	26	0	0.21	541	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
2	40 - Gallery, 2nd Fl.	800	1 Track Lamp, GE 25 deg Halogen, 70w, Surface Mount	1	70	4	0.28	224	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DDM P 930 NFL 30	1	17	4	0.07	54	0.21	170	\$21	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$40.00	\$260.00	\$40.00	10.29	\$0.00	\$0.00	\$0.00	FALSE	-				
9	40 - Gallery, 2nd Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	9	0.45	1,170	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	9	0.17	433	0.28	737	\$93	0	No New Controls	0	0.0%	0	\$0	\$630.00	\$90.00	\$720.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-				
3	40 - Gallery Exit, 2nd Fl.	2600	LED Lamp, 2w, Surface Mount, Exit Signs	1	2	2	0.00	10	Existing to Remain	Existing to Remain	1	2	0	0.00	10	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
9	41 - Gallery, 2nd Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	18	0.90	2,340	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	18	0.33	866	0.57	1,474	\$186	0	No New Controls	0	0.0%	0	\$0	\$1,260.00	\$180.00	\$1,440.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-				
2	41 - Gallery, 2nd Fl.	2600	1 Track Lamp, GE 25 deg Halogen, 70w, Surface Mount	1	70	6	0.42	1,092	Re-Lamp	Install Sylvania Lamp LED 17 PAR30 DDM P 930 NFL 30	1	17	6	0.10	265	0.32	827	\$104	0	No New Controls	0	0.0%	0	\$0	\$330.00	\$60.00	\$390.00	\$60.00	3.17	\$0.00	\$0.00	\$0.00	FALSE	-				
3	41 - Gallery Exit, 2nd Fl.	3000	LED Lamp, 2w, Surface Mount, Exit Signs	1	2	2	0.00	12	Existing to Remain	Existing to Remain	1	2	0	0.00	12	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
33	42 - Conference Room, 2nd Fl.	2600	1-Lamp, Track, CFL, 23w, Electronic Ballast, Surface Mount	1	23	6	0.14	359	Existing to Remain	Existing to Remain	1	23	0	0.14	359	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
9	42 - Conference Room Exit, 2nd Fl.	2600	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	1	0.05	130	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	1	0.02	48	0.03	82	\$10	0	No New Controls	0	0.0%	0	\$0	\$70.00	\$10.00	\$80.00	\$0.00	7.75	\$0.00	\$0.00	\$0.00	FALSE	-				
3	42 - Conference Room Exit, 2nd Fl.	2600	LED Lamp, 2w, Surface Mount, Exit Signs	1	2	1	0.00	5	Existing to Remain	Existing to Remain	1	2	0	0.00	5	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
15	43 - Bathroom, 2nd Fl.	2600	2x2, 2-Lamp, T8 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	1	0.07	190	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	81	0.04	109	\$14	0	No New Controls	0	0.0%	0	\$0	\$110.00	\$35.00	\$145.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-				
14	44 - Corridor, 2nd Fl.	3000	2x2, 2-Lamp, T8 32w, U-tube, Electronic Ballast, Recessed Mount, Prismatic Lens	2	73	2	0.15	438	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	186	0.08	252	\$32	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	9.13	\$0.00	\$0.00	\$0.00	FALSE	-				
15	44 - Corridor, 2nd Fl.	3000	2x2, 2-Lamp, T8 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	1	0.07	219	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	93	0.04	126	\$16	0	No New Controls	0	0.0%	0	\$0	\$110.00	\$35.00	\$145.00	\$0.00	9.13	\$0.00	\$0.00	\$0.00	FALSE	-				
14	45 - Office, 2nd Fl.	2600	2x2, 2-Lamp, T8 32w, U-tube, Electronic Ballast, Recessed Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-				
14	46 - Office, 2nd Fl.	2600	2x2, 2-Lamp, T8 32w, U-tube, Electronic Ballast, Recessed Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-				
9	47 - Foyer, 2nd Fl.	3000	1 Track Lamp, Halogen ARI11, 50w, Surface Mount	1	50	2	0.10	300	Re-Lamp	Install Sora Premium Lamp SR111-18-36D-830-03	1	18.5	2	0.04	111	0.06	189	\$24	0	No New Controls	0	0.0%	0	\$0	\$140.00	\$20.00	\$160.00	\$0.00	6.72	\$0.00	\$0.00	\$0.00	FALSE	-				

