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**Local Government Energy Program  
Energy Audit Report**

**Reeb House  
Unitarian Society of Ridgewood  
121 Cottage Place  
Ridgewood, NJ 07450**

**Project Number: LGEA113**



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## EXECUTIVE SUMMARY

The Unitarian Society of Ridgewood's Reeb House is a two-story 3,630-ft<sup>2</sup> facility with a basement and attic. It contains the administration offices, the Minister's office, kitchen, youth room, meeting room, and board room. The building was originally built in the 1930's but underwent a major addition approximately 20 years ago when the building was enlarged and a majority of the mechanical equipment which is currently in use was installed. This included addition of an office space towards the rear of the building and large staircase to serve as an alternative means of egress for the building in the event of an emergency.

The following table provides a comparison of the current building energy usage based on the period from November 2013 through October 2014 for electricity and natural gas with the proposed energy usage resulting from the installation of recommended Energy Conservation Measures (ECMs) excluding any renewable energy.

*Table 1: State of Building—Energy Usage*

|                                             | Electric Usage (kWh/yr) | Gas Usage (therms/yr) | Current Annual Cost of Energy (\$) | Site Energy Use Intensity (kBtu/sq ft /yr) | Source Energy Use Intensity (kBtu/sq ft /yr) | Joint Energy Consumption (MMBtu/yr) |
|---------------------------------------------|-------------------------|-----------------------|------------------------------------|--------------------------------------------|----------------------------------------------|-------------------------------------|
| Current                                     | 5,585                   | 1,654                 | \$3,188                            | 50.8                                       | 65                                           | 184                                 |
| Proposed                                    | 5,004                   | 1,429                 | \$2,796                            | 44.1                                       | 57                                           | 160                                 |
| Savings                                     | 581                     | 225                   | \$392                              | 6.7                                        | 8                                            | 24                                  |
| % Savings                                   | 10.4%                   | 13.6%                 | 12.3%                              | 13.3%                                      | 12.7%                                        | 13.3%                               |
| *Includes operation and maintenance savings |                         |                       |                                    |                                            |                                              |                                     |

SWA has entered energy information about the Reeb House into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy Benchmarking system. This facility is categorized as a "Office" space type. However, an ENERGY STAR Energy Performance Rating for this facility could not be generated because the Reeb House is below the minimum size requirement for the "Office space type. The Site Energy Utilization Intensity (Site EUI) was calculated to be 51.1 kBtu/ft<sup>2</sup>/yr compared to the National Median of 116.9 kBtu/ft<sup>2</sup>/yr. See the ECM section for guidance on how to reduce the building's energy intensity.

## Recommendations

Based on the current state of the building and its energy use, SWA recommends implementing the following Energy Conservation Measures:

| Recommended ECMs                                     | Incentive Program (APPENDIX G for Details) |
|------------------------------------------------------|--------------------------------------------|
| Install Door Sweeps on Exterior Doors                | N/A                                        |
| Install Low-Flow Aerators                            | N/A                                        |
| Replace Halogen and Fluorescent Lamps with LED Lamps | SmartStart                                 |

Appendix H contains an Energy Conservation Measures table.

In addition to these ECMs, SWA recommends the following Operation and Maintenance (O&M) measures that would contribute to reducing energy usage at low or no cost:

- Modify the Heating Thermostat Schedule
- Purchase Energy Star® Appliances

- Purchase Energy Star® Window AC Unit
- Repair/Replace Damaged/Missing Roof Soffit Vents

There may be energy procurement opportunities for the Reeb House to reduce annual utility costs. The building currently pays a higher than average utility rate for gas, and should be able to further reduce utility costs. SWA recommends further evaluation with energy suppliers, listed in Appendix D.

### Energy Conservation Measure Implementation

The following table shows an estimated implementation timeline for the recommended ECMs at the Reeb House.

*Table 2: Estimated Energy Conservation Timeline*

| Est. Implementation Timeline | Savings (\$) | Simple Payback Period | Initial Investment (\$) | CO2 Savings (lbs/yr) |
|------------------------------|--------------|-----------------------|-------------------------|----------------------|
| 0-5 Year                     | \$392        | 1.8                   | \$717                   | 3,516                |
| 5-10 Year                    | N/A          | N/A                   | N/A                     | N/A                  |
| >10 year                     | N/A          | N/A                   | N/A                     | N/A                  |
| <b>Total</b>                 | <b>\$392</b> | <b>1.8</b>            | <b>\$717</b>            | <b>3,516</b>         |

### Environmental Benefits

SWA estimates that implementing the recommended ECMs is equivalent of planting 9 trees to absorb CO2 from the atmosphere.

## INTRODUCTION

Launched in 2008, the Local Government Energy Audit (LGEA) Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize up to 100% of the cost of the audit. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

Steven Winter Associates, Inc. (SWA) is a 40-year-old architectural/engineering research and consulting firm, with specialized expertise in green technologies and procedures that improve the safety, performance, and cost effectiveness of buildings. SWA has a long-standing commitment to creating energy-efficient, cost-saving and resource-conserving buildings. As consultants on the built environment, SWA works closely with architects, developers, builders, and local, state, and federal agencies to develop and apply sustainable, 'whole building' strategies in a wide variety of building types: commercial, residential, educational and institutional.

SWA performed an energy audit and assessment at the Reeb House for the Unitarian Society of Ridgewood at 121 Cottage Place, Ridgewood, NJ. The process of the audit included a facility visit on February 12<sup>th</sup> 2015, benchmarking and energy bill analysis, assessment of existing conditions, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current building conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current building systems along with a detailed inventory of building energy systems, recommendations for improvement and recommendations for energy purchasing and procurement strategies.

The goal of this Local Government Energy Audit is to provide sufficient information to the Unitarian Society of Ridgewood to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures.

## HISTORICAL ENERGY CONSUMPTION

### Energy Usage, Load Profile and Cost Analysis

SWA reviewed electric utility and natural gas utility bills from November 2012 through October 2014 that were received from the Unitarian Society of Ridgewood (USR). A 12-month period of analysis from November 2013 through October 2014 was used for all calculations regarding electrical and natural gas energy savings.

Electricity – The building is currently served by one electric meter, supplied by Direct Energy and delivered by Public Service Electricity and Gas Company. Electricity is predominantly used for lighting, ventilation equipment, cooling equipment and miscellaneous plug loads. Electricity was purchased at an average aggregated rate of \$0.228/kWh and Reeb House consumed approximately 5,585 kWh, or \$2,678 of electricity, for the electric billing analysis period.

The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate base load or minimum electric usage required to operate the building. The baseline usage for the facility is approximately 405 kWh. The consumption profile seen is typical for a building with similar characteristics as peak consumption occurs in June. It is expected that the building with electric cooling systems experience peak consumption during the summer months. However, it is expected that July have a similarly high consumption but there is a significant decrease. As this does not correlate with any changes in cooling degree days as explored below it is difficult the root cause of the decreased consumption. Building staff should consider investigating this anomaly.

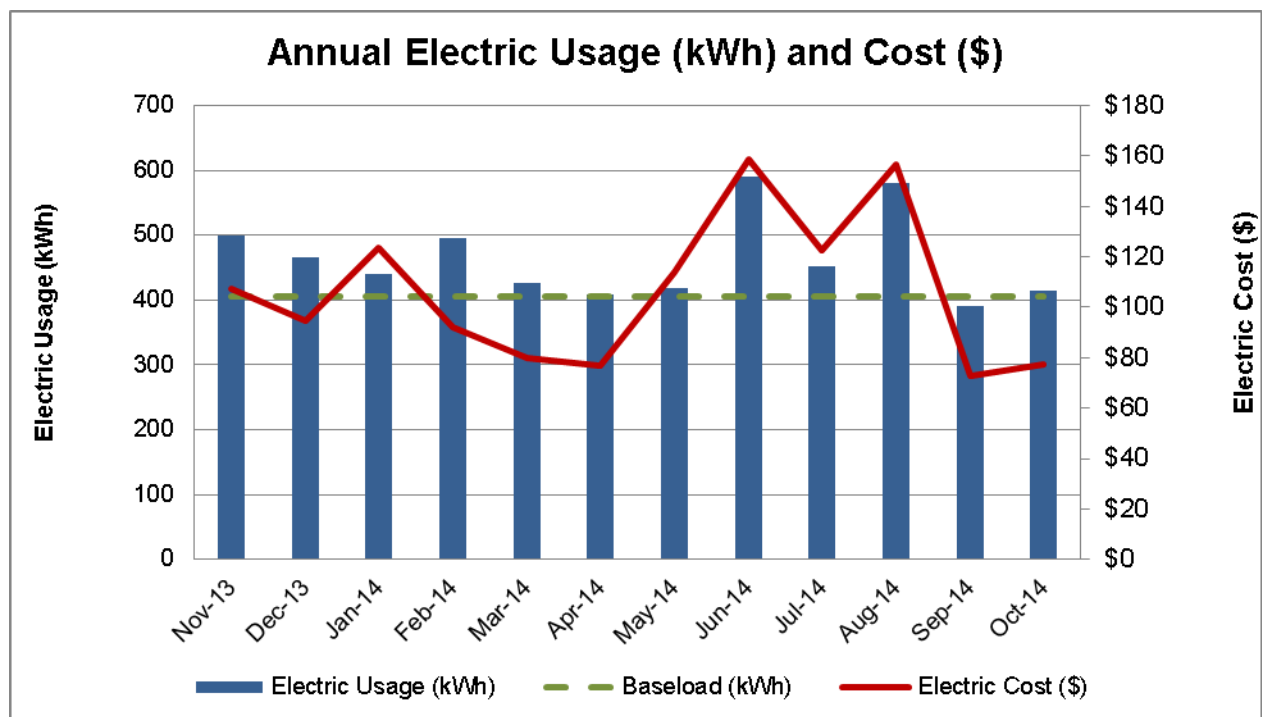


Figure 1 Annual Electric Usage and Costs

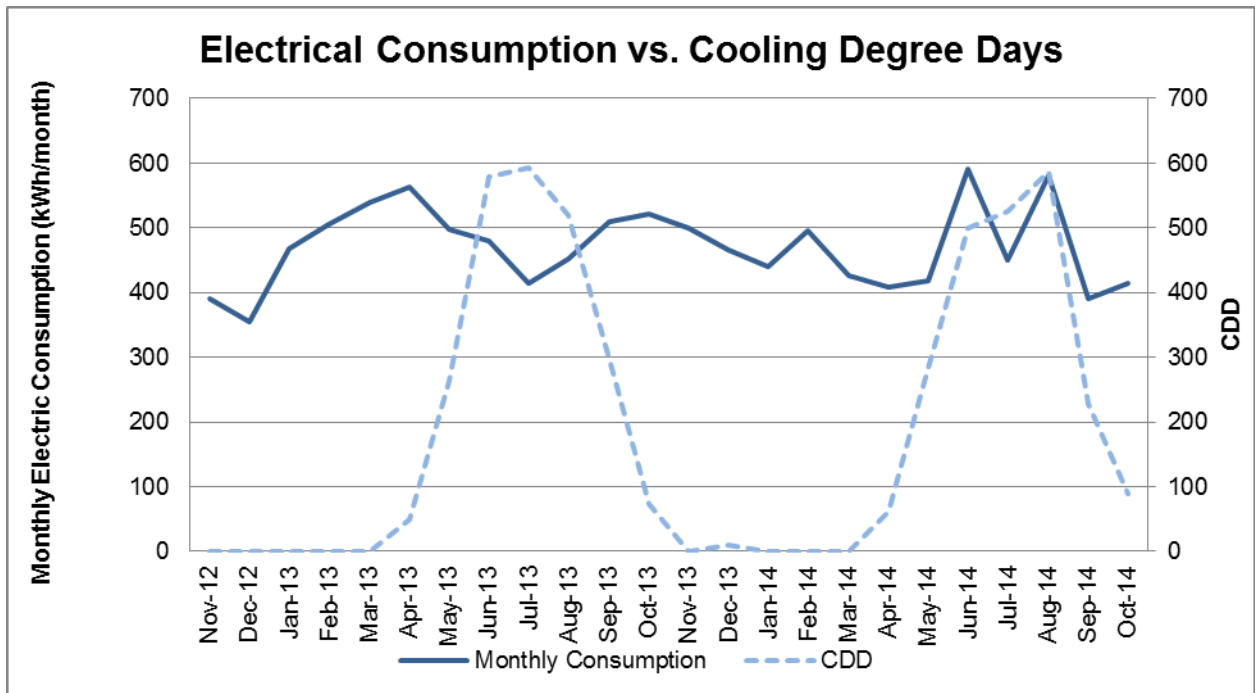


Figure 2 Electric Consumption and Cooling Degree Day Curves

The chart above shows the monthly electricity usage along with the cooling degree days or CDD. Cooling degree days is the difference of the average daily temperature and a base temperature of 50°F, on a particular day. As seen in the chart the building does not appear to respond well to cooling degrees. This is shown by the lack of correlation between electricity consumption and cooling degree days. It is unknown why the consumption during the summer of the first year decreased while cooling degree days peaked. Additionally, it is unknown why the consumption decreased during July of the second year. It is recommended that this analysis be performed periodically to provide a means of tracking performance with regard to cooling requirements. Further investigation by building staff should be completed to identify the root cause of the anomalies described above.

**Natural Gas** – The building is served by one natural gas meter, which is supplied by Direct Energy and delivered by Public Service Electricity and Gas Company. Natural gas was purchased at an average aggregated rate of \$1.16/therm and the Reeb House consumed 1,654 therms, or \$1,912 of natural gas, for the analyzed billing period. The chart below shows the monthly natural gas usage and costs. As expected, usage peaks in the winter months in conjunction with the enabling of heating mode. Consumption of natural gas then continues at a baseline value of 12 therms/month during the remainder of the year as domestic hot water is provided by a natural gas hot water heater.



