

City of Cambridge  
Climate Protection Action Committee

**RECOMMENDATION**

Energy Efficiency Improvements and Greenhouse Gas Reductions for Municipal Buildings

August 2013

The Climate Protection Action Committee (CPAC) is an advisory body to the City Manager on climate protection issues and implementation. CPAC has recently studied and discussed energy performance in municipal building projects. Based on these discussions, CPAC recommends that the City consider taking some steps to address energy performance in new construction and in existing buildings.

City Green Building Policy

Cambridge was an early adopter of the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) standards. Since the renovation of City Hall Annex, it has been City policy that all new construction and major renovations of municipal buildings follow the LEED standards. As a result, the City has seven LEED certified projects with more in the pipeline. LEED has enabled the City to incorporate cutting edge technology that otherwise might not have been utilized into municipal building projects.

The City was also one of the first adopters of the Stretch Energy Code, which applies a higher energy efficiency design standard to new construction, including municipal projects.

Recently, the City embarked on a higher level of green design by designing the Martin Luther King Jr. School project to be as close to a net zero energy design as possible. Net zero energy projects are a new frontier for buildings and Cambridge is again an early adopter. The City has also gone further by conducting a comparative building life cycle assessment (LCA) of the greenhouse gas emissions (GHG) of the proposed new King School versus renovating the existing building to inform decision making and the project design.

These progressive policies and projects have shown the City to be a leader. We do not believe any municipalities in Massachusetts can match Cambridge's accomplishments on municipal building projects. Use of standards and tools that promote higher energy performance also contributes to minimizing the impact of energy costs on the municipal budget.

New Construction & Major Renovations

One of the consequences of being an early adopter is that lessons are learned as new techniques are applied. In green building design and construction, one of the major lessons learned is that a green building design does not always lead to the desired and modeled level of energy performance. This lesson has been experienced by projects across the country. CPAC believes that in the case of Cambridge projects, designing with LEED has produced better buildings than would have otherwise resulted from conventional designs using base building and energy codes. However, we think there is room for improvement in energy performance and ongoing verification.

In the case of City building projects that involve renovating or replacing an existing building, it is difficult to compare projects on a before and after basis. The replacement building typically includes new systems that were not in the old building, such as central air conditioning in some cases. New buildings also tend to get used more due to the improved conditions for occupants and better space for programs and meetings. Those changes tend to drive up energy use. Under LEED, the energy performance of a building design is compared to a base building, not the existing building, using computer simulations. So it is possible that the computer energy model will show that the proposed design is better than the conventional base case but still result in higher energy usage in the building that is to be renovated or replaced. In that event, a project can drive up the City's gross energy consumption, carbon footprint, and costs.

The City has also expanded the total floor area of municipal facilities with new buildings and additions. This enables the City to provide more and better services. However, this also adds to the City's overall energy demand and carbon footprint.

New construction and major renovation projects are producing more environmentally sustainable municipal buildings than would have been constructed without the LEED policy in place. However, these green projects may not result in reducing total municipal energy use and carbon emissions.

The City is planning a major program to renovate or replace school buildings over the coming years, which is important to the Cambridge education system. The energy performance that results from these projects will be critical to the City's goals to reduce greenhouse gas emissions. Energy performance goals should be set for these projects in the context of trying to reduce total municipal carbon emissions.

### Existing Buildings

While Cambridge is fortunate that it has the resources to construct new buildings and carry out major renovations, most municipal buildings will probably not receive a makeover in the near term. Fortunately, the City has worked to reduce energy use in existing buildings through capital improvement projects, re-commissioning of building systems, and occupant behavior initiatives. The City has also set a 20 percent energy use reduction goal for buildings and vehicles under its Green Communities commitment and has a goal to obtain at least 20% of its electricity from renewable sources.

Improvements in energy performance in existing buildings offer a means to manage the impacts of energy use in new buildings and major renovations in a way that enables the City to hold steady or reduce its overall carbon footprint. For example, if the City decided that a new building needed to be added or that a renovation was needed that added either space or energy intensity to provide better or different services, improvements to the energy performance of existing buildings could be programmed to offset the impact, hopefully with an overall net improvement. It would be desirable for these projects to be linked.

### Options & Tools

*LEED* – The City currently utilizes LEED to set minimum green building requirements for municipal and private sector projects. It also requires projects subject to Article 22 of the Zoning ordinance to achieve a minimum Silver rating under LEED. The Kendall Square/Central Square study process recommended

that projects in the study area achieve at least a Gold rating. To lead by example, the City could subject municipal projects to this higher standard.

There are different LEED rating systems. Generally, municipal projects will fall under the systems for new construction, schools, or core and shell. There is also LEED for existing buildings, operations, and maintenance (LEED EBOM). This system provides a tool for improving and maintaining high performance in existing buildings and incorporates credits based on how a building actually uses energy rather than on the basis of energy modeling, which is used for new construction.