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	Base 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
15	48 - Corridor, 2nd Fl.	3000	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	4	0.29	876	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	4	0.12	372	0.17	504	\$64	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$140.00	\$580.00	\$0.00	9.13	\$0.00	\$0.00	\$0.00	FALSE	-
3	48 - Corridor Exits, 2nd Fl.	3000	LED Lamps, 2w, Surface Mount, Exit Signs	1	2	2	0.00	12	Existing to Remain	Existing to Remain	1	2	0	0.00	12	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
15	49 - Office, 2nd Fl.	2600	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-
14	50 - Office Entry, 2nd Fl.	2600	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Recessed Mount, Prismatic Lens	2	73	1	0.07	190	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	81	0.04	109	\$14	0	No New Controls	0	0.0%	0	\$0	\$110.00	\$35.00	\$145.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-
15	51 - Office, 2nd Fl.	2600	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-
16	52 - Corridor, 2nd Fl.	3000	1x4, 2-Lamp, T8, 32w, Electronic Ballast, Surface Mount, Prismatic Lens	2	58	1	0.06	174	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	108	0.02	66	\$8	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$35.00	\$115.00	\$0.00	13.83	\$0.00	\$0.00	\$0.00	FALSE	-
3	52 - Corridor Exit, 2nd Fl.	3000	LED Lamps, 2w, Surface Mount, Exit Signs	1	2	1	0.00	6	Existing to Remain	Existing to Remain	1	2	0	0.00	6	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
15	53 - Office, 2nd Fl.	2600	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-
15	54 - Office, 2nd Fl.	2600	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-
15	55 - Office, 2nd Fl.	2600	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-
15	56 - Office, 2nd Fl.	2600	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-
15	57 - Office, 2nd Fl.	2600	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-
15	58 - Corridor, 2nd Fl.	3000	2x2, 2-Lamp, T8, 32w, U-tube, Electronic Ballast, Surface Mount, Prismatic Lens	2	73	1	0.07	219	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	93	0.04	126	\$16	0	No New Controls	0	0.0%	0	\$0	\$110.00	\$35.00	\$145.00	\$0.00	9.13	\$0.00	\$0.00	\$0.00	FALSE	-
34	59 - Bathroom, 2nd Fl.	2600	1-Lamp, Incandescent, 60w, Surface Mount	1	60	2	0.12	312	Re-Lamp	Install 11w LED A-Lamp	1	11	2	0.02	57	0.10	255	\$32	0	No New Controls	0	0.0%	0	\$0	\$38.00	\$20.00	\$58.00	\$20.00	1.18	\$0.00	\$0.00	\$0.00	FALSE	-
34	60 - Closet, 2nd Fl.	750	1-Lamp, Incandescent, 60w, Surface Mount	1	60	1	0.06	45	Re-Lamp	Install 11w LED A-Lamp	1	11	1	0.01	8	0.05	37	\$5	0	No New Controls	0	0.0%	0	\$0	\$19.00	\$10.00	\$29.00	\$10.00	4.10	\$0.00	\$0.00	\$0.00	FALSE	-
34	61 - Closet, 2nd Fl.	750	1-Lamp, Incandescent, 60w, Surface Mount	1	60	1	0.06	45	Re-Lamp	Install 11w LED A-Lamp	1	11	1	0.01	8	0.05	37	\$5	0	No New Controls	0	0.0%	0	\$0	\$19.00	\$10.00	\$29.00	\$10.00	4.10	\$0.00	\$0.00	\$0.00	FALSE	-
35	62 - Classroom 1, Lower Level	2600	2x4, 4-Lamp, T8, 32w, Electronic Ballast, Recessed Mount, Prismatic Lens	4	109	11	1.20	3,117	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	4	72	11	0.79	2,059	0.41	1,058	\$133	0	No New Controls	0	0.0%	0	\$0	\$1,760.00	\$385.00	\$2,145.00	\$0.00	16.09	\$0.00	\$0.00	\$0.00	FALSE	-
36	63 - Pump Room, Lower Level	750	1x4, 2-Lamp, T12, 40w, Magnetic Ballast, Pendant Mount	2	94	5	0.47	351	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	5	0.18	135	0.29	218	\$27	0	No New Controls	0	0.0%	0	\$0	\$400.00	\$175.00	\$575.00	\$0.00	20.98	\$0.00	\$0.00	\$0.00	FALSE	-
37	64 - Classroom, Lower Level	2600	2x4, 2-Lamp, T8, 32w, Electronic Ballast, Recessed Mount	2	58	7	0.41	1,056	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	7	0.25	655	0.15	400	\$50	0	No New Controls	0	0.0%	0	\$0	\$560.00	\$245.00	\$805.00	\$0.00	15.96	\$0.00	\$0.00	\$0.00	FALSE	-
38	65 - Storage, Lower Level	750	2x4, 4-Lamp, T8, 32w, Electronic Ballast, Recessed Mount	4	109	7	0.76	572	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	4	72	7	0.50	378	0.26	194	\$24	0	No New Controls	0	0.0%	0	\$0	\$1,200.00	\$245.00	\$1,365.00	\$0.00	55.77	\$0.00	\$0.00	\$0.00	FALSE	-
39	66 - Men's Rest Room, Lower Level	2600	2x4, 2-Lamp, T12, 40w, Magnetic Ballast, Recessed Mount, Prismatic Lens	3	151	3	0.45	1,178	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	3	54	3	0.16	421	0.29	757	\$95	0	No New Controls	0	0.0%	0	\$0	\$360.00	\$105.00	\$465.00	\$0.00	4.88	\$0.00	\$0.00	\$0.00	FALSE	-
39	67 - Women's Rest Room, Lower Level	2600	2x4, 2-Lamp, T12, 40w, Magnetic Ballast, Recessed Mount, Prismatic Lens	3	151	3	0.45	1,178	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	3	54	3	0.16	421	0.29	757	\$95	0	No New Controls	0	0.0%	0	\$0	\$360.00	\$105.00	\$465.00	\$0.00	4.88	\$0.00	\$0.00	\$0.00	FALSE	-
40	68 - Corridor, Lower Level	3000	2x2, 2-Lamp, T8, 17w, Electronic Ballast, Recessed Mount, Prismatic Lens	3	47	3	0.14	423	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	3	0.09	279	0.05	144	\$18	0	No New Controls	0	0.0%	0	\$0	\$330.00	\$105.00	\$435.00	\$0.00	23.97	\$0.00	\$0.00	\$0.00	FALSE	-
3	69 - Corridor Exits, Lower Level	3000	LED Lamps, 2w, Surface Mount, Exit Signs	1	2	3	0.01	18	Existing to Remain	Existing to Remain	1	2	0	0.01	18	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
40	69 - Corridor, Lower Level	3000	2x2, 2-Lamp, T8, 17w, Electronic Ballast, Recessed Mount, Prismatic Lens	3	47	4	0.19	564	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	4	0.12	372	0.06	192	\$24	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$140.00	\$580.00	\$0.00	23.97	\$0.00	\$0.00	\$0.00	FALSE	-
42	69 - Corridor, Lower Level	3000	2x2, 2-Lamp, T12, 40w, Magnetic Ballast, Pendant Mount	2	70	6	0.42	1,260	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	6	0.19	558	0.23	702	\$88	0	No New Controls	0	0.0%	0	\$0	\$660.00	\$210.00	\$870.00	\$0.00	9.84	\$0.00	\$0.00	\$0.00	FALSE	-
36	70 - Storage, Lower Level	750	1x4, 2-Lamp, T12, 40w, Magnetic Ballast, Pendant Mount	2	94	5	0.47	351	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	5	0.18	135	0.29	218	\$27	0	No New Controls	0	0.0%	0	\$0	\$400.00	\$175.00	\$575.00	\$0.00	20.98	\$0.00	\$0.00	\$0.00	FALSE	-
43	71 - Mechanical Room, Lower Level	750	1x2, 2-Lamp, T12, 40w, Magnetic Ballast, Pendant Mount	2	70	4	0.28	210	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	4	0.12	93	0.16	117	\$15	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$140.00	\$580.00	\$0.00	39.34	\$0.00	\$0.00	\$0.00	FALSE	-
44	72 - Office, Lower Level	2600	2x2, 2-Lamp, T8, 17w, Electronic Ballast, Recessed Mount, Parabolic LED	3	47	4	0.19	489	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	4	0.12	322	0.06	166	\$21	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$140.00	\$580.00	\$0.00	27.66	\$0.00	\$0.00	\$0.00	FALSE	-
44	73 - Office, Lower Level	2600	2x2, 2-Lamp, T8, 17w, Electronic Ballast, Recessed Mount, Parabolic LED	3	47	4	0.19	489	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	4	0.12	322	0.06	166	\$21	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$140.00	\$580.00	\$0.00	27.66	\$0.00	\$0.00	\$0.00	FALSE	-
45	74 - Sprinkler Valve	750	1x4, 2-Lamp, T12, 90w, Magnetic Ballast, Surface Mount	2	212	8	1.70	1,272	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	4	72	8	0.58	432	1.12	840	\$106	0	No New Controls	0	0.0%	0	\$0	\$1,280.00	\$280.00	\$1,560.00	\$0.00	14.74	\$0.00	\$0.00	\$0.00	FALSE	-

