**Meeting Agenda**

**I. Call to Order** (Welcome, Sara, Todd, Lee, Chris, Alex, George, & Sharon!)

**II. Approval of Minutes** (7-23-20; 8-14-20) *

**III. Sustainability Study Recommendations** (Lefebvre, Draper) *

**IV. Adjournment**

**Please note that the list of topics in this notice was comprehensive at the time of posting, however the public body may consider and take action on unforeseen matters not reasonably anticipated by the Chair 48 hours in advance of the meeting.

* Denotes handout(s) will be made available.

Red indicates vote required.
Meeting of the Jones Library, Inc. Sustainability Subcommittee  
July 23, 2020 9:30 a.m. conducted via Zoom

Sustainability Members Present: Sara Draper, Chris Riddle, Todd Holland, Alex Lefebvre, Lee Jennings  
Also Present: Sharon Sharry, George Hicks, and members of the public.

I. Sustainability meeting called to order at 9:03 am.

II. MOTION: To approve the minutes of July 2, 2020. Approved 5-0-0

III. Sustainability Report  
   b. LCA - gave us snap shot of carbon footprint between steel and timber. In depth analysis of steel.  
      From decision-making perspective, is that enough information or do we need more in depth  
      analysis of timber? Question if at some later point would we get that number. For example, if  
      we wanted someone to buy offsets at a later date for the building to be carbon neutral, would  
      want to know.  
   c. Recommend move forward with timber frame and would need to see updated LCA for that  
      updated design. Based on 1/3 reduction seems like a good idea.  
   d. Public Questions:  
      i. Are there differences in the load bearing capacity of CLT and steel (loaded bookcases  
         weigh more than typical office loads)?  
      ii. Yes - architect design accounts for differences in loads and where placement of posts  
         would be.  
      iii. Typically fancy wood finishes would sit on furring strips, which provides a very small  
         space for insulation. In my old house, small holes were cut at the top of walls and  
         insulation blown in without disturbing most of the finished walls. This would have to be  
         done only on exterior wall facing interior walls. Would this work and what could it  
         achieve?  
      iv. No area in walls to really blow anything into.  
   e. Air Source Heat vs. Ground Source Heat  
   f. ECMs - GWP and long term cost  
   g. Concrete recommendations in COVID environment is to disable HVAC Controls - do we invest  
      in the technology assuming we will go back to ‘normal’ some day and use the controls?  
   h. ECM #10- payback is 7 years  
   i. Discussed we are not ready to make recommendations to the Board yet. Sara and Todd to reach  
      out to FAA to ask follow up questions to see if we can get to the next step to make a  
      recommendation to the Board.

IV. Next Steps:  
   a. Presentation to Board of recommendations  
   b. Fund raising for additional costs  
   c. Energy Audit by G&C (entry point for rebates - Todd was going to reach out to EverSource prior  
      to us signing an updated contract)  
   d. Rebates & Operational Offsets
V. Lee left the meeting at 10:51am

VI. Sara to reach out to find out cost per ton decision metric.

Meeting adjourned 11:14am

Respectfully submitted by Alex Lefebvre
I. Sustainability meeting called to order at 10:05 am.