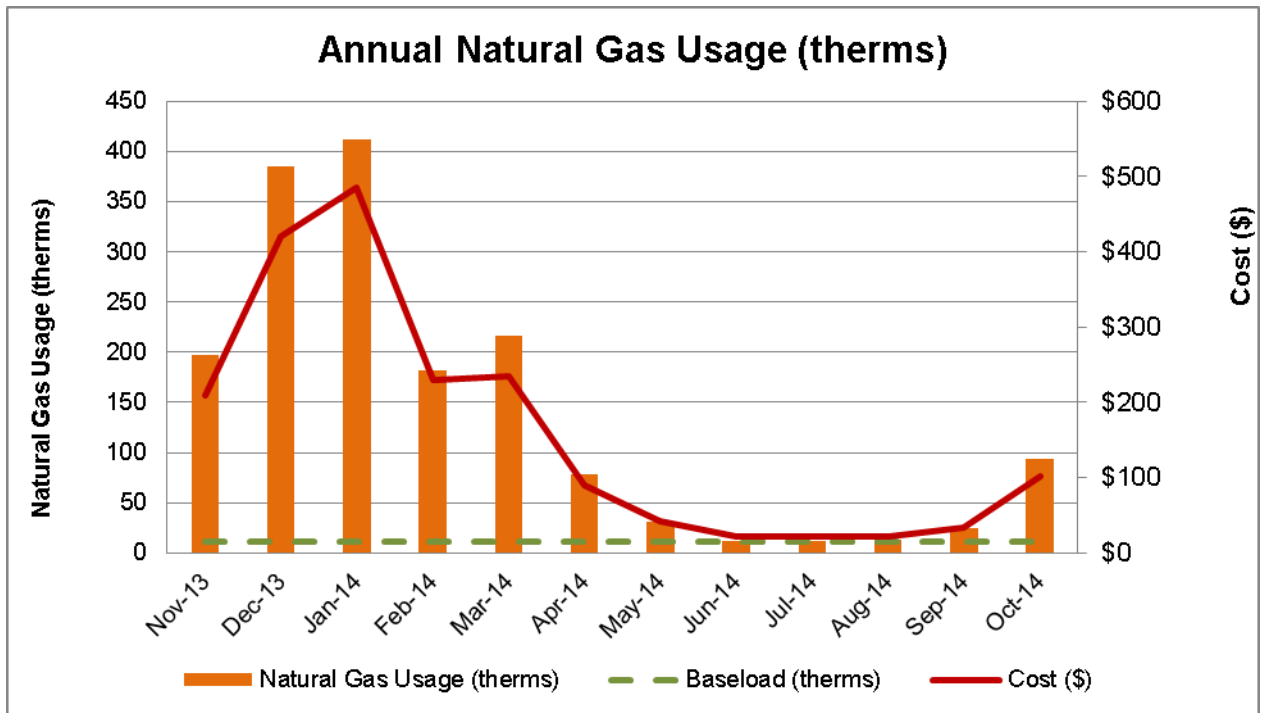


Figure 3 Annual Natural Gas Usage

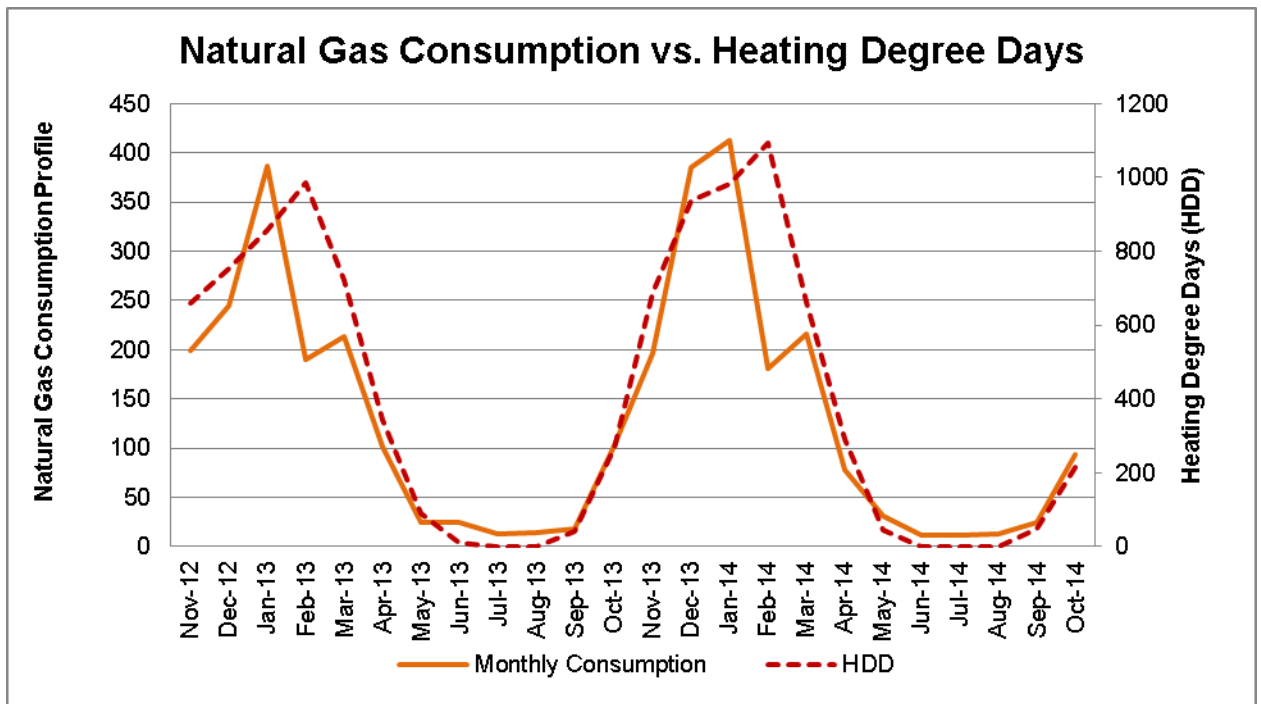


Figure 4 Natural Gas Usage and Heating Degree Day Curves

The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature of 65°F, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base temperature. As expected, the natural gas consumption profile follows a curve similar to the HDD curve. Here we also see that there are little to no anomalies and any variation in consumption from year to year is due to changes in



HDD and therefore heating requirements. The noticeable anomalies occur in February of both years and may correspond with a change in occupancy for the month.

The following pie charts and table show energy use for the Reeb House are based on utility bills for the analyzed billing period. Note: Electrical cost at \$67/MMBtu of energy is more than 5 times as expensive as natural gas at \$12/MMBtu.

| Annual Energy Consumption / Costs |            |             |                |             |             |
|-----------------------------------|------------|-------------|----------------|-------------|-------------|
|                                   | MMBtu      | % MMBtu     | \$             | %\$         | \$/MMBtu    |
| Electric Misc                     | 2          | 1%          | \$111          | 3%          | \$67        |
| Electric for Cooling              | 4          | 2%          | \$293          | 9%          | \$67        |
| Electric for Heating              | 5          | 3%          | \$357          | 11%         | \$67        |
| Lighting                          | 8          | 4%          | \$515          | 16%         | \$67        |
| Domestic Hot Water (Gas)          | 2          | 1%          | \$25           | 1%          | \$12        |
| Building Space Heating (Gas)      | 163        | 89%         | \$1,887        | 59%         | \$12        |
| <b>Totals</b>                     | <b>184</b> | <b>100%</b> | <b>\$3,188</b> | <b>100%</b> | <b>\$17</b> |
|                                   |            |             |                |             |             |
| Total Electric Usage              | 19         | 10%         | \$1,301        | 41%         | \$68        |
| Total Gas Usage                   | 165        | 90%         | \$1,887        | 59%         | \$11        |
| <b>Totals</b>                     | <b>184</b> | <b>100%</b> | <b>\$3,188</b> | <b>100%</b> | <b>\$17</b> |

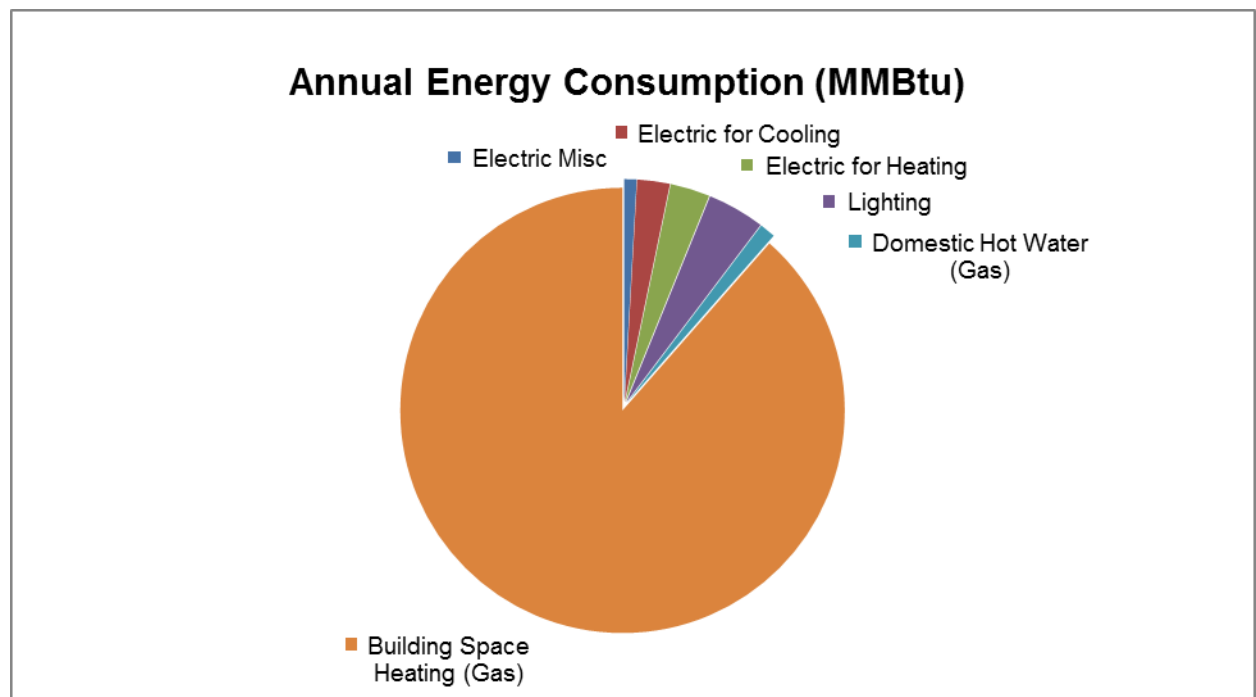


Figure 5 Annual Energy Consumption Breakdown Estimate

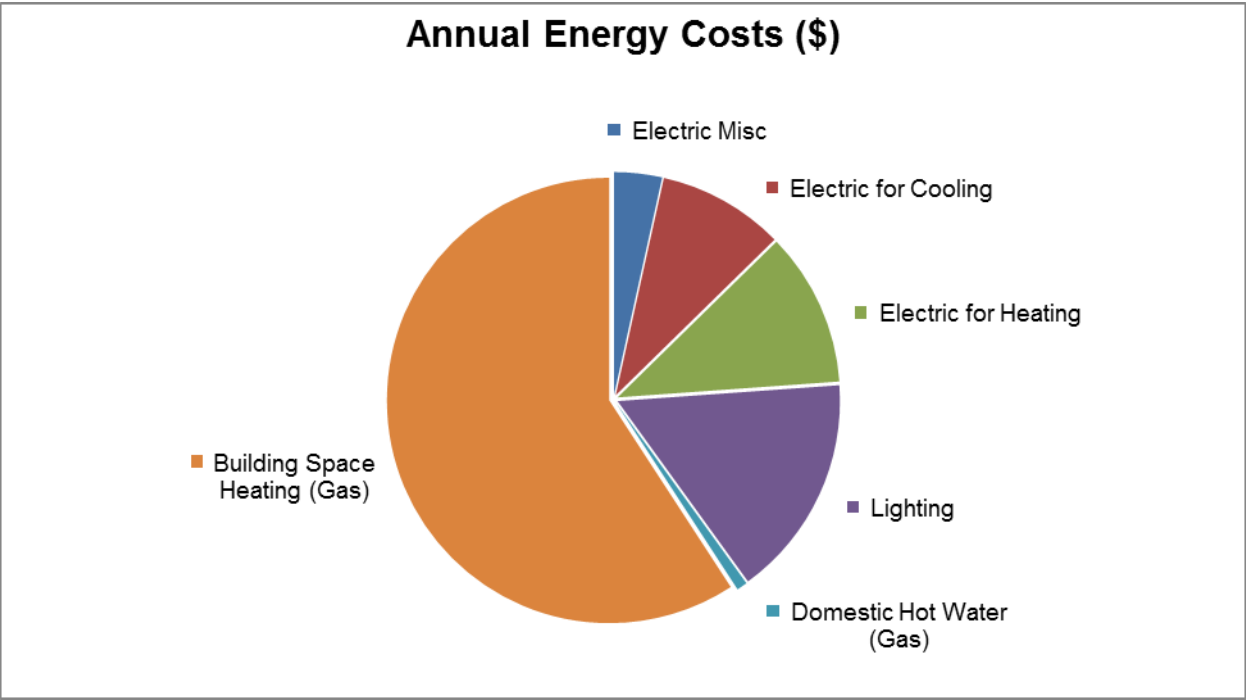


Figure 6 Annual Energy Cost Breakdown Estimate

## Energy Benchmarking

SWA has entered energy information about the building in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This facility is categorized as a "Office" space type. However, an ENERGY STAR Energy Performance Rating was not able to be determined because "Office" space type is required to be a minimum of 5,000 square feet. The Site Energy Utilization Intensity (Site EUI) was calculated to be 51.1 kBtu/ft<sup>2</sup>/yr compared to the National Median of 116.9 kBtu/ft<sup>2</sup>/yr. The Source Energy Utilization Intensity (Source EUI) was calculated to be 64.8 kBtu/ft<sup>2</sup>/yr compared to the National Median of 148.1 kBtu/ft<sup>2</sup>/yr the Reeb House, therefore, has a lower source EUI, with approximately 56% difference from the national average kBtu/ft<sup>2</sup>/yr. See the ECM section for guidance on how to further reduce the building's energy intensity.

The ENERGY STAR® Portfolio Manager uses a national survey conducted by the U.S. Energy Information Administration (EIA). This national survey, known as the Commercial Building Energy Consumption Survey (CBECS), is conducted every four years, and gathers data on building characteristics and energy use from thousands of buildings across the United States. Due to insufficient data in the 2007 survey, Portfolio Manager continues to use data provided by 2003 survey. The Portfolio Manager software uses this data to create a database by building type. By entering the building parameters and utility data into the software, Portfolio Manager is able to generate a performance scale from 1-100 by comparing it to similar buildings. This 100 point scale determines how well the building performs relative to other buildings across the country, regardless of climate and other differentiating factors.

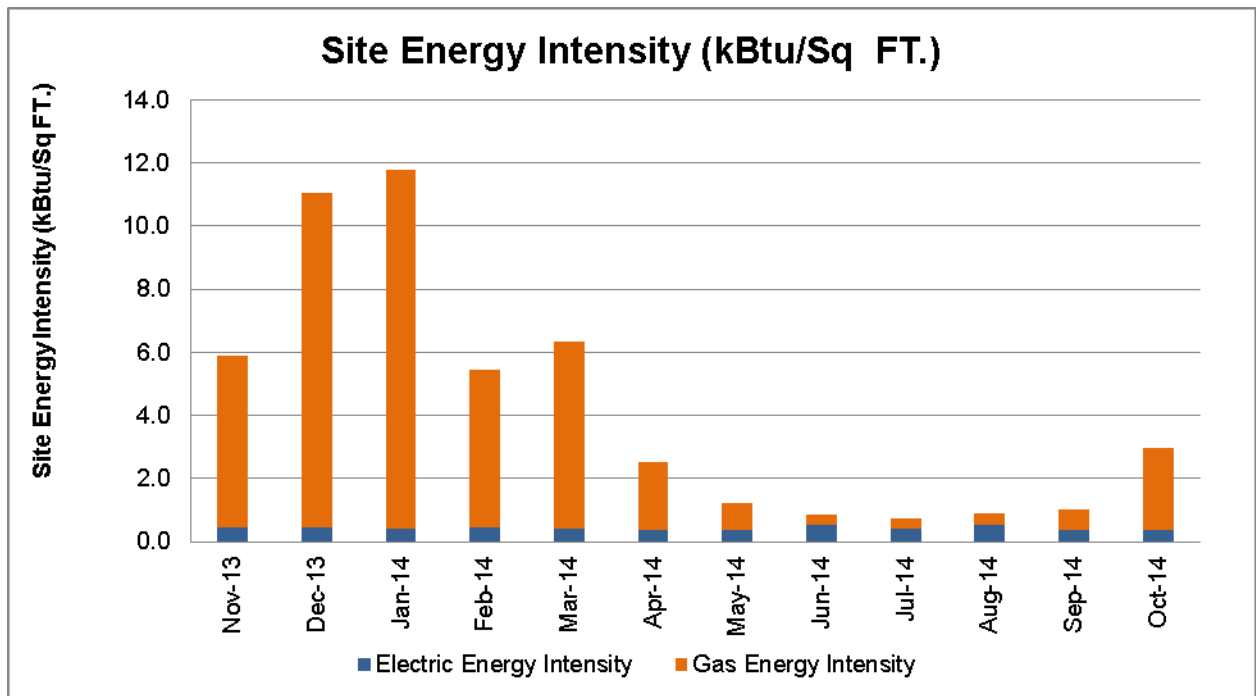


Figure 7 Monthly Site Energy Intensity Breakdowns per Energy Type

Per the LGEA program requirements, SWA has assisted the Unitarian Society of Ridgewood in creating an ENERGY STAR® Portfolio Manager account and sharing the library information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the Unitarian Society of Ridgewood ( [REDACTED] ).

## **Tariff Analysis**

Tariff analysis can help determine if the Reeb House is paying the lowest rate possible for electric and gas service. Tariffs are typically assigned to buildings based on size and building type. Rate fluctuations are expected during periods of peak usage. Natural gas prices often increase during winter months since large volumes of natural gas is needed for heating equipment. Similarly, electricity prices often increase during the summer months when additional electricity is needed for cooling equipment.

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs for the Reeb House. The electric use for the building is direct-metered and purchased under a service rate schedule that includes an annual demand charge, peak summer demand charge and societal benefits charge. The rate schedule is a market-rate based on electric usage and electric demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The Reeb House is also paying for natural gas under a rate schedule, which includes fixed costs such as customer service charges.

## **Energy Procurement Strategies**

Utility analysis was conducted using an average aggregated rate which is estimated based on the total cost divided by the total energy usage for each utility over a 12 month period. Average aggregated rates do not separate demand charges from usage, and instead provide a metric of inclusive cost per unit of energy. Average aggregated rates are used in order to equitably compare building utility rates to average utility rates throughout the state of New Jersey.

The average estimated NJ commercial utility rate provided by US Energy Information Administration for electric is \$0.137/kWh, while Reeb House pays a rate of \$0.228/kWh. The building's annual electric utility costs are \$511 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows rate fluctuations up to 24% over the analyzed billing period. The electric rate fluctuations in the winter and spring can be attributed to a combination of demand charges and market rate changes. The Reeb House already utilizes a third-party supplier, which reduces the supply costs and brings the overall electric costs down although SWA recommends that other third party suppliers be investigated to determine if there is a more economic way to source electricity.

