The Sustainability Issue
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ENERGY CONSERVATION AND SUSTAINABILITY STEPS
AT THE KINGSTON LIBRARY

By Emilie Hauser

Abstract: The Kingston Library made a decision to adopt New York’s Climate Smart pledge, designed for communities but equally relevant for institutions wishing to save money, improve service quality and reduce environmental impact. In implementing this commitment, the Library learned lessons that can guide every building manager, from measuring performance to engaging stakeholders.

This article outlines the Kingston Library’s green journey over the past decade, describes tools used to measure the effectiveness of implemented energy conservation measures, and summarizes the lessons learned. Other sustainability measures are also mentioned, including library programming, community engagement, and stormwater management. Many libraries are beginning to take the plunge into investing in their own sustainability; Kingston Library has taken the time to document our progress, showing in the process that what is good for the environment is also good for operating costs. Energy conservation and other sustainability practices are described. Guidance is provided on the use of tools that can help other libraries measure and track their energy use and improve their sustainability.

INTRODUCTION

Public libraries serve their communities as learning and educational centers by offering reading material, computer access, and library programming that will benefit the community. Libraries can also function as living laboratories by planning ahead to address future challenges now. The lessons learned can then be shared with the community, giving patrons and others local models for good management and planning.

Kingston Library strives to “think globally and acts locally” and become a green library. In the early 2000s, the Board of the Kingston Library committed to make upgrades to its building that would both increase energy efficiency and increase comfort for patrons and staff. This initial commitment was

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followed by the decision to support the City of Kingston’s Climate Smart Communities and Green Jobs Pledge by helping to meet the goal to reduce energy usage and GHG emissions 20% by 2020. The measures implemented under this plan have stabilized and slightly decreased our energy use and decreased the library’s carbon footprint. We hope that this story will inspire other libraries to take action.

BACKGROUND
Kingston Library serves the 24,000 residents of the City of Kingston, county seat of Ulster County. For almost a century, the library was an association library. It became a special district public library after a public vote in 2000. The library now receives most of its funding from property taxes. In addition to fulfilling its mission to provide books and materials for the public, Kingston Library also strives to be a green library. Following the definition by Aulisio, 2013, the library defines a green library to be any library that promotes sustainability through education, operations, and outreach. While there are many definitions of sustainability, we use the 1987 United Nation definition: “meeting the needs of present generations without compromising the ability of future generations to meet their needs.”

In September 2010, Kingston Library’s Board of Trustees passed the Climate Smart Community Library Pledge. The Pledge, included in Appendix 1, requires the library to consider climate change adaptation and mitigation measures in its long-term planning, to gather and track data on GHG emissions, and to provide community programming to educate the public on climate change and related topics. The Kingston Library Climate Smart Advisory Committee (CSAC) was formed in 2011 with the mission of implementing the pledge. The committee’s initial responsibility was to review the issues and propose a sustainability plan addressing facility operations and library programming. The CSAC Report, completed in 2012, comprises a greenhouse gas inventory of emissions related to library operations, suggestions for preparing for climate change and implementing additional sustainability measures, and a plan for community programming and transportation measures.

LIBRARY BUILDING
The library building is a former elementary school dating to 1878. The building footprint occupies just less than 8,000 sq. Ft. and has a total interior area of about 24,000 sq. ft., including the basement. The site is a full city block with a 26,000 sq. Ft. parking lot. The library has occupied the two-story brick building since 1978, but only acquired the building from the school district in 2004, becoming fully responsible for its upkeep and improvement. Natural gas is used for space heating and hot water.

The library had an energy audit near the turn of the 21st century. Although this audit report is no longer in our possession, we do know that the recommendations of this audit were used to identify projects to be funded by a $1 million major bond act for capital expenditures. The bond funding was supplemented by state grants. These energy improvement measures have been carried out over the last decade and include a new roof covering, attic insulation, lighting upgrades, and window replacement, see Table 1. Details of these improvements are described in Appendix 2. The roof covering and attic insulation were part of a larger structural repair to the building roof. Some CSAC
members were involved in these initial efforts for energy conservation and realized that analyzing energy use over time would validate the effectiveness of these improvements.

