GREEN
INTERFAITH
NETWORK
INC.

08 July 2016

Gary Walrath, Executive Director
Rocky Mount Historical Association and Museum
200 Hyder Hill Road
P.O. Box 160
Piney Flats, TN 37686-0160

Re: GINI Energy Assessment Report of Rocky Mount's Physical Plant

Dear Mr. Walrath:

Thank you for allowing members of the Green Interfaith Network to conduct an energy and environmental assessment of your facility at the Rocky Mount Museum. Part of GINI's mission is to support communities to protect the environment through promoting sustainable practices.

A summary of the findings of the June 17, 2016 energy assessment will be found on the next five pages.

A part of the GINI Energy Assessment process is to offer the opportunity for a $500 incentive to implement some of the recommended energy conservation and efficiency measures that will enable your organization to save money, which can be re-directed toward important functions. If Rocky Mount is interested in pursuing this incentive, please complete the Memorandum of Understanding and complete a report back to GINI outlining what conservation and efficiency steps Rocky Mount will be conducting with the financial incentive. GINI would like to receive these documents by September 1, 2016, so that the GINI Board can review and approve the request at the GINI September Board meeting.

Should you have any questions, please don't hesitate to contact me via e-mail at shellstahl@hotmail.com.

Sincerely,

Shelley

Shelley Stahlman, President
Green Interfaith Network Incorporated

Attachment

Summary of Findings from Energy Assessment

Rocky Mount Historical Association and Museum, Piney Flats, Tennessee

- The approximate 20,000 square foot Massengill Overmountain museum building (two levels) serves as the historical artifact storage, educational classroom and display space for the public to view how early settlers in northeastern Tennessee lived. A separate historically restored home (the Cobb House) allows visitors to have docents explain living conditions in the 18th and 19th centuries. There is also a separate approximate 2,000 square foot more modern home on the site that houses a caretaker for the historical site.
- In general, the physical plant appears well-maintained. Though the museum building was built in the mid-20th century, approximately five years ago a significant portion of the display space was renovated. Rocky Mount uses volunteers for minor repairs and improvements. The five museum heating, ventilation and air conditioning (HVAC) units are a mixture of older and newer heat pumps. There are two 15-Ton and one 7.5-Ton Carrier Heat Pump rooftop units, replaced around 2004. The larger 15-Ton units condition the auditorium and exhibit areas, while the smaller 7.5-Ton Carrier unit handles the lobby and gift shop areas. These Carrier units are lower efficiency (9 SEER) units, by today's standards. Additionally, two Goodman HVAC units were added less than five years ago with higher efficiencies (11-12 SEER). Major repairs are contracted out. There is no preventative maintenance contractors or programs in place for the HVAC systems.
- The largest concern found by GINI are the largest energy use and bills occur during the winter months (particularly January and February). In December, GINI understands that the facility is often open at night and there can be a number of people entering and leaving the buildings. What is particularly puzzling is that during January and February the museum is closed (or open for limited occasions) for visitors.
- This energy assessment concentrated on suggested improvements to the museum building, primarily, and the caretaker's house, secondarily. Green Interfaith Network did not provide suggestions regarding the Cobb House, as this is on the historic register and subject to many restrictions regarding renovations. Additionally, the Cobb House is only heated during the winter season when Rocky Mount is open.
- There are a number of operations and maintenance (O&M) activities that can be instituted with modest costs and time investments. A fewer number of longer-term energy conservation measures (ECM) may be considered either in conjunction with the O&M practices or later, when the O&M activities have been completed and energy/cost reductions are in place and being documented.

Commendable Energy and Environmental Conservation Activities

- The renovated portion of the museum now employs LED lighting for both spot and general lighting requirements. LED lighting (and LED Exit Lights) use 50% less electricity than a comparable T-8 or T-12 fluorescent bulb (12-18 W versus 32-40 W) with a generally longer lifespan.
- The use of the two smaller Goodman 5-Ton high-efficiency air conditioning units for smaller portions of the museum contributes to lower operating costs. The newer units should provide reliable service for another ten or more years.
- For area lighting using the older 4-foot T-12 fluorescent light bulbs, GINI noted that in some locations that two of the four light bulbs were removed (or disconnected) to save energy. GINI also noted that some 4-foot lighting fixtures were using the more efficient T-8 fluorescent bulbs.
- The energy use (as evidenced by past power bills) at the caretaker's house is modest. Two factors contribute to effective stewardship of electrical usage: (1) the caretaker's consistent surveillance of extravagant electrical use, and (2) adequate insulation in the attic and use of storm windows.