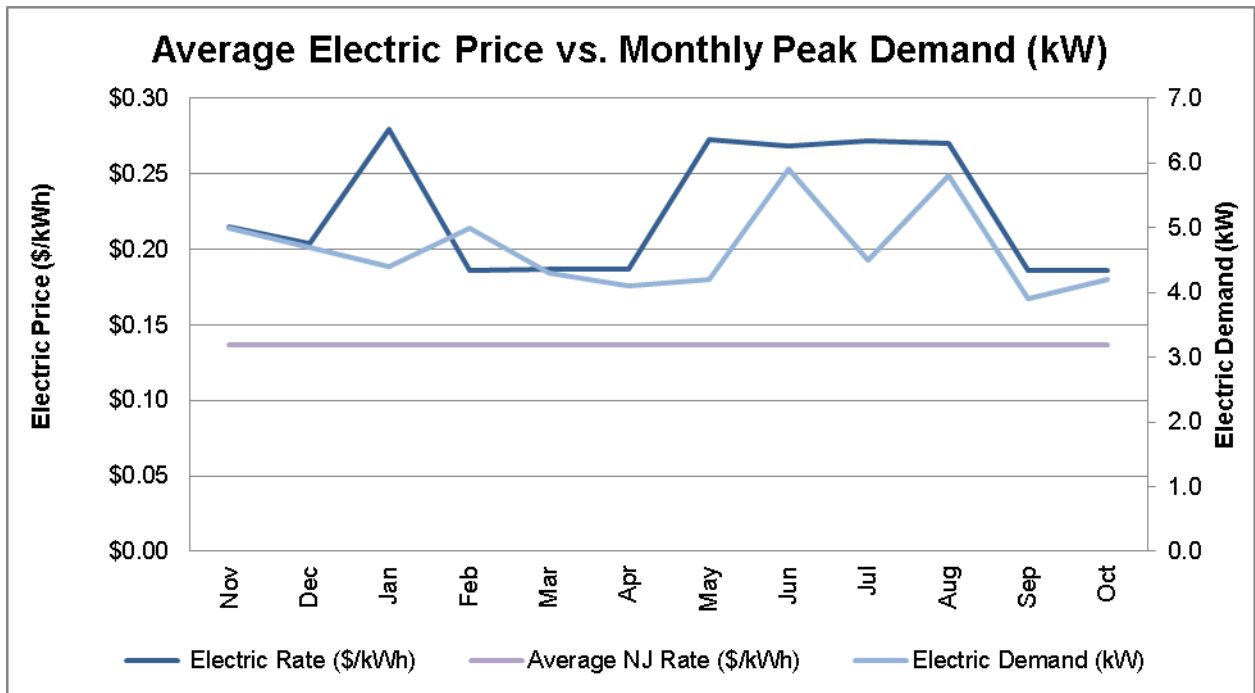


Figure 8 Average NJ Electric Rate, Average Aggregated Electric Rate and Electric Demand

The average estimated NJ commercial utility rate provided by US Energy Information Administration for gas is \$0.811/therm, while the building pays a rate of \$1.16/therm. The Reeb House's annual natural gas costs are \$571 higher, when compared to the average estimated NJ commercial utility rates. The natural gas rate analysis shows fluctuations up to 38% over the analyzed billing period excluding months where there was no natural gas consumption. Utility rate fluctuations when entering and exiting the heating months were caused by a combination of low usage and the assessment of fixed fees and costs.

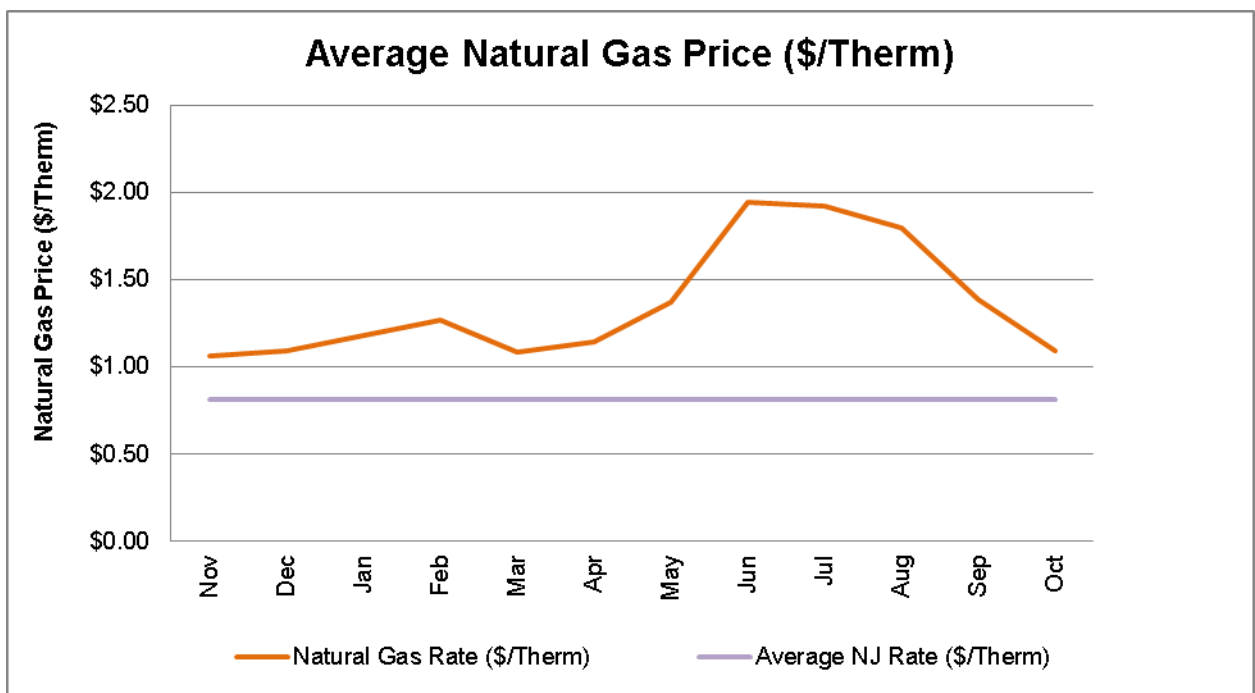


Figure 9 Average NJ Gas Rate and Monthly Gas Rates

SWA recommends that the building continue utilizing the opportunity of purchasing electricity and natural gas from third-party suppliers in order to maintain a reduced rate. Additionally, SWA recommends that the society further explore opportunities of purchasing electricity and natural gas from another third-party supplier to reduce the annual cost of energy for the Reeb House further. Appendix D contains a complete list of third-party energy suppliers for the Reeb House's service area.

## EXISTING FACILITY AND SYSTEMS DESCRIPTION

This section gives an overview of the current state of the facility and systems. Please refer to the Proposed Further Recommendations section for recommendations for improvement.

Based on a visit from SWA in February 2015, the following data was collected and analyzed.

### Building Characteristics

The Unitarian Society of Ridgewood Reeb House is a two-story 3,630-ft<sup>2</sup> facility with a basement and attic. It contains the administration offices, the Minister's office, kitchen, youth room, meeting room, and board room for the Anderson Building which is located next door. The building was originally built in the 1930's but underwent a major addition approximately 20 years ago when the building was enlarged and a majority of the mechanical equipment which is currently in use was installed. This included addition of an office space towards the rear of the building and large staircase to serve as an alternative means of egress for the building in the event of an emergency.

There are several functions and end-users of the facility. The USR rents out the spaces in the building to various groups for activities including: meetings and education classes. A majority of the activities are held in the board room which has capacity to seat approximately 15 people. The building has both front and rear entrances although the rear entrance serves as the primary means of entry/exit as it is closer to the parking lot behind the Anderson Building.



*Image 1: Rear Entrance*

### Building Occupancy Profiles

The Reeb House is occupied on Sunday mornings from 9AM to 12PM and Monday to Friday from 9AM to 3PM in the 1<sup>st</sup> floor offices. The building is occupied additionally as booked by outside groups utilizing the various spaces.

Additional occupancy of the building was obtained from schedules provided by the Unitarian Society of Ridgewood for November and December 2014. It was assumed that the occupancy in these months was typical and representative of the occupancy schedule for the remainder of the year. From the schedules it was calculated that the Reeb House board room is occupied for an additional 2.5 hours a week and the Reeb House basement meeting room is occupied for an additional 2 hours a week.



## **Building Envelope**

On February 12, 2015, SWA performed a building envelope analysis. At this time, the average outside dry bulb temperature was approximately 28°F with an average wind speed of 7 mph. The building envelope consists of the outer shell of the building including the walls, windows, doors, and roof. This section will examine the overall condition of the envelope and note any deficiencies discovered during the audit.

*General Note:* All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise on detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

### **Exterior and Interior Walls**

The exterior construction of the building is wooden paneling with an unconfirmed level of insulation. Based on the year of construction of the section and staff provided information, SWA estimates that there is little insulation installed in the exterior walls. Because the building has little insulation, the exterior walls likely experience more heat loss.

Most of the Reeb House exterior was found to be in good-to-fair condition, with a few notable areas of uncontrolled moisture and air leakage near entry doors. However, the attic space and roof was found to be in relatively poor condition, with numerous area of uncontrolled moisture and air leakage.

### **Roof**

The roof consists of several high-sloped sections covered with asphalt shingles and was inaccessible for inspection at the time of the site visit. SWA found that the underside of the roof was not insulated indicating that the building was built utilizing a cold roof design and any insulation would be installed in the ceiling of the second floor. However, SWA was unable to determine the level of insulation due to the flooring installed in the attic space. It is estimated that any insulation would be minimal based on the year of construction but accurately determining the existing insulation levels would require removal of some of the ceiling in the 2<sup>nd</sup> floor or some of the flooring in the attic space. Additionally, as the existing level of insulation is unknown SWA was unable to make a recommendation for improvement. Similar to the determination of insulation levels, any improvement in the level of insulation would also require the removal of the ceiling or flooring as described above.

It was noted upon inspection of the roof from the attic space that there were numerous large openings in the venting soffit which prevent isolation from the outside environment. Specifically, it was noted by building staff that there have been issues previously with wildlife inhabiting the attic space and based on the current condition of the roof it is likely that this will continue to be an issue. SWA has provided an O&M recommendation for repairing/replacing any missing or damaged soffit to prevent any issues with wildlife. It is not expected to have any impact on the energy consumption of the building.



*Image 2: Original Roofing Section Sample*



*Image 3: Sample Attic Flooring and Roof Condition*



*Image 4: Sample of Roof Opening*



*Image 5: Sample of Roof Opening*

Roofs, related flashing, gutters and downspouts were inspected during the field audit.

## **Base**

The building's original base contains an unfinished basement level that serves as storage space and contains the DHW and boiler. The added base which was included in the renovations added a meeting room at the base of the rear staircase.

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall, the base was reported to be in good condition with few signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues that were neither visible on the interior nor exterior.

## **Windows**

The buildings windows consist of the following types:

1. Single Pane Windows with Wooden Frames
  - a. Whole Building

Windows, shading devices, sill, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage, and other energy compromising issues. The windows in the front of the building appeared to be original and in good

condition. The windows in the rear of the building were installed during the renovations and also appear to be in good condition. Overall the windows throughout the building showed little evidence of gaps/air leakage or uncontrolled moisture entry.



*Image 6: Sample Single Pane Window*

## **Exterior Doors**

The building contains the following exterior doors:

1. Wooden swing door with two single pane glazing and a wooden frame. This door was located at the front entrance of Reeb House and is infrequently utilized.
2. Wooden swing door with single pane glazing and a wooden frame. This door was located at the rear entrance of Reeb House and serves as the primary means of entry/exit for the building.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, weather-stripping for the doors was found to be in good condition with only a few signs of air-leakage. In particular, the weather stripping at the rear door appeared to be worn and a small gap between the door and the frame was present. Missing or worn weather stripping allows unconditioned air to enter the building, leading to increased energy using for space conditioning.

## **Building Air-Tightness**

Overall, the field auditors found the building to adequately air-tight with a few areas of suggested improvements, such as the entry doors described above. The air tightness of buildings helps maximize all other implemented energy measures and investments, and minimizes potentially costly long-term maintenance, repair and replacement expenses.

Additionally, as noted above the roof has large gaps which do not provide a sufficient barrier to isolate the interior and exterior environments. While the building was built utilizing a cold deck design which allows for venting between the attic space and the exterior environment the barrier that exists should be sufficient to prevent any other major issues including the infiltration by wildlife which was noted as a previous issue.

## Mechanical Systems

### Heating, Ventilation and Air Conditioning

The primary HVAC system at Reeb House consists of four window mounted air conditioners and a gas-fired steam boiler supplying radiators in each room. To supplement the primary HVAC systems staff use portable resistance heaters in offices during cold winter days.

### Equipment

#### Heating Systems

Heating for Reeb House is provided by a single natural gas-fired Crown Boiler Company steam boiler with a 113 MBH of heating capacity and a design efficiency of 81%. The boiler was installed in 1996 and has almost reached the end of its estimated useful life. The boiler serves two zones; the 1<sup>st</sup> Floor and the 2<sup>nd</sup> Floor. Steam is supplied by the boiler to radiators in each room. The zones and heating schedules are provided below.

*Table 3 Summary of Heating Controls*

| Zone                  | Control System           |
|-----------------------|--------------------------|
| 1 <sup>st</sup> Floor | Thermostat with Schedule |
| 2 <sup>nd</sup> Floor | Thermostat with Schedule |

The schedule for the 1<sup>st</sup> Floor zone is as follows:

- Monday to Sunday between 6:00AM and 10:00PM → Heat to 68°F
- Monday to Sunday between 10:00PM and 6:00AM → Heat to 64°F

The schedule for the 2<sup>nd</sup> Floor zone is as follows:

- Monday to Sunday between 6:00AM and 8:00AM → Heat to 70°F
- Monday to Sunday between 8:00AM and 5:00PM → Heat to 68°F
- Monday to Sunday between 5:00PM and 10:00PM → Heat to 70°F
- Monday to Sunday between 10:00PM and 6:00AM → Heat to 62°F

#### Cooling Systems

There is no central cooling system installed in Reeb House, cooling in the building is provided through four packaged window mounted air conditioners. Two of these window mounted air conditioners are portable and regularly removed from windows at the end of the cooling season. During the cooling season these are located in the Minister's Office and Youth Room.

The 1<sup>st</sup> floor is cooled by a single permanent window mounted air conditioning unit; this air conditioner appears to be insufficient to cool the entire 1<sup>st</sup> floor. The electrical tag was not visible therefore the capacity, efficiency and year of installation could not be verified. However, it is estimated based on the appearance of the unit that it is approximately 20 years old and beyond its estimated useful life.

The fourth window mounted air conditioner is installed in the archive room. This unit stays in the room permanently although it appears to be able to be removed if needed. The installation date of this unit was not able to be verified.

The table below summarizes the portable window mounted air conditioners.

*Table 4 Summary of Air Conditioning Units*

| Description                                                                                           | Location                         | Year Installed | Estimated Remaining Useful Life % |
|-------------------------------------------------------------------------------------------------------|----------------------------------|----------------|-----------------------------------|
| Fedders Permanent Window AC<br>Cooling Capacity - CNV                                                 | 1st Floor Front Stairwell Window | 1995           | -33%                              |
| Kenmore Portable AC<br>Cooling Capacity - 5,200 Btu/Hr<br>Cooling Efficiency - 11 EER<br>Quantity - 2 | Minister's Office and Youth Room | 2012           | 80%                               |
| General Electric Window AC<br>Cooling Capacity - 5,050 Btu/Hr<br>Cooling Efficiency - 9.7 EER         | Archive Room Window              | CNV            | CNV                               |

### Ventilation

Ventilation throughout the facility is provided by windows and window mounted air conditioning units. The windows and air conditioners are all manually controlled by the occupants.

### Controls

Wall mounted thermostats are located in the Youth Room on the 2<sup>nd</sup> floor and in the Front Office on the 1<sup>st</sup> floor. These temperature sensors control the amount of steam circulated to the zones as per the programmed schedule and temperature.



Image 7: Thermostat Control in Youth Room



Image 8: Thermostat Control in Front Office Area

### Domestic Hot Water

Domestic hot water is provided by one (1) natural gas domestic hot water heater, which is located in the basement. It is a 40-gallon Kenmore water heater with an input of 40 MBH of natural gas. The unit has an adjustable thermostat which allows selection of the water temperature however the thermostat has no indications for temperature but instead indicates the temperatures between "Warm" and "Very Hot".



*Image 9: DHW Heater*

## **Electrical Systems**

### **Lighting**

See attached lighting schedule in Appendix B for a complete inventory of lighting throughout the building including estimated power consumption and proposed lighting recommendations.

**Interior Lighting** – Lighting throughout the building primarily consisted of a mix of T-8 linear fluorescent fixtures and compact fluorescent globes. Bathrooms have circular fluorescent lamps.

**Exit Lights** – All of the emergency exits signs have been upgraded to LED exit signs, which operate on low wattage and have a long lifespan.

**Exterior Lighting** – Lighting along the exterior at the rear of the building consisted of 90 watt halogen globes in 2 lamp fittings each with movement sensors. However, the building staff indicated that the sensors had issues and on occasion lights would stay on for long periods of time. The front of the building is lit by a 60-watt incandescent lamp which is also equipped with a motion sensor.



*Image 10: Compact Fluorescent Fixture in Front Office Area*

### **Other Electrical Systems**

In addition to the major building systems described above, Reeb House is equipped with a few other electrical systems. This primarily includes kitchen appliances, including cooking equipment, coffee makers, microwave and refrigerator. In addition there are coffee makers in the front office and Minister's office as well as a number of computers situated in various rooms.



## **RENEWABLE AND DISTRIBUTED ENERGY MEASURES**

Renewable energy is defined as any power source generated from sources which are naturally replenished, such as sunlight, wind and geothermal. Technology for renewable energy is improving and the cost of installation is decreasing due to both demand and the availability of government-sponsored funding. Renewable energy reduces the need for using either electricity or fossil fuel, therefore lowering costs by reducing the amount of energy purchased from the utility company. Solar photovoltaic panels and wind turbines use natural resources to generate electricity. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Cogeneration or Combined Heat and Power (CHP) allows for heat recovery during electricity generation.