**METHODS FOR TRACKING ENERGY USE**

To see if the earlier improvements had made a difference and to see how we could further improve, the CSAC gathered and analyzed utility data, used an energy performance measuring tool and had a second energy audit. Utility data are necessary for all three methods. The methods are described first, discussion of results follow.

**UTILITY DATA**

A simple way to understand energy consumption and cost is to gather utility bills, in this case, natural gas and electricity, and enter the data into a spreadsheet program. We were able to locate utility bills back to late 2000 and originally looked at ten years of data. Your utility company may allow you to retrieve historic bills from their website. Graphs of electric and gas usage are shown on the next page in figures 1 and 2.

**EPA Portfolio Manager**

We used the EPA Portfolio Manager (3) to track and compare the Library’s performance the over the years and to compare the library building with similar buildings around the nation (4). The tool calculates the building’s energy consumption per unit area, total greenhouse gas emissions and other measures.

Portfolio Manager requires basic information on the building and grounds, including gross floor space (24651 ft²), usable space (16,435 ft²), parking lot area, hours of operation (51 hours per week), number of full time staff (five), and number of computers (27). Data from utility bills, cost for and use of natural gas, electricity and water must be entered. We originally entered utility data for ten years (2001-2011) and have subsequently added new data, up to August 2014.

EPA Portfolio Manager is a free and fairly intuitive tool. Library staff, trustees, volunteers or a consultant can teach themselves how to use the program, utilizing training modules, FAQs and other resources. The EPA Portfolio Manager defines about 80 property types, of these there are about 20 property types which can receive an Energy Star Score. It compares similar properties nationwide which can be eligible for Energy Star certification. At this time, libraries are not eligible for Energy Star rating and certification. There are other benchmarking tools available, both proprietary and free. Check with other institutions in your area to see what tools they are using.

<table>
<thead>
<tr>
<th>Date</th>
<th>Energy Improvement</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer 2005</td>
<td>Lighting</td>
<td>$15,645</td>
</tr>
<tr>
<td>Fall 2005</td>
<td>Membrane Roofing</td>
<td>$100,000</td>
</tr>
<tr>
<td>Fall 2006</td>
<td>Heat Zones</td>
<td>$34,470</td>
</tr>
<tr>
<td>Winter 2007</td>
<td>Window Replacement</td>
<td>$220,040</td>
</tr>
<tr>
<td>Winter 2008</td>
<td>Attic Insulation</td>
<td>$12,180</td>
</tr>
<tr>
<td>Summer 2009</td>
<td>Set Back Thermostats</td>
<td>$2,200</td>
</tr>
<tr>
<td>Summer 2014</td>
<td>Occupancy Sensors</td>
<td>NA</td>
</tr>
</tbody>
</table>
ENERGY AUDIT

In late summer 2011 we took advantage of free energy audits for businesses and institutions provided by the New York State Energy Research and Development Authority (NYSERDA). This second energy audit was conducted by L & S Energy Services Inc. The audit examined the building envelope and the systems for lighting, space heating and cooling and water heating. It also included an inventory of equipment. Data from one year (2010) of utility bills was used. There was no blower door or infrared examination of the building, as would be performed in a home performance audit (also funded by NYSERDA). This audit gave us important information on how we were using energy, and therefore how to reduce energy. (See resulting charts in results section.)
RESULTS

Referring back to energy usage Figures 1 and 2 shows that electricity (green) and gas (blue) consumption has been steadily trending down. (Note the trend lines). There has been an increase in 2012 and 2013; however we can only speculate about the cause.

For more detailed analysis, EPA Portfolio Manager calculates our energy consumption based on building area and with considerations for weather, see Table 2 and Figure 3. As recommended by the Portfolio Manager we are showing source energy use intensity (EUI). Defined by Portfolio Manager, EUI expresses a building’s energy use as a function of its size. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses. By taking all energy use into account, the score provides a complete assessment of energy efficiency in a building. In order to account for changes in weather we show weather normalized values, which considers the energy the property would have consumed during 30-year average weather conditions. Portfolio Manager allows us to compare the library to similar buildings and operations. The building is performing about 68% better than the national mean for similar buildings.