II. Reviewed ECMs with architects to get clarifications about exactly what getting for additional costs.
   a. Of those ECMs that are not an easy yes or easy no, what are the GWP of those ECMs?
      i. Only so much information we can get at this moment because in schematic and/or may be prohibitively expensive.
   b. Noted that the Committee’s EUI Goal is within ball park
   c. Todd and Sara created a table with additional information for each ECM, including Carbon costs of each ECM. Todd used a number ISO New England Emission rate.
   d. ECMs that seem obvious/no brainer about cost and payback
   e. EUI - Lighting Controls ECM 7
   f. Demand Control Ventilation ECM 10
   g. Sara talked to Smith about carbon cost, use $70/ ton ($50-$100 per ton of carbon) of carbon for internal decision making.
   h. ECM #2 - Attic insulation - waiting on answer about material - FAA responded it is mineral wool insulation type. Noted that the payback period is usually very short for energy savings vs upfront cost on insulation. Payback cost seemed long based on Todd’s experience. With the cost payback as written probably would not recommend but if not correct, may recommend. FAA will double check numbers and confirm payback. Noted that the Library had insulation done in the last few years. Likely what is left is the ‘hard’ stuff and more expensive. Based on that information, don’t think it makes sense to do insulation in the old portion of the building unless there is some type of rebate that would have it make sense.
      i. ECM #4 - energy model of looking at just the North side windows rather than all windows.
   j. We don’t know the cost of just the north side windows to make a recommendation at this time. However, confirmed that we can make a recommendations to proceed with design that says triple pane glazing on just the North side, we would have a line item for those windows only to allow for decision making. FAA commented that they can also think of alternatives we would like to them to price at that time.
   k. Tally Report for next phase of design. Would be additional fee to add Tally report in D&D. Now that it is set up think it easier to continue to run reports as we move through process in the future.
   l. ECM 6 - window overhang would need to be decided now because design work.
   m. ECM 8 is cost prohibitive.
   n. Asked if we can prioritize list if we get a set amount to spend
      i. ECM 7, ECMs 9-12 should be a definite yes to do.
ii. ECM 6 should study as part of design but will not add cost unless we decide to proceed with the actual overhang.

iii. ECM 4 - on the north side as a line item to allow for consideration when we have more information.

III. If we want net zero, need to find a place to buy offsets or find a place to buy offsite. Building is net zero ready.

IV. CLT
   a. it is what people are going to see, it is the visible piece. If we use CLT, we will reduce embodied carbon of project 2/3. From a carbon footprint perspective makes sense. From cost perspective $4k carbon per ton is cost savings. Over same 60 year life span would be $70/year in carbon cost savings.
   b. Confirmed that CLT can take the load of the building and won’t impact our ability for a flexible design.

V. Inquiry about grants or rebates to offset these ECMs, CLT or other options. FAA stated that typically entities don’t start paying attention to you until you have a building started. So we won’t really know what is available until we are further down the road.

Meeting adjourned 11:22 am

Respectfully submitted by Alex Lefebvre
Jones Library Expansion Project: Sustainability Recommendations

Jones Library Sustainability Committee
Wednesday, August 26, 2020
Background

As part of the grant award process and in consultation with the Library, the MBLC requested certain changes be made to the schematic design that was submitted in the grant application. The primary change requested was to move the location of the large meeting room.

This request from the MBLC provided the Library with a unique opportunity to advise FAA of the shift in focus of the Town of Amherst toward sustainability and to provide the goals specifically generated by the Library’s Sustainability Committee to the revised schematic design.

The information in this presentation is a result of this work.
Context: Amherst Climate Goals

- 50% reduction in town wide greenhouse gas emissions by 2030 (compared to 2016 emissions)
- 25% reduction by 2025
- Carbon neutrality by 2050 (but as early as 2030)
Sustainability Committee Goals sent to FAA

- Low energy use (efficiency)
- Renewable energy supply
- Avoid fossil fuels
- Minimize carbon emissions of construction
- Balance efficiency with low-carbon construction

- Ambitious Energy Use Intensity (EUI)
- Net Zero Energy Ready Building
- Eliminate fossil fuels in building
- Use low embodied carbon materials
- Whole Building Life Cycle Analysis
EUI Goal

- EUI refers to the energy use per square foot of a building in kBtu/sf/year
- The EUI goal provided to FAA was 25-30
- Libraries nationally average 71.6
- Jones Library today 72.3
- Expanded/Renovated Jones Library currently 34.4
Energy Conservation Measures (ECMs)