Fixture Reference	Location	Average Burn Hours	EXISTING FIXTURES					PROPOSED FIXTURE RETROFIT					RETROFIT ENERGY SAVINGS					PROPOSED LIGHTING CONTROLS					LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST					
			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	Base 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
74	Sprinkler Valve Exit	750	1	2	1	0.00	2	Existing to Remain	Existing to Remain	1	2	0	0.00	2	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
45	75 - HVAC Room	750	2	212	2	0.42	318	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	4	72	2	0.14	108	0.28	210	\$26	0	No New Controls	0	0.0%	0	\$0	\$120.00	\$70.00	\$390.00	\$0.00	14.74	\$0.00	\$0.00	\$0.00	FALSE	-
76	76 - Storage, Lower Level	750	2	58	12	0.70	522	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	12	0.43	324	0.26	198	\$25	0	No New Controls	0	0.0%	0	\$0	\$960.00	\$420.00	\$1,380.00	\$0.00	55.32	\$0.00	\$0.00	\$0.00	FALSE	-
46	77 Elevator Machine Room, Lower Level	750	4	188	1	0.19	141	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	4	72	1	0.07	54	0.12	87	\$11	0	No New Controls	0	0.0%	0	\$0	\$160.00	\$35.00	\$195.00	\$0.00	17.79	\$0.00	\$0.00	\$0.00	FALSE	-
17	78 - Storage, Lower Level	750	3	75	1	0.08	56	Re-lamp	Install Sylvania Lamp LED 6 A19 F827G2	3	18	1	0.02	14	0.06	43	\$5	0	No New Controls	0	0.0%	0	\$0	\$27.00	\$15.00	\$42.00	\$10.00	5.94	\$0.00	\$0.00	\$0.00	FALSE	-
48	79 - Corridor, Lower Level	3000	3	82	3	0.25	738	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	3	54	3	0.16	486	0.08	252	\$32	0	No New Controls	0	0.0%	0	\$0	\$360.00	\$105.00	\$465.00	\$0.00	14.64	\$0.00	\$0.00	\$0.00	FALSE	-
44	79 - Corridor, Lower Level	3000	3	47	2	0.09	282	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	186	0.03	96	\$12	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	23.97	\$0.00	\$0.00	\$0.00	FALSE	-
3	79 - Corridor Exit, Lower Level	3000	1	2	2	0.00	12	Existing to Remain	Existing to Remain	1	2	0	0.00	12	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
49	80 - Corridor, Lower Level	3000	2	70	3	0.21	630	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	3	0.09	279	0.12	351	\$44	0	No New Controls	0	0.0%	0	\$0	\$330.00	\$105.00	\$435.00	\$0.00	9.84	\$0.00	\$0.00	\$0.00	FALSE	-
3	80 - Corridor Exit, Lower Level	3000	1	2	1	0.00	6	Existing to Remain	Existing to Remain	1	2	0	0.00	6	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
48	81 - Storage, Lower Level	750	3	82	5	0.41	308	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	3	54	5	0.27	203	0.14	105	\$13	0	No New Controls	0	0.0%	0	\$0	\$600.00	\$175.00	\$775.00	\$0.00	58.58	\$0.00	\$0.00	\$0.00	FALSE	-
48	82 - Office, Lower Level	2600	3	82	8	0.66	1,706	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	3	54	8	0.43	1,123	0.22	582	\$73	0	No New Controls	0	0.0%	0	\$0	\$960.00	\$260.00	\$1,240.00	\$0.00	16.90	\$0.00	\$0.00	\$0.00	FALSE	-
44	82 - Office, Lower Level	2600	3	47	2	0.09	244	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.03	83	\$10	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	27.66	\$0.00	\$0.00	\$0.00	FALSE	-
3	82 - Office Exit, Lower Level	2600	1	2	1	0.00	5	Existing to Remain	Existing to Remain	1	2	0	0.00	5	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
50	83 - Boiler Room, Lower Level	750	1	100	2	0.20	150	Re-Lamp	Install 11w LED A-Lamp	1	11	2	0.02	17	0.18	134	\$17	0	No New Controls	0	0.0%	0	\$0	\$38.00	\$20.00	\$58.00	\$20.00	2.26	\$0.00	\$0.00	\$0.00	FALSE	-
49	84 - Office, Lower Level	2600	2	70	2	0.14	364	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	203	\$26	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	11.35	\$0.00	\$0.00	\$0.00	FALSE	-
23	85 - Storage, Lower Level	750	2	58	10	0.58	435	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	10	0.36	270	0.22	165	\$21	0	No New Controls	0	0.0%	0	\$0	\$800.00	\$350.00	\$1,150.00	\$0.00	55.32	\$0.00	\$0.00	\$0.00	FALSE	-
48	86 - Exhibit, Lower Level	2600	3	82	8	0.66	1,706	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	3	54	8	0.43	1,123	0.22	582	\$73	0	No New Controls	0	0.0%	0	\$0	\$960.00	\$260.00	\$1,240.00	\$0.00	16.90	\$0.00	\$0.00	\$0.00	FALSE	-
51	86 - Exhibit, Lower Level	2600	1	12	12	0.14	374	Existing to Remain	Existing to Remain	1	12	0	0.14	374	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
3	86 - Exhibit Exit	2600	1	2	1	0.00	5	Existing to Remain	Existing to Remain	1	2	0	0.00	5	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
52	87 - Women's Rest Room	2600	3	151	1	0.15	393	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	3	54	1	0.05	140	0.10	252	\$32	0	No New Controls	0	0.0%	0	\$0	\$120.00	\$35.00	\$155.00	\$0.00	4.88	\$0.00	\$0.00	\$0.00	FALSE	-
53	87 - Women's Rest Room	2600	1	57	1	0.06	148	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	1	18	1	0.02	47	0.04	101	\$13	0	No New Controls	0	0.0%	0	\$0	\$40.00	\$35.00	\$75.00	\$0.00	5.87	\$0.00	\$0.00	\$0.00	FALSE	-
52	88 - Men's Rest Room, Lower Level	2600	3	151	1	0.15	393	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	3	54	1	0.05	140	0.10	252	\$32	0	No New Controls	0	0.0%	0	\$0	\$120.00	\$35.00	\$155.00	\$0.00	4.88	\$0.00	\$0.00	\$0.00	FALSE	-
53	88 - Men's Rest Room, Lower Level	2600	1	57	1	0.06	148	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	1	18	1	0.02	47	0.04	101	\$13	0	No New Controls	0	0.0%	0	\$0	\$40.00	\$35.00	\$75.00	\$0.00	5.87	\$0.00	\$0.00	\$0.00	FALSE	-
45	89 - Storage, Lower Level	750	2	212	4	0.85	636	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	4	72	4	0.29	216	0.56	420	\$53	0	No New Controls	0	0.0%	0	\$0	\$640.00	\$140.00	\$780.00	\$0.00	14.74	\$0.00	\$0.00	\$0.00	FALSE	-
54	90 - Storage, Lower Level	750	1	26	1	0.03	20	Existing to Remain	Existing to Remain	1	26	0	0.03	20	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
50	91 - Closet, Lower Level	750	1	100	1	0.10	75	Re-Lamp	Install 11w LED A-Lamp	1	11	1	0.01	8	0.09	67	\$8	0	No New Controls	0	0.0%	0	\$0	\$19.00	\$10.00	\$29.00	\$10.00	2.26	\$0.00	\$0.00	\$0.00	FALSE	-
45	92 - Storage 047, Lower Level	750	2	212	1	0.21	159	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	4	72	1	0.07	54	0.14	105	\$13	0	No New Controls	0	0.0%	0	\$0	\$160.00	\$35.00	\$195.00	\$0.00	14.74	\$0.00	\$0.00	\$0.00	FALSE	-
54	93 - Storage, Lower Level	750	1	26	2	0.05	39	Existing to Remain	Existing to Remain	1	26	0	0.05	39	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	
55	94 - Corridor, Lower Level	3000	1	28	2	0.06	168	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	1	18	2	0.04	108	0.02	60	\$8	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$70.00	\$150.00	\$0.00	19.84	\$0.00	\$0.00	\$0.00	FALSE	-
56	94 - Corridor, Lower Level	3000	1	32	2	0.06	192	Existing to Remain	Existing to Remain	1	32	0	0.06	192	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-	