<table>
<thead>
<tr>
<th>Year Ending</th>
<th>Source EUI (kBtu/ft²)</th>
<th>Weather Normalized Source EUI (kBtu/ft²)</th>
<th>National Median Source EUI (kBtu/ft²)</th>
<th>Percent Better than National Median Source EUI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>85.8</td>
<td>NA</td>
<td>235.6</td>
<td>63.6</td>
</tr>
<tr>
<td>2005</td>
<td>82.4</td>
<td>NA</td>
<td>235.6</td>
<td>65</td>
</tr>
<tr>
<td>2009</td>
<td>62.9</td>
<td>63.5</td>
<td>235.6</td>
<td>73.3</td>
</tr>
<tr>
<td>2010</td>
<td>64.8</td>
<td>66.5</td>
<td>235.6</td>
<td>72.5</td>
</tr>
<tr>
<td>2011</td>
<td>71.4</td>
<td>74.4</td>
<td>235.6</td>
<td>69.7</td>
</tr>
<tr>
<td>2012</td>
<td>64.8</td>
<td>70.4</td>
<td>235.6</td>
<td>72.5</td>
</tr>
<tr>
<td>2013</td>
<td>72.9</td>
<td>74.9</td>
<td>235.6</td>
<td>69.1</td>
</tr>
</tbody>
</table>

The analysis found that the Library has reduced its energy use per area over the years, with increases in 2011 and 2013. The greenhouse gas emissions (GHG) have the same trend, see Figure 4. Most of the energy improvements were made between 2005 and 2008; we conclude that the decrease in energy use is
a result of these improvements. The cause of the decrease in performance in 2011 and 2013 is not understood but could be from changes in the use of computers, other equipment, or overall use of the building.

Audit Results

The energy audit report made only minor recommendations, reflecting the substantial changes the Library had already taken beginning in 2005. The audit explains how we use energy. Space heating uses the most energy (natural gas) and dominates the cost, see Figures 5 and 6. Lighting and air conditioning follow. Looking just at electricity consumption, lighting uses the most amount of energy (44%), followed by air conditioning (39%) and equipment (17%). Parsing out the electricity use of the equipment (Figure 7), the refrigerators, computers and monitors, and hot-water pumps were found to be the biggest consumers of electricity, adding up to about 90%. It is interesting to note that two refrigerators, used for staff lunches and occasional events consume almost as much energy (39%) as the computers and monitors (46%). The elevator and other office equipment are not mentioned in the audit.

![Figure 4: Kingston Library Total Greenhouse Gas Emissions (Metric Tons CO2e)](chart)

**Recommended Improvements from the Audit**

The recommended improvements included installation of a boiler heat timer, occupancy sensors, minor lighting changes and door weather stripping. The audit provided estimated costs and simple payback and energy savings details. (Listed in Appendix 3.) We have since made some lighting changes, installed weather-stripping on doors, and installed occupancy sensors in the restrooms. Occupancy sensors automatically turn lights on and off based on movement. Boiler improvements have not been made, as we hope to replace the boiler.
Figure 5: Annual energy consumption by type June 2010
Jul 2011
Total = 1.012 million kBTU

- Equipment: 71%
- Lighting: 13%
- Air conditioner: 11%
- Heat & hot water: 5%

Figure 6: Annual energy cost by type: (Jul 2010-Jun 2011)
Total cost = $20600

- Equipment: 41%
- Lighting: 26%
- Air conditioner: 23%
- Heat & hot water: 10%

Figure 7: Percent of Equipment Electricity Use - July 2010 to June 2011

- Marathon Hot Water Pumps: 24%
- Computers & CRTs (13): 28%
- Computers & LEDs (14): 18%
- Refrigerator - Mini: 15%
- Refrigerator - Whirlpool: 15%
We felt that the audit recommendations were minor. There are two reasons for this. The fact that we had previously made improvements, insulated the attic, installed more efficient lighting and installed energy efficient windows. Also, the scope of the audit was limited: the building envelope was not tested, either with a blower door test or infrared study, which would locate drafts and air leaks. There was no consideration of the building floor plan. For example, the automatic doors open into a central corridor space, sending blasts of cold or hot air into the building.