- Based on the Sustainability Goals provided, FAA revised the schematic design to increase energy efficiency of the building and lower the EUI.
- FAA presented additional Energy Conservation Measures (ECMs) to further reduce the EUI:
<table>
<thead>
<tr>
<th>ECM #</th>
<th>Measure</th>
<th>Electricity Savings kWh</th>
<th>Annual Cost Savings</th>
<th>EUI Reduction</th>
<th>Initial Cost</th>
<th>Payback Period (years)</th>
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<tbody>
<tr>
<td>ECM#1</td>
<td>Attic Insulation</td>
<td>4,449</td>
<td>$890</td>
<td>-0.23</td>
<td>$76,411</td>
<td>86</td>
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<td>ECM#2</td>
<td>Existing Wall Insulation</td>
<td>27,062</td>
<td>$5,412</td>
<td>-1.42</td>
<td>$343,634</td>
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<td>ECM#4</td>
<td>Triple Pane Window Glazing</td>
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<td>$3,430</td>
<td>-0.90</td>
<td>$1,346,798</td>
<td>393</td>
</tr>
<tr>
<td>ECM#5</td>
<td>High Performance Glazing for new Windows (Option to ECM #4)</td>
<td>72</td>
<td>$14</td>
<td>-0.00</td>
<td>$201,768</td>
<td>14,412</td>
</tr>
<tr>
<td>ECM#6</td>
<td>Window Overhang</td>
<td>3,084</td>
<td>$617</td>
<td>-0.16</td>
<td>$216,400</td>
<td>351</td>
</tr>
<tr>
<td>ECM#7</td>
<td>Lighting Controls</td>
<td>20,159</td>
<td>$4,032</td>
<td>-1.06</td>
<td>$25,768</td>
<td>6</td>
</tr>
<tr>
<td>ECM#8</td>
<td>Geothermal Heating/Cooling</td>
<td>38,583</td>
<td>$7,716</td>
<td>-2.02</td>
<td>$1,138,854</td>
<td>148</td>
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<td>ECM#9</td>
<td>HVAC Occupancy Controls</td>
<td>1,246</td>
<td>$249</td>
<td>-0.07</td>
<td>$73,648</td>
<td>296</td>
</tr>
<tr>
<td>ECM#10</td>
<td>HVAC Demand Ventilation Controls</td>
<td>60,414</td>
<td>$12,083</td>
<td>-3.16</td>
<td>$84,426</td>
<td>7</td>
</tr>
<tr>
<td>ECM#11</td>
<td>Plug Load Controls</td>
<td>6,650</td>
<td>$1,330</td>
<td>-0.35</td>
<td>$56,134</td>
<td>42</td>
</tr>
<tr>
<td>ECM#12</td>
<td>Photovoltaics</td>
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<td>$2,448</td>
<td>-0.64</td>
<td>$50,674</td>
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</tr>
<tr>
<td>Total</td>
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<td>$76,428</td>
<td>-10</td>
<td>$3,614,515</td>
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</table>

- **Recommended**
- **Not Recommended**
- **To be considered during design development**
## Committee Recommendations

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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>20,142</strong></td>
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<td><strong>-5.28</strong></td>
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- EUI for the expanded and renovated building would be reduced from 34.4 to 29.12 meeting the goal of 25-30.

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<td>$216,400</td>
</tr>
<tr>
<td><strong>Total Savings with ECM#4</strong></td>
<td></td>
<td>191,038</td>
<td><strong>$38,207</strong></td>
<td><strong>-1.06</strong></td>
<td><strong>$1,563,198</strong></td>
</tr>
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*Limit to north facing windows. Cost to be included as a line item during design and development.

** Review during design development to determine cost/benefit analysis.

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*Limit to north facing windows. Cost to be included as a line item during design and development.

** Review during design development to determine cost/benefit analysis.
Net Zero Energy Ready Building

- A Net Zero Energy building is efficient enough for renewable energy to offset its annual energy consumption
- On-site space for renewable energy at the Jones Library is limited
- The renovated and expanded Jones Library could be net zero with the purchase of offsite renewable energy
- Some on-site solar PV panels would provide some power and communicate sustainable design ethos
Eliminate Fossil Fuels in Building

✓ Done!

