Meetings Agenda

I. Call to Order (Welcome, Austin, Tammy, Alex, Lorin, Kent, Bonnie, Janice, Joan, George, and Sharon!)

II. Approval of Minutes (7-2-20) *

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

II. Feasibility meeting called to order at 9:03 am

III. Minutes
A. MOTION: To approve the minutes of February 26, 2020 for Feasibility Committee. Approved 6-0-0
B. MOTION: Motion to approve the minutes of February 13, 202 for Sustainability Committee. Approved 4-0-0 (Lee Jennings joined the meeting after the vote).

IV. Sustainability Report
A. FAA presented their sustainability report.
B. Explained that the Tally Life Cycle Assessment does not figure in the demolition into lifecycle analysis. This would require an entirely different process and is very difficult to do the calculation. Can do an analysis on what would be demo’ed - assume transportation, where going and most common disposal method. Can do it, but there would be a lot of assumptions. Can do it as separate assumptions but can’t roll into Tally as the program is not designed for this piece.
C. Question if FAA looked at other types of electrified heating and cooling other than geothermal wells? The base proposal uses a VRF system. The Environmental Consideration Measures are those beyond the base proposal for the renovation/expansion. The cost savings/operating costs is based on the base design.
D. Ground Source vs VRF - on this parcel, given the proximity of property line would an air-cooled system be able to meet the noise requirements? Would have to do calculation on boundary noise system but don’t anticipate a problem. VRF would be quieter in the library than the geothermal. Have run into same issues around noise in downtown Boston and have found that with proper screening and baffling they have been able to solve that problem.
E. Confirmation that the total embodied and operation carbon calculation includes both the existing and new building, not just the new. What does green bar show in the graph? It is the base design without the additional ECM measures and without the CLT.
F. EUI pie chart by use type - the % going to lighting seems very high? Library usage around lighting tends to be higher. The base considers code required lighting controls in the number. One of ECMs is to add further lighting controls. Comment that Hampshire College’s predicted energy pie chart model actual overestimated lighting and underestimated HVAC. Believe that is primarily due to
G. Post COVID 19 operation of HVAC systems - one of recommendations is to disable control ventilation and run systems for pre- or post occupancy flush period (4 hour pre-occupancy purge). May need to rerun numbers on this new assumption. Doing things now for short term to mitigate issues around COVID 19 - don’t know how long will need to deal with that.

H. UV introduced into HVAC systems? Have looked at this and other systems. This system is primarily heat recovery, brought in without cross contamination.

I. Could we relook at ECMs based on new realities for COVID-19? Would need to run these ideas as we move forward. Would run again and change during DD.


K. Table showing ECM - is there a version that includes the Global warming /embodied potential of each measure to help us get a good look across everything? Can add a column to show that.

L. Do we know how close we are to NetZero? The design is NetZero capable with offset renewals but can’t do with what we can put on the building. Building configuration does not lend itself to a lot of PVs. May be able to get more than 10kw projected but likely need offsite or purchase to get to net zero. In DD consider looking at configuration of building to optimize? Have monitors on the roof which helps bring more daylight into the building. If don’t have monitors could substitute more PV. With existing 1928 building have other limitations about what can be done.

M. Tally assumptions for assessment calculations - includes most parts of the building. Timber would make a difference in global warming potential. What insulation was assumed? Included what is in the design package in the new building. What is in the existing, not particularly insulating 1928 portion of the building. One of the ECMs that was included was around insulation. No cavity in 1928, wood paneling and fireplaces trying to keep. What type of insulation system is going on in the slab, roof, walls (can make a difference in the bottom line footprint). At the end of report, everything assumed is articulated.

N. Maybe a good amount of room for improvement just using insulation material and not having to get into redesign. No line item for type of insulation in new building (not R value but embodied carbon). Operation is looking good, so focus can be on embodied. Will add on to ECM chart. R32 for walls and roof.

O. Geothermal - what type of landscape features are allowed over geothermal wells? Wells are down 3-4 feet so normal plantings are usually allowed. Nothing with deep roots or structural support. Wells are not big, spaced wide apart. The circles are the 15 foot dimeter - in the middle only doing a 12” bore. Could something like the Kinsey garden go in the plan? The disturbance is limited to 12” bore and area around it but not entire 15 feet.

P. Large parking lot behind the site. If we had permission, could do below the parking lot. The heat of the parking lot can sometimes mess with the heat of the water. Need to drill deeper to avoid those issues.

Q. Hybrid systems, part geothermal and part air source to reduce the size of the field? Can and have done that before. The cost inside the building is the same for geothermal as VRF. Cost of geothermal is external to building and has to be treated as an add on.

R. Discussed that this document is the beginning of the process and that the Sustainability should continue to review, discuss, and determine if we have the information needed for next steps. Will need to come up with recommendations to the Board. Also need to continue discussions as we move through actual design and development.
S. How can you get to repair of wells? Rare to need repairs, would need to excavate.
T. Are costs of ECM 4 and 5, net or gross? Those are net increases.
U. ECM 4 - how much of cost and energy savings is for window replacement in the 1928 building? Did not break out that way. Can look at that and get back to us.
V. $0 for gas savings because not using gas at all. The baseline does not use gas.
W. Estimated recovery for geothermal is 147 years. Is that normal? Every year it gets longer and longer for recovery. Several years ago, the cost of gas or electricity was higher and the efficiency of equipment was lower. Now when comparing against geothermal, using equipment that is extremely efficient and does not offset the outdoor well costs. Well costs are substantial. Everything inside building with current codes, does not change what doing inside the building from one system to another.
X. Any knowable maintenance issues associated with what is being proposed? MEP - typical maintenance.
Y. What is FAA’s experience with these kinds of design elements. How comfortable about CLT approach in buildings like this one? Worked with structural engineer who is working on several CLT structures. Feel very confident. The person who did design has a lot of experience with CLT. CLT uses a burn rate to decide safety and each municipality approaches differently and would require investigation. Because of the Olver Building at UMass think may be less of a municipal issue. Given large meeting room and need long span, would be difficult with a flat ceiling, proposal was best solution to cut down the depth of the steel and transfer load to wood above.
Z. How thinking about library design differently in light of COVID and what would be the implications to the sustainability of the building if we wanted to make changes, such as amount of seating in meeting room? Physical building - idea of separate children’s entrance that has been discussed takes down the load of people heading to one place. People concerned about computer use and how we space out. Trying to squeeze down space works against what is needed with COVID. Do we need to rethink spacing in the building? What is most important is flexibility in the building, partitions, and the furnishings to address concerns related to COVID, future health issues, and future library usage.