### **Existing systems**

Currently there are no renewable energy systems installed in the building.

### **Evaluated Systems**

#### **Solar Photovoltaic**

Photovoltaic panels convert light energy received from the sun into a usable form of electricity. Panels can be connected into arrays and mounted directly onto building roofs, as well as installed onto built canopies over areas such as parking lots, building roofs or other open areas. Electricity generated from photovoltaic panels is generally sold back to the utility company through a net meter. Net-metering allows the utility to record the amount of electricity generated in order to pay credits to the consumer that can offset usage and demand costs on the electric bill. In addition to generation credits, there are incentives available called Solar Renewable Energy Certificates (SRECs) that are subsidized by the state government. Specifically, the New Jersey State government pays a market-rate SREC to facilities that generate electricity in an effort to meet state-wide renewable energy requirements.

The Reeb House was assessed for suitability for a solar photovoltaic system. However, because the roof has several sloped areas and is partially obscured by tree cover, the building is not a good candidate for a solar photovoltaic installation.

#### **Solar Thermal Collectors**

Solar thermal collectors are not cost-effective for this building and would not be recommended due to the insufficient and intermittent use of domestic hot water throughout the building to justify the expenditure.

#### **Wind**

The Reeb House is not a good candidate for wind power generation due to insufficient wind conditions in this area of New Jersey.

#### **Geothermal**

The Reeb House is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, as well as extensive installation of geothermal wells and pumping equipment.



## **Combined Heat and Power**

The Reeb House is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a constant electrical base load to accommodate the electricity generated, as well as a means for using waste heat generated.

## PROPOSED ENERGY CONSERVATION MEASURES

Energy Conservation Measures (ECMs) are recommendations determined for the building based on improvements over current building conditions. ECMs have been determined for the building based on installed cost, as well as energy and cost-savings opportunities.

### Recommendations: Energy Conservation Measures

| #     | Energy Conservation Measures                         |
|-------|------------------------------------------------------|
| ECM 1 | Install Door Sweeps on Exterior Doors                |
| ECM 2 | Install Low-Flow Aerators                            |
| ECM 3 | Replace Halogen and Fluorescent Lamps with LED Lamps |

In order to clearly present the overall energy opportunities for the building and ease the decision of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight/potential overlaps between some of the listed ECMs (i.e. lighting change influence on heating/cooling).

## ECM 1: Install Door Sweeps on Exterior Doors

Reeb House was found to have front and back doors containing deficient weather-stripping. These doors have gaps between the doors themselves and the bottom framing, which allows for unwanted air infiltration and heat transfer between conditioned indoor spaces and unconditioned spaces or the outdoors. This results in increased energy to heat and cool the spaces, as well as in the infiltration of air that contains dust and particulates that impact cleanliness and indoor environmental quality.

SWA recommends installing durable, high-quality door sweeps on these doors. Maintenance should inspect doors and frames and repair any damage or misalignment prior to the installation of this measure.

### Installation Cost:

Estimated Installed Cost: \$200 per door.

### Economics:

| ECM # | ECM Description                       | Est. Installed Cost (\$) | Est. Incentives (\$) | Net Est. ECM Cost with Incentives (\$) | 1st Yr Savings (kWh) | Demand Reduction/Mon (kW) | 1st Yr Savings (Therms) | 1st Yr Savings (kBtu/Sq FT) | Total 1st Yr Savings (\$) | Life of Measure (Yr) | Est. Lifetime Cost Savings (\$) | Simple Payback (Yr) | Lifetime Return on Investment (%) | Annual Return on Investment (%) | Internal Rate of Return (%) | Net Present Value (\$) | CO <sub>2</sub> Reduced (lbs/Yr) |
|-------|---------------------------------------|--------------------------|----------------------|----------------------------------------|----------------------|---------------------------|-------------------------|-----------------------------|---------------------------|----------------------|---------------------------------|---------------------|-----------------------------------|---------------------------------|-----------------------------|------------------------|----------------------------------|
| 1     | Install Door Sweeps on Exterior Doors | \$400                    | \$0                  | \$400                                  | 195                  | 0.0                       | 219                     | 6.2                         | \$298                     | 3                    | \$894                           | 1.3                 | 123%                              | 41%                             | 31%                         | \$165                  | 2,765                            |

### Assumptions: SWA calculated the heating and cooling loads using Bin data analysis.

|                   |       |       |                                 |       |           |                     |       |           |
|-------------------|-------|-------|---------------------------------|-------|-----------|---------------------|-------|-----------|
| gap area          | 9     | sqin  | heating setpoint T              | 72    | F         | cooling setpoint T  | 68    | F         |
| pressure diff     | 0.02  | in wc | night/weekend heating enabled < | 62    | F         | relative humidity   | 50%   | %         |
| est. infiltration | 47.68 | CFM   | night/weekend cooling enabled > | 60    | F         | room enthalpy       | 25.30 | btu/lb    |
| heating enabled < | 50    | F     | total heating hours             | 5,877 | Hrs       | total cooling hours | 999   | Hrs       |
| cooling enabled > | 60    | F     | heating load                    | 8,878 | kBtu/year | cooling load        | 876   | kBtu/year |

|                                                                                                                                            |             |                 |                                |        |             |
|--------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------|--------------------------------|--------|-------------|
| <b>Assumptions</b>                                                                                                                         |             |                 |                                |        |             |
| # Doors Requiring Weatherstripping                                                                                                         | 2           |                 | Annual Cooling Hours           | 999    |             |
| Gap Area Per Unit                                                                                                                          | 9           | in <sup>2</sup> | Annual Heating Hours           | 5,877  |             |
| Pressure Difference                                                                                                                        | 0.02        | in. wc          | Annual Cooling Load Per Door   | 876    | kBtu/yr     |
| Air Infiltration Per Door                                                                                                                  | 23          | CFM             | Annual Heating Load Per Door   | 8,878  | kBtu/yr     |
| Total Infiltration                                                                                                                         | 46          | CFM             | Space Cooling Setpoint         | 68     | °F          |
| Cost to Weatherstrip Door                                                                                                                  | \$200       |                 | Space Heating Setpoint         | 72     | °F          |
| Cooling Energy Type                                                                                                                        | Electricity |                 | Cooling Equipment Efficiency   | 11.7   | EER         |
| Heating Energy Type                                                                                                                        | Natural Gas |                 | Heating Equipment Efficiency   | 80%    | %           |
| <u>Utilities Cost</u>                                                                                                                      |             |                 | <u>Energy content per type</u> |        |             |
| Electricity                                                                                                                                | \$0.23      | kWh             | Electricity                    | 3.412  | kBtu/kWh    |
| Natural Gas                                                                                                                                | \$1.16      | therms          | Natural Gas                    | 100    | kBtu/therms |
| <u>Energy Savings</u>                                                                                                                      |             |                 | <u>Cost Savings</u>            |        |             |
| Electricity                                                                                                                                | 150         | kWh/year        | Electricity                    | \$ 34  | /year       |
| Natural Gas                                                                                                                                | 222         | therms/year     | Natural Gas                    | \$ 257 | /year       |
| <b>Equations</b>                                                                                                                           |             |                 |                                |        |             |
| Airflow Through Leakage Area = 2610 x [Gap Area] x [Pressure Difference] ^ (0.5)                                                           |             |                 |                                |        |             |
| Annual Heating Load = {1.08 x [Airflow Through Leakage Area]                                                                               |             |                 |                                |        |             |
| x ([Temp of Conditioned Space] - [Temp of Unconditioned Space])                                                                            |             |                 |                                |        |             |
| x [annual heating hours]} / 1000                                                                                                           |             |                 |                                |        |             |
| Annual Cooling Load = {4.5 x [Airflow Through Leakage Area]                                                                                |             |                 |                                |        |             |
| x [(Outside Air Enthalpy - Room Enthalpy)]                                                                                                 |             |                 |                                |        |             |
| x [annual cooling hours]} / 1000                                                                                                           |             |                 |                                |        |             |
| Annual Electricity Savings = (([Annual Cooling Load Per Door] x [# of Doors]) x 1000) / [Cooling Equipment Efficiency]                     |             |                 |                                |        |             |
| Annual Natural Gas Savings = (([Annual Heating Load Per Door] x [# of Doors]) / [Heating Energy Content]) / [Heating Equipment Efficiency] |             |                 |                                |        |             |
| * Please refer to <a href="#">Appendix F</a> for the Weather BIN data calculation spreadsheet used to calculate heating/cooling hours and  |             |                 |                                |        |             |

## Rebates/Financial Incentives:

- None

Please see APPENDIX G for more information on Incentive Programs.

## ECM 2: Install Low-Flow Aerators

Reeb House was found to have two (2) bathroom faucets and a single kitchen faucet equipped with aerators which were not of the low-flow variety. The higher flow aerators increase the energy consumption associated with domestic hot water production and increase water/sewer charges.

SWA recommends replacing the existing aerators with low-flow aerators to reduce the energy consumption associated with providing DHW to the occupants of the Reeb House. The specific flow desired by the occupants of the Reeb House or the Unitarian Society can influence the aerator selected but SWA has based the energy savings on a minimum of 25% reduction in total DHW requirements. To reduce the implementation cost of this measure it is assumed that building staff is able to quickly remove and replace the existing aerators with new low flow aerators. Before installing the new aerator building staff should inspect the faucets for any leaks and make the necessary repairs prior to the installation of this measure. Additional cost savings will be realized from the reduced water/sewer bills however, these savings were not incorporated into the analysis provided.

### Installation Cost:

Estimated Installed Cost: \$5 per Faucet.

### Economics:

| ECM # | ECM Description           | Est. Installed Cost (\$) | Est. Incentives (\$) | Net Est. ECM Cost with Incentives (\$) | 1st Yr Savings (kWh) | Demand Reduction/Mon (kW) | 1st Yr Savings (Therms) | 1st Yr Savings (kBtu/Sq FT) | Total 1st Yr Savings (\$) | Life of Measure (Yr) | Est. Lifetime Cost Savings (\$) | Simple Payback (Yr) | Lifetime Return on Investment (%) | Annual Return on Investment (%) | Internal Rate of Return (%) | Net Present Value (\$) | CO <sub>2</sub> Reduced (lbs/Yr) |
|-------|---------------------------|--------------------------|----------------------|----------------------------------------|----------------------|---------------------------|-------------------------|-----------------------------|---------------------------|----------------------|---------------------------------|---------------------|-----------------------------------|---------------------------------|-----------------------------|------------------------|----------------------------------|
| 2     | Install Low-Flow Aerators | \$15                     | \$0                  | \$15                                   | 0                    | 0.0                       | 5                       | 0.1                         | \$6                       | 10                   | \$62                            | 2.4                 | 313%                              | 31%                             | 39%                         | \$32                   | 59                               |

### Assumptions:

| Inputs                                 | Existing          | Proposed          |
|----------------------------------------|-------------------|-------------------|
| Type of building                       | Office            |                   |
| Number of Occupants                    | 6                 |                   |
| Daily Hot Water Consumption (gallons)  | 12                |                   |
| Annual Occupied Days                   | 260               |                   |
| Energy Type                            | Natural Gas       | Natural Gas       |
| Energy Conversion                      | 100.000           | 100.000           |
| Boiler Efficiency                      | 85%               | 85%               |
| Density of Water                       | 8.34              | lb/gal            |
| Annual Hot Water Consumption (gallons) | 3,120 gallons     | 2,340 gallons     |
| Entering Water Temperature             | 50 °F             | 50 °F             |
| Exiting Water Temperature*             | 120 °F            | 120 °F            |
| Utility Rate                           | \$1.156 \$/therms | \$1.156 \$/therms |
| DHW Energy Consumption                 | 2,143 kBtu        | 1,607 kBtu        |
| DHW Energy Consumption                 | 21 therms         | 16 therms         |
| Energy Cost                            | \$25              | \$19              |
| Energy Cost Savings                    | \$6               |                   |
| Low-Flow Percent Savings               | 25%               |                   |

**Rebates/Financial Incentives:**

- None

Please see APPENDIX G for more information on Incentive Programs.

### ECM #3: Replace Halogen and Fluorescent with LED Lamps

The building contains several areas that could benefit from the installation of replacement LED equivalent light globes. These are of office and external area that are either constantly throughout the day or have high wattage lamps and could show significant energy savings by having lower wattage lamps that LED technology offers.

Calculations have assumed that external contractor is used to replace globes. If internal maintenance staff do the replacement then payback periods will decrease.

#### Installation Cost:

Estimated Installed Cost: \$ 357.12

Installation Labor costs are based on estimated 6 fixtures per hour and \$60 per hour labor rate, equal to \$6.00 per fixture for the bulb changes. An incentive is available which provides \$5 per lamp through the Smart Star Program.

#### Economics:

| ECM # | ECM Description                                      | Est. Installed Cost (\$) | Est. Incentives (\$) | Net Est. ECM Cost with Incentives (\$) | 1st Yr Savings (kWh) | Demand Reduction/Mon (kW) | 1st Yr Savings (Therms) | 1st Yr Savings (kBtu/Sq FT) | Total 1st Yr Savings (\$) | Life of Measure (Yr) | Est. Lifetime Cost Savings (\$) | Simple Payback (Yr) | Lifetime Return on Investment (%) | Annual Return on Investment (%) | Internal Rate of Return (%) | Net Present Value (\$) | CO <sub>2</sub> Reduced (lbs/Yr) |
|-------|------------------------------------------------------|--------------------------|----------------------|----------------------------------------|----------------------|---------------------------|-------------------------|-----------------------------|---------------------------|----------------------|---------------------------------|---------------------|-----------------------------------|---------------------------------|-----------------------------|------------------------|----------------------------------|
| 3     | Replace Halogen and Fluorescent Lamps with LED Lamps | \$357                    | \$55                 | \$302                                  | 386                  | 0.6                       | 0                       | 0.4                         | \$88                      | 15                   | \$1,324                         | 3.4                 | 338%                              | 23%                             | 28%                         | \$675                  | 692                              |

#### Assumptions:

SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis. Refer to Lighting Study on Appendix B for further information.

|                                                                                                                                                                              |                    |                            |                    |        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------|--------------------|--------|
| <i>Assumptions</i>                                                                                                                                                           |                    |                            |                    |        |
| Average Electric Rate                                                                                                                                                        | \$0.23             | \$/kWh                     | # of Summer Months | 5      |
| Average Summer Demand Rate                                                                                                                                                   | \$0.00             | \$/kW/month                | # of Winter Months | 7      |
| Average Winter Demand Rate                                                                                                                                                   | \$0.00             | \$/kW/month                | Cost Per Fixture   | Varies |
| <i>Existing</i>                                                                                                                                                              |                    | <i>Proposed</i>            |                    |        |
| Lamp Type                                                                                                                                                                    | Inc. and Hal.      | Lamp Type                  | LED_Lamp           |        |
| # of Fixtures                                                                                                                                                                | 0                  | # of Fixtures              | 0                  |        |
| # of Lamps                                                                                                                                                                   | 11                 | # of Lamps per Fixture     | 11                 |        |
| Watts per Lamp                                                                                                                                                               | 32-90 w            | Watts per Fixture          | 14-50 w            |        |
| Operational Hours per Week                                                                                                                                                   | Varies - See Chart | Operational Hours per Week | Varies - See Chart |        |
| Operational Hours per Year                                                                                                                                                   | Varies - See Chart | Operational Hours per Year | Varies - See Chart |        |
| Total kW                                                                                                                                                                     | 3.4                | Total kW                   | 2.8                |        |
| Annual Energy Use (kWh)                                                                                                                                                      | 2255               | Annual Energy Use (kWh)    | 1869               |        |
| Rated Hours Per Lamp                                                                                                                                                         | 2000               | Rated Hours Per Lamp       | 30000              |        |
| Annual Electric Cost                                                                                                                                                         | \$515.17           | Annual Electric Cost       | \$426.90           |        |
|                                                                                                                                                                              |                    | Total Watts Saved (Watts)  | 0.6                |        |
|                                                                                                                                                                              |                    | Total Energy Saved (kWh)   | 386.4              |        |
|                                                                                                                                                                              |                    | Total Cost Savings         | \$88.27            |        |
| <i>Equations</i>                                                                                                                                                             |                    |                            |                    |        |
| Total operating hours = ([Hrs / weekday] x [5 Days / week] x [52 weeks / year]) + ([Hrs/weekend] x [2 days/week] x [52 weeks / year])                                        |                    |                            |                    |        |
| # of fixtures = [from field survey]                                                                                                                                          |                    |                            |                    |        |
| Annual Energy Use (kWh) = [wattage of fixture] x [# of fixtures] x [total operating hours] / 1000                                                                            |                    |                            |                    |        |
| Electricity cost for fixture type = {[ \$ / kWh] x [annual kWh for fixture type]} + [Total kW x demand cost summer x 5 months] + [ Total kW x demand cost winter x 7 months] |                    |                            |                    |        |
| Estimated Implementation Cost = {[Material Cost Per Fixture] x [Installation Cost Per Fixture] x [# of fixtures]}                                                            |                    |                            |                    |        |
| Annual Savings = {[Existing Annual Electric Cost] - [Proposed Annual Electric Cost]} + [Estimated Maintenance Cost]                                                          |                    |                            |                    |        |

|                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Material Costs are based on the following:                                                                                                                                                                                                                                                                               |
| LED Elite 14W LED retrofit is a 90W halogen replacement by TCP - <a href="https://www.1000bulbs.com/product/113761/TCP-14P3824KNFL.html">https://www.1000bulbs.com/product/113761/TCP-14P3824KNFL.html</a>                                                                                                               |
| 8W LED retrofit is a 50W incandecent replacement by PLT - <a href="https://www.1000bulbs.com/product/113450/PLT-101236A19FR.html">https://www.1000bulbs.com/product/113450/PLT-101236A19FR.html</a>                                                                                                                      |
| 18W LED is a 32W T-8 Fluro replacement by Denkyu <a href="http://www.lighting-spot.com/led-t8-tube-6000k-18-watt-100-277v.html?fee=9&amp;fep=7406&amp;gclid=CPmyw_muxsQCFYE7gQod1kEAsw">http://www.lighting-spot.com/led-t8-tube-6000k-18-watt-100-277v.html?fee=9&amp;fep=7406&amp;gclid=CPmyw_muxsQCFYE7gQod1kEAsw</a> |
| Installation Labor costs are based on estimated 6 fixtures per hour and \$60 per hour labor rate, equal to \$6.00 per fixture for the bulb changes                                                                                                                                                                       |

### Rebates/Financial Incentives:

Smart Start incentives is available of \$5 per lamp.