(This was already part of the schematic design; the building will remain fossil fuel free)
Low Embodied Carbon Materials

- Embodied carbon refers to the environmental impact of materials used in construction
- 11% of global greenhouse emissions
- Schematic Design submitted in grant was steel framed structural system
- Revised Schematic Design: Cross-laminated timber (CLT) ($365,926 additional cost)
Committee recommends:

- Using cross-laminated timber structure (CLT)
- Continuing to review materials chosen as part of the design development process
Whole Building Life Cycle Analysis

- The Committee wanted to be sure that climate impact of demolition + new construction would be mitigated by the improved operational efficiency of the new building.

- FAA estimated the carbon emissions of demolition, construction, and operating the new building, and compared this with a “do nothing” approach.

- The renovation + addition project has a net climate benefit over its lifetime!
Recommendations Summary

- Proceed with ECMs 7 and 9-12 ($290,650)
- Include ECMs 4 and 6 in design development to determine if they should be implemented
- Use alternative cross-laminated timber structural system ($365,926)

During Design Development:
- Review cost/benefit of ECMs 4 and 6
- Include an updated embodied carbon analysis of materials chosen
- Utilize Life Cycle Assessment as part of continuing decision matrix
Next Steps

- Explore fund raising opportunities
- Consult on rebate and grant opportunities once available
- Explore options to purchase offsite renewable energy
- September 17, 2020, 4:30pm, with FAA

  - Trustees to vote on approval of final schematics and Sustainability Recommendations
Jones Library
Sustainability Goals Schematic Design Package

August 5, 2020
The Jones Library was built in 1928 and has since had only one major renovation in 1993. The proposed project would create a 3-story addition at the rear of the building and renovate the existing historic building to meet the contemporary needs of the facility. Among the goals of this project are a series of sustainability goals as outlined in the memo dated October 28th, 2019. Finegold Alexander Architects appreciates the clear goals of the Sustainability Committee and its strong commitment to sustainable design. The design team has performed an investigation of the design goals as reflected in the proposed Schematic Design\(^1\). As a Schematic Design report, the findings enumerated within this report are to inform a baseline which can be studied and improved upon at each subsequent phase. The findings are presented below and in the attached documents.

**EUI Goal/Net Zero**

Based on email correspondence from the Jones Library, the current site EUI of the existing library building is 73.2 kBtu/sf/year. This is consistent with data collected by the 2012 Commercial Building Energy Consumption Survey (CBECS) which lists the Median site EUI for library buildings in the United States as 71.6 kBtu/sf/year. An analysis of the proposed design based off the schematic energy model (Attachment A) indicates a predicted Energy Use Intensity (pEUI) of 34.4, showing a 52% decrease in energy performance over the median site EUI for library buildings. The pEUI does not assume the use of any on site renewable energy sources which could further decrease the EUI. The design team has

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\(^1\) An alternate low carbon composite wood and CLT structural system was also developed.
The proposed design currently includes a high efficiency VRF space conditioning system. Under the current design, the yearly cost of space conditioning would be $27,255.09. An investigation of an alternative geothermal system shows that, the yearly cost of space conditioning with a geothermal system would be $19,559.45. Due to the current moratorium on limiting gas usage to the current installed capacity, information on possible rebates is not currently available. Without rebates, the simple payback period for a geothermal system would be 148 years (Attachment C).

Eliminate Use of Fossil Fuels
The existing building is serviced by natural gas that is powering the heating boilers and hot water heater. The proposed design eliminates all gas-powered systems and replaces them with systems that are powered by electricity (Attachment D).

**Investigation of On-Site Renewable Source Options**

The proposed design currently includes a high efficiency VRF space conditioning system. Under the current design, the yearly cost of space conditioning would be $27,255.09. An investigation of an alternative geothermal system shows that, the yearly cost of space conditioning with a geothermal system would be $19,559.45. Due to the current moratorium on limiting gas usage to the current installed capacity, information on possible rebates is not currently available. Without rebates, the simple payback period for a geothermal system would be 148 years (Attachment C).

