EECBG
AUDIT REPORT

Maryland Energy ADMINISTRATION
Powering Maryland's Future

December 30, 2010

Stephen Sonnett
Town of Upper Marlboro
commissionersonnett@uppermarlboromd.gov

Dear Mr. Sonnett:

On behalf of the Maryland Energy Administration's (MEA) EmPOWER Energy Efficiency and Conservation Block Grant (EECBG) program, MEA Technical Assistance Team member Erik Lundquist has performed a building performance field audit showing preliminary energy savings and financial analysis of energy efficiency improvements for the Upper Marlboro Town Office.

This *Audit Report* presents summary information regarding potential EECBG projects. Your primary opportunities for energy efficient upgrades include installing a proper air barrier (ceiling), sealing the ducts, and upgrading the insulation. Please feel free to use this information in submitting your project for MEA approval.

Address:
Upper Marlboro Town Office
14211 School Lane
Upper Marlboro, MD 20772

PROJECT LOCATION DESCRIPTION

Summary of Findings[1]

Building: Built in the 1960's as an open air swimming pool bath house, a truss roof was added in the 1980's when the building was converted to office use. It is a single story block wall structure on slab with relatively new double pane casement windows, four steel doors, and two glass doors. The roof is asphalt shingle in good condition and is unvented. The drainage around the foundation is good, although the downspout at the east corner needs a diverter to carry rainwater away from the slab foundation. The conditioned area of the building is 1575 square feet.

Mechanical Systems: The building is serviced by an air source heat pump (HSPF 6.8) utilizing a forced air duct system. The York air handler unit was manufactured in 1987, and the 5 ton, 6 or 7 SEER condenser/compressor unit was manufactured in 1979. The air handler unit is in a utility room and the forced air ducts are located in the attic space. The water heating is provided by a relatively new 50 gallon electric storage tank water heater located in the utility room.

Health and Safety Findings

No health and safety issues concerning measures discussed in this report were discovered during the inspection.

Comfort and Energy

Air Leakage: Building leakage corresponds directly to heat loss (energy loss). ASHRAE has developed a nationally recognized standard (Building Airflow Standard, or BAS) for minimum leakage rates in buildings based on size (or occupancy) and location. The blower door measures the building leakage at a pressure of 50 Pascals and provides a result in cfm50, which is cubic feet per minute (of airflow) at 50 Pascals (pressure). This measurement can then be compared to the calculated BAS range. Air sealing the building to the high end of the BAS range will result in the minimum amount of air leakage while still allowing for a safe and proper air exchange to naturally occur. The blower door test revealed a leakage rate of 3,000 cfm50 for the Town Office. The BAS range calculated for the building is 1470 to 1030 cfm50, which means air leakage is occurring at a rate ***2.0 times higher*** than is optimal in relation to the building's size and location. The majority of this leakage is at the ceiling of the building through the track ceiling tiles. Track ceiling tiles are not a sufficient air barrier and do not prevent airflow and heat exchange with the attic.

Insulation: Insulation above the track ceiling tiles consists of a layer of R-19 (nominal) fiberglass batts face stapled to the joists of the roof trusses. This installation results in the insulation being suspended several inches above the track ceiling tiles except over the utility room, which has a drywall ceiling with the insulation installed on top. The suspended position of the insulation above the ceiling renders the insulation ineffective, a situation which is exacerbated by the insufficient air barrier of the track ceiling tile system. In other words, the insulation provides no R-value to the building at present, except over the utility room. The DOE currently recommends R-38 to R-60 attic insulation for buildings in this region. The presence of wall insulation was undetermined during the inspection.

[1] All numerical values are approximate

EECBG PROJECT RECOMMENDATIONS – Air Seal, Duct Seal, and Install Insulation

Primary Improvement Recommendations

There are two ways to approach the lack of an upper air barrier and the associated energy deficiencies at the Town Office, listed here as the traditional approach and the alternative approach.

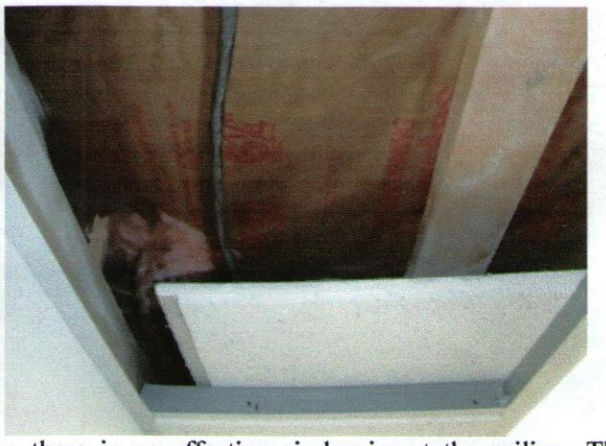
The Traditional Approach: Seal with drywall and add cellulose insulation