LEED EBOM could be applied to existing buildings to improve their performance and to new buildings and major renovations after 3 to 4 years of occupancy to ensure that high performance is achieved and maintained.

*Energy Star* – The U.S. Environmental Protection Agency labels buildings under the Energy Star program based on actual energy performance. A full year of energy use data is required to participate. Essentially, Energy Star compares a building's energy use intensity (energy units/square foot) to a database of similar buildings. If the building performs among the top 25 percent, then it is eligible for an Energy Star label. Labels are only available for certain building types, which include offices and schools. Some types of buildings, like water treatment plants, are not possible to label because the EPA does not have sufficient data to justify a comparison.

*ASHRAE 189.1* – ASHRAE is the standard-setting organization of the air conditioning, heating, and ventilation industry. In 2010, ASHRAE issued a code-based green building standard that is intended to complement other green building standards such as LEED. One of the limitations of LEED is it is possible to design to the minimum standard in terms of energy efficiency and do nothing with renewable energy and still be labeled as a green building. The ASHRAE standard prescribes a minimum standard for energy measures that ensures a high level of energy performance. Elements of ASHRAE 189.1 could be incorporated into building design specifications.

*Life Cycle Assessment* – The City conducted a life cycle assessment (LCA) of GHG impacts for the first time on the King School project. The practice of LCA is in a nascent state. The American Institute of Architects (AIA) notes in its *Guide to Building Life Cycle Assessment in Practice* that the use of LCA is limited by the scarcity of financial incentives to apply the tool; the lack of data to perform assessments and therefore creating reliance on assumptions and use of disparate data sources; and lack of benchmarks set by government agencies to use for comparisons. AIA states “In the current state of LCA, the limitations must be recognized; however, it also needs to be recognized that with increasing use, research, and tools development these limitations will be resolved.” LCA helps designers demonstrate the sustainability of projects. Use of LCA by the City would contribute to making the tool more effective and build experience within the City.

*Green Schools* – The Cambridge School Department established a sustainability office in 2010. The program works to improve the sustainability of schools in terms of operations and supports the use of school facilities in sustainability learning. As more schools are renovated or replaced on the basis of green design, more will have sustainability features that relate to classroom activities. There are many tools, programs, and organizations that relate to sustainable schools including LEED for Schools and the School Building Assistance Program green building guidelines.

*Construction Procurement* – CPAC is not knowledgeable about building design and construction processes that the City is required to follow under state requirements. As allowed by state rules, it would make sense to incorporate sustainability performance standards or targets into design and construction contracts for municipal building projects, particularly in regard to energy performance.

*Performance Contracting* – For existing buildings, energy performance contracting offers a means for a city to engage a third party firm to assess a building for energy efficiency opportunities, implement the measures, and pay for them in a verifiable manner. These contracts typically involve a performance guarantee on energy savings from the installed retrofit measures. The advantage to the municipality is that the contract structure incentivizes the third party contractor to find all the feasible energy efficiency opportunities and to have all of the capital investment come through private financing with no upfront cost to the city. With this approach, a city can remove the barrier of budget constraints that delay action on improving energy performance. Performance contracts are complicated and it makes sense for a city to engage an owner’s agent to represent its interests. There have been negative experiences with performance contracts, but there are also many documented successes.

*Municipal GHG Management* – Protocols have been established to create greenhouse gas emission inventories for organizations including municipal government. The Climate Registry is probably the leading third-party verification organization for GHG inventories and management. These protocols provide guidelines on how to quantify greenhouse gas emissions associated with direct combustion of fossil fuels (e.g., natural gas, fuel oil, gasoline, diesel), use of electricity, and activities such as employee travel, waste generation, and others. Inventories are created which can be tracked over time for the assessment of trends and to make comparisons to similar organizations.

### Recommendations

CPAC makes the following recommendations to the City on the matters discussed above:

- Establish a process to evaluate options for setting verifiable building energy performance goals for new municipal construction and major renovation projects, such as LEED EBOM and Energy Star, and implement the best approach.
- Assess existing buildings for energy performance and greenhouse gas emissions through benchmarking and retro-commissioning to identify opportunities for improvements that could offset the additional energy use and GHG emission of new construction.
- Ensure that new City buildings and major renovations do not cause a net increase in municipal greenhouse gas emissions by establishing strong energy performance goals and by implementing companion projects that achieve GHG reductions in other facilities.
- Establish guidelines for how and under what circumstances to utilize life cycle assessments of at least GHG emissions in new municipal construction and major renovation projects to contribute to the development of this tool and to inform City decision-making. Plan for communicating the results of LCAs in community processes.