Was it time to celebrate and rest on our laurels? No, there is still more we can do, both in capital projects, simple equipment changes and in behavior change.

Capital projects include the replacement of the 50 year old boiler and floor plan adjustments to eliminate drafts at the entry doors. The latter two actions have been postponed as the Library completes an architectural master plan, which will address the building envelope.

Simple equipment changes include devices to switch off vampire draws of electricity by monitors and other equipment and filling the refrigerators with containers of water and ice so that they run more efficiently.

Behavior change applies to staff and patrons alike and includes such things as turning off lights and monitors, closing doors and not using the elevator. Other behavior change includes recycling, waste reduction, and alternative ways to get to the Library (bus, walk, bike rideshare).

**ENERGY COST / BENEFIT ANALYSIS**

In 2012, we wanted to look back at the many improvements and determine whether we could show whether they have been a good investment in terms of dollars. There are many ways to look at the economic value of energy improvements, simple payback, net present value and return on investment. Simple payback was provided by the energy audit. There are other resources which provide general simple payback information also.

We worked with a group of graduate students at the Bard College Center for Environmental Policy to figure out the net present value. They found that it was difficult to sort out the energy savings from any one improvement over time, since the energy improvements were not done successively with sufficient time to parse out specific effects.

However, the students’ efforts were helpful: showing that our energy use definitely tracks with heating and cooling degree days; pointing out our need to keep records of improvements and the importance of the institutional memory of former and current staff and trustees. We had to look back into meeting summaries, bills and bidding documents to find descriptions and costs of improvements and implementation dates. Institutional memory was important. We recommend others anticipate this need.

Even though we cannot show definitively that energy improvements were a good economic investment, we know that they were a good investment in building comfort and we can see that our energy use has decreased and the building performs much better than comparable buildings, according to the EPA Portfolio Manager. The committee took the advice of Zobler and Sauchelli (2009):
**Energy Conservation and Sustainability**

The benefits of doing the project sooner rather than later are numerous, starting with improved cash flow, better facilities, using the existing capital budget for other projects, helping make the facilities “green,” and more. In the end, a decision not to install more efficiency energy equipment and implement related energy-saving measures is a decision to continue paying higher utility bills. Using the captured energy savings to pay for financing the improvements is recommended, essentially making them “self-liquidating” obligations.

**Other Sustainability Measures**

The Committee’s Report, covers recommendations on solid waste and recycling, purchasing preparing for climate change, and the community aspects of transportation and programming. The reader is referred to this Report for detailed information. The following provided additional information on some of these topics.

**Renewable Energy**

Over the years, inquiries have been made with various solar energy vendors about installation of photovoltaic system to supplement electricity use. Experts have told the Library that the roof is not well-suited for such an installation. As technology and market changes there may be other options such as geothermal heat utility, ice-based air conditioning, district energy for heating and cooling and building integrated photovoltaics. These options are both aspirational and innovative and many would include working with neighboring buildings. In the meantime, the Library could consider purchasing renewable energy.

**Stormwater Management**

As part of re-paving the 26,000 sq. ft. parking lot, green infrastructure was installed to handle the stormwater flowing from roof and parking lot on site and overflow handled by municipal stormwater sewer. This included disconnection of roof leaders which flowed to the sanitary sewer system and installation of a rain garden and dry wells. The system led to the reduction of 400,000 gallons per year of rainwater entering the sanitary sewer system; no rainwater from the Library roof now enters the sanitary sewer system. This project is described at http://www.dec.ny.gov/lands/86684.html

**Sustainable Building Operations**

The Library does not have a formal sustainable building operations plan or operating procedures. However, it follows best management principles for waste management, purchasing, and buildings and grounds maintenance. Many checklists, guidance and benchmarking tools exist, three are listed below.