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Low Embodied Carbon Materials
The feasibility completed in 2016 and the revised schematic design focused on a conventional steel framed structural system that consisted of a composite concrete and metal deck slab on a structural steel column and beam system. In the interest of pursuing a building with low embodied carbon materials, we worked with our structural engineer (RSE) to prepare a schematic package with an alternative heavy timber hybrid structural system. The alternative proposes maintaining a conventional steel column system in the basement and a heavy timber structural on the upper floors. The heavy timber system consists of cross-laminated timber (CLT) floor slabs on glue laminated (glulam) columns and beams. The system alternatives are detailed in the attached structural documentation (Attachment E). The design team performed a comparative Life Cycle Assessment (Attachment F) that examined the environmental impact of the structural systems as shown in attachment E. The results showed that the timber structure resulted in significantly less Global Warming Potential than the steel structure.

To fully understand the impact of the structural system options, the building estimate includes a cost comparison (Attachment G). This estimate shows that the hybrid heavy timber and steel system would result in a cost increase of $365,926.00. The full breakout of this cost is detailed in the attached cost estimate.
Whole Building Life Cycle Assessment (LCA) is the most widely accepted method for assessing embodied carbon. In addition to exploring alternative structural systems to reduce the embodied carbon of the new addition, the design team has prepared a Whole Building Life Cycle Assessment that explores the embodied carbon of the proposed addition. This number is listed as Global Warming Potential and the results are expanded upon below. The design team is prepared to continue to work towards lowering the embodied carbon of the building with comparative analyses in subsequent phases.

**Whole Building Life Cycle Assessment**

The attached Life Cycle Assessment (LCA) was performed using the Tally Life Cycle Assessment software (Attachments H, I and J). The scope of the assessment includes core, shell, footings, foundations, structural wall assemblies from cladding to interior finishes, structural floors and ceilings, interior non-structural walls and finishes, and finishes on structural floors and ceilings for the new addition and the existing portion that will remain. The assessment found that, among other environmental impacts, the proposed design had a total Global Warming Potential of 1,433,189 kg CO₂eq. This number is based on the schematic design and should be considered a baseline. To gain a fuller understanding of the impact of the new work being performed, the design team also produced a LCA that evaluated the new addition alone and an LCA that evaluated the portion being demolished. The report of the new addition found that it has a total Global Warming Potential of 1,274,228 kg CO₂eq. It can be assumed that for the purposes of this report, Global Warming Potential of the demolition portion of the project can be represented by the End of Life impact alone. The report of the demolished portion found an End of Life Global Warming Potential of 17,773 kg CO₂eq. The environmental impacts as quantified by the impact categories in the LCA can be improved through various measures such as adding fly ash to the concrete and reducing material usage throughout the design. The design team is prepared to present options to lower to the environmental impacts of the facility at the discretion of the client as the project progresses into later stages of design.
In addition to studying the environmental impacts of construction, the design team studied the impacts of operational energy. Based on the current EUI of the existing building (73.2 kBtu/sf/year) and assuming 22% of that energy is heating from natural gas, over 60 years the Global Warming Potential is 18,288,925 kgCO\(_2\)eq. In addition to the proposed project having an initial Global Warming Potential of 1,433,189 kgCO\(_2\)eq, the study showed an operational Global Warming Potential of 11,382,681 kgCO\(_2\)eq and a total Global Warming Potential of 12,815,870 kgCO\(_2\)eq.