Fixture Reference	Location	Storage Room	EXISTING FIXTURES						PROPOSED EXISTING 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	Base 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				
57	94 - Corridor, Lower Level	3000	1-Lamp, CFL, 13w, Electronic Ballast, Surface Mount	1	13	1	0.01	39	Existing to Remain	Existing to Remain	1	13	0	0.01	39	0.00	0	0	0	No New Controls	0	0.0%	0	0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
58	95 - Storage, Lower Level	750	1x8, 1-Lamp, T12, 90w, Magnetic Ballast, Pendant Mount	1	106	1	0.11	80	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	27	0.07	53	\$7	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$35.00	\$115.00	\$0.00	17.38	\$0.00	\$0.00	\$0.00	FALSE	-				
59	96 - Storage, Lower Level	750	1x8, 2-Lamp, T12, 34w, Magnetic Ballast, Pendant Mount	2	80	4	0.32	240	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	4	0.14	108	0.18	132	\$17	0	No New Controls	0	0.0%	0	\$0	\$320.00	\$140.00	\$460.00	\$0.00	27.66	\$0.00	\$0.00	\$0.00	FALSE	-				
57	97 - Boiler Room, Lower Level	750	1-Lamp, CFL, 13w, Electronic Ballast, Surface Mount	1	13	1	0.01	10	Existing to Remain	Existing to Remain	1	13	0	0.01	10	0.00	0	0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
60	97 - Boiler Room, Lower Level	750	1-Lamp, CFL, 42w, Electronic Ballast, Surface Mount	1	42	1	0.04	32	Existing to Remain	Existing to Remain	1	42	0	0.04	32	0.00	0	0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
57	98 - Corridor, Lower Level	3000	1-Lamp, CFL, 13w, Electronic Ballast, Surface Mount	1	13	2	0.03	78	Existing to Remain	Existing to Remain	1	13	0	0.03	78	0.00	0	0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
55	98 - Corridor, Lower Level	3000	1x8, 1-Lamp, T8, 32w, Electronic Ballast, Surface Mount, Prismatic Lens	1	28	1	0.03	84	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	1	18	1	0.02	54	0.01	30	\$4	0	No New Controls	0	0.0%	0	\$0	\$40.00	\$35.00	\$75.00	\$0.00	19.84	\$0.00	\$0.00	\$0.00	FALSE	-				
61	99 - Men's Rest Room, Lower Level	2600	2x2, 2-Lamp, U-tube, 40w, Magnetic Ballast, Recessed Mount, Prismatic Lens	2	70	5	0.35	910	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	5	0.16	403	0.20	507	\$64	0	No New Controls	0	0.0%	0	\$0	\$550.00	\$175.00	\$725.00	\$0.00	11.35	\$0.00	\$0.00	\$0.00	FALSE	-				
61	100 - Women's Rest Room, Lower Level	2600	2x2, 2-Lamp, U-tube, 40w, Magnetic Ballast, Recessed Mount, Prismatic Lens	2	70	5	0.35	910	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	5	0.16	403	0.20	507	\$64	0	No New Controls	0	0.0%	0	\$0	\$550.00	\$175.00	\$725.00	\$0.00	11.35	\$0.00	\$0.00	\$0.00	FALSE	-				
61	101 - Rock Storage, Lower Level	750	2x2, 2-Lamp, U-tube, 40w, Magnetic Ballast, Recessed Mount, Prismatic Lens	2	70	6	0.42	315	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	6	0.19	140	0.23	176	\$22	0	No New Controls	0	0.0%	0	\$0	\$660.00	\$210.00	\$870.00	\$0.00	39.34	\$0.00	\$0.00	\$0.00	FALSE	-				
62	102 - Boiler Room, Lower Level	750	1x8, 2-Lamp, T12, 40w, Magnetic Ballast, Surface Mount	2	94	1	0.09	71	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	27	0.06	44	\$5	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$35.00	\$115.00	\$0.00	20.98	\$0.00	\$0.00	\$0.00	FALSE	-				
63	103 - Storage, Lower Level	750	1x8, 4-Lamp, T12, 40w, Magnetic Ballast, Surface Mount	2	188	2	0.38	282	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	4	72	2	0.14	108	0.23	174	\$22	0	No New Controls	0	0.0%	0	\$0	\$320.00	\$70.00	\$390.00	\$0.00	17.79	\$0.00	\$0.00	\$0.00	FALSE	-				
61	104 - Corridor, Lower Level	3000	2x2, 2-Lamp, U-tube, 40w, Magnetic Ballast, Recessed Mount, Prismatic Lens	2	70	3	0.21	630	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	3	0.09	279	0.12	351	\$44	0	No New Controls	0	0.0%	0	\$0	\$330.00	\$105.00	\$435.00	\$0.00	9.84	\$0.00	\$0.00	\$0.00	FALSE	-				
61	105 - Stair DA, Lower Level	3000	2x2, 2-Lamp, U-tube, 40w, Magnetic Ballast, Recessed Mount, Prismatic Lens	2	70	2	0.14	420	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	186	0.08	234	\$29	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	9.84	\$0.00	\$0.00	\$0.00	FALSE	-				
64	105 - Stair DA, Lower Level	3000	12" 0, 2-Lamp, CFL, Surface Mount, Prismatic Lens	2	64	2	0.13	384	Existing to Remain	Existing to Remain	2	64	0	0.13	384	0.00	0	0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-				