- Sustainable Buildings Checklist is a tool through the EPA Portfolio Manager which covers management and planning, energy conservation, indoor air quality, water use both potable, irrigation, and stormwater and materials management (trash and recycling).
ENERGY CONSERVATION AND SUSTAINABILITY


- S-CORE from the International Society of Sustainability Professionals is a multi-purpose sustainability assessment tool. Training is offered for a fee for building managers and professions in sustainability. http://www.sustainability-core.com/

SUSTAINABILITY AND THE LARGER COMMUNITY
The Library “thinks globally and acts locally”. The Library passed the climate smart pledge in support of the City of Kingston’s Climate Smart Communities and Green Jobs Pledge. The Library recognizes that we are part of fulfilling the goal set by the City of Kingston in its Climate Action Plan to reduce energy usage and GHG emissions 20% by 2020 or “20 by 20.” (7) The City of Kingston was recognized in April 2014 with a bronze Climate Smart Communities certification. The Library also contributes to the New York State goal set in 2009 by Governor Paterson with in Executive Order 24 that established a goal to reduce greenhouse gas emissions 80 percent from 1990 levels by the year 2050 by “80 by 50” (8).

The Committee works in partnership with the City’s climate committee and other sustainability initiatives. We are committed to engaging community members in meaningful conversation about energy reduction and sustainability. We plan to work with Sustainable Hudson Valley to develop a peer mentoring partnership of community institutions to improve energy and sustainability performance in 2015.

PROGRAMMING
As time and resources allow, the committee and Library offer presentations and create displays, often in cooperation with local non-profits and government entities. Adult programming has included films, presentations on car-pooling, home energy performance and place making. Displays have been produced on energy conservation, stormwater and rain gardens and the City of Kingston Climate Action Plan.

LESSONS LEARNED

- Utilize local experts. The energy improvements, benchmarking and communications have been helped by volunteer efforts of sustainability professionals.

- Capitalize on the passions of trustees and other volunteers and their willingness to learn.

- Spend the time to locate and enter data into a spreadsheet and energy management tools.
ENERGY CONSERVATION AND SUSTAINABILITY

- Start with simple low cost actions. Not all institutions have the ability to bond for capital funds, but by using energy audits and other tools libraries can develop a plan to implement low-cost measures and raise funds for more expensive measures, saving money for the future and increasing comfort for occupants.

- Utilize energy audits and other services offered by NYSERDA.

- Take weather into account, find someone to help with comparing energy use and heating and cooling degree days.

- Form a support group of like-minded institutions.

- Engage the community in the process and in celebrating success.

- Recognize that energy improvements may be invisible to patrons.

- Remember that a “decision not to install more efficiency energy equipment and implement related energy-saving measures is a decision to continue paying higher utility bills.”

CONCLUSION

Kingston Library has taken the time to document our progress in energy improvements and performance, showing in the process that what is good for the environment is also good for operating costs. It is important to keep good records and continually monitor and make adjustments. Capital spending for energy improvements meet objectives for sustainability, building comfort and reduced operating costs. We hope that this story will inspire other libraries to take action and become a green library.

APPENDIX 1

CLIMATE SMART COMMUNITY LIBRARY PLEDGE

September 16, 2010 Trustee Paul Werbalowsky moved and Trustee Edwin Pell seconded that:

WHEREAS, the City of Kingston passed a Climate Smart, Green Jobs Pledge on October 6, 2009 and Kingston Library would like to show support for that Pledge and;

WHEREAS, the Board of Trustees of the Kingston Library understands that climate change poses a real and increasing threat to our local and global environments which is primarily due to the burning of fossil fuels; and
WHEREAS, the effects of climate change will endanger the world’s infrastructure, economy and livelihoods; harm farms, orchards, ecological communities, including native fish and wildlife populations; spread invasive species and exotic diseases; reduce drinking water supplies and recreational opportunities; and pose health threats to our community’s citizens; and

WHEREAS, we believe that our local response to climate change provides us with an unprecedented opportunity to save money, and to contribute to livable, energy-independent and secure communities, and vibrant innovation economies; and

WHEREAS, we believe the scale of greenhouse gas (GHG) emissions reductions required for climate stabilization will require sustained and substantial efforts; and

WHEREAS, we believe that even if emissions were dramatically reduced today, communities would still be required to adapt to the effects of climate change for decades to come,

WHEREAS, we understand that public libraries are good stewards of public dollars and therefore should investigate and invest in energy efficient cost saving option,

IT IS HEREBY RESOLVED that Kingston Library, in order to reduce greenhouse gas emissions and adapt to a changing climate will take certain steps.