Please see APPENDIX G for more information on Incentive Programs.



## PROPOSED FURTHER RECOMMENDATIONS

### Operations and Maintenance

Operations and Maintenance measures consist of low/no cost measures that are within the capability of the current building staff to handle. These measures typically require little investment, and they yield a short payback period. These measures may address equipment settings or staff operations that, when addressed will reduce energy consumption or costs.

- **Modify Heating Thermostat Schedule** – It was found that the heating thermostat schedule in Reeb House was set in a way that was not optimal given the use profile of the building. Currently the building is heated to 70°F from 6AM – 8PM and between 5PM and 10PM every day. All other times the building is heated to 62°F, meaning that overnight the building is being heated even when it is not in use. Staff working in Reeb House reported that the temperature in the building was generally not comfortable and cold, they would therefore they utilized portable electric resistance heaters in the heating season.

It is recommended that the schedule be changed so that from 9AM – 5PM Monday to Saturday the building was heated to 72°F. This would results in the building being more comfortable for its occupants when in use. All other times there are very few uses therefore a freeze protection measure is recommended of heating to 45°F. It was calculated that there is a potential saving of around \$500 per year if this change is made to the heating schedule.

- **Purchase Energy Star® Rated Appliances** - SWA recommends that the building consider purchasing the most energy-efficient equipment, including ENERGY STAR® labeled appliances, when equipment is installed or replaced. ENERGY STAR® appliances meet stricter standards compared to standard appliances. Stricter standards include exceeding Federal minimum efficiencies and reduced environmental impact. More information can be found in the “Products” section of the ENERGY STAR® website at: <http://www.energystar.gov>.
- **Purchase Energy Star® Rated Window AC Unit** – SWA recommends that the building consider purchasing the most energy-efficient window AC unit possible to replace the existing AC unit installed on the 1<sup>st</sup> Floor. This will reduce the electrical consumption associated with cooling the 1<sup>st</sup> Floor of the Reeb House and could possibly improve occupant comfort. However, as the specific capacity and efficiency of the existing unit could not be determined SWA was unable to generate an accurate energy savings estimate or determine an implementation cost to replace the existing unit. More information can be found in the “Products” section of the ENERGY STAR® website at: <http://www.energystar.gov>.
- **Repair/Replace Damaged/Missing Roof Soffit Vents** – SWA recommends that any damaged or missing roof soffit vents be repaired or replaced to prevent any further issues with wildlife inhabiting the attic space. During the site visit SWA noted several areas for improvement and building staff indicated that issues had occurred previously as a result of the gaps in the roof soffit vents. As the soffit vents will provide limited changes to the amount of air exchanges within the attic space it is expected that this implementation will have no energy savings impacts.

## APPENDIX A: EQUIPMENT LIST

| Building System | Description                                                                                               | Model #                                   | Fuel        | Location                                  | Space Served   | Year Installed | Estimated Remaining Useful Life % |
|-----------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------|-------------------------------------------|----------------|----------------|-----------------------------------|
| Heating         | Crown Boiler Company Boiler<br>Capacity - 113,000 Btu/Hr<br>Input - 140,000 Btu/Hr<br>Efficiency - 81%    | Model # ABF-140SPD<br>Serial # 124324     | Natural Gas | Basement                                  | Whole Building | 1996           | 5%                                |
| DHW             | Kenmore Water Heater<br>Power Miser 9<br>Capacity - 40 Gal<br>Fuel - Natural Gas<br>BTU/Hr input - 40,000 | Model # 153.339461<br>Serial # A05A124039 | Natural Gas | Basement                                  | Whole Building | 2005           | 33%                               |
| Cooling         | Fedders Permanent Window AC<br>Cooling Capacity - CNV                                                     | Model # CNV                               | Electric    | 1st Floor Front Stairwell Window          | Office Area    | 1995           | -33%                              |
| Cooling         | Kenmore Portable AC<br>Cooling Capacity - 5,200 Btu/Hr<br>Cooling Efficiency - 11 EER<br>Quantity - 2     | Model # HS25-411-1P<br>Serial # Various   | Electric    | Put into Minister's Office and Youth Room | Office Area    | 2012           | 80%                               |
| Cooling         | General Electric Window AC<br>Cooling Capacity - 5,050 Btu/Hr<br>Cooling Efficiency - 9.7 EER             | Model # AEL05LSQ1<br>Serial # ZA643638    | Electric    | Archive Room Window                       | Archive Room   | CNV            | CNV                               |

**Note:** The remaining useful life of a system (in %) is an estimate based on the system date of built and existing conditions derived from visual inspection.

## APPENDIX B: LIGHTING STUDY

### Existing Fixtures

| Space Data (optional) |            |             |                    |           |                              | Existing Lighting Equipment |              |                     |              |                 |                  |                   |                   |                      |                  |              |                              |
|-----------------------|------------|-------------|--------------------|-----------|------------------------------|-----------------------------|--------------|---------------------|--------------|-----------------|------------------|-------------------|-------------------|----------------------|------------------|--------------|------------------------------|
| #                     | Building   | Level/Floor | Room Number        | Room Type | Measured Lighting Level (FC) | Lamp Type                   | Lamp Wattage | # Lamps per Fixture | Ballast Type | Fixture Wattage | Fixture Quantity | Hrs/Day [Weekday] | Hrs/Day [Weekend] | Months Used per Year | Controls         | Control Qty. | Annual Energy Use [kwh/year] |
| 1                     | Reeb House | 1           | Outside back       |           |                              | Halogen                     | 90W          | 2                   | n/a          | 180             | 3                | 2                 | 2                 | 12                   | Occupancy Sensor | 3            | 290.3                        |
| 2                     | Reeb House | 1           | Porch (front)      |           |                              | Incandescent                | 60W          | 1                   | n/a          | 60              | 1                | 2                 | 2                 | 12                   | Occupancy Sensor | 1            | 32.3                         |
| 3                     | Reeb House | 1 & 2       | tairwell at back   |           |                              | LED Exit Sign               |              | 1                   |              | 5               | 2                | 24                | 24                | 12                   | None             |              | 80.6                         |
| 4                     | Reeb House | 1 & 2       | tairwell at back   |           |                              | Circline_Lamp               | 22W_T5       | 1                   | Electronic   | 27.3            | 4                | 8                 | 4                 | 12                   | Switch           |              | 251.6                        |
| 5                     | Reeb House | 1           | Front Office       |           |                              | T8_U_Shaped_Fluorescent     | 32W          | 2                   | Electronic   | 65              | 4                | 8                 | 4                 | 12                   | Switch           |              | 599.0                        |
| 6                     | Reeb House | 1           | Front Office       |           |                              | CFL_Screw_In                | 13W          | 4                   | n/a          | 52              | 1                | 8                 | 4                 | 12                   | Switch           |              | 119.8                        |
| 7                     | Reeb House | 1           | Front Office       |           |                              | CFL_Screw_In                | 13W          | 1                   | n/a          | 13              | 1                | 8                 | 4                 | 12                   | Switch           |              | 30.0                         |
| 8                     | Reeb House | 1           | Meeting/Board Room |           |                              | CFL_Screw_In                | 13W          | 1                   | n/a          | 13              | 1                | 0.1               | 1                 | 12                   | Switch           |              | 1.6                          |
| 9                     | Reeb House | 1           | Front landing      |           |                              | CFL_Screw_In                | 13W          | 1                   | n/a          | 13              | 3                | 4                 | 4                 | 12                   | Switch           |              | 52.4                         |
| 10                    | Reeb House | 1           | Bathroom           |           |                              | Circline_Lamp               | 22W_T5       | 1                   | Electronic   | 27.3            | 1                | 1                 | 0.5               | 12                   | Switch           |              | 7.9                          |
| 11                    | Reeb House | 1           | Kitchen            |           |                              | CFL_Screw_In                | 13W          | 1                   | n/a          | 13              | 6                | 2                 | 1                 | 12                   | Switch           |              | 44.9                         |
| 12                    | Reeb House | 1           | Back Office        |           |                              | T8_Fluorescent              | 32W          | 4                   | Magnetic     | 131             | 1                | 8                 | 0                 | 12                   | Switch           |              | 251.5                        |
| 13                    | Reeb House | 2           | Youth Room         |           |                              | T8_Fluorescent              | 32W          | 2                   | Magnetic     | 68.2            | 6                | 0.5               | 2                 | 12                   | Switch           |              | 127.7                        |
| 14                    | Reeb House | 2           | Hallway            |           |                              | CFL_Screw_In                | 18W          | 2                   | n/a          | 36              | 3                | 0.25              | 0.5               | 12                   | Switch           |              | 11.7                         |
| 15                    | Reeb House | 2           | Spare office       |           |                              | T8_Fluorescent              | 32W          | 4                   | Electronic   | 106.7           | 2                | 0.5               | 0.5               | 12                   | Switch           |              | 35.9                         |
| 16                    | Reeb House | 2           | Bathroom           |           |                              | Circline_Lamp               | 22W_T5       | 1                   | Electronic   | 27.3            | 1                | 0.25              |                   | 12                   | Switch           |              | 1.6                          |
| 17                    | Reeb House | 2           | Minister's office  |           |                              | T8_Fluorescent              | 32W          | 4                   | Electronic   | 106.7           | 4                | 1                 | 2                 | 12                   | Switch           |              | 184.4                        |
| 18                    | Reeb House | 2           | Archive room       |           |                              | T8_Fluorescent              | 32W          | 4                   | Electronic   | 106.7           | 1                | 0                 | 0.5               | 12                   | Switch           |              | 5.1                          |
| 19                    | Reeb House | 0           | Stairs             |           |                              | T12_Fluorescent             | 20W          | 1                   | Magnetic     | 21.2            | 1                | 2                 | 2                 | 12                   | Switch           |              | 14.2                         |
| 20                    | Reeb House | 0           | Basement           |           |                              | CFL_Screw_In                | 23W          | 1                   | n/a          | 23              | 7                | 0.2               | 0                 | 12                   | Switch           |              | 7.7                          |
| 21                    | Reeb House | 0           | Basement           |           |                              | T8_Fluorescent              | 32W          | 2                   | Electronic   | 62              | 3                | 0.2               | 0                 | 12                   | Switch           |              | 8.9                          |
| 22                    | Reeb House | 0           | Basement           |           |                              | LED Exit Sign               |              |                     |              | 5               | 2                | 24                | 24                | 12                   | None             |              | 80.6                         |
| 23                    | Reeb House | 0           | Basement Stairwell |           |                              | T8_Fluorescent              | 32W          | 2                   | Electronic   | 62              | 2                | 0.2               | 0                 | 12                   | Switch           |              | 6.0                          |
| 24                    | Reeb House | 0           | RE Room            |           |                              | T8_Fluorescent              | 32W          | 2                   | Electronic   | 62              | 2                | 0.15              | 0                 | 12                   | Switch           |              | 4.5                          |
| 25                    | Reeb House | 3           | Attic              |           |                              | Halogen                     | 75W          | 1                   | Electronic   | 75              | 1                | 0.15              | 0                 | 12                   | Switch           |              | 2.7                          |
| 26                    | Reeb House | 3           | Attic              |           |                              | Incandescent                | 60W          | 1                   | n/a          | 60              | 1                | 0.15              | 0                 | 12                   | Switch           |              | 2.2                          |

Proposed Fixtures – Replacements are Highlighted Below

| Space Data (optional) |            |             |                    |           |                              | Proposed Lighting Equipment |                                            |                     |              |                 |                  |                   |              |                              | Savings                    |                     |                   | Cost          |                   | Simple Payback |
|-----------------------|------------|-------------|--------------------|-----------|------------------------------|-----------------------------|--------------------------------------------|---------------------|--------------|-----------------|------------------|-------------------|--------------|------------------------------|----------------------------|---------------------|-------------------|---------------|-------------------|----------------|
| #                     | Building   | Level/Floor | Room Number        | Room Type | Measured Lighting Level (fC) | Lamp Type                   | Lamp Wattage                               | # lamps per fixture | Ballast Type | Fixture Wattage | Fixture Quantity | Proposed Controls | Control Qty. | Annual Energy Use [kwh/year] | Total Energy Savings [kWh] | Demand Savings [kW] | Total Savings[\$] | Material Cost | Installation Cost | Years          |
| 1                     | Reeb House | 1           | Outside back       |           |                              | LED_Lamp                    | LED Elite 14W - 14 Watt Equal              | 2                   | n/a          | 28              | 3                | Occupancy Sensor  | 3            | 45.2                         | 245.1                      | 0.5                 | \$31.62           | \$209.82      | \$0.00            | 6.6            |
| 2                     | Reeb House | 1           | Porch (front)      |           |                              | LED_Lamp                    | LED - 8 Watt - A19 - 50 Watt Equal         | 1                   | n/a          | 8               | 1                | Occupancy Sensor  | 1            | 4.3                          | 28.0                       | 0.1                 | \$3.61            | \$5.30        | \$0.00            | 1.5            |
| 3                     | Reeb House | 1 & 2       | tairwell at back   |           |                              | LED Exit Sign               | 0                                          | 1                   | 0            | 5               | 2                | None              | 0            | 80.6                         | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 4                     | Reeb House | 1 & 2       | tairwell at back   |           |                              | Circline_Lamp               | 22W_T5                                     | 1                   | Electronic   | 27.3            | 4                | Switch            | 0            | 251.6                        | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 5                     | Reeb House | 1           | Front Office       |           |                              | T8_U_Shaped_Fluorescent     | 32W                                        | 2                   | Electronic   | 65              | 4                | Switch            | 0            | 599.0                        | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 6                     | Reeb House | 1           | Front Office       |           |                              | CFL_Screw_In                | 13W                                        | 4                   | n/a          | 52              | 1                | Switch            | 0            | 119.8                        | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 7                     | Reeb House | 1           | Front Office       |           |                              | CFL_Screw_In                | 13W                                        | 1                   | n/a          | 13              | 1                | Switch            | 0            | 30.0                         | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 8                     | Reeb House | 1           | ting/Board Room    |           |                              | CFL_Screw_In                | 13W                                        | 1                   | n/a          | 13              | 1                | Switch            | 0            | 1.6                          | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 9                     | Reeb House | 1           | Front landing      |           |                              | CFL_Screw_In                | 13W                                        | 1                   | n/a          | 13              | 3                | Switch            | 0            | 52.4                         | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 10                    | Reeb House | 1           | Bathroom           |           |                              | Circline_Lamp               | 22W_T5                                     | 1                   | Electronic   | 27.3            | 1                | Switch            | 0            | 7.9                          | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 11                    | Reeb House | 1           | Kitchen            |           |                              | CFL_Screw_In                | 13W                                        | 1                   | n/a          | 13              | 6                | Switch            | 0            | 44.9                         | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 12                    | Reeb House | 1           | Back Office        |           |                              | LED_Lamp                    | LED T8 Tube 6000K 18 Watt Frosted 100-277V | 4                   | n/a          | 72              | 1                | Switch            | 0            | 138.2                        | 113.3                      | 0.1                 | \$14.61           | \$76.00       | \$0.00            | 5.2            |
| 13                    | Reeb House | 2           | Youth Room         |           |                              | T8_Fluorescent              | 32W                                        | 2                   | Magnetic     | 68.2            | 6                | Switch            | 0            | 127.7                        | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 14                    | Reeb House | 2           | Hallway            |           |                              | CFL_Screw_In                | 18W                                        | 2                   | n/a          | 36              | 3                | Switch            | 0            | 11.7                         | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 15                    | Reeb House | 2           | Spare office       |           |                              | T8_Fluorescent              | 32W                                        | 4                   | Electronic   | 106.7           | 2                | Switch            | 0            | 35.9                         | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 16                    | Reeb House | 2           | Bathroom           |           |                              | Circline_Lamp               | 22W_T5                                     | 1                   | Electronic   | 27.3            | 1                | Switch            | 0            | 1.6                          | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 17                    | Reeb House | 2           | Minister's office  |           |                              | T8_Fluorescent              | 32W                                        | 4                   | Electronic   | 106.7           | 4                | Switch            | 0            | 184.4                        | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 18                    | Reeb House | 2           | Archive room       |           |                              | T8_Fluorescent              | 32W                                        | 4                   | Electronic   | 106.7           | 1                | Switch            | 0            | 5.1                          | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 19                    | Reeb House | 0           | Stairs             |           |                              | T12_Fluorescent             | 20W                                        | 1                   | Magnetic     | 21.2            | 1                | Switch            | 0            | 14.2                         | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 20                    | Reeb House | 0           | Basement           |           |                              | CFL_Screw_In                | 23W                                        | 1                   | n/a          | 23              | 7                | Switch            | 0            | 7.7                          | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 21                    | Reeb House | 0           | Basement           |           |                              | T8_Fluorescent              | 32W                                        | 2                   | Electronic   | 62              | 3                | Switch            | 0            | 8.9                          | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 22                    | Reeb House | 0           | Basement           |           |                              | LED Exit Sign               |                                            |                     |              | 5               | 2                | None              | 0            | 80.6                         | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 23                    | Reeb House | 0           | Basement Stairwell |           |                              | T8_Fluorescent              | 32W                                        | 2                   | Electronic   | 62              | 2                | Switch            | 0            | 6.0                          | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 24                    | Reeb House | 0           | RE Room            |           |                              | T8_Fluorescent              | 32W                                        | 2                   | Electronic   | 62              | 2                | Switch            | 0            | 4.5                          | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 25                    | Reeb House | 3           | Attic              |           |                              | Halogen                     | 75W                                        | 1                   | Electronic   | 75              | 1                | Switch            | 0            | 2.7                          | 0.0                        | 0.0                 | \$0.00            |               |                   |                |
| 26                    | Reeb House | 3           | Attic              |           |                              | Incandescent                | 60W                                        | 1                   | n/a          | 60              | 1                | Switch            | 0            | 2.2                          | 0.0                        | 0.0                 | \$0.00            |               |                   |                |