**Attachments:**
Attachment A: Energy Model pEUI report
Attachment B: Potential Energy Conservation Measures
Attachment C: Summary of Renewable Energy Investigation
Attachment D: Summary of Proposed New Systems
Attachment E: Structural System Schematic Schemes and Narrative
Attachment F: Life Cycle Assessment Design Option Comparison
Attachment G: Structural System Estimate
Attachment H: Life Cycle Assessment Report (New and Existing)
Attachment I: Life Cycle Assessment Report (New)
Attachment J: Life Cycle Assessment Report (Demolition)
Attachment A: Energy Model pEUI Report
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Analysis Methodology 5
EXECUTIVE SUMMARY

Andelman and Lelek Engineering, Inc. (ALE) was retained by BLW Engineers to complete an energy performance analysis for the renovation/addition to Jones Library in Amherst, MA. The main objective of the study was to create an eQuest model in order to estimate annual energy use for the renovated library and new addition based on the proposed design. This information is used to determine the estimated energy use intensity (EUI) of the proposed project.

This report is based on Schematic Design information, including a description of the proposed mechanical systems, as well as information on the existing library exterior envelope construction and hours of operation.

The proposed building is estimated to use $34.4\text{ kBtu/sf/yr}$ of site energy and $103.3\text{ kBtu/sf/yr}$ of source energy. The breakdown of energy by end use is shown in Figure 1 below. The EUI compares favorably to the nationwide median for libraries, which is listed as 71.6 kBtu/sf/yr site and 143.6 kBtu/sf/yr site in the Energy Star Portfolio Manager Technical Reference.

Please note that there are many factors which may cause the building’s actual energy use to differ from modeled energy use. These include weather, actual patterns of use, plug load variations, operating controls, and existing building construction (effectiveness of blown-in insulation, tightness with respect to air infiltration). The model does not include any special treatment for special collection areas such as humidification.

Figure 1 – Summary of Energy Consumption
FACILITY DESCRIPTION

Figure 1: eQuest model of the Jones Library

General
The Jones Library is located in Amherst, MA. The building occupancy is based on current hours of operation (approximately 59 hours per week during the school year and 53 hours per week during the summer).

Architectural
The existing library is multi-wythe masonry with air space with blown in insulation. Existing windows are single pane clear glass with storm sash. Attics have blown-in insulation. The new addition is assumed to meet the minimum requirements of IECC 2018 for wall and roof insulation as well as for glazing performance.

Mechanical Systems
The building will be served by a VRF heating/cooling system and a dedicated outdoor air ventilation system with exhaust air heat recovery. It is assumed that the mechanical systems meet the minimum performance requirements of IECC 2018.

Plumbing Systems
The demand for domestic hot water for a library is relatively low. It is assumed that domestic hot water will be provided by electric water heater(s).

Electric Lighting Systems
The electric lighting systems are assumed to meet the minimum requirements of IECC 2018, 0.78 W/sf, building area method.

Miscellaneous equipment loads are assumed to be as follows:

- 1.5 W/sf for offices and meeting rooms
- 0.1 W/sf for corridors, stairs, etc.
- 2.0 W/sf for workshops
- 5 W/sf for tel/ data closet

Equipment (plug loads) loads comprise all non-HVAC equipment plugged into convenience outlets, including computers, printers, monitors, kitchen equipment, etc.
ANALYSIS METHODOLOGY

To analyze the future energy consumption patterns of the building, a computer model of the facility was developed and building consumption simulations were performed using the eQuest building analysis program. eQuest uses the latest DOE-2.3 building energy analysis software as its calculating engine. This very flexible program permits modeling of a variety of building types and components including complex building geometry, lighting systems, HVAC systems, central plant equipment, and utility rate structure. Westfield, MA TMY3 weather data was used in the analysis.

ENERGY CONSERVATION MEASURES

Several potential energy conservation measures were modeled to calculate annual energy savings for the measures. The following table summarizes the savings for each measure. It should be noted that the savings for the photovoltaic measure (ECM #12) was calculated using the PV-Watt program.