1. Install a proper drywall ceiling attached to the joists of the roof trusses throughout the entire building (except the utility room). This will require removal of the track ceiling tile system (which can be reinstalled afterwards, if necessary) in order to access the work. All drywall seams should be taped and properly finished. The existing insulation can remain in place provided it is in contact with the new drywall ceiling.
2. Air seal the ceiling/attic by sealing all top plate gaps (especially at the exterior walls) and all electrical, plumbing, and duct penetrations with spray foam insulation. All openings, holes, gaps, and cracks between the office level and the attic should be sealed airtight.
3. Seal the HVAC duct system. Seal every accessible duct joint with duct mastic or spray foam insulation to form an airtight seal, including the junction of the duct boots and the registers.
4. After steps #1 and #2 have been completed, ensure that the existing fiberglass batt insulation is in contact with the drywall ceiling or adjust it if necessary, then install 12 inches of blown cellulose insulation (@R-40) on top of the existing fiberglass batts.

The Alternative Approach: Seal and insulate roof with spray foam

1. Install 6 inches (layered) of closed cell spray foam insulation (@R-40) directly to the underside of the roof deck. The foam application should be continuous throughout the roof area and extend into the soffits. The existing batt insulation should be permanently removed. The foam roof application will provide a continuous air and thermal barrier for the Town Hall, precluding the need for a drywall ceiling installation and for duct sealing.

Upon the completion of the retrofit work a final air leakage test should be conducted in order to ensure that the building does not exceed the minimum airflow standard, as well as to confirm the effectiveness of the work.



There is no ceiling above the track ceiling tiles, so there is no effective air barrier at the ceiling. The suspended insulation is rendered ineffective by the lack of an air barrier.

The duct joints throughout the HVAC systems are leaky and need to be sealed.

Other Recommendations

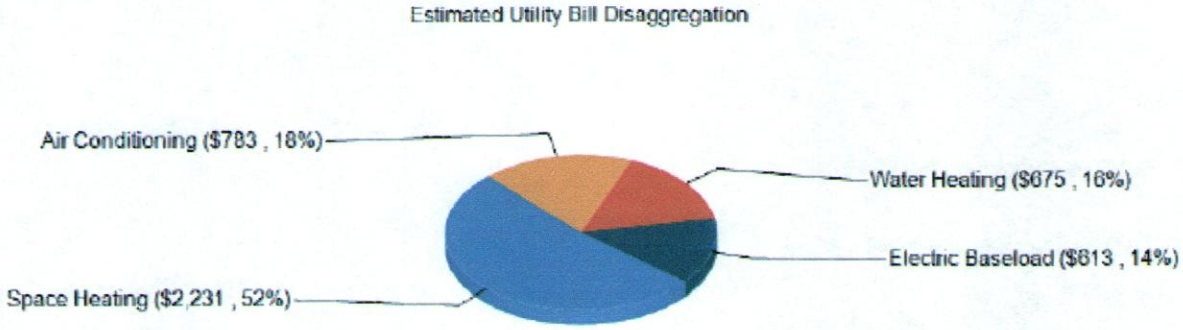
1. Clean out and unplug the small refrigerator in the utility room. As long as this appliance is not being used regularly it should be unplugged to save energy.
2. Install a proper filter in the HVAC air handler.
3. Fix or replace the weather stripping around the steel doors. Magnetic weather stripping, if installed properly, would provide a better seal than the current compression weather stripping.
4. After the above Primary Recommendations are implemented, the HVAC heat pump/AC should be replaced with a higher efficiency Energy Star certified system. The current air handler unit is 23 years old, 7 years beyond its normal service life expectancy, and the compressor is 31 years old, over 16 years beyond its normal service life expectancy. The Town should require the HVAC contractor to provide an ACCA "Manual J" heat load analysis of the building in order to correctly size the new equipment. Ideally a zoned system is recommended. For even higher efficiency a ground source (geothermal) system should be considered, which would also provide your water heating needs and allow you to eliminate the storage tank water heater. There are utility rebates available for upgrading your older system - check with your utility (Pepco) at: http://www.pepco.com/energy/conservation/meiin/ and look under "HVAC Efficiency Program".
5. Replace the analog thermostat with a programmable "smart" set-back thermostat designed specifically for a heat pump. Program the thermostat to reduce heating and cooling during those periods when the building is unoccupied.
6. Replace all T12 fluorescent lamps and ballasts with T8 28 watt lamps and high efficiency electronic ballasts to reduce lighting costs.
7. Add a downspout diverter to the downspout at the east corner of the building. This measure will not save energy but will prevent potential moisture issues.