10	106 - Stair EA, Lower Level	3000	12" 0, 2-Lamp, Incandescent, 60w, Surface Mount	2	120	1	0.12	360	Re-Lamp	Install 11w LED A-Lamp	2	22	1	0.02	66	0.10	294	\$37	0	No New Controls	0	0.0%	0	\$0	\$19.00	\$10.00	\$29.00	\$20.00	0.24	\$0.00	\$0.00	\$0.00	FALSE	-				
65	44A - Office, 2nd Fl.	2600	2x2, 2-Lamp, U-tube, 40w, Magnetic Ballast, Surface Mount, Prismatic Lens	2	70	2	0.14	364	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	203	\$26	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	11.35	\$0.00	\$0.00	\$0.00	FALSE	-				
66	44A - Office, 2nd Fl.	2600	6' 0", 1-Lamp (Missing Lamp)	0	0	2	0.00	0	Re-Lamp	Install 11w LED A-Lamp	1	11	2	0.02	57	(0.02)	(57)	(57)	0	No New Controls	0	0.0%	0	\$0	\$38.00	\$20.00	\$58.00	\$20.00	(5.27)	\$0.00	\$0.00	\$0.00	FALSE	-				
61	44B - Office, 2nd Fl.	2600	2x2, 2-Lamp, U-tube, 40w, Magnetic Ballast, Recessed Mount, Prismatic Lens	2	70	2	0.14	364	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	203	\$26	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	11.35	\$0.00	\$0.00	\$0.00	FALSE	-				
67	49A - Office, 2nd Fl.	2600	2x2, 2-Lamp, U-tube, 32w, Electronic Ballast, Recessed Mount, Prismatic Lens	2	73	2	0.15	380	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	2	0.06	161	0.08	218	\$28	0	No New Controls	0	0.0%	0	\$0	\$220.00	\$70.00	\$290.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-				
67	61A - Office, 2nd Fl.	2600	2x2, 2-Lamp, U-tube, 32w, Electronic Ballast, Recessed Mount, Prismatic Lens	2	73	4	0.29	759	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	4	0.12	322	0.17	437	\$55	0	No New Controls	0	0.0%	0	\$0	\$440.00	\$140.00	\$580.00	\$0.00	10.54	\$0.00	\$0.00	\$0.00	FALSE	-				
36	Storage G, Attic North	750	1x8, 2-Lamp, T12, 40w, Magnetic Ballast, Pendant Mount	2	94	1	0.09	71	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	27	0.06	44	\$5	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$35.00	\$115.00	\$0.00	20.98	\$0.00	\$0.00	\$0.00	FALSE	-				
68	Storage E, Attic North	750	1x8, 2-Lamp, T12, 40w, Magnetic Ballast, Surface Mount	2	94	1	0.09	71	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	27	0.06	44	\$5	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$35.00	\$115.00	\$0.00	20.98	\$0.00	\$0.00	\$0.00	FALSE	-				
55	Storage Q, Attic North	750	1x8, 1-Lamp, T8, 32w, Electronic Ballast, Surface Mount, Prismatic Lens	1	28	1	0.03	21	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	1	18	1	0.02	14	0.01	8	\$1	0	No New Controls	0	0.0%	0	\$0	\$40.00	\$35.00	\$75.00	\$0.00	79.37	\$0.00	\$0.00	\$0.00	FALSE	-				
69	Janitor, Attic North	750	1-Lamp, Incandescent, 60w	1	60	1	0.06	45	Re-Lamp	Install 11w LED A-Lamp	1	11	1	0.01	8	0.05	37	\$5	0	No New Controls	0	0.0%	0	\$0	\$19.00	\$10.00	\$29.00	\$10.00	4.10	\$0.00	\$0.00	\$0.00	FALSE	-				
69	Storage O, Attic North	750	1-Lamp, Incandescent, 60w	1	60	1	0.06	45	Re-Lamp	Install 11w LED A-Lamp	1	11	1	0.01	8	0.05	37	\$5	0	No New Controls	0	0.0%	0	\$0	\$19.00	\$10.00	\$29.00	\$10.00	4.10	\$0.00	\$0.00	\$0.00	FALSE	-				
69	Storage H, Attic North	750	1-Lamp, Incandescent, 60w	1	60	1	0.06	45	Re-Lamp	Install 11w LED A-Lamp	1	11	1	0.01	8	0.05	37	\$5	0	No New Controls	0	0.0%	0	\$0	\$19.00	\$10.00	\$29.00	\$10.00	4.10	\$0.00	\$0.00	\$0.00	FALSE	-				
16	Storage J, Attic North	750	1x8, 2-Lamp, T8, 32w, Electronic Ballast, Surface Mount, Prismatic Lens	2	58	1	0.06	44	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	27	0.02	17	\$2	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$35.00	\$115.00	\$0.00	55.32	\$0.00	\$0.00	\$0.00	FALSE	-				
70	Storage C1, Attic North	750	1x2, 2-Lamp, T12, 25w, Magnetic Ballast, Surface Mount	2	55	1	0.06	41	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	20	1	0.02	15	0.04	26	\$3	0	No New Controls	0	0.0%	0	\$0	\$70.00	\$35.00	\$105.00	\$0.00	31.75	\$0.00	\$0.00	\$0.00	FALSE	-				
62	Storage K, Attic North	750	1x8, 2-Lamp, T12, 40w, Magnetic Ballast, Surface Mount	2	94	2	0.19	141	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	2	0.07	54	0.12	87	\$11	0	No New Controls	0	0.0%	0	\$0	\$160.00	\$70.00	\$230.00	\$0.00	20.98	\$0.00	\$0.00	\$0.00	FALSE	-				
69	Storage B, Attic North	750	1-Lamp, Incandescent, 60w	1	60	1	0.06	45	Re-Lamp	Install 11w LED A-Lamp	1	11	1	0.01	8	0.05	37	\$5	0	No New Controls	0	0.0%	0	\$0	\$19.00	\$10.00	\$29.00	\$10.00	4.10	\$0.00	\$0.00	\$0.00	FALSE	-				