## APPENDIX C: UPCOMING EQUIPMENT PHASEOUTS

### LIGHTING:

- As of **July 1, 2010** magnetic ballasts most commonly used for the operation of T12 lamps are no longer being produced for commercial and industrial applications.
- As of **January 1, 2012** 100 watt incandescent bulbs have been phased out in accordance with the Energy Independence and Security Act of 2007.
- As of **July 2012** many non energy saver model T12 lamps have been phased out of production.
- As of **January 1, 2013** 75 watt incandescent bulbs have been phased out in accordance with the Energy Independence and Security Act of 2007.
- As of **January 1, 2014** 60 and 40 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.
- Energy Independence and Security Act of 2007 incandescent lamp phase-out exclusions:
  1. Appliance lamp (e.g. refrigerator or oven light)
  2. Black light lamp
  3. Bug lamp
  4. Colored lamp
  5. Infrared lamp
  6. Left-hand thread lamp
  7. Marine lamp
  8. Marine signal service lamp
  9. Mine service lamp
  10. Plant light lamp
  11. Reflector lamp
  12. Rough service lamp
  13. Shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp)
  14. Sign service lamp
  15. Silver bowl lamp
  16. Showcase lamp
  17. 3-way incandescent lamp
  18. Traffic signal lamp
  19. Vibration service lamp
  20. Globe shaped "G" lamp (as defined in ANSI C78.20-2003 and C79.1-2002 with a diameter of 5 inches or more)
  21. T shape lamp (as defined in ANSI C78.20-2003 and C79.1-2002) and that uses not more than 40 watts or has a length of more than 10 inches
  22. A B, BA, CA, F, G16-1/2, G-25, G30, S, or M-14 lamp (as defined in ANSI C79.1-2002 and ANSI C78.20-2003) of 40 watts or less
  23. Candelabra incandescent and other lights not having a medium Edison screw base.
- When installing compact fluorescent lamps (CFLs), be advised that they contain a very small amount of mercury sealed within the glass tubing and EPA guidelines concerning

cleanup and safe disposal of compact fluorescent light bulbs should be followed. Additionally, all lamps to be disposed should be recycled in accordance with EPA guidelines through state or local government collection or exchange programs instead.

**HCFC (Hydro chlorofluorocarbons):**

- As of **January 1, 2010**, no production and no importing of R-142b and R-22, except for use in equipment manufactured before January 1, 2010, in accordance with adherence to the Montreal Protocol.
- As of **January 1, 2015**, No production and no importing of any HCFCs, except for use as refrigerants in equipment manufactured before January 1, 2010.
- As of **January 1, 2020** No production and no importing of R-142b and R-22.

## APPENDIX D: THIRD PARTY ENERGY SUPPLIERS

<http://www.state.nj.us/bpu/commercial/shopping.html>

### PSE&G ELECTRIC SERVICE TERRITORY

Last Updated: 12/11/14

\*CUSTOMER CLASS - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL

| Supplier                                                                                                       | Telephone<br>& Web Site                                                                            | *Customer<br>Class  |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------|
| <b>Abest Power &amp; Gas of NJ, LLC</b><br>202 Smith Street<br>Perth Amboy, NJ 08861                           | (888)987-6937<br><br><a href="http://www.AbestPower.com">www.AbestPower.com</a>                    | R/C/I<br><br>ACTIVE |
| <b>AEP Energy, Inc. f/k/a BlueStar Energy Services</b><br>309 Fellowship Road, Fl. 2<br>Mount Laurel, NJ 08054 | (866) 258-3782<br><br><a href="http://www.aepenergy.com">www.aepenergy.com</a>                     | R/C/I<br><br>ACTIVE |
| <b>Alpha Gas and Electric, LLC</b><br>641 5 <sup>th</sup> Street<br>Lakewood, NJ 08701                         | (855) 553-6374<br><br><a href="http://www.alphagasandelectric.com">www.alphagasandelectric.com</a> | R/C<br><br>ACTIVE   |
| <b>Ambit Northeast, LLC d/b/a Ambit Energy</b><br>103 Carnegie Center<br>Suite 300<br>Princeton, NJ 08540      | 877-282-6284<br><br><a href="http://www.ambitenergy.com">www.ambitenergy.com</a>                   | R/C<br><br>ACTIVE   |
| <b>American Powernet Management, LP</b><br>437 North Grove St.<br>Berlin, NJ 08009                             | (877) 977-2636<br><br><a href="http://www.americanpowernet.com">www.americanpowernet.com</a>       | C/I<br><br>ACTIVE   |
| <b>Amerigreen Energy, Inc.</b><br>333Sylvan Avenue<br>Englewood Cliffs, NJ 07632                               | 888-559-4567<br><br><a href="http://www.amerigreen.com">www.amerigreen.com</a>                     | R/C<br><br>ACTIVE   |
| <b>AP Gas &amp; Electric, (NJ) LLC</b><br>10 North Park Place, Suite 420<br>Morristown, NJ 07960               | (855) 544-4895<br><br><a href="http://www.apgellc.com">www.apgellc.com</a>                         | R/C/I<br><br>ACTIVE |
| <b>Astral Energy LLC</b><br>16 Tyson Place<br>Bergenfield, NJ 07621                                            | (888)850-1872<br><br><a href="http://www.AstralEnergyLLC.com">www.AstralEnergyLLC.com</a>          | R/C/I<br><br>ACTIVE |
| <b>Barclays Capital Services, Inc.</b><br>70 Hudson Street<br>Jersey City, NJ 07302-4585                       | (800) 526-7000<br><br><a href="http://www.barclays.com">www.barclays.com</a>                       | C<br><br>ACTIVE     |
| <b>BBPC, LLC d/b/a Great Eastern Energy</b>                                                                    | (888) 651-4121                                                                                     | C                   |

|                                                                                                                       |                                                                                                            |                     |
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| 116 Village Blvd. Suite 200<br>Princeton, NJ 08540                                                                    | <a href="http://www.greateasternenergy.com">www.greateasternenergy.com</a>                                 | ACTIVE              |
| <b>Berkshire Energy Partners, LLC</b><br>9 Berkshire Road<br>Landenberg, PA 19350<br>Attn: Dana A. LeSage, P.E.       | (610) 255-5070<br><br><a href="http://www.berkshireenergypartners.com">www.berkshireenergypartners.com</a> | C/I<br><br>ACTIVE   |
| <b>Blue Pilot Energy, LLC</b><br>197 State Rte. 18 South<br>Ste. 3000<br>East Brunswick, NJ 08816                     | (800) 451-6356<br><br><a href="http://www.bluepilotenergy.com">www.bluepilotenergy.com</a>                 | R/C<br><br>ACTIVE   |
| <b>Brick Standard, LLC</b><br>235 Hudson Street Suite 1<br>Hoboken, NJ 07030                                          | (201)706-8101<br><br><a href="http://www.standardalternative.com">www.standardalternative.com</a>          | C/I<br><br>ACTIVE   |
| <b>CCES LLC dba Clean Currents Energy Services</b><br>566 Terhune Street<br>Teaneck, NJ 07666                         | (877) 933-2453<br><br><a href="http://www.cleancurrents.com">www.cleancurrents.com</a>                     | R/C<br><br>ACTIVE   |
| <b>Champion Energy Services, LLC</b><br>1200 Route 22<br>Bridgewater, NJ 08807                                        | (888) 653-0093<br><br><a href="http://www.championenergyservices.com">www.championenergyservices.com</a>   | R/C/I<br><br>ACTIVE |
| <b>Choice Energy, LLC</b><br>4257 US Highway 9, Suite 6C<br>Freehold, NJ 07728                                        | (888) 565-4490<br><br><a href="http://www.4choiceenergy.com">www.4choiceenergy.com</a>                     | R/C<br><br>ACTIVE   |
| <b>Clearview Electric, Inc.</b><br>1744 Lexington Avenue<br>Pennsauken, NJ 08110                                      | (888) CLR-VIEW<br>(800) 746- 4702<br><a href="http://www.clearviewenergy.com">www.clearviewenergy.com</a>  | R/C/I<br><br>ACTIVE |
| <b>Commerce Energy, Inc.</b><br>7 Cedar Terrace<br>Ramsey, NJ 07446                                                   | 1-866-587-8674<br><br><a href="http://www.commerceenergy.com">www.commerceenergy.com</a>                   | R/C<br><br>ACTIVE   |
| <b>Community Energy Inc.</b><br>51 Sandbrook Headquarters<br>Road<br>Stockton, NJ 08559                               | (866)946-3123<br><br><a href="http://www.communityenergyinc.com">www.communityenergyinc.com</a>            | R/C/I<br><br>ACTIVE |
| <b>ConEdison Solutions</b><br>Cherry Tree Corporate Center<br>535 State Highway<br>Suite 180<br>Cherry Hill, NJ 08002 | (888) 665-0955<br><br><a href="http://www.conedsolutions.com">www.conedsolutions.com</a>                   | C/I<br><br>ACTIVE   |



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| <b>ConocoPhillips Company</b><br>224 Strawbridge Drive<br>Suite 107<br>Moorestown, NJ 08057                                | (800) 646-4427<br><br><a href="http://www.conocophillips.com">www.conocophillips.com</a>                        | C/I<br><br>ACTIVE   |
| <b>Constellation NewEnergy, Inc.</b><br>900A Lake Street, Suite 2<br>Ramsey, NJ 07446                                      | (888) 635-0827<br><br><a href="http://www.constellation.com">www.constellation.com</a>                          | R/C/I<br><br>ACTIVE |
| <b>Constellation Energy</b><br>900A Lake Street, Suite 2<br>Ramsey, NJ 07446                                               | (877) 997-9995<br><br><a href="http://www.constellation.com">www.constellation.com</a>                          | R<br><br>ACTIVE     |
| <b>Credit Suisse, (USA) Inc.</b><br>700 College Road East<br>Princeton, NJ 08450                                           | (212) 538-3124<br><br><a href="http://www.creditsuisse.com">www.creditsuisse.com</a>                            | C<br><br>ACTIVE     |
| <b>Direct Energy Business, LLC</b><br>120 Wood Avenue, Suite 611<br>Iselin, NJ 08830                                       | (888) 925-9115<br><br><a href="http://www.business.directenergy.com/">http://www.business.directenergy.com/</a> | R<br><br>ACTIVE     |
| <b>Direct Energy Business Marketing, LLC (fka Hess Energy Marketing)</b><br>1 Hess Plaza<br>Woodbridge, NJ 07095           | (800) 437-7872<br><br><a href="http://www.business.directenergy.com/">http://www.business.directenergy.com/</a> | C/I<br><br>ACTIVE   |
| <b>Direct Energy Services, LLC</b><br>120 Wood Avenue, Suite 611<br>Iselin, NJ 08830                                       | (888) 925-9115<br><br><a href="http://www.directenergy.com">www.directenergy.com</a>                            | R<br><br>ACTIVE     |
| <b>Direct Energy Small Business, LLC (fka Hess Small Business Services, LLC)</b><br>One Hess Plaza<br>Woodbridge, NJ 07095 | (888) 464-4377<br><br><a href="http://www.business.directenergy.com/">http://www.business.directenergy.com/</a> | C/I<br><br>ACTIVE   |
| <b>Discount Energy Group, LLC</b><br>811 Church Road, Suite 149<br>Cherry Hill, New Jersey<br>08002                        | (800) 282-3331<br><br><a href="http://www.discountenergygroup.com">www.discountenergygroup.com</a>              | R/C<br><br>ACTIVE   |
| <b>DTE Energy Supply, Inc.</b><br>One Gateway Center,<br>Suite 2600<br>Newark, NJ 07102                                    | (877) 332-2450<br><br><a href="http://www.dtesupply.com">www.dtesupply.com</a>                                  | C/I<br><br>ACTIVE   |

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|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------|
| <b>Energy.me Midwest LLC</b><br>90 Washington Blvd<br>Bedminster, NJ 07921                                                        | (855) 243-7270<br><br><a href="http://www.energy.me">www.energy.me</a>                                   | R/C/I<br><br>ACTIVE |
| <b>Energy Plus Holdings LLC</b><br>309 Fellowship Road<br>East Gate Center, Suite 200<br>Mt. Laurel, NJ 08054                     | (877) 866-9193<br><br><a href="http://www.energypluscompany.com">www.energypluscompany.com</a>           | R/C<br><br>ACTIVE   |
| <b>Ethical Electric Benefit Co.<br/>d/b/a Ethical Electric</b><br>100 Overlook Center, 2 <sup>nd</sup> Fl.<br>Princeton, NJ 08540 | (888) 444-9452<br><br><a href="http://www.ethicalelectric.com">www.ethicalelectric.com</a>               | R/C<br><br>ACTIVE   |
| <b>Energy Service Providers,<br/>Inc., d/b/a New Jersey Gas &amp;<br/>Electric</b><br>1 Bridge Plaza fl. 2<br>Fort Lee, NJ 07024  | (866) 568-0290<br><br><a href="http://www.njgande.com">www.njgande.com</a>                               | R/C<br><br>ACTIVE   |
| <b>FirstEnergy Solutions</b><br>150 West State Street<br>Trenton, NJ 08608                                                        | (866) 625-7318<br><br><a href="http://www.fes.com">www.fes.com</a>                                       | C/I<br><br>ACTIVE   |
| <b>Gateway Energy Services<br/>Corp.</b><br>120 Wood Avenue Suite 611<br>Iselin, NJ 08830                                         | (866)348-4193<br><br><a href="http://www.directenergybusiness.com">www.directenergybusiness.com</a>      | R/C<br><br>ACTIVE   |
| <b>GDF SUEZ Energy<br/>Resources NA, Inc.</b><br>333 Thornall Street<br>Sixth Floor<br>Edison, NJ 08837                           | (866) 999-8374<br><br><a href="http://www.gdfsuezenergyresources.com">www.gdfsuezenergyresources.com</a> | C/I<br><br>ACTIVE   |
| <b>GDF Suez Retail Energy<br/>Solutions LLC d/b/a THINK<br/>ENERGY</b><br>333 Thornall St. Sixth Floor<br>Edison, NJ 08819        | 1-866-252-0078<br><br><a href="http://www.mythinkenergy.com">www.mythinkenergy.com</a>                   | R/C/I<br><br>ACTIVE |
| <b>Glacial Energy of New<br/>Jersey, Inc.</b><br>21 Pine Street, Suite 237<br>Rockaway, NJ 07866                                  | (888) 452-2425<br><br><a href="http://www.glacialenergy.com">www.glacialenergy.com</a>                   | C/I<br><br>ACTIVE   |
| <b>Global Energy Marketing<br/>LLC</b><br>129 Wentz Avenue<br>Springfield, NJ 07081                                               | (800) 542-0778<br><br><a href="http://www.globalp.com">www.globalp.com</a>                               | R/C/I<br><br>ACTIVE |