1. Planning

   • Set goals to reduce greenhouse gas (GHG) emissions and adapt to predicted climatic changes.

   • Encourage stakeholder and public input by establishing an advisory committee to review the issues and propose a plan of action including facility operations and library programming. Recognize that climate mitigation and adaptation requires behavior change and actions by the Board, Director, staff and library patrons.

   • Designate a joint staff-Board sub-committee who will oversee climate change initiatives and publicly report on progress.

   • Work cooperatively with national, state and local initiatives, including the City of Kingston’s Climate Smart Communities and Green Jobs Pledge, to ensure that efforts complement and reinforce one another.

   • Integrate climate change considerations into library activities, policies and long term planning. Inform and inspire the public.

2. Library Facility Operations

   • Gather data through an inventory of GHG gas emissions from electricity and natural gas usage, waste production, water use and other sources to establish baselines for Library operations. Set up a procedure to regularly collect data.
Energy Conservation and Sustainability

- Develop quantifiable interim GHG emission targets consistent with emission reduction goals such as Renewable Energy Task Force Plan (2008) goal of reducing electricity use by 15% from projected levels no later than 2015, NYS Governor’s Executive Order 24, which creates a NYS goal to reduce NYS GHG emissions by 80% of 1990 levels by 2050 and NYS Governor’s “45 by 15” initiative, which requires New York to meet 45 percent of its electricity needs through renewable energy and improved building energy efficiencies by 2015.

- Develop an emission reduction plan that details how to achieve the targets, and includes a schedule. The plan should address:
  - Energy conservation and efficiency retrofits
  - Renewable energy
  - Solid waste source reduction, reuse, recycling and other smart solid waste management practices
  - Water conservation
  - Actions that affect or influence the community
  - Purchasing policies for procuring climate smart goods and services.

- Carry out plans to reduce emissions, evaluate progress and make changes as required.

3. Library Programs

- Integrate climate change actions into library programs to inspire and engage patrons and the community.

- Provide opportunities to support community climate change mitigation and adaptation actions and a green innovative economy by providing climate-change related library materials, programming and other resources that will help community businesses and residents learn about climate protection, sustainability, and environmental goods and services.

- Lead by example, by highlighting the Library’s commitment to reducing energy use, saving tax dollars, and adapting to changing conditions. Report GHG emissions and targets to Library patrons and constituents.

- Demonstrate the benefits of recycling, water conservation, stormwater management, energy savings, energy efficiency, and renewable energy projects by regularly communicating goals and progress to patrons and stakeholders.
• Provide opportunities for the community to reduce their carbon footprint such as encouraging walking, bicycling, carpooling, and public transit for employees and patrons or by discouraging vehicle idling in the parking lot.

• Compare successes, cooperate and collaborate with community and neighboring library’s efforts to redirect less-effective actions and amplify positive results.

4. Adaptation to Unavoidable Climate Change

• Consider the risks and the Library’s vulnerability to unavoidable climate change and factor them into long-term decision-making. Climate change impacts that could affect the Library include increased stormwater and flooding, drought, and extreme and prolonged summer temperatures.

• Use guidance and recommendations from NYS Climate Action Plan and other resources.

5. An Evolving and Adaptive Process

• Acknowledge that research and policy on climate protection are constantly improving and evolving.

• Be willing to consider new ideas and commit to update plans and policies as needed.

• Monitor and evaluate progress and make changes as warranted

APPENDIX 2

ENERGY IMPROVEMENTS

The HVAC system was improved with the installation of seven heating zones which are controlled by individual thermostats, in 2007. In 2009, programmable set back thermostats were installed, and are set at 68 for daytime and 60 at night. In summer, they are set at 70 for daytime and 78 at night. Previously the manual thermostats were not changed from day to evening. The small investment in thermostats ($2200 including installation) can lead to significant savings.