V. Public Comment
A. Does existing design contemplate single pane windows? no, double pane and ECM bumps to triple pane.
B. Is it true the roof capacity limits solar PV potential? Yes

VI. Next steps
Looking for and depending upon a recommendation from the Sustainability Committee about the adequacy of what FAA has done and articulation of priorities from the point of view of Sustainability. Sara will send a list of follow up questions or information to be included with FAA revised report. Once revised report is received Sustainability will meet again to discuss priorities and send recommendations to the Board for consideration.

VII. Accessibility Study
A copy of the report was presented to both committees. No questions at this time. The report will be presented by Kuhn Riddle to the Town Council on July 13. Encouraged people to attend the meeting.
VIII. **MBLC Update**
No additional information to share. MBLC is meeting on July 9 where they will discuss the waitlisted libraries’ requests for delay and additional money due to fiscal uncertainty from COVID-19.

Meeting adjournments
- Sustainability Committee adjourned 10:37 am
- Feasibility Committee adjourned 10:38 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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<td>ECM#1</td>
<td>Attic Insulation</td>
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<td>-0.00</td>
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<tr>
<td>ECM#6</td>
<td>Window Overhang</td>
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<td>-0.16</td>
<td>$216,400</td>
<td>351</td>
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<tr>
<td>ECM#7</td>
<td>Lighting Controls</td>
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<td>$4,032</td>
<td>-1.06</td>
<td>$25,768</td>
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<tr>
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<td>Geothermal Heating/Cooling</td>
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<td>ECM#10</td>
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<td>$12,083</td>
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<tr>
<td>ECM#11</td>
<td>Plug Load Controls</td>
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<td>$1,330</td>
<td>-0.35</td>
<td>$56,134</td>
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<tr>
<td>ECM#12</td>
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<td><strong>-10</strong></td>
<td><strong>$3,614,515</strong></td>
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</table>

- **Green**: recommended
- **Red**: not recommended
- **Yellow**: to be considered during design development
## Committee Recommendations

<table>
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<tr>
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<td>-0.64</td>
<td>$50,674</td>
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<tr>
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<td>$20,142</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.

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>ECM#4</td>
<td>Triple Pane Window Glazing *</td>
<td>17,153</td>
<td>$3,430</td>
<td>-0.90</td>
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<td>$617</td>
<td>-0.16</td>
<td>$216,400</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>191,038</td>
<td>$38,207</td>
<td>-1.06</td>
<td>$1,563,198</td>
</tr>
</tbody>
</table>

*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)
Low Embodied Carbon Materials

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 it’s 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
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. 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

1 An alternate low carbon composite wood and CLT structural system was also developed.
enumerated additional energy conservation measures (ECMs) that could further decrease the site EUI at the discretion of the client (Attachment B). With the implementation of selected ECM’s, Net-Zero Energy could be achieved through purchased off-site renewable energy.

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).

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).
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 alternates 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\(\text{CO}_2\)eq. 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\(\text{CO}_2\)eq. 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\(\text{CO}_2\)eq. 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

August 5, 2020
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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 kBtu/sf/yr of site energy and 103.3 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

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

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<tr>
<th>ECM #</th>
<th>Measure Description</th>
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<th>$</th>
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<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>Total Savings w/ ECM #4</td>
<td>191,038</td>
<td>38,207</td>
<td>0</td>
<td>$0</td>
<td>$38,207</td>
<td></td>
</tr>
<tr>
<td>Percentage Reductions</td>
<td>29%</td>
<td>0%</td>
<td>0%</td>
<td>29%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Savings w/ ECM #4: $38,207

Percentage Reductions: 29%
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 louvered 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
  o Provide plug load controls
  o Use high efficiency equipment
• On-site Energy Production
  o Provide on-site renewable energy production systems such as PV arrays and geothermal heating and cooling
  o Purchase off-site renewable energy
Table 1: Summary of Energy Conservation Measures

<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>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>16,389 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>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>$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>
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<tr>
<td>ECM #7</td>
<td>Lighting Controls</td>
<td>20,159</td>
<td>$4,032</td>
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<td>$4,032</td>
<td>1.08</td>
<td>16,296 SF</td>
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<tr>
<td>ECM #8</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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</table>

**All Measures**

<table>
<thead>
<tr>
<th>Total Savings w/ ECM #4</th>
<th>191,038</th>
<th>$38,207</th>
<th>0</th>
<th>$38,207</th>
<th>10.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage Reductions</td>
<td>29%</td>
<td>0%</td>
<td>0%</td>
<td>29%</td>
<td>29%</td>
</tr>
<tr>
<td>Initial Cost</td>
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<td>$3,014,515.00</td>
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