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	Base 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
62	Storage A, Attic North	750	1x4, 2-Lamp, T12, 40w, Magnetic Ballast, Surface Mount	2	94	1	0.09	71	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	1	0.04	27	0.06	44	\$5	0	No New Controls	0	0.0%	0	\$0	\$80.00	\$35.00	\$115.00	\$0.00	20.98	\$0.00	\$0.00	\$0.00	FALSE	-
71	HVAC Room, Attic North	750	1-Lamp, CFL, 13w, Electronic Ballast	1	13	1	0.01	10	Existing to Remain	Existing to Remain	1	13	0	0.01	10	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
72	HVAC Room N, Attic North	750	1x4, 2-Lamp, T8, 32w, Electronic Ballast, Surface Mount	2	58	2	0.12	87	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	2	0.07	54	0.04	33	\$4	0	No New Controls	0	0.0%	0	\$0	\$160.00	\$70.00	\$230.00	\$0.00	55.32	\$0.00	\$0.00	\$0.00	FALSE	-
73	HVAC Room N, Attic North	750	1x2, 1-Lamp, T12, 25w, Magnetic Ballast, Surface Mount	1	28	1	0.03	21	Bypass Ballast & Install LED Tube Lamp	Install 18w 2' LED Tube Lamp	1	10	1	0.01	8	0.02	14	\$2	0	No New Controls	0	0.0%	0	\$0	\$35.00	\$35.00	\$70.00	\$0.00	41.15	\$0.00	\$0.00	\$0.00	FALSE	-
74	HVAC Room N, Attic North	750	2-Lamp, Incandescent, 60w	2	120	3	0.36	270	Re-Lamp	Install 11w LED A-Lamp	2	22	3	0.07	50	0.29	221	\$28	0	No New Controls	0	0.0%	0	\$0	\$114.00	\$45.00	\$159.00	\$60.00	3.56	\$0.00	\$0.00	\$0.00	FALSE	-
69	Stair C3, Attic North	3000	1-Lamp, Incandescent, 60w	1	60	1	0.06	180	Re-Lamp	Install 11w LED A-Lamp	1	11	1	0.01	33	0.05	147	\$19	0	No New Controls	0	0.0%	0	\$0	\$19.00	\$10.00	\$29.00	\$10.00	1.03	\$0.00	\$0.00	\$0.00	FALSE	-
69	Attic Corridor, Attic North	3000	1-Lamp, Incandescent, 60w	1	60	3	0.18	540	Re-Lamp	Install 11w LED A-Lamp	1	11	3	0.03	99	0.15	441	\$56	0	No New Controls	0	0.0%	0	\$0	\$57.00	\$30.00	\$87.00	\$30.00	1.03	\$0.00	\$0.00	\$0.00	FALSE	-
69	Storage at the Top of Stairs, Attic North	750	1-Lamp, Incandescent, 60w	1	60	2	0.12	90	Re-Lamp	Install 11w LED A-Lamp	1	11	2	0.02	17	0.10	74	\$9	0	No New Controls	0	0.0%	0	\$0	\$38.00	\$20.00	\$58.00	\$20.00	4.10	\$0.00	\$0.00	\$0.00	FALSE	-
74	Stair F2, Attic North	3000	2-Lamp, Incandescent, 60w	2	120	1	0.12	360	Re-Lamp	Install 11w LED A-Lamp	2	22	1	0.02	66	0.10	294	\$37	0	No New Controls	0	0.0%	0	\$0	\$38.00	\$15.00	\$53.00	\$20.00	0.89	\$0.00	\$0.00	\$0.00	FALSE	-
69	Stair F2, Attic North	3000	1-Lamp, Incandescent, 60w	1	60	2	0.12	360	Re-Lamp	Install 11w LED A-Lamp	1	11	2	0.02	66	0.10	294	\$37	0	No New Controls	0	0.0%	0	\$0	\$38.00	\$20.00	\$58.00	\$20.00	1.03	\$0.00	\$0.00	\$0.00	FALSE	-
3	Stair F2 Exits, Attic North	3000	LED Lamp, 2w, Surface Mount, Exit Signs	1	2	2	0.00	12	Existing to Remain	Existing to Remain	1	2	0	0.00	12	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
53	Freight Elevator, Lower Level	8760	1x4, 1-Lamp, T12, 40w, Magnetic Ballast, Surface Mount, Prismatic Lens	1	57	4	0.23	1,997	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	1	18	4	0.07	631	0.16	1,367	\$172	0	No New Controls	0	0.0%	0	\$0	\$160.00	\$140.00	\$300.00	\$0.00	1.74	\$0.00	\$0.00	\$0.00	FALSE	-
62	Freight Elevator, Lower Level	8760	1x4, 2-Lamp, T12, 40w, Magnetic Ballast, Surface Mount	2	94	4	0.38	3,294	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	4	0.14	1,261	0.23	2,032	\$256	0	No New Controls	0	0.0%	0	\$0	\$320.00	\$140.00	\$460.00	\$0.00	1.80	\$0.00	\$0.00	\$0.00	FALSE	-
72	70A - Fire Pump Room, Lower Level	750	1x4, 2-Lamp, T8, 32w, Electronic Ballast, Surface Mount	2	58	2	0.12	87	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	2	0.07	54	0.04	33	\$4	0	No New Controls	0	0.0%	0	\$0	\$160.00	\$70.00	\$230.00	\$0.00	55.32	\$0.00	\$0.00	\$0.00	FALSE	-
62	Elevator Mechanical Room, Lower Level	750	1x4, 2-Lamp, T12, 40w, Magnetic Ballast, Surface Mount	2	94	2	0.19	141	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	2	0.07	54	0.12	87	\$11	0	No New Controls	0	0.0%	0	\$0	\$160.00	\$70.00	\$230.00	\$0.00	20.98	\$0.00	\$0.00	\$0.00	FALSE	-
75	71A - Storage, Lower Level	750	2x2, 4-Lamp, T8, 17w, Electronic Ballast, Surface Mount	4	56	10	0.56	420	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	10	0.31	233	0.25	188	\$24	0	No New Controls	0	0.0%	0	\$0	\$1,100.00	\$350.00	\$1,450.00	\$0.00	61.38	\$0.00	\$0.00	\$0.00	FALSE	-