BASELINE ANALYSIS

1. Energy Consumption

You provided electric utility information for the Upper Marlboro Town Office covering the period of September 2009 to August 2010. The calculations and tables are provided through the BEACON Home Energy Advisor software. The following table summarizes the baseline consumption data by end use.

Annual Consumption by End Use	Fuel Type	Amount	Cost	% of Cost
Space Heating	Electricity	13523 kWh	$2,231	52%
Air Conditioning	Electricity	4745 kWh	$783	18%
Water Heating	Electricity	4091 kWh	$675	16%
Electric Baseload	Electricity	3717 kWh	$613	14%



- **Total annual electricity cost for the building is currently $4302 –100% of annual energy costs**

The electric retail energy provider is Pepco and the rate used for this analysis is $0.165 per kWh based on the recent utility statement.

Improvement Analysis

As a result of this building performance assessment, we recommend the following Energy Conservation Measures and building performance upgrades for the Town Hall:

Measure Category	Recommendation Action	Quantity/Description
Air Sealing		
Air Sealing Level	Reduce Air Leakage from Living Space	Reduce measured leakage by 50%
Treat Major Attic Bypasses - Attic	Reduce Air Leakage Through Attic	Seal Major Attic Bypasses
Insulation		
Attic Insulation - Attic	Insulate w/ Cellulose (open blow): 12 inches	1575 square feet
Ducts		
Duct Systems - sealing	Seal Ducts w/ Approved Materials	Accessible Ductwork

The following shows the projected energy savings from the proposed measures broken down into the same categories of use for the building as was shown in the table under **Energy Consumption**. Costs for improvement measures were obtained from NREL's National Residential Efficiency Measures Database. For each category the table provides the projected annual dollar savings and the percentage saved relative to existing usage:

End Use Category	Savings	Percent Savings within Category
Space Heating Savings	$605	27.1%
Air Conditioning Savings	$156	20.0%

Your annual energy savings from this project are estimated to total $762

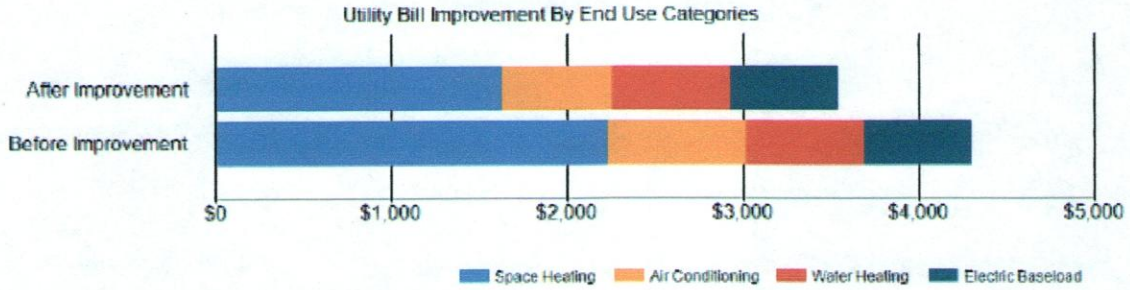
The project would reduce your total energy consumption cost by an estimated 17.7%

- **Actual annual energy consumption would be reduced by 18% or more.**
- **Annual carbon dioxide emissions ("carbon footprint") would be reduced by 6183 lbs.**

Keep in mind these savings calculations are approximate and only apply to the improvements listed under **Primary Improvement Recommendations**. Additional energy reductions and savings will result from implementing the improvements under **Other Recommendations.**

Projected Annual Utility Bill Improvement by End Use Category

If you install the measures recommended above, the annual energy cost savings would be **$761** and would change as follows by end use category:



End Use Category	Before Improvement	After Improvement
Space Heating	$2,231	$1,626
Air Conditioning	$783	$627
Water Heating	$675	$675
Electric Baseload	$613	$613
Total Cost	$4,302	$3,541

2. Financial Analysis

The projected energy savings from your building performance improvement project will pay for itself in a relatively short time (5 years). Simple Payback is calculated by dividing the Net Package Price by the Annual Projected Savings, a simple way of calculating how many years it would take for savings to cover the investment. The Lifetime Savings-to-Investment Ratio (SIR) measures overall lifetime cost-effectiveness by comparing the present value of all energy savings over the life of the installed measures to the Net Package Price. An SIR of over 1.0 is an indicator that the project will pay for itself through energy savings over time.

For this analysis, the total package price was calculated using the traditional air sealing and insulation approach.