<u>Suggested Operation and Maintenance Activities (lower cost or easier to implement)</u>

- ✓ The GINI assessment team observed that throughout the conditioned space in the museum, temperatures were set around 65-70°F to maintain temperatures around 68-72°F. The various types of thermostats employed are the older (and generally non-programmable) versions. GINI understands the challenges of a museum environment, as documented in the National Park Service's chapter on museum collections environment. Diurnal temperature cycling (e.g., cooler temperature set-point during the day and warmer temperature set-point at night during the summer months) is not recommended. GINI would recommend a gradual drift of increasing temperature set-point(s) from the spring to summer months to 73-75°F followed by a gradual drift downwards in the fall to winter months to 65-68°F. The change in set-point temperatures should be 1 or 2°F per month. Changing from analog to digital thermostats that can handle heat pumps will allow gradual changes in set-point temperatures. Costs for these thermostats are around $50 each. The museum's hygrothermographs should be monitored closely during and after any changes in temperature set-points.
- ✓ Check if there are any rooms that are used solely for offices or classrooms (non-curated items are present) that have their own HVAC system. The GINI assessment team could not readily determine which HVAC systems condition which areas of the building. Develop (or verify) a room use schedule for any thermostats that controls offices or classrooms. In these spaces diurnal temperature settings using a programmable thermostat (usually under $100 each) can be used to save energy costs. Verify that setback and occupied days and times start and end as scheduled. Verify and adjust (as needed) that the setback and occupied temperatures on the thermostats meet energy savings (55/85°F) and comfort (68/78°F) levels for your staff and visitors. Use temperature / humidity data loggers to record temperature fluctuations over a long period (week or longer) to ensure adequate comfort and energy savings.

- ✓ The GINI assessment team observed that one or more rooftop HVAC filters were dirty. According to the museum caretaker, there is no preventative maintenance done on any of the HVAC units. We recommend that a competent, commercial HVAC contractor be employed to perform periodic (annual – during winter shutdown or semi-annual – in December and June) maintenance. Items to check include:
    - o Clean or replace filters (inlet and ventilation)
    - o Drive belt tension or lubrication of direct drive fans
    - o Cleaning of heating and cooling coils
    - o Obstructions in vents
    - o Ensure proper operation of humidification system (in attic)
    - o Excessive air leaks in plenums and ducts
    - o Discharge pressures, variable air valves (or older-style dampers) and rebalance system, if needed
- ✓ Install a motion-activated light switch on the visitor's restrooms to the immediate right of the main entrance. There is one light switch that activates both bathrooms. A motion-activated light switch allows the two bathrooms' lights to go on as people enter (or leave) the entranceway. During periods of disuse, the lights would turn off. Investigate other non-public rooms or less frequented rooms to install wall-mounted motion-activated light switches. Cost per switch is about $30.
- ✓ Institute an energy monitoring team or individual to record and track energy and water use over time. The Johnson City Power Board's SMART HUB web application will allow tracking of the previous two years of data. GINI is providing a spreadsheet to track energy (electricity and natural gas) and water use and costs, along with the ability to track monthly total degree-day demands. GINI recommends completing the spreadsheet with costs and energy/water use from January 2014 to present.
- ✓ Institute educational reminders and visual cues to remind building users to turn off power to lights or appliances when not in use.
- ✓ Install LED bulbs to replace incandescent bulbs(particularly in the entrance lobby and auditorium) as resources allow.
- ✓ A few of EXIT signs (not in the renovated exhibit space) in the museum are older incandescent lit signage and those with exit flood lighting are incandescent or halogen. Replace EXIT signs with LED equivalent units. Ensure that power is available to the signs. Replacing old EXIT signs with LED EXIT signs can save about $100/year/unit.
- ✓ Examine existing roof and/or ceiling insulation. The museum's attic insulation looked to be in fair shape (using fiberglass bats) with some packing. Additional fiberglass batting can help with heat gain / loss through the roofing.
- ✓ Install switch-plate and wall-plate foam-based insulation pads on light switches and electrical outlets on exterior walls.
- ✓ Caulk or foam (low-expansion window insulation foam) corners of exterior windows to reduce air infiltration. Caulking the windows in the caretaker's house is also needed.

- ✓ Replace the metallic weather-stripping with elastomer-based weather-stripping in exterior doors.
- ✓ Institute administrative controls to place electronic devices on power outlet strips and deactivate the power strips when the devices are not in use. The electronic devices may include desk computers and photocopiers.
- ✓ Install hot water line insulation for at least the first three feet leading away from the hot water heaters.
- ✓ Drain and refill the hot water heaters annually to remove sediments.
- ✓ Institute administrative controls and educational reminders to use cold water for washing clothing and remove lint from dryer vents. Conduct a cleaning or replacement of dryer discharge vent hoses to reduce the chance of fires and improve dryer performance.
- ✓ Institute educational reminders for the kitchen freezers to use food storage wisely. One can place empty boxes in the freezers to take up much of the empty space, so that there's less air exchange when the doors are opened.
- ✓ **Safety Concern:** A few EXIT signs were non-functioning in renovated space. It appears that no power is supplied to these units when staff turn off circuit breakers in the rooms when not in use. The EXIT signs should be rewired to be on a circuit breaker that will not be turned off.
- ✓ **Safety Concern:** In the historic artifact storage area, the main electrical entrance and switch gearbox is located on a wall without an adequate cleared space around the area. The National Electric Code (in conjunction with the National Fire Protection Association) requires a 3 to 4-foot clearance area for electrical equipment less than 600 volts. OSHA (29 CFR 1910.303(g)) also requires a 3-foot clearance area for safe working conditions. GINI recommends clearing an area at least 36 inches away from the electrical cabinets and adhere yellow/black striped hazard (warning) floor tape, as a visual reminder not to store materials near the electrical gear.
- ✓ **Conditioned Space Concern:** Ensure that the humidification equipment in the attic is functioning correctly. The GINI assessment team observed that the equipment appears to be in disuse. One of the docents mentioned during the walk-through that humidification is turned on during fall-winter months and turned off during the spring months.