28	200 - Storage	750	2x2, 4-Lamp, T8, 17w, Electronic Ballast, Recessed Mount, Parabolic Lens	3	47	1	0.05	35	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	1	0.03	23	0.02	12	\$2	0	No New Controls	0	0.0%	0	\$0	\$110.00	\$35.00	\$145.00	\$0.00	95.90	\$0.00	\$0.00	\$0.00	FALSE	-
40	201 - Storage, Lower Level	750	2x2, 4-Lamp, T8, 17w, Electronic Ballast, Recessed Mount, Prismatic Lens	3	47	6	0.28	212	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	6	0.19	140	0.10	72	\$9	0	No New Controls	0	0.0%	0	\$0	\$660.00	\$210.00	\$870.00	\$0.00	95.90	\$0.00	\$0.00	\$0.00	FALSE	-
62	202 - Storage, Lower Level	750	1x4, 2-Lamp, T12, 40w, Magnetic Ballast, Surface Mount	2	94	16	1.50	1,128	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	16	0.58	432	0.93	696	\$88	0	No New Controls	0	0.0%	0	\$0	\$1,280.00	\$560.00	\$1,840.00	\$0.00	20.98	\$0.00	\$0.00	\$0.00	FALSE	-
72	202 - Storage, Lower Level	750	1x4, 2-Lamp, T8, 32w, Electronic Ballast, Surface Mount	2	58	4	0.23	174	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	4	0.14	108	0.09	66	\$8	0	No New Controls	0	0.0%	0	\$0	\$320.00	\$140.00	\$460.00	\$0.00	55.32	\$0.00	\$0.00	\$0.00	FALSE	-
28	203 - Office, Lower Level	2600	2x2, 3-Lamp, T8, 17w, Electronic Ballast, Recessed Mount, Parabolic Lens	3	47	6	0.28	733	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	6	0.19	484	0.10	250	\$31	0	No New Controls	0	0.0%	0	\$0	\$660.00	\$210.00	\$870.00	\$0.00	27.66	\$0.00	\$0.00	\$0.00	FALSE	-
41	204 - Office, Lower Level	2600	2x2, 4-Lamp, T8, 17w, Electronic Ballast, Recessed Mount, Prismatic Lens	4	56	6	0.34	874	LED Retrofit Kit	Install Philips LED Evo 2x2 Retrofit Kit	1	31	6	0.19	484	0.15	390	\$49	0	No New Controls	0	0.0%	0	\$0	\$660.00	\$210.00	\$870.00	\$0.00	17.70	\$0.00	\$0.00	\$0.00	FALSE	-
72	205 - Electrical Room, Lower Level	750	1x4, 2-Lamp, T8, 32w, Electronic Ballast, Surface Mount	2	58	3	0.17	131	Bypass Ballast & Install LED Tube Lamp	Install 18w 4' LED Tube Lamp	2	36	3	0.11	81	0.07	50	\$6	0	No New Controls	0	0.0%	0	\$0	\$240.00	\$105.00	\$345.00	\$0.00	55.32	\$0.00	\$0.00	\$0.00	FALSE	-
76	207 - Storage, Lower Level	750	1-Lamp, 70w par lamp incandescent	1	70	1	0.07	53	Re-Lamp	Install Sylvania Lamp LED 17 PAR 60 DIM P 900 NFL 30	1	17	1	0.02	13	0.05	40	\$5	0	No New Controls	0	0.0%	0	\$0	\$55.00	\$10.00	\$65.00	\$10.00	10.98	\$0.00	\$0.00	\$0.00	FALSE	-
70	208 - Elevator, Lower Level	8760	1x2, 2-Lamp, T12, 25w, Magnetic Ballast, Surface Mount	2	55	2	0.11	964	Bypass Ballast & Install LED Tube Lamp	Install 18w 2' LED Tube Lamp	2	20	2	0.04	350	0.07	613	\$77	0	No New Controls	0	0.0%	0	\$0	\$140.00	\$70.00	\$210.00	\$0.00	2.72	\$0.00	\$0.00	\$0.00	FALSE	-
79	209 - Changing Room #2, 1st FL	2600	6" 0, 1-Lamp, CFL, 15w, Electronic Ballast, Recessed Mount	1	13	8	0.10	270	Existing to Remain	Existing to Remain	1	13	0	0.10	270	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
80	209 - Changing Room #2, 1st FL	2600	1-Lamp, Incandescent, 25w, Surface Dressing Room	1	25	38	0.95	2,470	Existing to Remain	Existing to Remain	1	25	0	0.95	2,470	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
79	210 - Changing Room #1, 1st FL	2600	6" 0, 1-Lamp, CFL, 15w, Electronic Ballast, Recessed Mount	1	13	8	0.10	270	Existing to Remain	Existing to Remain	1	13	0	0.10	270	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
80	210 - Changing Room #1, 1st FL	2600	1-Lamp, Incandescent, 25w, Surface Dressing Room	1	25	38	0.95	2,470	Existing to Remain	Existing to Remain	1	25	0	0.95	2,470	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
81	211 - Vestibule, 1st FL	3000	6" 0, 1-Lamp, CFL, 42w, Electronic Ballast, Recessed Mount	1	42	2	0.08	252	Existing to Remain	Existing to Remain	1	42	0	0.08	252	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-
82	211 - Vestibule, 1st FL	3000	5 0, 1-Lamp, CFL, 42w, Electronic Ballast, Surface Mount	1	42	1	0.04	126	Existing to Remain	Existing to Remain	1	42	0	0.04	126	0.00	0	\$0	0	No New Controls	0	0.0%	0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	-	\$0.00	\$0.00	\$0.00	FALSE	-