Table 1: Summary of Energy Conservation Measures

<table>
<thead>
<tr>
<th>ECM #</th>
<th>Measure Description</th>
<th>kWh</th>
<th>$</th>
<th>0</th>
<th>$</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM #1</td>
<td>Attic Insulation - add R-19</td>
<td>4,449</td>
<td>$890</td>
<td>0</td>
<td>$0</td>
<td>$890</td>
</tr>
<tr>
<td>ECM #2</td>
<td>Existing Wall Insulation - add R-40</td>
<td>27,062</td>
<td>$5,412</td>
<td>0</td>
<td>$0</td>
<td>$5,412</td>
</tr>
<tr>
<td>ECM #4</td>
<td>Triple Pane Window Glazing for All Windows</td>
<td>17,153</td>
<td>$3,430</td>
<td>0</td>
<td>$0</td>
<td>$3,430</td>
</tr>
<tr>
<td>ECM #5</td>
<td>High Performance Glazing for New Windows (Option to ECM #4)</td>
<td>72</td>
<td>$14</td>
<td>0</td>
<td>$0</td>
<td>$14</td>
</tr>
<tr>
<td>ECM #6</td>
<td>Window Overhang - 2' deep</td>
<td>3,084</td>
<td>$617</td>
<td>0</td>
<td>$0</td>
<td>$617</td>
</tr>
<tr>
<td>ECM #7</td>
<td>Lighting Controls - 20% reduction for offices, meeting rooms, reading rooms</td>
<td>20,159</td>
<td>$4,032</td>
<td>0</td>
<td>$0</td>
<td>$4,032</td>
</tr>
<tr>
<td>ECM #8</td>
<td>Geothermal Heating/ Cooling</td>
<td>38,583</td>
<td>$7,716</td>
<td>0</td>
<td>$0</td>
<td>$7,716</td>
</tr>
<tr>
<td>ECM #9</td>
<td>HVAC Occupancy Controls for offices/ meeting rooms</td>
<td>1,246</td>
<td>$249</td>
<td>0</td>
<td>$0</td>
<td>$249</td>
</tr>
<tr>
<td>ECM #10</td>
<td>HVAC Demand Ventilation Controls</td>
<td>60,414</td>
<td>$12,083</td>
<td>0</td>
<td>$0</td>
<td>$12,083</td>
</tr>
<tr>
<td>ECM #11</td>
<td>Plug Load Controls - 20% reduction for offices/ meeting rooms</td>
<td>6,650</td>
<td>$1,330</td>
<td>0</td>
<td>$0</td>
<td>$1,330</td>
</tr>
<tr>
<td>ECM #12</td>
<td>Photovoltaics - 10 kW</td>
<td>12,238</td>
<td>$2,448</td>
<td>0</td>
<td>$0</td>
<td>$2,448</td>
</tr>
<tr>
<td>All Measures</td>
<td>Total Savings w/ ECM #4</td>
<td>191,038</td>
<td>38,207</td>
<td>0</td>
<td>$0</td>
<td>$38,207</td>
</tr>
<tr>
<td></td>
<td>Percentage Reductions</td>
<td>29%</td>
<td>0%</td>
<td>0%</td>
<td>29%</td>
<td></td>
</tr>
</tbody>
</table>

Natural Gas Savings: All Measures
Attachment B:
Potential Energy Conservation Methods
Below is a list of potential Energy Conservation Measures (ECMs) that could be considered for further study:

- Insulating the existing building
  - The attic has been insulated with blown in insulation, this could be replaced or supplemented, additional insulation could be added to reduce thermal bridging.
  - Add additional insulation to the existing walls to increase the R-value to match the new addition. Testing would be required to assess the extent to which insulation can be added.

- Insulating the new building
  - Add insulation to the design of the new addition to bring the R-value to 40. Adding insulation over the studs would reduce thermal bridging.