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| <b>Green Mountain Energy Company</b><br>211 Carnegie Center Drive<br>Princeton, NJ 08540                   | (866) 767-5818<br><a href="http://www.greenmountain.com/commercial-home">www.greenmountain.com/commercial-home</a> | C/I<br><br>ACTIVE   |
| <b>Harborside Energy LLC</b><br>101 Hudson Street<br>Suite 2100<br>Jersey City, NJ 07302                   | (877) 940-3835<br><a href="http://www.harborsideenergynj.com">www.harborsideenergynj.com</a>                       | R/C<br><br>ACTIVE   |
| <b>Hess Corporation</b><br>1 Hess Plaza<br>Woodbridge, NJ 07095                                            | (800) 437-7872<br><a href="http://www.hess.com">www.hess.com</a>                                                   | C/I<br><br>ACTIVE   |
| <b>HIKO Energy, LLC</b><br>655 Suffern Road<br>Teaneck, NJ 07666                                           | (888) 264-4908<br><a href="http://www.hikoenergy.com">www.hikoenergy.com</a>                                       | R/C/I<br><br>ACTIVE |
| <b>Hudson Energy Services, LLC</b><br>7 Cedar Street<br>Ramsey, New Jersey 07446                           | (877) Hudson 9<br><a href="http://www.hudsonenergyservices.com">www.hudsonenergyservices.com</a>                   | C<br><br>ACTIVE     |
| <b>IDT Energy, Inc.</b><br>550 Broad Street<br>Newark, NJ 07102                                            | (877) 887-6866<br><a href="http://www.idtenergy.com">www.idtenergy.com</a>                                         | R/C<br><br>ACTIVE   |
| <b>Independence Energy Group, LLC</b><br>211 Carnegie Center<br>Princeton, NJ 08540                        | (877) 235-6708<br><a href="http://www.chooseindependence.com">www.chooseindependence.com</a>                       | R/C<br><br>ACTIVE   |
| <b>Inspire Energy Holdings LLC</b><br>923 Haddonfield Road<br>3rd Fl. Building B2<br>Cherry Hill, NJ 08002 | (866) 403-2620<br><a href="http://www.inspireenergy.com">www.inspireenergy.com</a>                                 | R/C/I               |
| <b>Integrus Energy Services, Inc.</b><br>33 Wood Ave, South, Suite 610<br>Iselin, NJ 08830                 | (800) 536-0151<br><a href="http://www.integrusenergy.com">www.integrusenergy.com</a>                               | C/I<br><br>ACTIVE   |
| <b>Jsynergy, LLC</b><br>445 Central Ave. Suite 204<br>Cedarhurst, NY 11516                                 | (516) 331-2020<br><a href="http://Jsynergylc.com">Jsynergylc.com</a>                                               | R/C/I<br><br>ACTIVE |
| <b>Kuehne Chemical Company, Inc.</b><br>86 North Hackensack Avenue<br>South Kearney, NJ 07032              | (973) 589-0700<br><a href="mailto:kuehnechemical@comcast.net">kuehnechemical@comcast.net</a>                       | I                   |

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| <b>Liberty Power Delaware, LLC</b><br>1973 Highway 34, Suite 211<br>Wall, NJ 07719                                    | (866) 769-3799<br><br><a href="http://www.libertypowercorp.com">www.libertypowercorp.com</a>                                                    | C/I<br><br>ACTIVE   |
| <b>Liberty Power Holdings, LLC</b><br>1973 Highway 34, Suite 211<br>Wall, NJ 07719                                    | (866) 769-3799<br><br><a href="http://www.libertypowercorp.com">www.libertypowercorp.com</a>                                                    | R/C/I<br><br>ACTIVE |
| <b>Linde Energy Services</b><br>575 Mountain Avenue<br>Murray Hill, NJ 07974                                          | (800) 247-2644<br><br><a href="http://www.linde.com">www.linde.com</a>                                                                          | C/I<br><br>ACTIVE   |
| <b>Marathon Power LLC</b><br>302 Main Street<br>Paterson, NJ 07505                                                    | ( 888) 779-7255<br><br><a href="http://www.mecny.com">www.mecny.com</a>                                                                         | R/C/I<br><br>ACTIVE |
| <b>MP2 Energy NJ, LLC</b><br>111 River Street, Suite 1204<br>Hoboken, NJ 07030                                        | (877) 238-5343<br><br><a href="http://www.mp2energy.com">www.mp2energy.com</a>                                                                  | R/C/I<br><br>ACTIVE |
| <b>Natures Current, LLC</b><br>95 Fairmount Avenue<br>Philadelphia, Pennsylvania<br>19123                             | (215) 464-6000<br><br><a href="http://www.naturescurrent.com">www.naturescurrent.com</a>                                                        | R/C/I<br><br>ACTIVE |
| <b>MPower Energy NJ LLC</b><br>One University Plaza,<br>Suite 507<br>Hackensack, NJ 07601                             | (877) 286-7693<br><br><a href="http://www.mpowerenergy.com">www.mpowerenergy.com</a>                                                            | R/C/I<br><br>ACTIVE |
| <b>NATGASCO, Inc. (Supreme Energy, Inc.)</b><br>532 Freeman St.<br>Orange, NJ 07050                                   | (800) 840-4427<br><br><a href="http://www.supremeenergyinc.com">www.supremeenergyinc.com</a>                                                    | R/C/I<br><br>ACTIVE |
| <b>New Jersey Gas &amp; Electric</b><br>10 North Park Place<br>Suite 420<br>Morristown, NJ 07960                      | (866) 568-0290<br><br><a href="http://www.njgande.com">www.njgande.com</a>                                                                      | R/C/<br><br>ACTIVE  |
| <b>NextEra Energy Services New Jersey, LLC</b><br>651 Jernee Mill Road<br>Sayreville, NJ 08872                        | (877) 528-2890 Commercial<br>(800) 882-1276 Residential<br><br><a href="http://www.nexteraenergyservices.com">www.nexteraenergyservices.com</a> | R/C/I<br><br>ACTIVE |
| <b>Noble Americas Energy Solutions</b><br>The Mac-Cali Building<br>581 Main Street, 8th Floor<br>Woodbridge, NJ 07095 | (877) 273-6772<br><br><a href="http://www.noblesolutions.com">www.noblesolutions.com</a>                                                        | C/I<br><br>ACTIVE   |

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| <b>Nordic Energy Services, LLC</b><br>50 Tice Boulevard, Suite 340<br>Woodcliff Lake, NJ 07677                               | (877) 808-1027<br><a href="http://www.nordiceenergy.us.com">www.nordiceenergy.us.com</a>     | R/C/I<br><br>ACTIVE |
| <b>North American Power and Gas, LLC</b><br>222 Ridgedale Avenue<br>Cedar Knolls, NJ 07927                                   | (888) 313-9086<br><a href="http://www.napower.com">www.napower.com</a>                       | R/C/I<br><br>ACTIVE |
| <b>North Eastern States, Inc. d/b/a Entrust Energy</b><br>90 Washington Valley Road<br>Bedminster, NJ 07921                  | (888) 535-6340<br><a href="http://www.entrustenergy.com">www.entrustenergy.com</a>           | R/C/I<br><br>ACTIVE |
| <b>Oasis Power, LLC d/b/a Oasis Energy</b><br>11152 Westheimer, Suite 901<br>Houston, TX 77042                               | (800)324-3046<br><a href="http://www.oasisenergy.com">www.oasisenergy.com</a>                | R/C<br><br>ACTIVE   |
| <b>Palmco Power NJ, LLC</b><br>One Greentree Centre<br>10,000 Lincoln Drive East,<br>Suite 201<br>Marlton, NJ 08053          | (877) 726-5862<br><a href="http://www.PalmcoEnergy.com">www.PalmcoEnergy.com</a>             | R/C/I<br><br>ACTIVE |
| <b>Park Power, LLC</b><br>1200 South Church St.<br>Suite 23<br>Mount Laurel, NJ 08054                                        | (856) 778-0079<br><a href="http://www.parkpower.com">www.parkpower.com</a>                   | R/C/I<br><br>ACTIVE |
| <b>Plymouth Rock Energy, LLC</b><br>338 Maitland Avenue<br>Teaneck, NJ 07666                                                 | (855) 32-POWER (76937)<br><a href="http://www.plymouthenergy.com">www.plymouthenergy.com</a> | R/C/I<br><br>ACTIVE |
| <b>Power Management Co., LLC b/b/a PMC Lightsavers</b><br>Limited Liability Company<br>1600 Moseley Road<br>Victor, NY 14564 | (585) 249-1360<br><a href="http://www.powermanagementco.com">www.powermanagementco.com</a>   | C/I<br><br>ACTIVE   |
| <b>PPL Energy Plus, LLC</b><br>811 Church Road<br>Cherry Hill, NJ 08002                                                      | (800) 281-2000<br><a href="http://www.pplenergyplus.com">www.pplenergyplus.com</a>           | C/I<br><br>ACTIVE   |
| <b>PPL EnergyPlus Retail, LLC</b><br>788 Shrewsbury Avenue, Suite 220<br>Tinton Falls, NJ 07724                              | (732) 741-0505 – 2000<br><a href="http://www.pplenergyplus.com">www.pplenergyplus.com</a>    | C/I<br><br>ACTIVE   |
| <b>Progressive Energy Consulting, LLC</b>                                                                                    | (917) 837-7400                                                                               | R/C/I               |



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| PO Box 4582<br>Wayne, New Jersey 07474                                                                                     | <a href="mailto:Progressivenrg@optionline.net">Progressivenrg@optionline.net</a>           | ACTIVE          |
| <b>Prospect Resources, Inc.</b><br>208 W. State Street<br>Trenton, NJ 08608-1002                                           | (847) 673-1959<br><a href="http://www.prospectresources.com">www.prospectresources.com</a> | C<br>ACTIVE     |
| <b>Public Power &amp; Utility of New Jersey, LLC</b><br>One International Blvd, Suite 400<br>Mahwah, NJ 07495              | (888) 354-4415<br><a href="http://www.ppandu.com">www.ppandu.com</a>                       | R/C/I<br>ACTIVE |
| <b>Reliant Energy</b><br>211 Carnegie Center<br>Princeton, NJ 08540                                                        | (877) 297-3795<br>(877) 297-3780<br><a href="http://www.reliant.com">www.reliant.com</a>   | R/C/I<br>ACTIVE |
| <b>ResCom Energy LLC</b><br>18C Wave Crest Ave.<br>Winfield Park, NJ 07036                                                 | (888) 238-4041<br><a href="http://rescomenergy.com">http://rescomenergy.com</a>            | R/C/I<br>ACTIVE |
| <b>Residents Energy, LLC</b><br>550 Broad Street<br>Newark, NJ 07102                                                       | (888) 828-7374<br><a href="http://www.residentsenergy.com">www.residentsenergy.com</a>     | R/C             |
| <b>Respond Power LLC</b><br>1001 East Lawn Drive<br>Teaneck, NJ 07666                                                      | (877) 973-7763<br><a href="http://www.majorenergy.com">www.majorenergy.com</a>             | R/C/I<br>ACTIVE |
| <b>Save on Energy, LLC</b><br>1101 Red Ventures Drive<br>Fort Mill, SC 29707                                               | 1 (877)-658-3183<br><a href="http://www.saveonenergy.com">www.saveonenergy.com</a>         | R/C             |
| <b>SFE Energy</b><br>One Gateway Center<br>Suite 2600<br>Newark, NJ 07012                                                  | 1 (877) 316-6344<br><a href="http://www.sfeenergy.com">www.sfeenergy.com</a>               | R/C/I<br>ACTIVE |
| <b>S.J. Energy Partners, Inc.</b><br>208 White Horse Pike, Suite 4<br>Barrington, NJ 08007                                 | (800) 695-0666<br><a href="http://www.sjnaturalgas.com">www.sjnaturalgas.com</a>           | C<br>ACTIVE     |
| <b>SmartEnergy Holdings, LLC</b><br>100 Overlook Center<br>2nd Floor<br>Princeton, NJ NJ 08540<br>United States of America | (800) 443-4440<br><a href="http://www.smartenergy.com">www.smartenergy.com</a>             | R/C/I<br>ACTIVE |
| <b>South Jersey Energy Company</b><br>1 South Jersey Plaza, Route 54<br>Folsom, NJ 08037                                   | (800) 266-6020<br><a href="http://www.southjerseyenergy.com">www.southjerseyenergy.com</a> | R/C/I<br>ACTIVE |

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| <b>Spark Energy Gas, LP/<br/>Spark Energy</b><br>2105 City West Blvd.<br>Suite 100<br>Houston, TX 77042                | (713)600-2600<br><br><a href="http://www.sparkenergy.com">www.sparkenergy.com</a>                               | R/C/I<br><br>ACTIVE |
| <b>Sperian Energy Corp.</b><br>1200 Route 22 East, Suite<br>2000<br>Bridgewater, NJ 08807                              | (888) 682-8082<br><br><a href="http://www.sperianenergy.com">www.sperianenergy.com</a>                          | R/C/I<br><br>ACTIVE |
| <b>Starion Energy PA Inc.</b><br>101 Warburton Avenue<br>Hawthorne, NJ 07506                                           | (800) 600-3040<br><br><a href="http://www.starionenergy.com">www.starionenergy.com</a>                          | R/C/I<br><br>ACTIVE |
| <b>Stream Energy New Jersey,<br/>LLC</b><br>309 Fellowship Rd., Suite 200<br>Mt. Laurel, NJ 08054                      | (877) 369-8150<br><br><a href="http://www.streamenergy.net">www.streamenergy.net</a>                            | R/C<br><br>ACTIVE   |
| <b>Summit Energy Services,<br/>Inc.</b><br>10350 Ormsby Park Place<br>Suite 400<br>Louisville, KY 40223                | 1 (800) 90-SUMMIT<br><br><a href="http://www.summitenergy.com">www.summitenergy.com</a>                         | C/I<br><br>ACTIVE   |
| <b>Texas Retail Energy LLC</b><br>Park 80 West Plaza II, Suite<br>200<br>Saddle Brook, NJ 07663<br>Attn: Chris Hendrix | (866) 532-0761<br><br>Texasretailenergy.com                                                                     | C/I<br><br>ACTIVE   |
| <b>TransCanada Power<br/>Marketing Ltd.</b><br>190 Middlesex Essex<br>Turnpike, Suite 200<br>Iselin, NJ 08830          | (877) MEGAWAT<br><br><a href="http://www.transcanada.com/powermarketing">www.transcanada.com/powermarketing</a> | C/I<br><br>ACTIVE   |
| <b>TriEagle Energy, LP</b><br>90 Washington Valley Rd<br>Bedminster, NJ 07921                                          | (877) 933-2453<br><br><a href="http://www.trieagleenergy.com">www.trieagleenergy.com</a>                        | R/C/I<br><br>ACTIVE |
| <b>UGI Energy Services, Inc.<br/>dba UGI Energy Link</b><br>224 Strawbridge Drive<br>Suite 107<br>Moorestown, NJ 08057 | (800) 427-8545<br><br><a href="http://www.ugienergylink.com">www.ugienergylink.com</a>                          | C/I<br><br>ACTIVE   |
| <b>Verde Energy USA, Inc.</b><br>2001 Route 46<br>Waterview Plaza Suite 301<br>Parsippany, NJ 07054                    | (800) 388-3862<br><br><a href="http://www.lowcostpower.com">www.lowcostpower.com</a>                            | R/C<br><br>ACTIVE   |

|                                                                                                       |                                                                                              |                                   |
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| <b>Viridian Energy</b><br>2001 Route 46, Waterview<br>Plaza<br>Suite 310<br>Parsippany, NJ 07054      | (866) 663-2508<br><br><a href="http://www.viridian.com">www.viridian.com</a>                 | <b>R/C/I</b><br><br><b>ACTIVE</b> |
| <b>XOOM Energy New Jersey, LLC</b><br>744 Broad Street. 16 <sup>th</sup> Floor<br>Newark, NJ 07102    | (888) 997-8979<br><br><a href="http://www.xoomenergy.com">www.xoomenergy.com</a>             | <b>R/C/I</b><br><br><b>ACTIVE</b> |
| <b>YEP Energy</b><br>89 Headquarters Plaza North<br>#1463<br>Morristown, NJ 07960                     | (855) 363-7736<br><br><a href="http://www.yepenergyNJ.com">www.yepenergyNJ.com</a>           | <b>R/C/I</b><br><br><b>ACTIVE</b> |
| <b>Your Energy Holdings, LLC</b><br>One International Boulevard<br>Suite 400<br>Mahwah, NJ 07495-0400 | (855) 732-2493<br><br><a href="http://www.thisisyourenergy.com">www.thisisyourenergy.com</a> | <b>R/C/I</b><br><br><b>ACTIVE</b> |

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## APPENDIX E: GLOSSARY AND METHOD OF CALCULATIONS

**Net ECM Cost:** The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

**Annual Energy Cost Savings (AECS):** This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

**Lifetime Energy Cost Savings (LECS):** This measure estimates the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

**Simple Payback:** This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

**ECM Lifetime:** This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

**Operating Cost Savings (OCS):** This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measures (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

**Return on Investment (ROI):** The ROI is expressed as the percentage return of the investment based on the lifetime cost savings of the ECM. This value can be included as an annual or lifetime value, or both.