APPENDIX F

Location Description	Area (Sq FT)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW _{DC}	Total Annual kWh	Total KW _{AC}	Panel Weight (41.9 lbs)	W/SQFT
Morris Museum	9450	SHARP ND-240QCJ	433	17.5	7,595	103.92	118,677	84.2	18,143	13.68



= Proposed PV Roof Layout
=35.5 kWDC

= Proposed PV Parking Layout
= 68.4 kWDC

Notes:

1. Estimated kWh based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

Project Name: LGEA Solar PV Project - Morris Museum Location: Morristown, NJ Description: Photovoltaic System 100% Financing - 15 year										
Simple Payback Analysis										
		Photovoltaic System 100% Financing - 15 year								
Total Construction Cost		\$509,832								
Annual kWh Production		118,677								
Annual Energy Cost Reduction		\$14,953								
Average Annual SREC Revenue		\$17,980								
Simple Payback:		15.48								Years
Life Cycle Cost Analysis										
Analysis Period (years):		15				Financing %:		100%		
Discount Rate:		3%				Maintenance Escalation Rate:		3.0%		
Average Energy Cost (\$/kWh)		\$0.126				Energy Cost Escalation Rate:		3.0%		
Financing Rate:		6.00%				Average SREC Value (\$/kWh)		\$0.152		
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow	
0	\$0	0	0	0	\$0	0	0	0	0	
1	\$0	118,677	\$14,953	\$0	\$29,669	\$30,002	\$21,625	(\$7,004)	(\$7,004)	
2	\$0	118,084	\$15,402	\$0	\$29,521	\$28,668	\$22,959	(\$6,704)	(\$13,709)	
3	\$0	117,493	\$15,864	\$0	\$29,373	\$27,252	\$24,375	(\$6,390)	(\$20,098)	
4	\$0	116,906	\$16,340	\$0	\$23,381	\$25,748	\$25,879	(\$11,906)	(\$32,004)	
5	\$0	116,321	\$16,830	\$1,198	\$23,264	\$24,152	\$27,475	(\$12,731)	(\$44,735)	
6	\$0	115,740	\$17,335	\$1,192	\$23,148	\$22,458	\$29,169	(\$12,336)	(\$57,071)	
7	\$0	115,161	\$17,855	\$1,186	\$17,274	\$20,659	\$30,968	(\$17,684)	(\$74,755)	
8	\$0	114,585	\$18,391	\$1,180	\$17,188	\$18,748	\$32,879	(\$17,229)	(\$91,984)	
9	\$0	114,012	\$18,942	\$1,174	\$17,102	\$16,721	\$34,906	(\$16,757)	(\$108,741)	
10	\$0	113,442	\$19,511	\$1,168	\$11,344	\$14,568	\$37,059	(\$21,941)	(\$130,682)	
11	\$0	112,875	\$20,096	\$1,163	\$11,287	\$12,282	\$39,345	(\$21,406)	(\$152,088)	
12	\$0	112,311	\$20,699	\$1,157	\$11,231	\$9,855	\$41,772	(\$20,854)	(\$172,942)	
13	\$0	111,749	\$21,320	\$1,151	\$5,587	\$7,279	\$44,348	(\$25,871)	(\$198,813)	
14	\$0	111,190	\$21,959	\$1,145	\$5,560	\$4,543	\$47,084	(\$25,253)	(\$224,066)	
15	\$0	110,634	\$22,618	\$1,140	\$5,532	\$1,639	\$49,988	(\$24,617)	(\$248,683)	
Totals:		1,719,179	\$278,115	\$12,855	\$260,462	\$264,573	\$509,832	(\$248,683)	(\$1,577,376)	
Net Present Value (NPV)							(\$177,392)			



**AC Energy
&
Cost Savings**



(Type comments here to appear on printout; maximum 1 row of 80 characters.)

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	35.5 kW
DC to AC Derate Factor:	0.810
AC Rating:	28.8 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	12.6 ¢/kWh

Results			
Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (\$)
1	2.39	2131	268.51
2	3.17	2584	325.58
3	4.07	3616	455.62
4	4.83	4006	504.76
5	5.70	4766	600.52
6	5.94	4658	586.91
7	5.77	4621	582.25
8	5.38	4280	539.28
9	4.65	3683	464.06
10	3.61	3031	381.91
11	2.35	1934	243.68
12	2.01	1735	218.61
Year	4.16	41045	5171.67



**AC Energy
&
Cost Savings**



(Type comments here to appear on printout; maximum 1 row of 80 characters.)

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	68.4 kW
DC to AC Derate Factor:	0.810
AC Rating:	55.4 kW
Array Type:	Fixed Tilt
Array Tilt:	7.5°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	12.6 ¢/kWh

Results			
Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (\$)
1	2.29	3886	489.64
2	3.07	4791	603.67
3	3.99	6815	858.69
4	4.79	7645	963.27
5	5.68	9152	1153.15
6	5.94	8969	1130.09
7	5.76	8885	1119.51
8	5.34	8186	1031.44
9	4.57	6967	877.84
10	3.51	5645	711.27
11	2.26	3547	446.92
12	1.92	3144	396.14
Year	4.10	77632	9781.63