- Increasing the tightness of the new building
  - Reduce air leaking and thermal bridges above the current standard
  - Sealant & gasketing at all windows and doors
  - Permeable vapor barrier at basement, attic and/or roof

- Glazing
  - Provide triple glazed or high performance windows at all locations
  - Add louvers and overhangs to control direct sunlight

- Lighting controls
  - Provide lighting controls

- HVAC
  - Provide advanced HVAC controls

- Water
  - Reduce the hot water temperature throughout
  - Provide on-demand fixtures
  - Provide high efficiency fixtures
  - Use grey water where possible
  - Provide storm water capture and reuse
- Plug Loads
  - Provide plug load controls
  - Use high efficiency equipment
- On-site Energy Production
  - Provide on-site renewable energy production systems such as PV arrays and geothermal heating and cooling
  - Purchase off-site renewable energy
<table>
<thead>
<tr>
<th>ECM #</th>
<th>Measure Description</th>
<th>kWh</th>
<th>Electric Savings</th>
<th>Natural Gas Savings</th>
<th>Total Cost Savings</th>
<th>Total EUI Savings</th>
<th>Budget Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>EUI</td>
<td>Assumed Quantity</td>
</tr>
<tr>
<td>ECM #1</td>
<td>Attic Insulation</td>
<td>4,449</td>
<td>$890</td>
<td>0</td>
<td>$890</td>
<td>0.23</td>
<td>15,101 SF</td>
</tr>
<tr>
<td>ECM #2</td>
<td>Existing Wall Insulation</td>
<td>27,062</td>
<td>$5,412</td>
<td>0</td>
<td>$5,412</td>
<td>1.42</td>
<td>16,386 SF</td>
</tr>
<tr>
<td>ECM #4</td>
<td>Triple Pane Window Glazing for All Windows</td>
<td>17,153</td>
<td>$3,430</td>
<td>0</td>
<td>$3,430</td>
<td>0.90</td>
<td>7,250 SF</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECM #5</td>
<td>High Performance Glazing for New Windows</td>
<td>72</td>
<td>$14</td>
<td>0</td>
<td>$14</td>
<td>0.00</td>
<td>4,250 SF</td>
</tr>
<tr>
<td>ECM #6</td>
<td>Window Overhang</td>
<td>3,084</td>
<td>$817</td>
<td>0</td>
<td>$817</td>
<td>0.16</td>
<td>1,082 LF</td>
</tr>
<tr>
<td></td>
<td>Lighting Controls</td>
<td>20,150</td>
<td>$4,032</td>
<td>0</td>
<td>$4,032</td>
<td>1.06</td>
<td>16,296 SF</td>
</tr>
<tr>
<td></td>
<td>Geothermal Heating/ Cooling</td>
<td>38,583</td>
<td>$7,716</td>
<td>0</td>
<td>$7,716</td>
<td>2.02</td>
<td>35,500 SF</td>
</tr>
<tr>
<td>ECM #9</td>
<td>HVAC Occupancy Controls</td>
<td>1,246</td>
<td>$249</td>
<td>0</td>
<td>$249</td>
<td>0.07</td>
<td>35,500 SF</td>
</tr>
<tr>
<td>ECM #10</td>
<td>HVAC Demand Ventilation Controls</td>
<td>60,414</td>
<td>$12,083</td>
<td>0</td>
<td>$12,083</td>
<td>3.16</td>
<td>35,500 SF</td>
</tr>
<tr>
<td>ECM #11</td>
<td>Plug Load Controls</td>
<td>6,650</td>
<td>$1,330</td>
<td>0</td>
<td>$1,330</td>
<td>0.35</td>
<td>35,500 SF</td>
</tr>
<tr>
<td>ECM #12</td>
<td>Photovoltaics</td>
<td>12,238</td>
<td>$2,448</td>
<td>0</td>
<td>$2,448</td>
<td>0.64</td>
<td>7,257 SF</td>
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<tr>
<td>All</td>
<td>Total Savings w/ ECM #4</td>
<td>191,038</td>
<td>38,207</td>
<td>0</td>
<td>$38,207</td>
<td>10.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percentage Reductions</td>
<td>29%</td>
<td>0</td>
<td>0%</td>
<td>29%</td>
<td>29%</td>
<td></td>
</tr>
</tbody>
</table>