Air conditioners: Until 1997, only staff offices were air conditioned, using window units. At that time units were installed to cool the entire main floor and half of the upper floor. In 2008, the window units were replaced and the entire building is cooled. These units are aging, as evidenced by a need to replace one unit in 2012. Cooling uses large amounts of energy, eliminating inefficient
window units most likely reduced electricity consumption. Future replacement of older models with more efficient models or with a different system will help keep energy use stable.

Lighting: Lighting was retrofitted in 2005, with the installation of T8 fluorescent lighting and ballasts, replacing T12 bulbs. T8 refers to the diameter of the bulb, T8 is 8/8ths inches and T12 is 12/8th inches. Smaller diameter bulbs are more energy efficient. Incandescent bulbs were switched to compact fluorescent bulbs. The 2011 audit found a few instances where incandescent and T-12 lighting still existed. T8 lighting was state of the art at that time.

Insulation: The attic was insulated in 2008. We have no data on the R-value of this insulation. Insulation on boiler, steam pipes and a retrofit to recycle stack heat were also implemented. It is difficult to measure the effect on energy consumption.

Windows: Low energy transfer windows and frames were installed in 2007. The mortar in between the bricks was repaired and the frames caulked. These new windows have significantly reduced drafts.

White roof: When the need to re-roof the building arose in 2005, the material chosen was an Energy Star white reflective membrane. The white surface helps reduce heat build-up in summer, reflecting rather than absorbing the summer sun. There is presently an international standard to encourage the use of white roofs in order to reduce the use of energy and to make up for the loss of the reflectivity of the polar ice caps. (Mark Z. Jacobson and John E. Ten Hoeve, 2012: Effects of Urban Surfaces and White Roofs on Global and Regional Climate. *J. Climate*, 25, 1028–1044. doi: [http://dx.doi.org/10.1175/JCLI-D-11-00032.1](http://dx.doi.org/10.1175/JCLI-D-11-00032.1))

Audit Recommendations

Boiler Heat Timer: Installation of a heat timer on the gas fired boiler so it will operate more efficiently. This upgrade costs about $5000 and has a simple pay back of 5 years, the energy savings is estimated at $950/year. A boiler heat timer is a device which allows the duration of the steam supply to the building to be controlled in a cycle that is based on the outdoor temperature.

Lighting: Conversion of lighting to more energy efficient: switch from incandescent lamps to compact fluorescent lamps in a few locations, mostly in the basement; upgrading the remaining T-12 lamps to T-8 lamps and ballasts by attrition.

Occupancy Sensors: Installation of 12 occupancy sensors in restrooms and offices, that automatically turns off lights when no one is using the room. NYSERDA provides a financial incentive of $10 per sensor.

Weather Stripping: Installation of weather stripping on exterior doors, primarily the rear emergency exit.

**ACKNOWLEDGEMENTS**

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Kingston Library Report and Recommendations of the Climate Smart Library Advisory Committee (June 2012)


NYSERDA http://www.nyserdasolutions.org

http://www.energystar.gov/ia/partners/spp_res/NEMA%20Article%20Feb%202009.pdf

Endnotes:

1. The New York State Climate Smart Communities Program helps municipalities take action on climate change. The program is designed for municipalities, but libraries can benefit from many of the resources on its website.


3. EPA Portfolio Manager is an interactive energy management tool that allows building owners/operators to track and assess energy and water consumption in a secure online environment. This web-based tool is provided for free by ENERGY STAR®, a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

4. Library is defined by the EPA Portfolio Manager as buildings used to store and manage collections of literary and artistic materials such as books, periodicals, newspapers, films, etc. that can be used for reference or lending. Gross Floor Area should include all space within the building(s), including circulation rooms, storage areas, reading/study rooms, administrative space, kitchens used by staff, lobbies, conference rooms and auditoriums, fitness areas for staff, storage areas, stairways, and elevator shafts.

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5. Net present value: The difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of an investment or project. [http://www.investopedia.com/terms/n/npv.asp](http://www.investopedia.com/terms/n/npv.asp)

6. Return on Investment: A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. To calculate ROI, the benefit (return) of an investment is divided by the cost of the investment; the result is expressed as a percentage or a ratio. [http://www.investopedia.com/terms/r/returnoninvestment.asp](http://www.investopedia.com/terms/r/returnoninvestment.asp)