Simple Payback and Annual After-Tax Rate of Return	
Energy Saving Measures	$3,791.40
Total Package Price	$3,791.40
Rebate (subject to approval)	$0.00
Other Incentives	$0.00
Net Package Price	$3,791.40
Annual Projected Savings	$761.60
Simple Payback (yrs)	5.0
Annual Rate of Return	20.09%
Lifetime Savings-to-Investment Ratio	2.31

CONCLUSION

We recommend the measures discussed above and listed below for the Upper Marlboro Town Office:

- Proper air barrier (ceiling),
- Sealing the ducts, and
- Upgrading the insulation.

These measures are technically eligible to receive EmPOWER EECBG funds and, if implemented properly, will reduce energy consumption. The 5 year payback period and the 2.31 Lifetime Savings-to-Investment (SIR) ratio for these measures argue strongly for their cost effectiveness.

If you have a small amount of EECBG funding available after recommended EECMs are approved and implemented, you may want to contact Account Manager to explore ways to spend down the total award on "loose change" EECMs—such as CFL lamps, overhead fluorescent fixtures, or exit signs; central or window air conditioners, or a gas furnace; hot water tanks, tankless water heaters, or solar water heating systems; or ENERGY STAR-rated appliances including refrigerators, dishwashers, computers, and copiers.

Next Steps

On the following page, please find a checklist of items that must be submitted to MEA in order for your project to be approved. Following MEA approval, your Account Manager will work with you on Post-Project Approval steps. Please review Addendum D of your ARRA Addendum to the EECBG Grant Agreement for more information on the procurement requirements.

MEA and the EECBG Technical Assistance Team would like to be sure that you are aware of the following additional energy project funding sources that are available in case you wish to consider implementing future energy projects:

- EmPOWER Programs. The Maryland electric utility rebate programs in your area (e.g., for lighting and HVAC) include:
    - Southern Maryland Electrical Cooperative (SMECO): https://www.smeco.coop/save/index.htm
- MEA's Jane E. Lawton Loan Program. This Maryland state program has a limited amount of energy efficiency loan funding available that local governments are eligible for. The minimum loan size is $40,000 so this could be useful for projects that need a substantial amount of additional funding. For more information, browse to http://energy.maryland.gov/incentives/state-local/janeelawton.asp.

If you decide to leverage non-ARRA financial resources to expand your EECBG project beyond the scope estimated to be fundable using your grant, please keep in mind that if you commingle other funds with your EECBG grant for additional measures, you will be required to comply with all ARRA reporting requirements.

If you would like to discuss this analysis in greater detail, please contact me or your Account Manager.

Sincerely,

Erik Lundquist
MEA Technical Assistance Team Energy Auditor
elundquist@sentech.org
240-223-5538

PROJECT APPROVAL CHECK LIST

As outlined in Attachment E of your EECBG grant agreement, once you have decided on the project that you wish to implement with your EECBG grant funds, MEA must approve your project.

Below is a check list of items that must be submitted to MEA in order for your project to be approved. Your Technical Assistance Team representative will work with you to compile the documentation listed below and to submit the appropriate documentation to MEA.

Check List of Items for Project Approval	
1. Eligible Technology	
☐	a. Ensure that the proposed project is on the list of eligible energy technologies contained in Attachment A of your EECBG grant agreement.
2. Audit Report	
☐	a. Ensure that the project energy savings have been quantified in the *Audit Report* provided by MEA's Technical Assistance Contractor.
3. Historic Preservation	
☐	a. Submit Historical Preservation documentation to MEA. This can consist of either 1) a completed *Maryland Historical Trust (MHT) Project Approval Form* (Attachment C[2] of your grant agreement) signed by MHT *or* 2) documentation from MEA's qualified historian that your project is eligible to be exempted from the MHT review process under the Programmatic Agreement between MEA, MHT, and the U.S. Department of Energy (DOE).
4. Waste Management Plan	
☐	a. Complete and Submit the Maryland *EECBG Waste Management Plan Template, Part 1* (Attachment B in your EECBG grant agreement).

Your completed forms and supporting documentation should be sent to your assigned Technical Assistance Team *Account Manager,* who will make the forms available to MEA for review.

After review by MEA, MEA will send a signed copy of the EECBG *Project Approval Form* (Attachment E of your EECBG grant agreement) to you. Only after you have a signed copy of the *Project Approval Form* can you proceed to procurement and installation for your project—as detailed in the *Post-Project Approval Checklist* available from your *Account Manager*.

[2] All project forms can be found in your grant agreement, and also on MEA's EECBG website: http://www.energy.state.md.us/EECBG.asp