**Net Present Value (NPV):** The NPV calculates the present value of an investment's future cash flows based on the time value of money, which is accounted for by a discount rate (assumes bond rate of 3.0%).

**Internal Rate of Return (IRR):** The IRR expresses an annual rate that results in a break-even point for the investment. If the owner is currently experiencing a lower return on their capital than the IRR, the project is financially advantageous. This measure also allows the owner to compare ECMs against each other to determine the most appealing choices.

**Gas Rate and Electric Rate (\$/therm and \$/kWh):** The gas rate and electric rate used in the financial analysis is the total annual energy cost divided by the total annual energy usage for the 12 month billing period studied. The graphs of the monthly gas and electric rates reflect the total monthly energy costs divided by the monthly usage, and display how the average rate fluctuates throughout the year. The average annual rate is the only rate used in energy savings calculations.

### Calculation References

| Term           | Definition                                                                 |
|----------------|----------------------------------------------------------------------------|
| ECM            | Energy Conservation Measure                                                |
| AOCS           | Annual Operating Cost Savings                                              |
| AECS           | Annual Energy Cost Savings                                                 |
| LOCS*          | Lifetime Operating Cost Savings                                            |
| LECS           | Lifetime Energy Cost Savings                                               |
| LCS            | Lifetime Cost Savings                                                      |
| NPV            | Net Present Value                                                          |
| IRR            | Internal Rate of Return                                                    |
| DR             | Discount Rate                                                              |
| Net ECM Cost   | Total ECM Cost – Incentive                                                 |
| LECS           | AECS X ECM Lifetime                                                        |
| AOCS           | LOCS / ECM Lifetime                                                        |
| LCS            | LOCS+LECS                                                                  |
| Simple Payback | Net ECM Cost / (AECS + AOCS)                                               |
| Lifetime ROI   | (LECS + LOCS – Net ECM Cost) / Net ECM Cost                                |
| Annual ROI     | (Lifetime ROI / Lifetime) = [(AECS + OCS) / Net ECM Cost – (1 / Lifetime)] |

\* The lifetime operating cost savings are all avoided operating, maintenance, and/or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

### Excel NPV and IRR Calculation

In Excel, function =IRR (values) and =NPV (rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves \$850 annually in energy and maintenance costs (over a 10 year lifetime) and takes \$5,000 to purchase and install after incentives:

|    | A | B | C | D | E    | F             | G | H | I               |
|----|---|---|---|---|------|---------------|---|---|-----------------|
| 1  |   |   |   |   |      |               |   |   |                 |
| 2  |   |   |   |   |      |               |   |   |                 |
| 3  |   |   |   |   |      |               |   |   |                 |
| 4  |   |   |   |   | Year | Cash Flow     |   |   |                 |
| 5  |   |   |   |   | 0    | \$ (5,000.00) |   |   | Investment Cost |
| 6  |   |   |   |   | 1    | \$ 850.00     |   |   |                 |
| 7  |   |   |   |   | 2    | \$ 850.00     |   |   |                 |
| 8  |   |   |   |   | 3    | \$ 850.00     |   |   |                 |
| 9  |   |   |   |   | 4    | \$ 850.00     |   |   |                 |
| 10 |   |   |   |   | 5    | \$ 850.00     |   |   |                 |
| 11 |   |   |   |   | 6    | \$ 850.00     |   |   |                 |
| 12 |   |   |   |   | 7    | \$ 850.00     |   |   |                 |
| 13 |   |   |   |   | 8    | \$ 850.00     |   |   |                 |
| 14 |   |   |   |   | 9    | \$ 850.00     |   |   |                 |
| 15 |   |   |   |   | 10   | \$ 850.00     |   |   |                 |
| 16 |   |   |   |   | IRR  | 11.03%        |   |   |                 |
| 17 |   |   |   |   | NPV  | \$2,250.67    |   |   |                 |

ECM Lifetime: 10 years (rows 5-14)

Cash Flow: Annual Energy Cost Savings + Annual Maintenance Savings

Formula:  
 =IRR(F4:F14)  
 =NPV(0.03,F5:F14)+F4

## Solar PV ECM Calculation

There are several components to the calculation:

|                 |                                                                                                                                                                                                                                                                                                                                       |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Costs:          | Material of PV system including panels, mounting and net-metering + Labor                                                                                                                                                                                                                                                             |
| Energy Savings: | Reduction of kWh electric cost for life of panel, 25 years<br>Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume \$180/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh) |
| Assumptions:    | A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.                |

Total lifetime PV energy cost savings =  
kWh produced by panel \* [\$/kWh cost \* 25 years + \$180/Megawatt hour /1000 \* 15 years]

## ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.

Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours / annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

### New Jersey Clean Energy Program Commercial Equipment Life Span

| Measure                                                       | Life Span |
|---------------------------------------------------------------|-----------|
| Commercial Lighting — New                                     | 15        |
| Commercial Lighting — Remodel/Replacement                     | 15        |
| Commercial Custom — New                                       | 18        |
| Commercial Chiller Optimization                               | 18        |
| Commercial Unitary HVAC — New - Tier 1                        | 15        |
| Commercial Unitary HVAC — Replacement - Tier 1                | 15        |
| Commercial Unitary HVAC — New - Tier 2                        | 15        |
| Commercial Unitary HVAC — Replacement Tier 2                  | 15        |
| Commercial Chillers — New                                     | 25        |
| Commercial Chillers — Replacement                             | 25        |
| Commercial Small Motors (1-10 HP) — New or Replacement        | 20        |
| Commercial Medium Motors (11-75 HP) — New or Replacement      | 20        |
| Commercial Large Motors (76-200 HP) — New or Replacement      | 20        |
| Commercial VSDs — New                                         | 15        |
| Commercial VSDs — Retrofit                                    | 15        |
| Commercial Comprehensive New Construction Design              | 18        |
| Commercial Custom — Replacement                               | 18        |
| Industrial Lighting — New                                     | 15        |
| Industrial Lighting — Remodel/Replacement                     | 15        |
| Industrial Unitary HVAC — New - Tier 1                        | 15        |
| Industrial Unitary HVAC — Replacement - Tier 1                | 15        |
| Industrial Unitary HVAC — New - Tier 2                        | 15        |
| Industrial Unitary HVAC — Replacement Tier 2                  | 15        |
| Industrial Chillers — New                                     | 25        |
| Industrial Chillers — Replacement                             | 25        |
| Industrial Small Motors (1-10 HP) — New or Replacement        | 20        |
| Industrial Medium Motors (11-75 HP) — New or Replacement      | 20        |
| Industrial Large Motors (76-200 HP) — New or Replacement      | 20        |
| Industrial VSDs — New                                         | 15        |
| Industrial VSDs — Retrofit                                    | 15        |
| Industrial Custom — Non-Process                               | 18        |
| Industrial Custom — Process                                   | 10        |
| Small Commercial Gas Furnace — New or Replacement             | 20        |
| Small Commercial Gas Boiler — New or Replacement              | 20        |
| Small Commercial Gas DHW — New or Replacement                 | 10        |
| C&I Gas Absorption Chiller — New or Replacement               | 25        |
| C&I Gas Custom — New or Replacement (Engine Driven Chiller)   | 25        |
| C&I Gas Custom — New or Replacement (Gas Efficiency Measures) | 18        |
| O&M savings                                                   | 3         |
| Compressed Air (GWh participant)                              | 8         |

## APPENDIX F: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

|                                                                                                                                                                                                    |                                                                                                         |                                                                                                                                                                              |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  <p>LEARN MORE AT<br/>energystar.gov</p>                                                                          |                                                                                                         | <h1>ENERGY STAR® Statement of Energy Performance</h1>                                                                                                                        |  |
| <h1>N/A</h1>                                                                                                                                                                                       |                                                                                                         | <h2>Reeb House</h2> <p><b>Primary Property Function:</b> Office<br/> <b>Gross Floor Area (ft²):</b> 3,830<br/> <b>Built:</b> 1890</p>                                        |  |
| <p><b>ENERGY STAR® Score<sup>1</sup></b></p>                                                                                                                                                       |                                                                                                         | <p><b>For Year Ending:</b> October 31, 2014<br/> <b>Date Generated:</b> April 09, 2015</p>                                                                                   |  |
| <p><small>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.</small></p> |                                                                                                         |                                                                                                                                                                              |  |
| <h3>Property &amp; Contact Information</h3>                                                                                                                                                        |                                                                                                         |                                                                                                                                                                              |  |
| <b>Property Address</b><br>Reeb House<br>121 Cottage Place<br>Ridgewood, New Jersey 07450                                                                                                          | <b>Property Owner</b><br>_____<br>( ) - _____                                                           | <b>Primary Contact</b><br>_____<br>( ) - _____                                                                                                                               |  |
| <b>Property ID:</b> 4363780                                                                                                                                                                        |                                                                                                         |                                                                                                                                                                              |  |
| <h3>Energy Consumption and Energy Use Intensity (EUI)</h3>                                                                                                                                         |                                                                                                         |                                                                                                                                                                              |  |
| <b>Site EUI</b><br>51.1 kBtu/ft²                                                                                                                                                                   | <b>Annual Energy by Fuel</b><br>Natural Gas (kBtu) 166,365 (90%)<br>Electric - Grid (kBtu) 19,248 (10%) | <b>National Median Comparison</b><br>National Median Site EUI (kBtu/ft²) 116.9<br>National Median Source EUI (kBtu/ft²) 148.1<br>% Diff from National Median Source EUI -56% |  |
| <b>Source EUI</b><br>64.8 kBtu/ft²                                                                                                                                                                 | <b>Annual Emissions</b><br>Greenhouse Gas Emissions (Metric Tons CO2e/year) 11                          |                                                                                                                                                                              |  |
| <h3>Signature &amp; Stamp of Verifying Professional</h3>                                                                                                                                           |                                                                                                         |                                                                                                                                                                              |  |
| I _____ (Name) verify that the above information is true and correct to the best of my knowledge.                                                                                                  |                                                                                                         |                                                                                                                                                                              |  |
| Signature: _____                                                                                                                                                                                   |                                                                                                         | Date: _____                                                                                                                                                                  |  |
| <b>Licensed Professional</b><br>_____<br>( ) - _____                                                                                                                                               |                                                                                                         | <div style="border: 2px solid black; width: 200px; height: 120px; margin: 0 auto;"></div> <p>Professional Engineer Stamp<br/>(if applicable)</p>                             |  |

## APPENDIX G: INCENTIVE PROGRAMS

### New Jersey Clean Energy Pay for Performance

The NJ Clean Energy Pay for Performance (P4P) Program relies on a network of Partners who provide technical services to clients. LGEA participating clients who are not receiving Direct Energy Efficiency and Conservation Block Grants are eligible for P4P. SWA is an eligible Partner and can develop an Energy Reduction Plan for each project with a whole-building traditional energy audit, a financial plan for funding the energy measures and an installation construction schedule.

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures, and completion of a Post-Construction Benchmarking Report. The incentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15% performance threshold savings has been achieved.

For further information, please see: <http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings> .

### Direct Install 2011 Program\*

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC, and other equipment with energy efficient alternatives. The program pays **up to 70%** of the retrofit costs, including equipment cost and installation costs. Each project is limited to \$75,000 in incentives.

#### Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 200 kW** within 12 months of applying (the 200 kW peak demand threshold has been waived for local government entities who receive and utilize their Energy Efficiency and Conservation Block Grant in conjunction with Direct Install)
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies

#### Energy Provider Incentives

- **South Jersey Gas** – Program offers financing up to \$25,000 on customer's 40% portion of the project and combines financing rate based on portion of the project devoted to gas and electric measures. All gas measures financed at 0%, all electric measures financed at normal rate. Does not offer financing on projects that only include electric measures.
- **Atlantic City Electric** – Provides a free audit, and additional incentives up to 20% of the current incentive up to a maximum of \$5,000 per customer.

For the most up to date information on contractors in New Jersey who participate in this program, go to: <http://www.njcleanenergy.com/commercial-industrial/programs/direct-install> or visit the utility web sites.

## **Smart Start**

New Jersey's SmartStart Building Program is administered by New Jersey's Office of Clean Energy. The program also offers design support for larger projects and technical assistance for smaller projects. If your project specifications do not fit into anything defined by the program, there are even incentives available for custom projects.

There are a number of improvement options for commercial, industrial, institutional, government, and agricultural projects throughout New Jersey. Alternatives are designed to enhance quality while building in energy efficiency to save money. Project categories included in this program are New Construction and Additions, Renovations, Remodeling and Equipment Replacement.

### **Energy Provider Incentives**

- **South Jersey Gas** – Program to finance projects up to \$25,000 not covered by incentive
- **New Jersey Natural Gas** – Will match SSB incentives on gas equipment
- **PSE&G** - Provides funding for site-specific uses of emerging technology. The incentives are determined on a case by case basis.

For the most up to date information on how to participate in this program, go to:

<http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings>.

## **Renewable Energy Incentive Program\***

The Renewable Energy Incentive Program (REIP) provides incentives that reduce the upfront cost of installing renewable energy systems, including solar, wind, and sustainable biomass. Incentives vary depending upon technology, system size, and building type. Current incentive levels, participation information, and application forms can be found at the website listed below.

Solar Renewable Energy Credits (SRECs) represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the customer's account on the web-based SREC tracking system.

For the most up to date information on how to participate in this program, go to:

<http://www.njcleanenergy.com/renewable-energy/home/home>.

## **Utility Sponsored Programs**

Check with your local utility companies for further opportunities that may be available.

## **Energy Efficiency and Conservation Block Grant Rebate Program**

The Energy Efficiency and Conservation Block Grant (EECBG) Rebate Program provides supplemental funding up to \$20,000 for eligible New Jersey local government entities to lower the cost of installing energy conservation measures. Funding for the EECBG Rebate Program is provided through the American Recovery and Reinvestment Act (ARRA).

For the most up to date information on how to participate in this program, go to:  
<http://njcleanenergy.com/EECBG>.

### **Other Federal and State Sponsored Programs**

Other federal and state sponsored funding opportunities may be available, including BLOCK and R&D grant funding. For more information, please check <http://www.dsireusa.org/>.

\*Subject to availability. Incentive program timelines might not be sufficient to meet the 25% in 12 months spending requirement outlined in the LGEA program.



## APPENDIX H: ENERGY CONSERVATION MEASURES

| ECM Summary Table |                                                      |                          |                      |                                        |                      |                           |                         |                             |                           |                      |                                 |                     |                                   |                                 |                             |                        |                                  |
|-------------------|------------------------------------------------------|--------------------------|----------------------|----------------------------------------|----------------------|---------------------------|-------------------------|-----------------------------|---------------------------|----------------------|---------------------------------|---------------------|-----------------------------------|---------------------------------|-----------------------------|------------------------|----------------------------------|
| ECM #             | ECM Description                                      | Est. Installed Cost (\$) | Est. Incentives (\$) | Net Est. ECM Cost with Incentives (\$) | 1st Yr Savings (kWh) | Demand Reduction/Mon (kW) | 1st Yr Savings (Therms) | 1st Yr Savings (kBtu/Sq FT) | Total 1st Yr Savings (\$) | Life of Measure (Yr) | Est. Lifetime Cost Savings (\$) | Simple Payback (Yr) | Lifetime Return on Investment (%) | Annual Return on Investment (%) | Internal Rate of Return (%) | Net Present Value (\$) | CO <sub>2</sub> Reduced (lbs/Yr) |
| 1                 | Install Door Sweeps on Exterior Doors                | \$400                    | \$0                  | \$400                                  | 195                  | 0.0                       | 219                     | 6.2                         | \$298                     | 3                    | \$894                           | 1.3                 | 123%                              | 41%                             | 31%                         | \$165                  | 2,765                            |
| 2                 | Install Low-Flow Aerators                            | \$15                     | \$0                  | \$15                                   | 0                    | 0.0                       | 5                       | 0.1                         | \$6                       | 10                   | \$62                            | 2.4                 | 313%                              | 31%                             | 39%                         | \$32                   | 59                               |
| 3                 | Replace Halogen and Fluorescent Lamps with LED Lamps | \$357                    | \$55                 | \$302                                  | 386                  | 0.6                       | 0                       | 0.4                         | \$88                      | 15                   | \$1,324                         | 3.4                 | 338%                              | 23%                             | 28%                         | \$675                  | 692                              |
| Total             |                                                      | \$772                    | \$55                 | \$717                                  | 581                  | 0.6                       | 225                     | 6.7                         | \$392                     |                      | \$2,280                         | 1.8                 | 218%                              |                                 | -45%                        | \$872                  | 3,516                            |

**Assumptions:** Discount Rate: 3.0%; Energy Price Escalation Rate: 0%

## **APPENDIX I: METHOD OF ANALYSIS**

### **Assumptions and Tools**

Cost Estimates:                RS Means Online Version 5.0.3  
Published and established specialized equipment material and  
labor costs  
Cost estimates also based on utility bill analysis and prior  
experience with similar projects

### **Disclaimer**

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

**THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.**