<u>Suggested Energy Conservation Measures Activities (higher cost or more difficult to implement)</u>

- ✓ Replace high-use T12 4-foot fluorescent light fixtures with more energy-efficient LED light fixtures, as funding allows. Higher use areas include the offices, viewing spaces, and classrooms in use during most of the week and any fluorescent fixture that is required by safety code to be on continuously. GINI noted there are over 50 T-12 fluorescent fixtures in the museum building. It generally costs less to replace the entire lighting unit than to separately replace bulbs and ballasts.
    - o Lower-cost alternatives for lighting energy savings include: (a) remove one or two bulbs in each bank of four T-12 fluorescent bulbs, provided there is

adequate light for the tasks needed or (b) replace T-12 bulbs to T-8 bulbs and ensure that any older T12 magnetic ballasts/starters are replaced with more energy efficient T8 electronic ballasts/starters. Contact your recycling facility regarding compliance with US EPA's and TDEC's Universal Waste requirements for the disposal of the mercury-containing light bulbs.

- ✓ Consider improved higher reflectivity asphalt shingles when the time comes to replace the roofing shingles. Look for EnergyStar™ roofing shingles, such as GAF Timberline Cool Series shingles, to reduce about 10% of typical energy demands.
- ✓ Consider adding a ridge vent to the museum roof line when replacing the asphalt shingles. Ridge vents add more passive ventilation to the already existing soffit vents and attenuate the heat build-up during the summer months.
- ✓ Consider insulating the rafters in the attic space above the museum, along with the existing insulation in the ceiling joists. Consider using a hybrid insulation system of spray foam (isocyanate or polyurethane) and fiberglass bats to get R-30 to R-45 insulation in the roof lines.
- ✓ Consider installing garage door insulation panels to retard heat gain/loss in the garage doors and windows that are covered by display walls. Each 1-inch thickness sheet provides about an R-4 insulation equivalent. A set of 8 panels costs $60.
- ✓ Consider installing motion-sensors integrated into light switches for the remaining bathrooms and small offices or classrooms. For larger spaces (e.g., hallways, theatre, collections rooms), consider installing ceiling mounted occupancy sensors ganged to the ceiling lights. This should reduce electrical use if people forget to turn off lights after leaving an area or room.
- ✓ Consider replacing older 3.5 gallon per flush toilets to more water efficient (0.9-1.3 gpf) toilets. A WaterSense™ non-commercial, manual flush toilet costs around $200.
- ✓ Consider replacing refrigerators, dishwasher and chest freezer with EnergyStar™ models, as resources allow.
- ✓ GINI commends Rocky Mount Historical Association for beginning to replace wired exterior lighting with solar-powered lighting and recommend continuing this replacement program.
- ✓ Consider replacing the windows (single pane with storm windows) in the caretaker's house to low-emissivity, argon-filled vinyl-clad double pane windows, as resources allow. Cost of each double-hung window start from $150-200.
- ✓ Consult with a qualified commercial geothermal HVAC contractor to consider replacing the three larger air-to-air heat pump and air conditioner systems with one or more geothermal systems. This option should only be considered after other building envelope improvements have been instituted. Also consider an integrated zoned system with VAVs (variable air valves), separate air handlers, and an automated control system.
- ✓ Investigate using 100% state funding for maintenance items as a substitute for using capital or operating funds (40% state / 60% historic association) for short-term and long-term improvements. Use of maintenance funds would be offset by future energy savings.

- ✓ Investigate combining several larger energy conservation measures into an EmPowerTN project application. Though the first round of funding of applications were received in late July 2015, there may be a future round of funding in the next state fiscal year (FY2016-2017). Last year's applications were due by July 24. Additional information can be located at: http://tn.gov/main/section/empower-tn/ . This energy assessment and energy cost spreadsheet may be used to support the EmPowerTN application.

Photographs

1) Entrance sign to Rocky Mount Historical Site
2) Rocky Mount Massengill Overmountain Museum
3) Back side and back entrance to Museum
4) Access to HVAC roof top units and attic area
5) HVAC roof top units
6) Attic insulation in Museum building
7) Analog, non-programmable thermostat with security cover to prevent temperature changes by non-authorized personnel
8) Older T-12 lighting troffers and incandescent spot lighting in auditorium
9) New LED spot lighting in renovated exhibit space
10) Exhibit space circuit breaker panel with instructions to turn off lights when are not in use
11) Less water efficient toilets in visitor's restroom (shower in rear adjoining room with water and sewer inlets/outlets)
12) Caretaker house
13) Caretaker attic insulation with R-30 or better fiberglass bats

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